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Free Paper Session 1

902.1

Real-time biopsy system for combined optical spectroscopy and electromagnetic tracking in a woodchuck hepatocellular carcinoma model

Q.M.B. de Ruiter¹, S. Xu¹, M. Li¹, J. Karanian¹, A. Mikhail¹, M. Mauda Havakuk¹, P. Heidari², A. Sajjadi², W.F. Pritchard¹, U. Mahmood², B.J. Wood¹

¹Center for Interventional Oncology, Radiology and Imaging Sciences, National Institutes of Health, Bethesda, MD, US,

²Department of Radiology, Massachusetts General Hospital, Boston, MA, US

Purpose: Feasibility and diagnostic accuracy assessment of a custom optical spectroscopy and electromagnetic (EM) tracking integrated platform for biopsy evaluation in a woodchuck hepatocellular carcinoma (HCC) model.

Material and Methods: EM tracking combined with a handheld Optical Medical Imaging (OMI) device for optical spectroscopy of indocyanine green (ICG) was integrated into a single biopsy platform to guide intra-tumoral sampling. An animal study, approved by the Institutional Animal Care and Use Committee, was conducted in a woodchuck HCC tumor model. The animal received 0.5 mg/kg ICG i.v. 24 hours prior to biopsies. Hepatic targets were percutaneously approached with the integrated EM needle-OMI device and adjusted according to ICG signal output to confirm ICG-positive tissue locations. Additionally, an in-room ICG point-of-care (POC) system measured ICG level for each biopsy specimen. All biopsies and post-mortem liver specimens were evaluated for diagnostic accuracy and compared to histopathology results.

Results: CT-based EM-tracked needle placement with an ICG confirmation was successfully completed within 2 minutes. In 4/7 needle placements (75%), the OMI demonstrated the presence of ICG. ICG/POC sensitivity of all pre-mortem acquired biopsy samples was 100% and specificity was 83%, resulting in an overall accuracy of 0.90. Ex vivo OMI readouts of liver specimens were 39±12 for normal (n=2) and 281±150 (n=10) for HCC confirmed tissue.

Conclusion: The custom platform can provide simultaneous optical and EM real-time feedback during biopsy. Since ICG uptake in liver is predictive of neoplasm, this information may provide the operating team with molecular, functional, and spatially localizing information intra-procedurally and in turn increase tissue sample sensitivity.

902.2

Augmented reality and artificial intelligence-based navigation during percutaneous vertebroplasty: a pilot prospective clinical study

P. Auloge¹, R.L. Cazzato¹, N. Ramamurthy², P. De Marini¹, C. Rousseau³, J. Garnon¹, Y.P. Charles⁴, J.-P. Steib⁴, A. Gangi¹
¹Interventional Radiology, University Hospital of Strasbourg, Strasbourg, FR, ²Radiology, Norfolk and Norwich University Hospital, Norwich, UK, ³Clinical Investigation Center INSERM 1414, University Hospital of Rennes, Rennes, FR, ⁴Service de Chirurgie du Rachis, University Hospital of Strasbourg, Strasbourg, FR

Purpose: To assess technical feasibility, accuracy, safety and patient radiation exposure of a novel navigational tool integrating augmented reality (AR) and artificial intelligence (AI), during percutaneous vertebroplasty of patients with vertebral compression fractures (VCFs).

Material and Methods: This prospective randomized study compared the trans-pedicular access phase of percutaneous vertebroplasty across two groups of 10 patients with symptomatic single-level VCFs. Trocar insertion was performed using AR/AI-guidance with motion-compensation in Group A, and standard fluoroscopy in Group B. The primary endpoint was technical feasibility in Group A. Secondary outcomes included the comparison of Group A and B in terms of accuracy of trocar placement (distance between planned/actual trajectory on sagittal/coronal fluoroscopic-images); complications; time for trocar deployment; and radiation dose/fluoroscopy-time.

Results: Technical feasibility in Group A was 100%. Accuracy in Group A was 1.68 ± 0.25 mm (skin entry-point), and 1.02 ± 0.26 mm (trocar-tip) in the sagittal plane, and 1.88 ± 0.28 mm (skin-entry point) and 0.86 ± 0.17 mm (trocar-tip) in the coronal plane, without any significant difference compared to Group B (p > 0.05). No complications were observed in the entire population. Time for trocar deployment was significantly longer in Group A (642 ± 210s) than Group B (336 ± 60s; p= 0.001). Dose-Area Product and fluoroscopy-time were significantly lower in Group A (182.6 ± 106.7 mGy. cm² and 5.2 ± 2.6s) than Group B (367.8 ± 184.7 mGy. cm² and 10.4 ± 4.1s; p=0.025 and 0.005), respectively.

Conclusion: AR/AI-guided percutaneous vertebroplasty appears feasible, accurate and safe, and facilitates lower patient radiation exposure compared to fluoroscopic-guidance.

Free Paper Session 2

902.3

Percutaneous electrochemotherapy of the pancreas is feasible and safe in a porcine survival model

R. Dezman¹, G. Serša², A. Seliskar³, V. Erjavec³, P. Popovič¹, B. Trovosek⁴, G. Gašljevič⁵, N. Boc⁶, M. Bošnjak², U. Lampreht Tratar², B. Kos⁷, M. Djokic⁴, M. Štabuc¹, J. Izlakar⁶, N. Milevoj³, M. Brložnik³, M. Štukelj⁸, B. Krhin⁹, D. Miklavčič⁷, M. Čemažar¹
¹Clinical Institute of Radiology, University Medical Centre Ljubljana, Ljubljana, SI, ²Department of Experimental Oncology, Institute of Oncology Ljubljana, Ljubljana, SI, ³Small Animal Clinic, Veterinary Faculty, University of Ljubljana, Ljubljana, SI, ⁴Department of Abdominal Surgery, University Medical Centre Ljubljana, Ljubljana, SI, ⁵Department of Cytopathology, Institute of Oncology Ljubljana, Ljubljana, SI, ⁶Department of Radiology, Institute of Oncology, Ljubljana, SI, ⁷Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, SI, ⁸Clinic for Ruminants and Pigs, Veterinary Faculty, University of Ljubljana, Ljubljana, SI, ⁹Department of Laboratory Diagnostics, Institute of Oncology Ljubljana, Ljubljana, SI

Purpose: Use of thermal tumour ablation in the pancreatic parenchyma is limited because of the risk of pancreatitis, pancreatic fistula, bleeding or trauma to surrounding large vessels. Electrochemotherapy (ECT) is an electroporation-based treatment with already established place in the treatment of cutaneous and liver tumours. This study aimed to evaluate the feasibility and safety of percutaneous electrochemotherapy of the pancreas in a porcine survival model.

Material and Methods: Pigs were divided into two study groups. In the first group animals received CT guided percutaneous ECT with bleomycin i.v. (15.000 IU/m²) of the pancreatic tail and in the second group the pigs were treated with electroporation alone, without bleomycin. Electroporation was delivered through 2 needle electrodes 2 cm apart with 3 cm active part connected to the Cliniporator. Eight electric pulses of 2000V, 100 ms at frequency of 1 Hz were delivered. Both groups were followed for 7 days. Clinical parameters, computed tomography imaging (day 0 and day 7), laboratory analysis, and histology were performed.

Results: All animals survived electroporation alone and ECT with bleomycin procedure. After ECT, a hypodense lesion on computed tomography imaging indicated the ablation zone. Only a small (less than 2 times) transient increase in amylase and lipase levels was observed. None of the animals developed clinical signs of acute pancreatitis or related complications. The histological changes were minimal and present only around the electrodes.

Conclusion: This study shows that ECT with bleomycin is feasible and safe in the pancreatic parenchyma. Clinical studies are needed to evaluate the efficacy of ECT in pancreatic cancer.

1902.1

Percutaneous irreversible electroporation to treat locally advanced pancreatic cancer: the PANFIRE-2 trial final results

A. Ruarus¹, L. Vroomen¹, R. Puijk¹, M. de Jong¹, B. Zonderhuis², M. Besselink³, M.P. van den Tol², G. Kazemier², H. Scheffer¹, M. Meijerink¹
¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Surgery, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Surgery, Amsterdam UMC, location AMC, Amsterdam, NL

Purpose: Investigating the safety and efficacy of percutaneous irreversible electroporation (IRE) for locally advanced pancreatic cancer (LAPC) and recurrent pancreatic cancer after resection.

Material and Methods: In this prospective, single-arm, phase-II trial 40 patients with LAPC and 10 patients with recurrent disease ≤ 5 cm were treated with percutaneous IRE (NCT01939665). Adverse events were graded according to the Common Terminology Criteria for Adverse Events. Three-monthly CT-scans were performed to detect disease progression. Kaplan-Meier estimates were used for survival analysis. Survival was compared to a matched historical cohort of 22 patients treated with FOLFIRINOX alone.

Results: The median largest tumor diameter was 4.0 cm (range, 2.0–6.5 cm). After a median follow-up of 10 months, median time to local progression was 9.5 months (95%-confidence interval (CI): 9.0–10.0 months) and to distant progression also 9.5 months (95%-CI: 5.4–13.5 months). The median overall survival (mOS) from diagnosis was 18.3 months (95% CI: 11.7–25.0 months) for IRE alone and 16.6 months (95%-CI: 14.6–18.5 months) for IRE plus FOLFIRINOX. mOS in the FOLFIRINOX alone matched cohort was 12.5 months (95%-CI: 10.6–13.1 months). Twenty-one minor complications and 17 major complications (15 grade III, 2 grade IV) occurred in 26 patients. Two deaths occurred within 90-days after IRE, however these were unlikely procedure-related.

Conclusion: Percutaneous IRE is a relatively safe treatment for LAPC, although major complications can occur. mOS after IRE +/- FOLFIRINOX was superior to a matched cohort of patients treated with FOLFIRINOX alone. Randomized controlled studies are needed to confirm the outcome of IRE for LAPC compared to chemotherapy alone.

1902.2

Irreversible electroporation of locally advanced pancreatic cancer transiently alleviates immune suppression and creates a window for anti-tumor T-cell activation

H. Scheffer¹, A. Stam², L. Vroomen¹, B. de Bruijn², P. van den Tol³, G. Kazemier³, M. Meijerink¹, T. de Gruij²
¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Medical Oncology, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Surgery, Amsterdam UMC, location VUmc, Amsterdam, NL

Purpose: Local tumor ablation through irreversible electroporation (IRE) may offer a novel therapeutic option for locally advanced pancreatic cancer (LAPC). It may also serve as a means of in vivo vaccination. To obtain evidence of the induction of systemic antitumor immunity following local IRE-mediated ablation, we performed an explorative immune monitoring study.

Material and Methods: In ten patients enrolled in a clinical trial exploring the safety, feasibility, and efficacy of percutaneous image-guided IRE in LAPC, flow cytometric analysis was performed to determine the frequency and activation state of lymphocytic and myeloid subsets in pre- and post-treatment peripheral blood samples. Systemic T cell responses to the pancreatic cancer associated antigen Wilms Tumor (WT)1 were determined after in vitro stimulation in an interferon- γ enzyme-linked immunospot assay (Elispot), at baseline and at 2 weeks and 3 months after IRE.

Results: Our data show a transient decrease in systemic regulatory T cells (Treg) and a simultaneous transient increase in activated PD-1+ T cells, consistent with the temporary lifting of immune suppression after the IRE procedure. Accordingly, we found post-IRE boosting of a pre-existing WT1 specific T cell response in two out of three patients as well as the de novo induction of these responses in another two patients. There was a trend for these WT1 T cell responses to be related to longer overall survival ($p=0.055$).

Conclusion: These findings are consistent with a systemic immune stimulatory effect of IRE and support the combination of percutaneous IRE with therapeutic immune modulation.

1902.3

Additional hepatic 166Ho-radioembolization in patients with neuroendocrine tumours treated with 177Lu-DOTATATE: a single-center, interventional, non-randomized, non-comparative, open-label, phase II study (HEPAR PLUS trial)

A.J.A.T. Braat¹, R. van Rooij¹, R. Bruijnen², R.S. van Leeuwen³, W.W. de Herder⁴, M. Tesselaar⁵, H.W.A.M. de Jong¹, M.G.E.H. Lam¹
¹Radiology and Nuclear Medicine, University Medical Center Utrecht, Utrecht, NL, ²Radiology, University Medical Center Utrecht, Utrecht, NL, ³Cancer Center, University Medical Center Utrecht, Utrecht, NL, ⁴Endocrinology, Erasmus Medical Center, Rotterdam, NL, ⁵Oncology, Dutch Cancer Institute – Antonie van Leeuwenhoek, Amsterdam, NL

Purpose: At diagnosis 21% of the patients with a grade 1 neuroendocrine tumor (NET) and 30% with a grade 2 NET have distant metastases. The liver is the most commonly affected organ in metastatic disease and is the most incriminating factor for patient survival. Treatment with peptide receptor radionuclide therapy (PRRT) shows an 18% objective response rate and long median survival after treatment. Additional treatment of liver disease with radioembolization may improve outcome in NET patients. To investigate this hypothesis, a phase 2 study was initiated to assess effectiveness and toxicity of holmium-166 radioembolization (166Ho-RE) after PRRT with lutetium-177 (177Lu)-DOTATATE.

Material and Methods: The HEPAR PLUS trial ("Holmium Embolization Particles for Arterial Radiotherapy Plus 177Lu-DOTATATE in Salvage NET patients") was a single centre, interventional, non-randomized, non-comparative, open label study. Recruitment is completed. Thirty patients with >3 measurable liver metastases according to RECIST 1.1 and mRECIST received additional 166Ho-RE within 20 weeks after the 4th and last cycle of PRRT with 7.4 GBq 177Lu-DOTATATE. Primary objectives: tumour response, complete and partial response according to RECIST 1.1, and toxicity, based on CTCAE v4.03, three months after 166Ho-RE. Secondary endpoints included biochemical response, quality of life, biodistribution and dosimetry.

Results: Primary endpoint expected January 2019; results to be presented at ECIO 2019.

Conclusion: This was the first prospective study to combine PRRT and additional 166Ho-RE in metastatic NET. A radiation boost on intrahepatic disease using 166Ho-RE may lead to an improved response rate without significant additional short-term side-effects.

1902.4

Percutaneous hepatic perfusion with melphalan in patients with unresectable liver metastases from ocular melanoma using the Delcath System's second-generation hemofiltration system: a prospective phase II study

T.S. Meijer¹, M.C. Burgmans¹, B. Boekestijn¹, A.R. van Erkel¹, L.-F. de Geus-Oei¹, H. Handgraaf², D.E. Hilling², E.M. de Leede², J. Lutjeboer¹, C.H. Martini³, R.W. van der Meer¹, E.M. Sitsen³, F.M. Speetjens⁴, F.G.J. Tijl⁵, E. Kapiteijn⁴, A.L. Vahrmeijer
¹Department of Radiology and Nuclear Medicine, Leiden University Medical Center, Leiden, NL, ²Department of Surgery, Leiden University Medical Center, Leiden, NL, ³Department of Anesthesiology, Leiden University Medical Center, Leiden, NL, ⁴Department of Medical Oncology, Leiden University Medical Center, Leiden, NL, ⁵Department of Extra Corporeal Circulation, Leiden University Medical Center, Leiden, NL

Purpose: To investigate safety and efficacy of percutaneous hepatic perfusion with melphalan (M-PHP) using the Delcath System's second-generation (GEN 2) hemofiltration system in patients with liver metastases from ocular melanoma.

Material and Methods: Patients (18-75 years) with unresectable, histologically confirmed liver metastases from ocular melanoma without signs of extrahepatic disease were

eligible for this prospective, single-arm phase II study. M-PHPs were performed with melphalan 3 mg/kg (maximum dose: 220 mg). Primary endpoint: best overall response (BOR). Secondary endpoints: overall survival (OS), progression-free survival (PFS), hepatic PFS (hPFS), safety, and quality of life (QoL according to EORTC QLQ-C30 v3.0 questionnaires).

Results: 72 M-PHPs were performed in 35 patients (median: 2 M-PHPs). Response was evaluable in 32 patients. BOR was as follows: 3.1% had complete response, 68.8% partial response, 12.5% stable disease, and 15.6% progressive disease. After median follow-up of 16.8 months, median OS was 20.3 months (1-year OS 77.1%), median PFS and hPFS were 8.1 and 10.9 months, respectively. There were no deaths, myocardial/cerebral infarctions or severe bleeding complications. We reported 14 severe adverse events; febrile neutropenia (n=3) and pulmonary emboli (n=2) were most common. Although frequently reported, all hematologic grade 3/4 events were well-manageable or self-limiting. Questionnaire scores after treatment did not significantly differ from baseline, except for a temporary decrease in physical functioning 6 weeks after the second M-PHP (p=0.011).

Conclusion: M-PHP with the GEN 2 filter is a well-tolerated, safe therapy and can achieve long sustained hepatic disease control and prolonged survival in patients with liver metastases from ocular melanoma.

1902.5

Prospective and multicentric evaluation of 100- μ DEB-TACE in patients with non-resectable HCC

J. Urbano¹, J. Echevarria-Uraga², J.J. Ciampi-Dopazo³, J. Sanchez Corral⁴, B. Peña Baranda⁵, V. Nacarin⁶, R. González Costero⁷, J.J. Muñoz Ruiz-Canela⁸, J. Cuesta Pérez⁹, L. López Carreira¹⁰

¹Vascular & Interventional Radiology, Alfonso X el Sabio University, Madrid, ES, ²Vascular and Interventional Radiology, Hospital Galdakao, Bilbao, ES, ³Vascular and Interventional Radiology, Complejo Hospitalario de Toledo, Toledo, ES, ⁴Vascular and Interventional Radiology, Hospital Ramón y Cajal, Madrid, ES, ⁵Vascular and Interventional Radiology, Hospital de Basurto, Bilbao, ES, ⁶Vascular and Interventional Radiology, Hospital Virgen del Rocío, Sevilla, ES, ⁷Vascular and Interventional Radiology, Hospital Puerta de Hierro, Madrid, ES, ⁸Vascular and Interventional Radiology, Hospital Regional de Málaga, Málaga, ES, ⁹Vascular and Interventional Radiology, Hospital de Getafe, Madrid, ES, ¹⁰Vascular and Interventional Radiology, Hospital Lucus Augusti, Lugo, ES

Purpose: To evaluate safety, efficacy and OS of 100- μ DEB-TACE for treatment of non-resectable HCC. Small particles may allow a more concentrated drug delivery as well as greater tumor penetration than larger particles. However, there is still some concern regarding that small spheres could be more toxic.

Material and Methods: Ten hospitals were involved in this multicenter, single-arm, prospective study (NCT2670122). Approval from all ethical committees was obtained. All patients provided informed consent. The primary aim was safety and tolerability. The second end point was treatment

efficacy and OS after two years of follow up. DEB-TACE with selective and ultra-selective administration of up to 3 ml of tightly calibrated 100- μ drug-eluting microspheres with up to 150 mg of doxorubicin was administered to patients with Child-Pugh class \leq B7; ECOG 0. mRECIST was used for response evaluation.

Results: From March 2015 to November 2016, 131 patients were included. 70.2%, 18.3% and 11.5% patients were Child-Pugh class A5, A6 and B7, respectively. Mean patient age was 68.3 yr (47–84 yr). BCLC class A, B and C were 61.2%, 38.2%, 0.8% respectively. 223 nodules with a mean size of 27.7 mm (8–100 mm) and a mean of 1.7 nodules per patient were treated. A total of 244 TACEs have been performed (mean of 1.8 procedures per patient). The 6-month objective response rate was 72.8%. The 30-day mortality, minor complication rate and major complication rate were 0%, 6.9% and 4%. 2-yr OS will be analyzed.

Conclusion: Safety and 2 year efficacy of 100- μ DEB-TACE is comparable to standard bigger DEB-TACE.

1902.6

Dose-effect relationship for hepatic holmium-166 radioembolization in colorectal cancer patients

C. van Roekel¹, R. Bastiaannet¹, M. Smits¹, S. Elias², R. Bruijnen¹, J. Prince¹, H. de Jong¹, M.G.E.H. Lam¹

¹Radiology, University Medical Center Utrecht, Utrecht, NL,

²Julius Center, University Medical Center Utrecht, Utrecht, NL

Purpose: The aim of this study was to analyze the safety and efficacy of holmium-166 (166Ho)-microsphere radioembolization in colorectal cancer patients.

Material and Methods: Patients who underwent a post-therapy 166Ho-SPECT/CT, an FDG-PET/CT at baseline, and an FDG-PET/CT at three-months follow-up, were included for analysis. Dose-response relationship was assessed by relating the change in total lesion glycolysis (TLG) between baseline and follow-up to tumor absorbed dose. Response was categorized according to the PERCIST criteria. To define the maximum tolerable dose to the healthy liver parenchyma, liver enzymes and the presence of ascites and encephalopathy were assessed up to three months after treatment. Correlation between change in liver enzymes and parenchymal absorbed dose was assessed using linear regression analysis.

Results: In total, 35 patients with 113 lesions were included. The lesions were categorized as complete response (CR) (n=22), partial response (PR) (n=22), stable disease (SD) (n=49) and progressive disease (PD) (n=20). Mean tumor absorbed doses in the response categories were 287 Gy, 183 Gy, 172 Gy and 162 Gy (p=0.009). At a patient level, there was 1 patient with CR, 11 patients with PR, 17 patients with SD and 6 patients with PD. Overall, toxicity was mild, with new CTCAE grade 4 toxicity occurring in only 5 patients (4 GGT, 1 bilirubin). There was a significant correlation between change in ASAT, GGT and AF and parenchymal absorbed dose. A dose of 45 Gy was deemed safe.

Conclusion: Significant dose-effect relationships were established for 166Ho radioembolization in colorectal cancer patients, with a safe parenchymal absorbed dose of 45 Gy.

1902.7**RFA vs robotic partial nephrectomy for T1a renal cell carcinoma: a propensity score-matched comparison of mid-term outcome****B.K. Park***Radiology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, KR*

Purpose: To compare oncological and functional mid-term outcomes following robotic partial nephrectomy (RPN) and radiofrequency ablation (RFA) for treating T1a renal cell carcinoma (RCC) using propensity score-matching.

Material and Methods: Between December 2008-April 2016, 63 patients from each treatment group were propensity score-matched for age, sex, American Society of Anesthesiologists score, tumour size, tumour laterality, tumour histology, R.E.N.A.L. nephrometry score and preoperative estimated glomerular filtration rate (eGFR). Post-treatment follow-up periods for RPN and RFA ranged from 1-90 months (median, 24.6) and 1-65 months (21), respectively. Tumour location, percentage of eGFR preservation and 2-year recurrence-free survival rates were compared between groups.

Results: Exophytic and endophytic RCC occurred in 73.0% (46/63) and 27.0% (17/63) of the RPN group, and 52.4% (33/63) and 47.6% (30/63) of the RFA group, respectively ($p=0.017$). There was 91.7% preservation of eGFR in the RPN group and 86.8% in the RFA group ($p=0.088$). Two-year recurrence-free survival rate was 100% in the RPN and 95.2% in the RFA group ($p=0.029$).

Conclusion: RPN provides a higher recurrence-free survival rate than RFA. However, RFA is a better treatment option for an endophytic or recurrent RCC that is difficult to treat with RPN.

1902.8**Therapeutic outcomes of thermal ablation for endophytic vs exophytic renal cell carcinoma****W. Zhou¹, S. Herwald¹, R. Arellano²***¹Radiology, Tufts University School of Medicine, Boston, MA, US,**²Division of Interventional Radiology, Massachusetts General Hospital, Boston, MA, US*

Purpose: To compare the safety and oncological outcomes of computed tomography (CT)-guided thermal ablation for endophytic versus exophytic renal cell carcinoma (RCC).

Material and Methods: A retrospective analysis of 394 patients (M:F = 267:127, mean age = 71 yrs) treated between October 2006 and December 2017 was performed. Exophytic RCC was defined as a tumor lesion with more than 50% tumor volume [SH1] protruding out of the renal parenchyma. Endophytic RCC was defined as a tumor lesion completely within the renal parenchyma. Rates of complications, residual disease and local recurrence were compared between exophytic and endophytic RCCs.

Results: Of the 405 biopsy-proven cT1N0M0 RCCs that were treated with percutaneous CT-guided thermal ablation, 242 (59%) were exophytic and 63 (16%) were endophytic. The

rate of complications was significantly higher in endophytic tumors (5/63, 8%), compared to exophytic tumors (6/242, 2%; $p = 0.038$). Residual disease was observed in 6/63 (10%) of the endophytic tumors and 18/242 (7%) of the exophytic tumors. There was no significant difference in local recurrence between endophytic tumors (4/65, 6%) and exophytic tumors (19/242, 7%; $p = 0.64$).

Conclusion: CT-guided thermal ablation of endophytic RCC poses a significantly higher risk of major complications compared to exophytic RCC. However, there is no increased risk of residual or locally-recurrent disease.

1902.9**Transarterial embolization of prostate with biodegradable flutamide-loaded PLA/PLGA microspheres for benign prostate hyperplasia: preliminary study in normal swine model****F. Nurili¹, T. Acar², S. Derman², I. Yurdaisik³, A. Bas⁴, H. Cakiroglu⁵, S. Ozkanli⁶, O. Aras¹***¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Bioengineering, Yildiz Technical University, Istanbul, TR, ³Radiology, Istinye University, Istanbul, TR, ⁴Radiology, Istanbul University, Istanbul, TR, ⁵SÜDETAM, Sakarya University, Adapazari, TR, ⁶Pathology, Istanbul Medeniyet University, Istanbul, TR*

¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Bioengineering, Yildiz Technical University, Istanbul, TR, ³Radiology, Istinye University, Istanbul, TR, ⁴Radiology, Istanbul University, Istanbul, TR, ⁵SÜDETAM, Sakarya University, Adapazari, TR, ⁶Pathology, Istanbul Medeniyet University, Istanbul, TR

Purpose: To prospectively evaluate whether transarterial embolization with biodegradable Flutamide-loaded PLA/PLGA microspheres with sustained release properties in the prostate of swine can induce shrinkage in the volume of prostatic tissue. Flutamide is a strong nonsteroidal antiandrogen acts as selective, competitive and silent antagonist.

Material and Methods: Sustained release Flutamide-loaded polylactide/poly (lactic-co-glycolic acid) (PLA/PLGA) microspheres were successfully fabricated using the single emulsion (o/w) solvent evaporation method in our preliminary study. Twelve male swine were randomly assigned to either the experimental group (n=6) or control group (n=6). Selective angiography was performed to deliver microspheres. In the experimental group, 200–700 micron in diameter Flutamide-loaded microspheres were used for embolization. 250 mg of total flutamide was used per procedure. 6 weeks later animals euthanized for necropsy, the prostates were removed for size measurement and histopathologic examination. Paired Student t test was used for statistical analysis.

Results: All procedures were technically successful. The mean prostate volume after embolization in the experimental group was significantly ($P<0.001$) diminished compared with the mean prostate volume for the control group. Microscopic examination showed that normal gland structure was partially replaced by fibrosis and atrophy in the residual gland tissue.

Conclusion: Embolization of the prostatic arteries with Flutamide-loaded PLA/PLGA microspheres can induce strong shrinkage of the prostate. This study shows that transarterial targeted embolization of prostatic arteries with Flutamide-loaded PLA/PLGA microspheres with sustained release properties may provide an effective alternative approach to the treatment for benign prostatic hyperplasia in humans.

1902.10

An ex vivo bench and perfused liver assessment and extension of the ablation zone by “EdgeBoost” with IR-Circle: a new bipolar ablation device

K.H. Altoukhi, J. Akhter, A. Mekkawy, N.A. Alzahrani, S.J. Valle, D.L. Morris
Department of Surgery, St. George Hospital, Sydney, NSW, AU

Purpose: There is an unmet need in ablation technology to produce large and spherical ablations. The aim of this study was to create ablations via a rotational technique using a new minimally invasive probe whilst maintaining ablation size and sphericity.

Material and Methods: The new device entails single-sided deployable coils with a reduced probe needle diameter (16mm). The device ablates ‘outside in’ and larger ablations are created via a rotational technique. The devices used had 3x2 cm or 3x1.5 cm diameter overlapping coils. EdgeBoost was created via multi-dimensional redeployment of the bipolar coils in the same tract by rotating the device’s orientation and deploying coils lateral to the initial ablation area. Ex vivo bovine liver was used for all experiments. Multiple set deployment angles were used. Perfused experiments were performed.

Results: A total of 37 ablations were performed. An ablation size of 7.5 x 6 x 7 cm was achieved in 3 consecutive ablations using the 3 x 2 cm diameter coils with a 1.6 mm probe needle in an outside in approach via multi-dimensional EdgeBoost at 0/180° and 90/270° placements. Using the 0°, 180°, 45/315°, 135/225° dimensions, the mean ablation size for the 3 x 1.5 cm probe ex-vivo was 4.5 x 4.2 x 5 cm. When repeated in the perfused liver model, the mean ablation size was 5.1 x 5.1 x 5 cm with a mean ablation time of 13.2 minutes. Using the 3 x 2 cm probe in the perfused liver model, the mean ablation size was 5.8 x 5.4 x 5.7 cm.

Conclusion: The new probe shows promising potential as minimally invasive approach, to produce large ablations. Additionally, the EdgeBoost increases ablation diameter by over 1cm whilst maintaining relative sphericity.

Posters

Kidney

P-1

Safety of percutaneous renal cryoablation: an international multicentre experience from the EuRECA retrospective database

J. Garnon¹, D.J. Breen², A. King², B. Lagerveld³, M.J.L. van Strijen⁴, T. Nielsen⁵, F. Keeley⁶

¹Interventional Radiology, University Hospital of Strasbourg, Strasbourg, FR, ²Department of Radiology, Southampton University Hospitals, Southampton, UK, ³Urology, Onze Lieve Vrouwe Gasthuis, Amsterdam, NL, ⁴Dept. of Radiology, Sint Antonius Hospital, Nieuwegein, NL, ⁵Urology, Aarhus University Hospital, Aarhus, DK, ⁶Urology, Bristol Urological Institute, Bristol, UK

Purpose: To scrutinise the safety profile of percutaneous cryoablation for renal tumors measuring less than 7cm utilising data extracted from an international multicentre registry.

Material and Methods: A retrospective review of all immediate and delayed complications from a multicentre database (EuRECA) was performed, and were categorised according to the Clavien-Dindo (C-D) classification. Statistical analysis was performed for both overall complications (Clavien-Dindo 1 to 5) and major complications (Clavien-Dindo 3 to 5). The following criteria were identified as potential predictive factors for complications: centre number, modality of image guidance, tumor size (<4 cm or >4 cm), number of tumors treated in the same session (1 or >1), and tumor histology.

Results: 713 renal tumors underwent ablation in 647 individual sessions. Mean lesion size was 2,8 cm (range 0,8 – 6,7). There were 609 tumors (84%) measuring 4 cm or less, and 104 (16%) measuring more than 4 cm. Histopathology included 486 Renal cell carcinomas (RCC), with clear cell being the most frequent subtype. Per-procedural modality of image guidance included Computed-Tomography (CT) (78% of procedures), cone-beam CT (12,5%) and Magnetic resonance imaging (MRI) (9,5%). 54 complications (Clavien-Dindo 1 to 5) occurred as a result of the 647 procedures, corresponding to an overall complication rate of 8,3%. The most frequent complication was bleeding (3,2%), with 9 cases (1,4%) requiring subsequent treatment. The rate of major complication was 3,4%. The only statistically significant prognostic factor for a major complication was a tumour size >4 cm.

Conclusion: Percutaneous renal cryoablation has an excellent safety profile. Tumours > 4 cm are associated with a higher risk of major complications.

P-2

A web-based and user-friendly planning tool to predict outcome for percutaneous cryoablation of renal tumours including validation of the simulation model

T.J. van Oostenbrugge¹, J. Heidkamp², P. Voigt³, M. Moche³, P. Weir⁴, P. Mariappan⁴, R. Flanagan⁴, M. Pollari⁵, S. Payne⁶, R. Ellerweg⁷, M. Kolesnik⁸, H. Langenhuisen¹, S. Jenniskens², J.J. Fütterer⁹

¹Urology, Radboudumc, Nijmegen, NL, ²Radiology and Nuclear Medicine, Radboudumc, Nijmegen, NL, ³Department für Bildgebung und Strahlenmedizin, Universitätsklinikum Leipzig AöR, Leipzig, DE, ⁴NUMA, NUMA, Dublin, IE, ⁵Department of Neuroscience and Biomedical Engineering, Aalto-korkeakoulusäätö, Helsinki, FI, ⁶Institute of Biomedical Engineering, University of Oxford, Oxford, UK, ⁷Life Science Informatik, Fraunhofer Institute for Applied Information Technology, Sankt Augustin, DE, ⁸Fraunhofer Institute for Applied Information Technology, Fraunhofer Institute for Applied Information Technology, Sankt Augustin, DE, ⁹Diagnostic and Interventional Radiology, Radboud University, Nijmegen, NL

Purpose: To develop and validate a web-based planning tool to predict outcome for percutaneous image-guided cryoablation of renal tumors.

Material and Methods: A web-based environment including a viewer, segmentation and registration tools, and simulation model was developed. 20 cryo-procedure scans (1 CT-, 19 MRI-guided) were used to validate the performance of the simulation model. The kidney and tumor were segmented on the planning CT/MRI. The intra-operative scans were registered to the pre-operative images. This generated needle coordinates likewise to the original situation. A simulation was executed which estimated the cryoablation lesion. The real lesion was segmented using a 1-month follow-up scan and was quantitatively compared to the predicted lesion. Outcomes were: 1) sensitivity (SN), a ratio between the combined volume of the simulated lesion (Σ) plus the real lesion (S) and S alone (low ratio meaning more underestimation) and 2) the positive predictive value (PPV), a ratio between the combined volume of Σ plus S and Σ (low ratio meaning more overestimation). A ratio of 1.0 means a perfect match between S and Σ . Also the average absolute error (α) in mm between the boundaries of Σ and S was measured.

Results: Mean tumor size was 27 mm (12-44). Mean SN, PPV and α were 0.89 (SD \pm 0.10), 0.53 (SD \pm 0.23) en 3.76 mm (SD \pm 2.34).

Conclusion: We present a planning tool to predict the outcome for cryoablation of renal tumors. Based on the first validation results further refinement of the simulation model is needed.

P-3**What could be the optimal type of embolic agent and interval for transarterial embolization (TE) prior to CT-guided thermal ablation (TA) of renal tumors? – histopathologic considerations on the basis of pre-operative renal tumor embolization data**

C.M. Sommer¹, G.M. Richter², F. Pan¹, D.F. Vollherbst³, T.D. Do¹, P.L. Pereira⁴, H.U. Kauczor¹, K. Kriegsmann⁵, G. Hatiboglu⁶, M. Kriegsmann⁷

¹Diagnostic and Interventional Radiology, University Hospital Heidelberg, Heidelberg, DE, ²Clinic for Diagnostic and Interventional Radiology, Stuttgart Clinics, Stuttgart, DE, ³Department of Neuroradiology, University Hospital Heidelberg, Heidelberg, DE, ⁴Radiology, Minimally Invasive Therapies and Nuclearmedicine, SLK-Clinics GmbH Heilbronn, Ruprecht-Karls-University Heidelberg, Heilbronn, DE, ⁵Department of Internal Medicine V, University Hospital Heidelberg, Heidelberg, DE, ⁶Department of Urology, University Hospital Heidelberg, Heidelberg, DE, ⁷Department of Pathology, University Hospital Heidelberg, Heidelberg, DE

Learning Objectives: To describe histopathologic aspects in resection specimens after pre-operative renal tumor embolization with intention of knowledge transfer in terms of optimization of Transarterial Embolization (TE) prior to CT-guided thermal ablation (TA) of renal tumors.

Background: TE prior to CT-guided TA of renal tumors is an interesting approach to simplify CT-guidance (due to permanent tumor visualization), to decrease the rate of hemorrhage during needle positioning (due to tumor devascularization), and to increase the rate of A0 ablation (e.g. due to reduction of heat-sink/cold-sink effects). According to the literature, TE prior to CT-guided TA is promising (and recommended) especially for large tumors (e.g. T1b) and tumors in difficult locations (e.g. endophytic T1a). However, there is no dedicated publication describing the impact of type of embolic agent and interval on embolization outcome. For potential knowledge transfer, pre-operative renal tumor embolization data is analyzed with a focus on histopathology.

Clinical Findings/Procedure: Between 03/2003 and 09/2018, 159 patients underwent pre-operative embolization of different types of renal tumors. For TE, fluid embolics (e.g. histoacryl/iodized oil or Ethibloc/iodized oil), particulate embolics (e.g. very small microspheres), and coils or plugs, or combinations, were used. The interval "embolization-resection" was 2.2±11.7 days (0–113). Available resection specimens were used to describe histopathologic aspects (e.g. distribution/occlusion patterns of embolic agent and embolization-associated hemorrhage/inflammation). Different cases are discussed.

Conclusion: For pre-operative embolization of renal tumors, both type of embolic agent and interval have significant impact on different histopathologic aspects. Specific knowledge transfer is helpful in terms of optimization of TE prior to CT-guided TA of renal tumors.

P-4**Percutaneous thermoablation of small renal masses (T1a) in surgical candidate patients: oncologic outcomes**

R.N. Zangiacomo¹, G.L.P. Martins², P.C.C. Viana³, M.A. Arap³, W. Nahas⁴, M. Srougi⁴, G.G. Cerri⁵, M.R. Menezes²

¹Interventional Radiology, Radiology Institute of University of São Paulo, São Paulo, BR, ²Interventional Radiology, ICESP, São Paulo, BR, ³Interventional Radiology, Hospital Sírio Libanês, São Paulo, BR, ⁴Urology, Hospital Sírio Libanês, São Paulo, BR, ⁵Radiology, Hospital Sírio Libanês, São Paulo, BR

Purpose: Evaluate the oncological outcomes of percutaneous thermoablation (pTA) used as first-line therapy for small renal masses (T1a) in healthy and surgical candidate patients.

Material and Methods: Institutional review board-approved retrospective review of data in 85 surgical candidate patients (ASA physical status of 1–2), with 95 biopsy-proven malignancy renal masses (T1a), treated with pTA between November 2010 and July 2016 with a minimal of 24 months follow-up. Local tumor progression-free (LTPFS), metastases-free, cancer specific-free and overall survival (OS) rates calculated using Kaplan-Meier method. Descriptive analysis was also calculated.

Results: Median tumor size was 2.3 cm (range, 0.7–4.0 cm). Median follow-up was 57.2 months (range, 24–117 months). No residual tumor was found at the first imaging follow-up. Local tumor progression were detected in four patients (4.1%) and were retreated successfully with pTA. No patient developed metastatic renal cell carcinoma and none died from renal tumor. The median LTPFS was 54.7 months and 5-yr LTPFS rate was 97.3%. Median and 5-yr OS were 57.2 months and 93.3%, respectively. Three patients presented with major complications including ureteropelvic junction stenosis, active bleeding and urinary obstruction due to ureteral blood clots. Limitations include retrospective review, selection bias and a small population sample.

Conclusion: In a cohort of sporadic T1a SRM, pTA can be a viable and effective option as first line therapy in surgical candidate patients, with oncologic outcomes comparable to standard surgical treatments.

P-5**Safety and oncologic efficacy using an innovative liquid nitrogen-based cryogenic device in SRMs**

T.L. Gasper¹, R. Sachner¹, S. Croitoru¹, K. Dorfman¹, Y. Halpern¹, S. Shprits², O. Avitan², Z. Bahouth², O. Nativ², A. Zisman³

¹Radiology, Bani Zion Medical Center, Haifa, IL, ²Urology, Bani Zion Medical Center, Haifa, IL, ³Urology, Assaf Harofeh Medical Center, Be'er Ya'akov, IL

Purpose: We assessed safety, efficacy, and oncologic outcomes of the new innovative Liquid Nitrogen device in patients with early-stage (T1a) SRMs.

Material and Methods: 74 patients (mean age: 69 y; 68% males) with 78 lesions were treated (mean: 2.35 cm); Mean R.E.N.A.L score was 6.53; 16% were endophytic.

Patients were screened by CT/MRI for SRMs ≤ 4.0 cm. Percutaneous cryoablation performed in all patients under CT with sedation/light general anesthesia. cryoablation was performed using ProSense™; (10G/13G; IceCure Medical Ltd, Caesarea, Israel). It's extremely low temperatures (-196°C) produces larger lethal zone per needle. was done in two cycles of freezing with intervening passive thaw. Average freezing cycles: 22 minutes. Average procedure time: 50.5 minutes. Patients underwent imaging and clinical surveillance every 3 months of year 1 and annually thereafter. Oncologic success was indicated by a reduction in lesion size and lack of enhancement on CT or MRI. Safety was determined by monitoring Creatinine and (Hb) levels.

Results: Ablation was oncologically successful in all 78 lesions; mean Cr and Hb levels remained unchanged. 45 lesions have been followed in 42 patients for ≥ 12 months (mean: 18.2 mo). 3 treatment failures occurred (6.6%) – of them one is a candidate for repeat procedure. One serious event was noted; new-onset ipsilateral hydronephrosis in a patient treated for a complex medial lower pole lesion (1.2%).

Conclusion: Cryoablation of SRM with innovative Liquid Nitrogen cryogenic device is feasible and safe procedure with similar oncologic results as NSS and with low rate of serious adverse events.

P-6

A comparative evaluation of procedural and therapeutic outcomes of thermal ablation for T1b vs T1a renal cell carcinoma

W. Zhou¹, S. Herwald¹, R. Arellano²

¹Radiology, Tufts University School of Medicine, Boston, MA, US,

²Division of Interventional Radiology, Massachusetts General Hospital, Boston, MA, US

Purpose: To compare the perioperative and oncological outcomes of computed tomography (CT)-guided thermal ablation for T1bN0M0 renal cell carcinoma (RCC) relative to T1aN0M0 RCC.

Material and Methods: A retrospective analysis of 392 patients (M:F = 265:127, mean age = 71 yrs) who underwent CT-guided thermal ablation between October 2006 and December 2017 was performed. RCC tumors were classified as T1a (<4 cm diameter) or T1b (4-7 cm diameter). Procedural time, rate of major complications and treatment response were compared between T1a and T1b RCCs. Local recurrence-free survival, metastatic-free survival and overall survival rates were tabulated using the Kaplan-Meier method and compared with log-rank tests.

Results: Of the 402 biopsy-proven cT1N0M0 RCC that were treated with percutaneous CT-guided thermal ablation, 340 (84%) were T1a and 62 (16%) were T1b RCCs. The rate of major complications was significantly higher in T1b tumors (4/58, 6%), compared to T1a RCCs (5/335, 2%; $p = 0.03$). Procedural time, ablation time and the rate of residual disease were similar between T1a and T1b RCCs ($p = 0.41$, $p = 0.29$, $p = 0.62$ respectively). At five-years' follow-up, there was no significant difference in the rates of local recurrence-free survival, metastatic-free survival and overall survival between T1a and T1b RCCs.

Conclusion: Thermal ablation is an effective treatment option for T1b RCC, providing comparable perioperative and oncological outcomes relative to T1a RCC. However, thermal ablation of T1b RCC poses a higher risk of major complications and therefore may require careful planning.

P-7

Image-guided thermal ablation for renal cell cancer: evaluation of long-term oncological outcomes in patients with at least 5 years of follow-up

W. Zhou¹, S. Herwald¹, R. Arellano²

¹Radiology, Tufts University School of Medicine, Boston, MA, US,

²Division of Interventional Radiology, Massachusetts General Hospital, Boston, MA, US

Purpose: To assess the long-term oncological effectiveness of image-guided percutaneous thermal ablation for cT1N0M0 renal cell carcinoma (RCC).

Material and Methods: A retrospective review of 152 consecutive patients (M:F = 99:53, mean age = 72 yrs) who underwent thermal ablation between December 2002 and August 2012 with a minimal imaging follow-up time of 5 years (mean = 7.4 yrs, SD = 1.7 yrs) was performed. Assessment of treatment efficacy and rate of complications was performed. Local recurrence-free, metastatic-free and overall survival rates were tabulated using the Kaplan-Meier method.

Results: 158 biopsy-proven recurrent RCC measuring 0.4 to 6.1 cm (mean = 2.8 cm) were treated with CT-guided thermal ablation. There were no major complications reported. Residual disease was observed in 10/158 (6%) of cases, all of which were successfully re-treated with thermal ablation. Local recurrence occurred in 14/158 (9%) of cases. At 10 years' follow-up, the estimated overall survival rate was 94% (95% CI: 87%–98%), local-recurrence free survival was 84% (95% CI: 82%–95%), and metastatic-free survival was 90% (95% CI: 80%–93%).

Conclusion: A long-term follow up of image-guided percutaneous thermal ablation shows a low risk of recurrence and a durable survival benefit, supporting thermal ablation as a reliable treatment strategy for cT1 RCC. Future studies will help elucidate the optimal imaging surveillance strategy for recurrent disease after thermal ablation.

Liver

P-8

Comparison of four different transarterial regimens for treatment of hepatocellular carcinoma – a retrospective study

A. Almat'hami¹, H. Alobaidi¹, Y. Alzahrani², R. Zener³, D. Wiseman³, A. Mujoomdar³

¹Interventional Radiology, Prince Sultan Military Medical City, Riyadh, SA, ²Interventional Radiology, King Abdulaziz Medical City, Riyadh, SA, ³Victoria Hospital – Interventional Radiology, London Health Sciences Centre, London, ON, CA

Purpose: This single-center retrospective study aims to compare four different regimens of trans-arterial chemoembolization (TACE) for the treatment of unresectable hepatocellular carcinoma (HCC) to assess tumor response, time to progression, and median survival.

Material and Methods: 98 TACE procedures on 88 patients (77 males, 11 females; mean age 68.4 years) performed between June 2007 and July 2014 for patients with unresectable HCC were included. Four groups based on regimen were compared. This includes 10 patients treated with I-131-lipiodol combined with cisplatin and doxorubicin (Group A), 15 patients treated with cisplatin and doxorubicin mixed with lipiodol (Group B), 53 patients treated with doxorubicin mixed with lipiodol (Group C), and 10 patients treated with doxorubicin-eluting beads (DEB-TACE) (Group D). The outcome measures reviewed were imaging response, time to progression (TTP), technical success, and median survival. The tumor measurements were analyzed based on mRECIST criteria. Statistical analysis was performed using ANOVA and post-hoc Tukey's test.

Results: There is no statistically significant difference in the baseline tumor size among the study groups $P=0.67$. A complete response to the treatment was slightly higher in group B, and C (15% and 13% respectively) compare to groups A and D (10%). The median TTP was shorter in group A (4.0 months) compare to (6.0 months) in group B, C, and D. There is no significant difference in median survival among the study groups ($P=0.96$).

Conclusion: There is no significant difference in imaging response, TTP and survival between single agent TACE, dual agent TACE, radio-chemoembolization with dual agents and DEB-TACE.

P-9

Coaxial liver biopsy vs. direct puncture for liver biopsy: a retrospective cohort study

R. Varela Ponte¹, N. Martinez Lago², M. Vieito Villar³, J.M. Carreira Villamor¹

¹Radiology, Complejo Hospitalario Universitario de Santiago, Santiago De Compostela, ES, ²Medical Oncology, University Hospital of A Coruña, A Coruña, ES, ³Drug Development Unit, Vall d'Hebron Oncology Institute, Barcelona, ES

Purpose: To evaluate initial results and to compare the technique of coaxial biopsy with direct needle biopsy in the biopsy of space-occupying lesions in the liver.

Material and Methods: We conducted a unicentric, observational, retrospective, cohorts study of patients undergoing percutaneous liver biopsy of space-occupying lesions between December 2012 and February 2018 at the University Clinical Hospital of Santiago de Compostela. Data were analyzed for a correlation between the technique of biopsy (coaxial vs direct puncture) and clinicopathological characteristics, number of cylinders extracted, failed biopsies and complications.

Results: We included 295 biopsies, belonging to 277 patients. The median age was 69 years (range 32-88), 64.1% males, 45.1% previous diagnosis of neoplasia, 82.4% were inpatient procedures. Direct puncture was found in 48.1% and coaxial in 51.9%. Risk factors associated with complications show no statistical differences between patients included in both techniques (right hepatic lobe involvement 65.1%, upper hepatic segments involvement 45.4%, proximity to the hepatic capsule 69.5%, inability to cross healthy hepatic parenchyma 24.1%, >100 mm distance to skin 14.2%, interposition of bone/vascular structures 8.5% and non-cooperating patients 3.4%). The median number of cylinders extracted was 3 (range 0-6). 90.5% of biopsies were satisfactory, 4.1% had insufficient material and 5.4% biopsies failed. Complications such as pain or hematoma were present in 3.4% of patients. Coaxial biopsy was associated with obtaining a satisfactory biopsy ($p<0.001$), more cylinders extracted ($p<0.001$) and no difference in complications percentage ($p=0.529$).

Conclusion: Coaxial biopsy was associated with obtaining better number of cylinders, lower percentage of failed biopsies; with no difference in the percentage of complications.

P-10

Comparison of the efficacy and prognostic factors of transarterial chemoembolization plus microwave ablation vs rhenium transarterial radioembolisation alone in patients with a large solitary or multinodular hepatocellular carcinomas

B.R. Raveendran Sheela

Clinical Imaging and Interventional Radiology, Aster Medcity, Kochi, IN

Purpose: To evaluate the efficacy and prognostic factors associated with transcatheter arterial chemoembolization (TACE) combined with microwave ablation (MWA) versus Rhenium TARE alone for a large solitary or multinodular hepatocellular carcinomas (HCCs).

Material and Methods: This retrospective study involved 88 patients with a large solitary or multinodular HCCs (not more than 10 tumors) who underwent TACE + MWA ($n=40$) or Rhenium TARE alone ($n=48$) between August 2016 and August 2018. Local tumor control, survival outcomes, and complications were compared between the two groups. Prognostic factors for time to progression (TTP) and overall survival (OS) were evaluated by univariate and multivariate analyses.

Results: The median duration of follow-up was 12 months (range, 4–24 months). The median TTP and OS were 12.5 months and 24 months, respectively, for the TACE + MWA group and 6.7 months and 17.1 months, respectively, for the TARE group ($p < 0.001$). The 1, 2 year OS rates were 85.9 and 59.8 % 32.6%, respectively, for the TACE + MWA group and 59.0 and 40.4% for the rhenium TARE group ($p < 0.001$). The corresponding recurrence rates were 47.8 and 78.3% for the TACE + MWA group, respectively, and 74.7 and 96.4% respectively, for the TARE group ($p < 0.001$).

Conclusion: TACE + MWA appears to have more advantages compared to Rhenium TARE in prolonging OS, with a satisfactory TTP, for inpatients with solitary large or multinodular HCCs.

P-11

Intermediate/advanced HCC, SIRT and balloon-occlusive microcatheter: the right way?

A. Paladini¹, G.E. Vallati², G. Pizzi², F. Cappelli²

¹Diagnostic and Interventional Radiology, "Maggiore della Carità" Hospital, Novara, IT, ²Diagnostic and Interventional Radiology, IFO, Rome, IT

Purpose: Use of selective internal radiation therapy (SIRT) with 90-Yttrium resin microspheres (Y90-ms) for hepatocellular carcinoma (HCC) is increasing, and need for quantification and dosimetry is becoming more widespread to facilitate treatment planning and dose delivery verification. The use of new balloon microcatheter for Y90-ms infusion is a promising innovative technique potentially improving dose distribution within tumor. The aim of this study was to quantitatively evaluate the benefits of using Occlusafe microcatheter in terms of 3D dose distribution as predictor of patients' outcome.

Material and Methods: An enrollment of 10 patients with unresectable HCC who underwent planning pre-SIRT phase was performed. Volumes of the normal liver and tumor were contoured using a software based on pre- and post-treatment SPECT/CT images. Two radiologists performed a qualitative volumetric evaluation in a blinded and randomized fashion using mRECIST parameters. Quantitative analysis of activity distribution based on pre- and post-treatment imaging and dose gradient was performed using a home-made tool for tumor/non-tumor (T/NT) evaluation.

Results: Higher T/NT ratio was observed on pre- and post-SIRT images thanks to the use of Occlusafe microcatheter compared with our historical cohort. In particular, the agreement of dose-distribution pre- and post-SIRT was observed in 100% patients, higher than 80% previously reported by our group. The evaluation of the two radiologists, using mRECIST parameters, showed a high dose-outcome relationship.

Conclusion: Volumetric and activity distribution of superselective angiography pre- and post-treatment confirm Occlusafe microcatheter as an improved strategy for increase T-NT ratio and dose distribution prediction in SIRT procedure thus increasing the predictive capability of treatment planning.

P-12

Response to SIRT (Selective Internal Radiation Therapy) in patients affected by unresectable multifocal intra-hepatic cholangiocarcinoma: results of a preliminary study

A. Paladini¹, G.E. Vallati², G. Pizzi², F. Cappelli²

¹Diagnostic and Interventional Radiology, "Maggiore della Carità" Hospital, Novara, IT, ²Diagnostic and Interventional Radiology, IFO, Rome, IT

Purpose: The aim of this paper is to demonstrate the results in terms of overall survival (OS) and response to treatment in a cohort of 43 patients (Pt) affected by unresectable multifocal intra-hepatic cholangiocarcinoma (ICC) and treated with SIRT.

Material and Methods: Between 2011 and 2018, we treated 43 Pt affected by multifocal ICC with SIRT. Response to treatment was evaluated after 2 TC performed at 3 and 6 months.

Results: The 3-month radiological evaluation was performed on 40 Pt following the mRECIST criteria with the analysis of complete (CR) or partial (PR) response to treatment, stability (SD) or progression disease (PD). Analyzing the target lesions, the response to treatment (CR + PR) was 20% according to the RECIST 1.1 criteria, 70% according to mRECIST and 60% according to the EASL criteria. The median OS was 17.9 months (range: 14.3-21.4 months). A shorter OS was found in Pt treated with medical or surgical therapies before SIRT: 16 versus 52 months of the Pt treated only with SIRT. We reported a greater correlation between OS and CR and PR according to the mRECIST and EASL criteria compared to RECIST 1.1 criteria. Treatment was well tolerated and no mortality was seen in the first 30 days post-treatment. No peri-procedural complications were documented.

Conclusion: SIRT documented excellent results in terms of efficacy in Pt affected by ICC and portal thrombosis also. It is a safe and repeatable treatment and therefore it is a valid loco-regional therapy in Pt affected by unresectable ICC.

P-13

Health-related quality of life evaluation in "left" versus "right" access for percutaneous transhepatic biliary drainage using EORTC QLQ-BIL-21 questionnaire

D.G. Castiglione¹, C. Gozzo¹, G. Caltabiano², S. Palmucci³, A. Basile³, A. Musumeci³, L. Mammìno³

¹Radiological Sciences – Dibimed, AOUP Paolo Giaccone- Palermo, Palermo, IT, ²Department of Interventional Radiology, "ARNAS" Garibaldi Hospital, Catania, IT, ³Unità di Radiodiagnostica e Radioterapia Oncologica, Azienda Ospedaliero Universitaria "Policlinico-Vittorio Emanuele", Catania, IT

Purpose: To investigate the impact of the different access for percutaneous transhepatic biliary drainage (PTBD) in term of "Quality of Life" (QoL) in the management of malignant obstructive jaundice. Our purpose is to suggest data that can help to determine adequate supportive care and influence decision based on quality of life aspects.

Material and Methods: Patients with malignant obstructive jaundice were randomized to right or left access for PTBD. In order to demonstrate differences in term of QoL between these groups, we asked patients to give answer to "EORTC

QLQ-BIL21" questionnaire the week after the treatment. We analysed data of 60 consecutive patients with malignant obstructive jaundice admitted to our hospital from February 2017 to April 2018.

Results: Percutaneous Transhepatic Biliary Drainages were performed through right access in 30 cases (subgroup A) and 30 cases through left access (subgroup B). During one week's follow-up, there was an extremely significant difference ($p < 0.001$) between subgroup A and B in term of pain. In particular subgroup A shows higher intercostal pain and respiratory difficulties compared to subgroup B.

Conclusion: Both right and left access are similar in terms of technical success and resolution of jaundice. In our experience, the right access is associated with greater intercostal pain and more respiratory difficulties compared to the left one. Left access for PTBD offers a better Quality of Life and it is of critical importance to assess the meaning of this consideration in performing PTBD when both access are feasible.

P-14

Propofol vs midazolam sedation for percutaneous radiofrequency (RFA) and microwave ablation (MWA) in patients with hepatic malignancies: a single-center comparative analysis of two historical cohorts

R. Puijk¹, V. Ziedses des Plantens¹, S. Nieuwenhuizen¹, A. Ruarus¹, L. Vroomen¹, M. de Jong¹, B. Geboers¹, C. Hoedemaker-Boon², D. Thöne-Passchier², C. Gerçek², J. de Vries¹, H. Scheffer¹, P. van den Tol³, M. Meijerink¹

¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Anesthesiology, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Surgery, Amsterdam UMC, location VUmc, Amsterdam, NL

Purpose: In percutaneous radiofrequency (RFA) and microwave ablation (MWA), peri-procedural unrest, pain and respiratory concerns can be detrimental to achieve a safe and efficacious ablation and impair treatment outcome. The aim of this retrospective study was to compare the two most commonly used types of sedation, midazolam-fentanyl and propofol-alfentanil sedation, in patients with colorectal liver metastases (CRLM) and hepatocellular carcinoma (HCC).

Material and Methods: This IRB waived single center comparative analysis of two historical cohorts analyzed 100 patients treated for one or more hepatic malignancies from December 2012 until May 2018. Safety, peri-procedural pain perception, the 1-year local tumor progressionfree (LTPFS) and overall survival (OS) were assessed using uni- and multivariate logistic regression to correct for potential confounders.

Results: In 139 procedures (79 midazolam; 60 propofol), 206 liver tumors (159 CRLM; 47 HCC) were treated with percutaneous RFA or MWA. Propofol was superior to midazolam sedation regarding 1-year LTPFS (4/93 [4.3%] vs. 35/113 [31.0%]; [$P < 0.001$]). Sedation technique ($P = 0.001$) and administered intraprocedural (al)fentanyl dose ($P = 0.007$) were independent predictors for LTPFS. Multivariate analyses revealed that sedation technique ($P = 0.02$) and primary tumor-type ($P = 0.028$) were independently associated with LTPFS. Perception of pain during ($P < 0.001$) and directly after

treatment ($P < 0.001$) was significantly worse in patients who received midazolam sedation.

Conclusion: Compared to midazolam, propofol sedation diminishes the peri-procedural perception of pain and improves local tumor progression-free survival. Hence, propofol sedation reduces the number of repeat procedures required to eradicate hepatic malignancies and should be favored over midazolam sedation.

P-15

Major impact of personalised dosimetry on the targeted tumor response using 90Y loaded glass microspheres SIRT in HCC: results of a prospective and multicentric randomized study

E. Garin¹, L. Tselikas², B. Guiu³, J. Chalaye⁴, J. Edeline⁵, S. Laffont¹, T. de Baère⁶, C. Cassinotto³, T. Tacher⁴, M. Terroir-Cassou-Mounat¹, F. Ben Bouallègue⁷, G. Amadeo⁸, X. Palard¹, B. Campillo-Gimenez⁹, Y. Rolland¹⁰

¹Nuclear Medicine, Cancer Institute Eugène Marquis, Rennes, FR, ²Interventional Radiology, Gustave Roussy – Cancer Campus, Villejuif, FR, ³Radiology, CHU Montpellier, Montpellier, FR, ⁴Nuclear Medicine, CHU Henri Mondor, Créteil, FR, ⁵Oncology, Cancer Institute Eugène Marquis, Rennes, FR, ⁶Dept. of Interventional Radiology, Institut Gustave Roussy, Villejuif, FR, ⁷Nuclear Medicine, CHU Montpellier, Montpellier, FR, ⁸Hepatology, CHU Henri Mondor, Créteil, FR, ⁹Biostatistics, Cancer Institute Eugène Marquis, Rennes, FR, ¹⁰Interventional Radiology, Cancer Institute Eugène Marquis, Rennes, FR

Purpose: The goal of this randomized multicentric study was to evaluate tumor absorbed dose (TD) and response rate (RR) of the index lesion after 90Y loaded glass microsphere SIRT in HCC patients using a standard or a personalized dosimetric approach.

Material and Methods: 56 HCC patients with at least one lesion larger than 7cm (index lesion) were included and treated by SIRT. Treatment arm was randomly assigned (1:1). In the standard dosimetric arm (SDA) the goal was to deliver 120 ± 20 Gy to the treated volume. In the personalized dosimetric arm (PDA) the goal was to deliver at least 205 Gy to the index lesion, intensification with a dose > 150 Gy to the treated volume was allowed but without exceeding 120 Gy to the healthy treated liver. Dosimetry was based on MAA SPECT/CT. Response of the index lesion was evaluated at 3 month using EASL criteria.

Results: RR was significantly increased in the PDA versus the SDA, respectively 71.4% and 35.7%, $p = 0.007$. Mean tumor dose (MTD) was significantly higher in the PDA versus the SDA, respectively 324 ± 131 Gy and 221 ± 110 Gy, $p = 0.01$. MTD was significantly higher for responding lesions vs non responding ones, respectively 329 ± 145 Gy and 225 ± 110 Gy, $p < 10^{-3}$. RR was significantly higher for $TD > 205$ Gy vs $TD < 205$, respectively 73.3% and 36.8%, $p = 0.011$. Two early deaths (occurring within 3m from SIRT) were reported in the SDA and none in the PDA.

Conclusion: MAA SPECT/CT based personalized dosimetry with intensification is safe and significantly highly increases the response rate of large HCC. It definitely has to be used in new RCT trial evaluating SIRT efficacy.

P-16**Ablation of colorectal liver metastases by irreversible electroporation: final results of the COLDFIRE-2 trial**

M. Meijerink¹, A. Ruarus¹, L. Vroomen¹, R. Puijk¹, B. Geboers¹, J. de Vries¹, K. Nielsen², G. Kazemier², K. van Lienden³, P. van den Tol², H. Scheffer¹

¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Surgery, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Radiology and Nuclear Medicine, Amsterdam UMC, location AMC, Amsterdam, NL

Purpose: Irreversible electroporation (IRE) is a primarily non-thermal image-guided tumor ablation technique that has shown promise to eradicate tumors nearby critical blood vessels, bile ducts and intestines. The aim of the COLDFIRE-2 trial was to investigate the safety and efficacy of IRE for unresectable colorectal liver metastases (CRLM) unsuitable for thermal ablation.

Material and Methods: This single-arm, two center phase 2 clinical trial included 50 patients with 18F-FDG PET-avid CRLM \leq 3.5 cm considered unsuitable for surgery and thermal ablation according to a multidisciplinary expert panel. The primary endpoint was technique efficacy. Secondary aims were safety, technical success, local control following repeat procedures, disease-free and overall survival.

Results: Between April 2014 and September 2018, 50 patients with 61 CRLM were treated with IRE. Technical success was 98%; in 1 patient treatment was stopped prematurely due to a serious cardiac arrhythmia triggered by the electrical pulses. After treatment, 69% of the lesions were completely eradicated. Following repeat procedures, local control was reached in 85% of patients. Ten minor complications and 16 major complications (14 grade III, 2 grade IV) occurred in 20 patients. One patient died within 90 days after IRE.

Conclusion: IRE represents a relatively safe and effective ablation method to eradicate CRLM \leq 3.5 cm considered unsuitable for surgery and thermal ablation. Given the local control, IRE should currently not be considered for resectable or thermally ablatable CRLM. The local control rate, the low toxicity and the parenchyma sparing character of IRE justifies a future study comparing IRE to stereotactic body radiotherapy (COLDFIRE-3).

P-17**Combined percutaneous microwave ablation (MWA) and transarterial chemoembolization (TACE) for hepatocellular carcinoma**

G. Poggi, B. Montagna, I. Palumbo, L. Franchi Bononi
Oncology, ICCP, Pavia, IT

Purpose: Thermal ablation therapies are useful for the treatment of unresectable hepatocellular carcinoma (HCC) $<$ 3 cm not suitable for surgery. However the likelihood of complete ablation declines rapidly as tumor diameter is greater than 3 cm. The combination of thermal ablation and transarterial chemoembolization (TACE) has resulted in higher

percentage of complete necrosis of the HCCs over 3 cm. Herein we report our long-term results of the combination of MWA and TACE in unresectable lesions of HCCs

Material and Methods: Between July 2009 and September 2017, 44 patients affected by 48 nodules of HCC were treated with a combination of TACE followed by percutaneous US-guided MWA. The lesions had a mean diameter of 4.07 cm (range 2.8 – 8.8 cm, SD 1.45). The size distribution of the lesions was: 9 lesions (20%) $<$ 3 cm, 27 lesions (60%) >3 & $<$ 5 cm and 9 lesions (20%) $>$ 5 cm. Percutaneous US-guided MWA was performed using the HS-AMICA (Apparatus for MICrowave Ablation; Hospital Service SpA, Aprilia, Italy).

Results: During the follow-up period of 74 months 18 patients died and 13 patients were lost to follow-up. The median survival time was 51 months. The 1-, 3- and 5-year survival rates were respectively 95.1%, 60.9% and 30.9%. Survival time was analysed according to the size of the lesions. In patients with small, intermediate and large HCCs were observed a median survival of 71, 62 and 34 months, respectively.

Conclusion: Our data showed that combination of MWA and TACE for treatment of HCCs is a feasible method with long-term survival.

P-18**Pharmacokinetic analyses in patients with unresectable hepatocellular carcinoma treated by TACE with doxorubicin drug-eluting microspheres**

K. Malagari¹, M. Burrel², M. Reig², R. Duran³, A. Digkila⁴, A. Denys⁵, M. Brunet², J. Bruix²

¹2nd Dept. of Radiology, University of Athens Medical School, Athens, GR, ²Radiology, Hospital Clinic, Barcelona, ES, ³Radiodiagnostic and Interventional Radiology, CHUV University Hospital, Lausanne, CH, ⁴Medical Oncology, CHUV, Lausanne, CH, ⁵Radiology, CHU Vaudois, Lausanne, CH

Purpose: To assess the pharmacokinetic (PK) profile, safety and efficacy of LifePearl® microspheres loaded with doxorubicin for treatment of unresectable HCC by TACE.

Material and Methods: This is a multicenter, ongoing, prospective study based on 2 cohorts. In cohort I, loading dose was escalated from 75 via 100 to 150 mg with 3 patients in each group. Blood samples, collected on pre-specified time points, were analyzed by independent laboratory. After safety evaluation of the highest dose, enrollment of additional 16 patients in cohort II started for PK and treatment efficacy evaluation. PK was evaluated according to the final dose received (\leq 75mg, 76-100mg and 101-150mg doxorubicin). Safety was evaluated within 30 days after procedure. Response was evaluated according to mRECIST in target lesions as best overall response.

Results: Study enrolled 25 patients (68% males), mean age of 73.8 \pm 8.5 years, 92 % and 8% Child-Pugh A and B respectively. Mean number of target lesions and diameter was 1.8 \pm 1.3 and 72.6 \pm 45.3 mm respectively. The mean systemic Cmax (ng/mL) at \leq 75 mg, 76-100mg and 101-150mg of doxorubicin was 286.7 \pm 220.1, 157.1 \pm 94.6 and 227.8 \pm 139.5 respectively. Three patients reported 2 AEs \geq grade 3 assessed as non-related to

LifePearl®. Four SAEs were reported in patients treated with 150 mg of doxorubicin. Objective response (70%) and disease control (85,5%) were achieved in out the 20 patients with at least one imaging control available. Significant drop of AFP levels was observed.

Conclusion: Preliminary results indicate that LifePearl® is safe and effective for the treatment of HCC. Final study results will be presented.

P-19

Treatment of unresectable HCC with doxorubicin-eluting microspheres: a single-center experience

G.A. Tovar¹, J. Sampere¹, A. García Gámez¹, V. Benito Santamaría¹, D. Balaguer², J. Villalba³
¹Interventional Radiology, Hospital Universitari Germans Trias i Pujol, Badalona, ES, ²Radiology, Hospital Universitari Germans Trias i Pujol, Badalona, ES, ³Interventional Radiology, Hospital de la Santa Creu i Sant Pau, Barcelona, ES

Purpose: To investigate safety and tumor response of transarterial chemoembolization with polyethylene glycol (PEG) drug-eluting microspheres LifePearl® microspheres (LP-TACE) in hepatocellular carcinoma (HCC) patients.

Material and Methods: This is a retrospective study of 42 adult patients with HCC who provided informed consents. Patients were treated with chemoembolization with LP-TACE loaded with doxorubicin. Adverse events were reported according to CTCAE v4 and response to treatment was evaluated according to mRECIST.

Results: Data were collected from 42 patients (83.3% males). The median age was 71.5 years (range 51.0-82.0). BCLC 0 (2.4%), A (16.7%) and B (80.9%). Child-Pugh A (85.7%) and B (14.3%). The mean number of lesions per patient was 2.1±1.3, with a mean sum of diameter of 48.2 ± 25.2 mm. A total of 81 LP-TACE procedures were reported. Up to four LP-TACE procedures were performed per patient, with a median of two. The mean dose of doxorubicin loaded into LifePearl® microspheres was 79.1±16.6 mg Best overall response was evaluated for 21 patients. Complete response was achieved in 52.4% of the patients, partial response in 33.3% and progressive disease in 14.3%. The mean number of days to best overall response was 232.2 ± 264.9. Adverse events were observed in ten out of 42 patients (23.1%) being 3 the maximum grade. Three patients (7.1%) reported grade 3 adverse events.

Conclusion: At the interim analysis, LP-TACE resulted in a safe procedure with clinically significant tumor response. Updates from the final analysis will be presented at congress.

P-20

Percutaneous stereotactic CT-based microwave ablation for neuroendocrine liver metastasis

M. Maurer¹, A. Lachenmayer², G. Beldi², D. Candinas², C. Kim-Fuchs²
¹Radiology, Bern University Hospital, Bern, CH, ²Department of Surgery, Bern University Hospital, Bern, CH

Purpose: To analyse the success of percutaneous stereotactic CT-based microwave ablation (MWA) for liver metastases from neuroendocrine tumours (NET) in terms of local recurrences or reduction of symptoms in a palliative setting.

Material and Methods: Between 01/2015 and 06/2018, 380 different hepatic tumours were ablated percutaneously in 203 patients. Of these, 18 (4.7%) ablations were done in seven patients with NET liver metastases. Median age was 69 years (54–75 years). Three primary tumours were in the pancreas, four in the small bowel and one of unknown primary. Ablations were either done in a curative setting or as a means of reducing tumour load to treat symptomatic patients.

Results: There were no peri-, and postinterventional complications. The first follow up with an MRI was done three months after the intervention, with an overall median follow up of 18.9 months (4.2–33.1). There was no local recurrence in patients treated with curative intent. One out of six patients developed new metastases in the liver and received two further sessions (five lesions) and is now tumour free. The patient with palliative ablation had a significant reduction of symptoms in the follow-up.

Conclusion: Percutaneous stereotactic CT-based MWA for patients with NET liver metastasis is a safe treatment option. Ablations can be used to treat metastasis in a curative setting or to reduce tumour load and symptoms in patients not amenable to definitive surgery. Especially patients with difficult to reach intrahepatic lesions profit from stereotactic guidance.

P-21

Chemosaturation percutaneous hepatic perfusion (CS-PHP) with Melphalan: evaluation of 2D-perfusion angiography (2D-PA) as a tool to detect leakage of venous double-balloon catheter

C.L.A. Dewald, S.K. Maschke, T.C. Meine, J. Renne, M. Kirstein, F. Wacker, B. Meyer, J.B. Hinrichs
 Radiology, Hanover Medical School, Hanover, DE

Purpose: To evaluate feasibility of 2D-PA to detect leakage of the double-balloon catheter used to isolate the hepatic inferior vena cava (IVC) in patients undergoing CS-PHP.

Material and Methods: Overall, 112 CS-PHP (09/2015-09/2018) in 52 patients were retrospectively screened for leakage of the double-balloon catheter and consecutive correction of the catheter position. Finally, 18 procedures in 12 patients were included. To detect leakage of contrast agent alongside the double-balloon using 2D-PA, acquired digital subtraction angiography (DSA) series were post-processed. A reference region-of-interest (ROI) was placed in the IVC between the upper and lower balloon. Corresponding target ROIs were placed on DSA pre- and post-balloon adjustment. Two different target ROIs were used to assess impact of localization and shape. Time to peak (TTP), peak density (PD), area under curve (AUC) and ratios of reference ROI/target ROIs were calculated.

Results: Leakages were located as follows: 15/18 cranial and 3/18 caudal. At the cranial balloon both ROIs showed a significant decrease of PDtROI/PDREF and AUCtROI/AUCREF (ROI1:p<0,0001;p<0,0001; ROI2:p<0,0001;p<0,0001) and a

significant increase of TTPtROI/TTPREF (ROI1:p=0,0009; ROI2:p=0,0003). When comparing ROI1 and ROI2 before balloon correction, PDtROI/PDREF of ROI1 was slightly higher (p=0.05), whereas TTPtROI/TTPREF and AUCtROI/AUCREF showed no significant difference. Surprisingly, following balloon correction the 2D-PA ratios of the two tested ROIs were significantly different (p<0.05).

Conclusion: Detection of leakages alongside the cranial balloon using 2D-PA is feasible. Position of the upper ROI may have an impact on the measurements.

P-22

Stereotactic image-guided microwave ablation for malignant liver tumors: can computer-assistance broaden treatment eligibility?

P. Tinguely¹, A. Lachenmayer¹, V. Banz¹, S. Weber², D. Candinas¹, M. Maurer³

¹Department of Surgery, Bern University Hospital, Bern, CH,

²ARTORG Center for Biomedical Engineering, University of Bern, Bern, CH, ³Radiology, Bern University Hospital, Bern, CH

Purpose: Treatment success of microwave ablation for liver lesions depends on tumor reachability and accurate ablation probe positioning. We investigated factors influencing targeting accuracy, procedural efficiency and technical success of percutaneous stereotactic image-guided microwave ablation (SIMWA) for malignant liver lesions.

Material and Methods: Data from all patients treated with SIMWA from 2015 to 2017 were analyzed retrospectively. A computed tomography (CT)-based navigation system was used for needle trajectory planning, stereotactic needle positioning, validation of needle positions and validation of ablation zones and technical success. Factors potentially influencing target positioning errors (TPE) of positioned ablation needles were analyzed using univariable and multivariable linear generalized estimating equations (GEE).

Results: Overall 301 lesions (174 HCC, 87 CRLM, 17 NET, 23 other) were treated in 153 patients. In 25 (8%) lesions multiple parallel needles were placed to create larger ablation zones. Correction of needle position was necessary in 4 (1%) lesions. Median TPE per ablation needle was 2.9mm (0.2–14.1mm) (n=384). Factors significantly influencing TPE were underlying cirrhosis (Mean diff. 0.686, CI 0.212–1.161), trajectory length (0.202, 0.127–0.277) and intercostal entry point (0.685, 0.015–1.3019). Subcapsular or superior dorsal lesion location (segments VII/VIII) did not influence TPE. Median time per intervention was 67 min (20–253 min), and technical success rate was 96% (290/301 lesions).

Conclusion: Due to precise trajectory planning and stereotactic needle positioning, SIMWA allows highly accurate and successful targeting of intrahepatic lesions, even for otherwise difficult-to-target tumors. This might allow broadening of treatment eligibility for patients with malignant liver tumors not reachable with conventional image-guidance.

P-23

LifePearl® Anthracyclin Registry in selective chemoembolization of patients with unresectable hepatocellular carcinoma: PARIS study preliminary results

T. de Baère¹, L. Tselikas², G. Verset³, B. Guiu⁴, M. Ronot⁵, P. Chevallier⁶, G. Sergent⁷, P. Goffette⁸

¹Dept. of Interventional Radiology, Institut Gustave Roussy, Villejuif, FR, ²Dept. of Interventional Radiology, Gustave Roussy Cancer Center, Villejuif, FR, ³Oncology, Hôpital Erasme, Brussels, BE, ⁴Radiology, CHU Montpellier, Montpellier, FR, ⁵Service de Radiologie, Hopital Beaujon, Clichy, FR, ⁶Radiologie, CHU Archet, Nice, FR, ⁷Radiology, CHRU Lille, Lille, FR, ⁸Radiology, Cliniques Universitaires Saint Luc, Brussels, BE

Purpose: To assess liver toxicity, safety and treatment efficacy of LifePearl® microspheres loaded with anthracycline for Transarterial Chemoembolization (LP-TACE) in patients with unresectable hepatocellular carcinoma (HCC).

Material and Methods: Multicenter, prospective, single arm study of HCC patients treated with LifePearl® loaded with doxorubicin or idarubicin with safety as a primary end point. Liver toxicity was assessed by CT or MRI and blood test obtained after LP-TACE. Tumour response was reported as a best overall response and evaluated according to mRECIST.

Results: Out of 102 enrolled patients 93.14% were males, with mean age of 65.94±10.4 years and 81.19% with cirrhosis (95.5% Child Pugh A and 4.5% B). The mean number of HCC lesions was 2.5±1.9 and mean sum of diameters of tumors was 70.0±39mm. A total of 173 LP-TACE were performed. Seventy-five patients (77,3%) were treated with doxorubicin and 22 (22.6%) with idarubicin with a mean dose of 74.4±22mg and 11.7±4mg, respectively. Adverse events were reported for 58 patients. Serious adverse events were reported in 18 patients, in four of them possibly or probably related to LifePearl®. Different types of liver/biliary toxicities were detected in 17 patients (16.3%), including 3 acquired bilomas. Objective response and disease control rates were 72.1% and 96,5% respectively in 86 patients with at least one imaging control available with no differences in between doxorubicin and idarubicin treated patients.

Conclusion: LP-TACE showed relatively low liver toxicity and very high disease control rate in patients with unresectable HCC.

P-24

Comparison of the efficacy and prognostic factors of transarterial chemoembolization plus microwave ablation vs transarterial chemoembolization alone in patients with a large solitary or multinodular hepatocellular carcinoma

L. Zheng, H.L. Li, C.Y. Guo

Department of Minimal-invasive Intervention, The Affiliated Cancer Hospital of Zhengzhou University, Henan Cancer Hospital, ZhengZhou, CN

Purpose: To evaluate the efficacy and prognostic factors associated with TACE combined with microwave ablation (MWA) versus TACE alone for a large solitary or multinodular HCC.

Material and Methods: This retrospective study involved 258 patients with a large solitary or multinodular HCCs (not more than 10 tumors) who underwent TACE+MWA (n = 92) or TACE alone (n = 166) between July 2011 and April 2015. Local tumor control, survival outcomes, and complications were compared between the two groups. Prognostic factors for TTP and OS were evaluated by univariate and multivariate analyses.

Results: The median duration of follow-up was 21.2 months (range, 4–45 months). The median TTP and OS were 12.5 months and 26.6 months, respectively, for the TACE+MWA group and 6.7 months and 17.1 months, respectively, for the TACE group (P<0.001). The 1-, 2-, and 3-year OS rates were 85.9%, 59.8%, and 32.6%, respectively, for the TACE+MWA group and 59.0%, 40.4%, and 11.4%, respectively, for the TACE group (P<0.001). The corresponding recurrence rates were 47.8%, 78.3%, and 94.6% for the TACE+MWA group, respectively, and 74.7%, 96.4%, and 97.6%, respectively, for the TACE group (P<0.001). On logistic regression analyses, treatment method, tumor size, and tumor number were significant prognostic factors for TTP and OS.

Conclusion: TACE+MWA appears to have advantages over TACE in prolonging OS with a satisfactory TTP in patients with solitary large or multinodular HCC. Treatment method, tumor size, and tumor number are significant prognostic factors for TTP and OS. Further randomized, multi-center, prospective trials are required to confirm the findings of this study.

P-25

Analysis of risk factors for survival after TIPS for variceal bleeding

M.B. Pitton¹, J. Moehricke¹, S. Schotten¹, T. Zimmermann², J. Mittler³, C. Düber¹

¹Diagnostic and Interventional Radiology, University Medical Center of Mainz, Mainz, DE, ²Gastroenterology, University Medical Center of Mainz, Mainz, DE, ³Surgery, University Medical Center of Mainz, Mainz, DE

Purpose: To analyze predictors of overall survival after TIPS in patients with acute variceal bleeding.

Material and Methods: 88 patients with liver cirrhosis and variceal bleeding (63 male, 25 female) were treated with TIPS using ePTFE covered stents, 75 patients without ascites, 13 with some amount of ascites. Overall survival was analyzed and related to (1) baseline characteristics (age, sex, etiology of cirrhosis, additional diagnoses, former history of variceal bleeding, former endoscopic ligation (EBL), Child-Pugh-stage, accompanying ascites, history of spontaneous bacterial peritonitis (SBP), hepato-renal syndrome (HR), hepatic encephalopathy (HE), hemodialysis, and laboratory tests (INR, creatinine, bilirubin, albumin, thrombocytes)), (2) procedural complications, and (3) hemodynamic outcome parameters (portosystemic pressure gradient, PSG) after TIPS.

Results: TIPS was technically successful in all cases with a 98.9% primary success rate. In one case, TIPS was successfully created in a second attempt. Major procedural complications occurred in 3.4% (right heart failure, cardiac fibrillation, bleeding from puncture tract). 3d-mortality rate was 11.4% (7 variceal bleeding, 2 cardiac events, 1 sepsis). Follow-up was

25.3±33.7months (range 0-136months). Overall survival at 1-, 3-, and 5-years was 54.5, 43.2, and 35.2%, respectively. The reintervention rate was 27.3% (19.3% dilatation/recanalisation, 5.7% TIPS reduction, and/or 4.5% variceal embolization). Predictive risk factors for survival were emergency-TIPS, Child-Pugh-stage, MELD, increasing age, SBP, HR, HE, extent of ascites, high grade esophageal varices, and laboratory tests. History of EBL, cardiac co-disease and PSG after TIPS were not predictive.

Conclusion: Survival after TIPS depended on clinical baseline characteristics and emergency setting. Beside clinical measures of liver function, independent co-factors like personal characteristics should be realized.

P-26

Predictive factors of survival after TIPS for refractory ascites in end-stage liver disease

M.B. Pitton¹, M. Moddemann¹, S. Schotten¹, J. Mittler², T. Zimmermann³, R. Kloeckner¹, C. Düber¹

¹Diagnostic and Interventional Radiology, University Medical Center of Mainz, Mainz, DE, ²Surgery, University Medical Center of Mainz, Mainz, DE, ³Gastroenterology, University Medical Center of Mainz, Mainz, DE

Purpose: To analyze the risk factors of overall survival after TIPS using ePTFE-covered stentgrafts in patients with refractory ascites.

Material and Methods: 213 patients with liver cirrhosis and refractory ascites (129 male, 84 female) were treated with ePTFE-covered TIPS. Patients with portal vein thrombosis, acute or subacute bleeding with need for treatment, and Budd-Chiari-Syndrome were excluded from analysis. Overall survival was analyzed depending on 1. the baseline clinical characteristics before TIPS (age, sex, etiology of cirrhosis, additional diagnoses, former history of variceal bleeding, former endoscopic ligation (EBL), Child-Pugh-stage, number of paracentesis needed, history of SBP or hepatic encephalopathy (HE), hemodialysis, INR, Bilirubin, Albumin, Creatinin), 2. procedural complications during TIPS, and 3. hemodynamic outcome (portosystemic pressure gradient, PSG) after TIPS, and hemodialysis within 4 weeks after TIPS.

Results: Overall survival was 49.4 +/- 4.7 months. Technical success was 100%, with a 97.2% primary success rate. 3d- and 30d-mortality rate was 0.9% and 8.0%, respectively. The reintervention rate was 26.8% (25.8% dilatation/recanalization, 8.9% TIPS reduction during follow-up). Significant risk factors for survival were age>70y, male gender, etiology (hepatitis vs. alcoholic), additional diagnosis (cardiac diseases, and others), creatinin, bilirubin >2mg/dl, Child-C-stage, and need for hemodialysis within 4 weeks after TIPS. Prior history of bleeding, EBL, SBP, HE, and hemodialysis before TIPS were not significant. Procedural complications and PSG after TIPS were also not statistically significant.

Conclusion: Survival after TIPS significantly depends on diverse clinical baseline characteristics. Beside clinical measures of liver function (Child-stage) and etiology of liver disease, independent co-factors like additional diagnoses and personal characteristics should be realized.

P-27**A resident's guide to hepatic venous pressure measurement: utility, technique, pitfalls and outcome studies**

A. Mai, P. Cramer, T. Braaten, A. Pillai

Diagnostic and Interventional Radiology, McGovern Medical School at The University of Texas Health Science Center, Houston, TX, US

Learning Objectives:

- To review the utility and application of hepatic venous pressure measurement in the diagnosis and management of portal hypertension.
- To illustrate the technique and some of the more common complications in measuring the hepatic venous pressure.

Background: Portal hypertension is a major complication of chronic liver disease that can cause significant morbidity and mortality secondary to the resulting ascites, splenomegaly, varices, and encephalopathy. Hepatic venous pressure measurement provides an accurate assessment of the presence and severity of portal hypertension and is increasingly becoming critical in the clinical management of portal hypertension. This presentation will provide an overview of hepatic venous pressure measurement, including its utility, how it is obtained, and guidelines for its use in the diagnosis and management of portal hypertension.

Clinical Findings/Procedure: The hepatic venous pressure measurement is obtained through hepatic vein catheterization. Specifically once a catheter has been placed in the hepatic vein, the hepatic venous pressure gradient (HVPG) is determined by measuring the pressure difference between the occluded and non-occluded hepatic vein. The HVPG can then be used to diagnose and monitor portal hypertension, determine treatment response, and quantify patient risk. Though hepatic catheterization is fairly safe, there are potentially serious complications, including the formation of hematoma or arteriovenous fistula.

Conclusion: This exhibit will educate readers on the technique of measuring a hepatic venous pressure gradient and its utility in the management of patients with portal venous hypertension.

P-28**Usefulness and safety of biliary percutaneous transluminal forceps biopsy in diagnosis of malignant biliary obstruction: single-centre experience**

F. Corvino¹, F. Giurazza¹, M. Silvestre¹, G. Cangiano¹, E. Cavaglia¹, A. Corvino², R. Niola¹

¹*Interventional Radiology, Cardarelli Hospital, Naples, IT*

²*Radiology Department, Parthenope University, Naples, IT*

Purpose: To evaluate the usefulness and safety of percutaneous transluminal forceps biopsy in patients suspected of having a malignant biliary obstruction.

Material and Methods: Fifty-five consecutive patients (35 men and 20 women; mean age, 75.6 years) with obstructive jaundice underwent percutaneous forceps biopsy. Steno-obstruction involved the common bile duct (n. 15), common hepatic duct (n. 28), hilum (n. 8), ampullary segment of the

common bile duct (n. 4) and were biopsied with 8-F biopsy forceps. The final diagnosis was confirmed with pathologic findings at surgery, additional histocytologic data or clinical and radiologic follow-up.

Results: 49 of 55 biopsies resulted in correct diagnosis of malignancy. Fifteen biopsy diagnosis were proved to be true-negative. There were ten false negative and no false-positive diagnoses. The diagnostic performance of transluminal forceps biopsy in malignant biliary obstructions was as follows: sensitivity, 82%; specificity, 100%; and accuracy 83.2%. No major complications related to biopsy procedures occurred.

Conclusion: Percutaneous forceps biopsy, easy to perform through a transhepatic biliary drainage tract, provides relatively high accuracy in the diagnosis of malignant biliary obstructions.

P-29**Percutaneous electrochemotherapy of hepatocellular carcinoma at hepatic hilum**

L. Tarantino¹, A. Nasto¹, G. Busto², R. Fristachi³, L. Cacace³, P. Tarantino⁴, R.A. Nasto⁵, S. Bortone⁶, M.R. Romano⁷, M. Fabozzi¹

¹*Surgery, A.Tortora Cancer Hospital, Pagani, IT*, ²*Oncology, A.Tortora Cancer Hospital, Pagani, IT*, ³*Pathology, A.Tortora Cancer Hospital, Pagani, IT*, ⁴*Division of Early Drug Development, European Institute of Oncology, Milan, IT*, ⁵*Surgery, University Federico II, Naples, IT*, ⁶*Radiology, A.Tortora Cancer Hospital, Pagani, IT*, ⁷*ICU, A.Tortora Cancer Hospital, Pagani, IT*

Purpose: We evaluated the feasibility, efficacy and safety of Electrochemotherapy (ECT), a non-thermal ablation technique, in a series of patients with Hepatocellular Carcinoma infiltrating the hepatic hilum (hh-HCC).

Material and Methods: 15 patients (13M,2F; 43-85 year, mean: 61 year), 11 in Child-Pugh-A, 4 in Child-Pugh-B-class, with biopsy proven hh-HCC (diameter range: 2.5-5.5 cm; mean: 3.6 cm) underwent ECT. 9 patients had complete or partial portal vein tumor thrombosis (PVTT), 6 patients had a hh-HCC next to main portal vein bifurcation. All patients underwent control of the efficacy by contrast-enhanced-MDCT 4 weeks after treatment and follow-up CT controls every 6 months thereafter.

Results: No perioperative major complication occurred. 2/15 (13%) patients died because of hemorrhage from GEV at 4 and 5 weeks after treatment. Post-treatment CT showed complete absence of enhancement of the treated nodule and/or PVTT in 11/13(85%) and partial necrosis in 2/13(15%) cases. The follow-up ranged from 15 to 36 months (median: 14 months). Follow-up-CT showed local progression of the tumor in the 2 cases of partial response. 4 patients dropped-out the follow-up at 6, 9, 10 and 12 months because of death from liver failure in 3 and hemorrhage from gastroesophageal varices in 1 case, respectively. In these 4 patients, 6-months-CT confirmed complete necrosis and absence of local recurrence. In the other 7 patients, no local recurrence was detected at CT during follow-up. During follow-up, intrahepatic recurrences in other segments were detected in 4/13 (31%) patients.

Conclusion: ECT seems to be a feasible, safe and effective treatment for local control of hh-HCC.

P-30**CEUS monitoring of intratumoral microcirculation after electroporation of liver tumors****L. Tarantino***Surgery, A.Tortora Cancer Hospital, Pagani, IT*

Purpose: To assess, with Contrast enhanced Ultrasound (CEUS), the changes in intra-peri-tumoral microcirculation of Liver Tumors treated with Electroporation.

Material and Methods: We studied 12 consecutive patients (10M,2F; 43–85 year, mean: 72 year), with 6 Hepatocellular Carcinoma, 4 Cholangiocarcinoma, 2 single metastasis (1 from colon, 1 from breast carcinoma) treated with Irreversible Electroporation (IRE) (4 cases) or Electrochemotherapy (ECT) (8 cases). Diameter of tumors ranged 3.2–7.5 cm (mean: 4.3 cm). After peripheral intravenous injection of 4.8 ml of a second generation US contrast agent (SonoVue, Bracco, Milan, Italy). Patients underwent: 1) Pre-treatment CEUS within 24 hours before Electroporation; 2) Intraoperative CEUS at the end of the procedure; 3) Post-treatment CEUS 24 hours after Electroporation; 4) week-one CEUS control; 5) One-month CEUS control.

Results: Before treatment, in comparison with liver parenchyma, CEUS showed:

- a) hyperenhancement in 10 and isoenhancement in 2 cases in arterial phase; isoenhancement in 6 and hypoenhancement in 6 cases in the venous phase; hypoenhancement in the late phase (wash-out) in all cases.

After Electroporation CEUS showed: a) a completely avascular treated area (absence of enhancement during all CEUS phases) at the end of procedure, intraoperatively;

- b) irregular and faint enhancement in the peripheral parts of the treated areas at 24-hours after treatment; c) a clear-cut avascular area and recovery of peripheral enhancement of the treated volume at one week CEUS; d) shrinkage of the central unenhanced area at one-month CEUS.

Conclusion: CEUS is a useful tool to assess the efficacy of Electroporation in the treatment of liver tumors. Also, CEUS can show the transient hypovascularity followed from “vascular recovery” of the peritumoral normal tissue and the fast progressive shrinkage of the killed tumor mass.

P-31**Survival, tumour response, safety and prognostic factors 70-150µm versus 100-300µm particles for Doxorubicin drug-eluting bead TACE in patients with unresectable hepatocellular carcinoma: a four-year Australian experience****Y.R. Huo**¹, H. Xiang², M.V. Chan², C. Chan²¹Faculty of Medicine, University of New South Wales, Sydney, NSW, AU, ²Radiology, Concord Repatriation General Hospital, Sydney, NSW, AU

Purpose: The purpose of this study was to investigate the overall survival, efficacy and safety of 70-150µm and 100-300µm doxorubicin drug-eluting beads transarterial chemoembolisation (DEB TACE) in patients with unresectable hepatocellular carcinoma (HCC).

Material and Methods: Retrospective, cohort study of 51 patients with unresectable HCC who underwent DEB-TACE over four years were studied; 23 treated with 100–300µm particles and 28 with 70–150µm particles.

Results: The median overall survival (OS) and median PFS for 70–150µm particles were not reached, whilst for the 100–300µm group, it was 29.2 months and 15.0 months, respectively. At 1-month follow up, patients treated with 70–150µm had significantly better mRECIST tumour response rates compared to 100-300µm (CR 38.5% vs 19%; PR 57.7% vs 42.9%; SD 0% vs 4.8%; PD 3.8% vs 33.3%, p=0.027). Patients treated with 100–300µm DEB particles were significantly more likely to have Progressive Disease on 1-month follow up tumour imaging compared those treated with 70–150µm DEB sizes (Odds Ratio 7.15, p=0.007). The 30-day mortality rate was similar between the two groups (3.6% for 70–150µm vs 4.3% for 100-300µm). Univariate analysis demonstrated significant prognostic factors affecting overall survival included BCLC radiology stage, portal vein thrombosis, bilirubin, albumin, ALP, AST and Creatinine in univariate analysis. Multivariate analysis with Cox Regression demonstrated overall survival was significantly associated with BCLC radiology stage (adjusted HR: 10.5, p=0.002), albumin (adjusted HR: 15.0, p=0.02) and ALP (adjusted HR 62, p=0.001).

Conclusion: DEB TACE with 70–150µm particles demonstrates improved 1-month objective tumour response compared to 100-300µm, whilst having a favourable safety profile, progression-free survival rate and overall survival.

P-32**Predictive factors of complete response of hepatic transarterial chemoembolizations with drug eluting beads in patients with hepatocellular carcinoma****L.S. Alberton, L.G.M. Valle, G.G. Moratti, P.M. Falsarella, R.B. Martins, V.D.O. Carvalho, C.A. Lima, L. Lembrança, J.M.M. Leal Filho, F.L. Galastri, B.B. Affonso, F. Nasser**
Interventional Radiology, Hospital Israelita Albert Einstein, São Paulo, BR

Purpose: To evaluate the existence of radiological factors predictors of complete response in hepatic hepatocellular carcinoma (HCC) nodules, submitted to transarterial chemoembolization.

Material and Methods: A retrospective, unicentric study involving 123 patients, a total of 166 nodules, in patients from the institutional liver transplantation program, submitted to hepatic chemoembolization with Drug-eluting Beads (DEB-TACE), with indication criteria for downstaging or bridging to transplant, between 2011 to June. The nodules were divided into 3 groups according to the diameter: group 1 (nodules up to 2 cm); group 2 (nodules between 2 and 5 cm); group 3 (nodules greater than 5 cm). Diameter and necrosis rate were assessed by contrast enhanced magnetic resonance or computed tomography, performed 30–45 days after treatment and then every 3 months.

Results: When comparing the size reduction and the mean size of all nodules, we observed a reduction of the size up to the fifth control (150 to 210 days) post-chemoembolization in relation to the pre-treatment measurement, and later evolving

with stability in size ($p < 0.001$). Among the 166 nodules analyzed, 49 presented recurrence during follow-up. Comparing the size of the nodules in relation to recurrence in the three groups, we observed that the mean diameter in the nodules that presented recurrence was higher than those that maintained complete necrosis.

Conclusion: nodules with complete necrosis present with reduction of diameter until approximately 200 days after the Chemoembolization with spheres carrier (DEB-TACE).

P-33

Five-year survival post chemoembolization with HepaSphere 30.60 for HCC not amenable to curative treatments

K. Malagari¹, H. Moschouris², T. Kiakidis³, S. Howard⁴, A.D. Kelekis⁵, D. Filippiadis⁵, A. Chatziioannou⁶, V. Vergadis⁷, E. Bruntzos⁵, N. Kelekis⁵
¹2nd Dept. of Radiology, University of Athens Medical School, Athens, GR, ²Radiology, Tzanion Hospital, Pireus, GR, ³Radiology, Evgenidion Hospital, Athens, GR, ⁴Medical School, Boston Massachusetts University, Boston, MA, US, ⁵Second Department of Radiology, Unit of Interventional Radiology, Attikon University Hospital, Athens, GR, ⁶1st Dept. of Radiology, National and Kapodistrian University of Athens, Athens, GR, ⁷Radiology, Laikon Hospital, Athens, GR

Purpose: Long-term results in HCC treated with chemoembolization with HepaSphere 30.60 loaded with doxorubicin.

Material and Methods: Analysis included 142 consecutive patients who received chemoembolization with HepaSphere 30.60 by a set 1–3 scheduled procedures and then on demand. Patients were followed up for safety and efficacy.

Results: The median follow up was 46.8 months (range 4–72). Thirty days mortality was 0 % without grade 4 and 5 adverse events. Seventy patients (49.3%) were BCLC A and 72 BCLC B (50.7%) with a median sum of diameters 6.1cm (mean 6.7±2.0). Liver function status was Child Pugh A in 104 patients (73.23%) and B in 38 (26.76%). The median Overall Survival (OS) was 31.0 months (mean 33.3±15.20; range 8–69) that for BCLC A was 41 months (mean 41.14±15.29; range 13–69), and for BCLC B 26.0 months (mean 26.0 ±10.52; range 8–51). OS for BCLC A patients at 1, 3, and 5 years was 95.83%, 75.71% and 21.42% while OS was for the same time points was 94.44%, 36.11% and 2.7% for BCLC B respectively. Progression-Free Survival (PFS) and median LTTP of the target lesion for BCLC A patients was 11.87months (mean 11.87±4.71; range 3–24) and for B 7.5months (mean 7.85±2.92; range 3–18). Multivariate analysis demonstrated that local response was a significant parameter for OS and LTTP ($p < 0.0001$) while sum of diameters and lesion number were definite parameters that affect outcome of LPFS and OS ($p < 0.001$).

Conclusion: HepaSphere provides a safe and effective treatment for HCC not amenable to curative treatments with comparable results to other loadable microspheres.

P-34

Percutaneous radiofrequency ablation for hepatic tumors: factors affecting baseline impedance

J.W. Seo, S. Hwang
 Radiology, Inje University Ilsan Paik Hospital, Goyang-Si, KR

Purpose: To evaluate factors that affect the baseline impedance on the radiofrequency ablation for hepatic tumor.
Material and Methods: The study included a cohort (n=55) of patients with hepatic tumor who underwent radiofrequency ablation between November 2015 and April 2018. We used conventional 15-G electrodes, internally cooled electrodes with a 200 W radiofrequency generator. The baseline impedance was measured before the procedure at different pad location with three variable active tip sizes (2.0, 2.5, 3.0 cm). We analyzed the difference of baseline impedance according to patients' body-mass index, waist-to-height ratio, the degree of liver cirrhosis, tumor origin, tumor location, previous chemoembolization or ablation procedure, whether injecting artificial ascites, active tip size, and the grounding pad location. Continuous variables were compared using the Mann-Whitney U test, independent two sample t test, and one-way analysis of variance (ANOVA).

Results: The factors which did not significantly influence the baseline impedance were body-mass index ($p=0.437$), waist-to-height ratio ($p=0.368$), Child-Pugh Score ($p=0.083$), tumor origin ($p=0.083$), tumor location ($p=0.143$), previous procedure status ($p=0.175$), and artificial ascites ($p=0.087$). The grounding pad location on the back showed significantly lower baseline impedance compared to conventional thigh position ($p=0.000$). Increase in size of the active tip showed gradual decrease in baseline impedance in all grounding pad location ($p=0.000\sim 0.016$).

Conclusion: The significant factors lowering the baseline impedance were grounding pad location and the size of active tip. Positioning grounding pads on the back provides low baseline impedance with short first roll-off time, ultimately resulting in short total ablation time.

P-35

Balloon-occluded transcatheter arterial chemoembolization (b-TACE) for hepatocellular carcinoma performed with polyethylene-glycol epirubicin-loaded drug-eluting microsphere: 3-6 months oncological results

P. Lucatelli, G. de Rubeis, L. Ginanni Corradini, B. Rocco, A. Cannavale, P. Nardis, M. Corona, M. Bezzi
 Radiological Sciences, Sapienza University of Rome, Rome, IT

Purpose: To report the 3-6 months oncological results of balloon-occluded trans-catheter-arterial-chemoembolization (b-TACE) performed with using polyethylene-glycol epirubicin-loaded drug-eluting microspheres in patients with hepatocellular carcinoma (HCC).

Material and Methods: Prospective, single centre, single arm study. 16 patients were treated (mean age 67.2±14.0 years; 14 males; 24 naïve lesions) in 20 procedures. Indications were down-staging (5/16), bridging (2/16), palliative (9/16). Follow-up (FU) was performed at 1 and 3–6 months with MDCT/MRI

and evaluated using mRECIST. Analysis was performed per-procedure basis; tumour's volume modification between pre-procedural and post-procedural was employed to stratify those patients who experienced partial response (PR).

Results: Two patients received a second b-TACE for treating another target lesion fed by a different feeder; in 2 cases a second b-TACE was performed for treating the residual vital tumor; two patients received adjunctive radiofrequency ablation. 1 month FU: Complete Response (CR) of 40% (8/20), PR of 60% (12/20) leading to an Objective Response (OR) of 100%. Patients classified as PR had a tumoral average reduction percentage of $61.4 \pm 31.2\%$ and an absolute reduction volume median of 7.6 cm^3 (CI 95% 2.3 to 14.1). Volume reduction was independently from the target lesion diameter (partial correlation weighted for diameter $r = -0.54$, $p < 0.05$). 3-6 months FU: CR of 61.11% (11/18), PR of 38.99% (7/18) leading to an OR of 100%. 2 patients didn't reach the FU yet.

Conclusion: b-TACE is able to maintain high tumour response, at 3–6 months FU, independently from target lesion size.

P-36

Uncommon radiologic findings that happened in the RFA sites in the liver

Y.M. Shin, S.J. Lee, S.Y. Kim, H.J. Won, P.N. Kim
Radiology, Asan Medical Center, Ulsan University, Seoul, KR

Learning Objectives: To present the various uncommon radiological findings in liver after RF ablation.

Background: Sometimes ablated sites in the liver shows uncommon radiologic findings. Understanding these imaging findings can be clinically useful to manage patients who underwent RFA.

Clinical Findings/Procedure: Usually after RFA of liver tumor, it shows involution or shrinkage. Rarely it shows atypical radiological findings such as 1. Calcification in RFA site 2. Rapid involution of RFA site within one month 3. Intrahepatic stone formation inside of dilated duct after RFA 4. Cystic degeneration of RFA site 5. Persistent benign enhancement inside of RFA site.

Conclusion: Sometimes ablated sites in liver shows uncommon radiological findings. We should be well acquainted the various uncommon radiological findings to prevent mis-understanding.

P-37

Safety of percutaneous hepatic perfusion with melphalan in patients with unresectable liver metastases from ocular melanoma using the Delcath System's second-generation hemofiltration system: a prospective non-randomized phase II study

T.S. Meijer¹, **M.C. Burgmans**¹, M. Fiocco², L.-F. de Geus-Oei¹, E. Kapiteijn³, E.M. de Leede¹, C.H. Martini¹, R.W. van der Meer¹, F.G.J. Tijl¹, A.L. Vahrmeijer¹

¹Department of Radiology and Nuclear Medicine, Leiden University Medical Center, Leiden, NL, ²Department of Medical

Statistics and Bioinformatics, Leiden University Medical Center, Leiden, NL, ³Department of Medical Oncology, Leiden University Medical Center, Leiden, NL

Purpose: Percutaneous hepatic perfusion with melphalan (M-PHP) is a first-line treatment for patients with liver metastases from ocular melanoma. Hematologic complications frequently occur due to incomplete filtration of melphalan by the hemofiltration system. In preclinical studies, the Delcath Systems' second-generation (GEN 2) filter has been shown to have a higher chemofiltration rate compared to first-generation filters. In this study, we investigated the safety and toxicity of M-PHP with the GEN 2 filter.

Material and Methods: Patients (18–75 years) with unresectable, histologically confirmed liver metastases from ocular melanoma without extrahepatic disease were eligible for inclusion in this prospective, single-arm, single-center phase II study. M-PHPs were performed with melphalan 3 mg/kg (maximum dose: 220 mg). Safety and toxicity were assessed according to CTCAE v4.03.

Results: A total of 67 M-PHP procedures were performed in 35 patients (median: 2 M-PHPs). There were no deaths, myocardial/cerebral infarctions or severe bleeding complications. Although seen in the majority of patients, hematologic grade 3/4 events were well-manageable or self-limiting and percentages were lower compared to studies using first-generation filters. Of all non-hematologic grade 3/4 events (n = 9), febrile neutropenia (n = 3) and pulmonary emboli (n = 2) were most common. Prior therapy for liver metastases was found to be a predictor of late grade 3/4 neutropenia with an odds ratio of 5.5 (95% CI: 1.4–21.7).

Conclusion: M-PHP using the GEN 2 filter has an acceptable safety and toxicity profile. Prior therapy of liver metastases is a possible predictive factor in developing grade 3/4 hematologic toxicity.

P-38

Intra-arterial peptide receptor radionuclide therapy for neuroendocrine tumor liver metastases

S.C. Ebberts¹, M.W. Barentsz², A.J.A.T. Braat³, M.G.E.H. Lam³
¹Nuclear Medicine, University Medical Center Utrecht, Utrecht, NL, ²Radiology, University Medical Center Utrecht, Utrecht, NL, ³Radiology and Nuclear Medicine, University Medical Center Utrecht, Utrecht, NL

Purpose: The current treatment of neuro-endocrine neoplasms (NEN) with peptide receptor radionuclide therapy (PRRT) consists of multiple cycles of intravenously administered lutetium-177 (177Lu)-DOTATATE. This study investigates whether intra-arterial (IA) administration of 177Lu-DOTATATE increases the delivered dose to intrahepatic metastases of NEN.

Material and Methods: A systematic review of available evidence on IA PRRT was conducted using PubMed and Embase. Included studies were original research publications focusing on absorbed tumor dose or tumor response after IA administration of PRRT for NEN. Furthermore, a multicenter randomized controlled trial is currently being conducted in The Netherlands to assess the added benefit of IA PRRT, in which the first patients have been included (LUTIA trial).

Results: Seven publications were included in this review, including 114 NEN patients treated IA with different therapeutic radiopharmaceuticals. Objective response was seen in 13–69%, disease stabilization in 18–52% and disease progression in 0–29% of patients. IA administration resulted in a 1.06–9.2 fold increase in tumor-to-non-tumor dose ratios in liver tumors, while normal liver and kidney doses remained within expected ranges. In the LUTIA trial, first results show promising benefits, with no added toxicities. Recruitment is ongoing and final results will be presented once the trial is completed.

Conclusion: There is limited but promising evidence that IA PRRT results in higher tumor-to-non-tumor dose ratios and a higher absorbed tumor dose compared to IV. Currently a multicenter RCT on IA PRRT is performed and first results look promising.

P-39

Chemoembolization using polyethylene glycol (PEG)-embolizing microspheres loaded with anthracyclines in HCC: predictive factors of response and efficacy evaluation

A.-M. Bucalau¹, I. Tancredi², R. Leveque², M. Pezzullo³, G. Verset⁴

¹Gastroenterology, Erasme Hospital, Brussels, BE, ²Interventional Radiology, Erasme Hospital, Brussels, BE, ³Radiology, Erasme Hospital, Brussels, BE, ⁴Oncology, Hôpital Erasme, Brussels, BE

Purpose: The aim of this study is to evaluate the efficacy and safety of transarterial chemoembolization (TACE) using polyethylene (PEG) embolizing microspheres and to determine the predictive factors of response in the hepatocellular carcinoma (HCC) patients.

Material and Methods: A retrospective study conducted between June 2015 and December 2017 in a tertiary, liver transplantation center in Belgium, that included 94 patients (84 males, 89.36%), with a mean age of 65± 10 years, treated with 75 mg Doxorubicin loaded PEG embolic beads. Data collected included liver function, tumor burden, previous HCC treatments, liver transplantation eligibility, treatment response at one month and adverse events.

Results: The one-month follow-up imaging post treatment (contrast-enhanced CT scan or MRI), showed a best overall response (BOR) of 91,39% (51.61% complete response, 33.33% partial response, 6.45% stable disease and 8.60% progressive disease) according to mRECIST assessment. Furthermore, twenty-one (43.80%) of 48 patients who presented with HCC beyond Milan criteria (before the first TACE) were successfully downstaged. The same trend was observed for University of California at San Francisco (UCSF) requirements, 17 patients (44.70%) of 38 became eligible for transplantation. Regression analysis displayed the number of nodules, 4 or more, as the only factor associated with poorer outcome. Abdominal pain (28.38%), temperature (5.16%), nausea/vomiting (6.45%) were the most frequent adverse events and their intensity was mostly mild.

Conclusion: Chemoembolization using PEG embolizing bead is effective and safe as indicated by the high tumor response rate and good tolerability.

P-40

Efficacy of the radioembolic treatment of “large” monofocal hepatocarcinoma in BCLC A-stage patients: monocentric experience

A. Vit, T. Gorgatti, V. Gavrilovic, A. Pellegrin, F. Rosella, M. Sponza
Radiology, ASUIUD, Udine, Udine, IT

Purpose: We studied the use of transarterial radioembolization (TARE) in patients with single large BCLC (Barcelona Clinic Liver Cancer)-A hepatocellular carcinoma (HCC). We evaluated overall survival (OS) and time to progression (TTP).

Material and Methods: We retrospectively enrolled all patients with HCC undergoing TARE at our University Hospital in the period from 2005 to 2017. We selected all patients with HCC greater than 5 cm in stage BCLC-A, for a total of 30 patients. They were followed up with contrast enhanced computed tomography or magnetic resonance (CE-CT or CE-MR), response was evaluated according to the Response Evaluation Criteria In Solid Tumors (RECIST) version 1.1 and/or modified RECIST. Kaplan-Meier and a Cox regression analyses were performed to evaluate OS and TTP.

Results: Median OS after TARE was 28 (10,7–45,3) months. On multivariate analysis, Child-Pugh class was identified as independent predictors of OS (P < 0.05, HR: 67.00). Although there were no statistically significant differences, there was a trend toward shorter survival as tumor size increased (P=0.098, HR: 3.85) and with greater Model for End-Stage Liver Disease (MELD) score (P=0,066, HR: 4,60). Median TTP after treatment was 18 (0,0–37,2) months. There were not independent predictors to TTP, however there is a trend toward shorter TTP in case of increased MELD score (P=0,075, HR: 5,80) and in presence of history of previous liver-directed therapies (P=0,059, HR: 13,16).

Conclusion: TARE can be considered a valid therapeutic option for “large” HCC in BCLC-A stage, particularly in patients with lower Child-Pugh score and MELD score.

P-41

The value of MDCT three-dimensional vascular remodeling in TACE for HCC

T. Qiang
Interventional Department, Jiangxi Cancer Hospital, Nanchang, CN

Purpose: To investigate the feasibility and accuracy of multidetector computer tomography (MDCT) three dimensional vascular remodeling for assessment of subsegmental tumor feeding vessels in transarterial chemoembolization (TACE) of hepatocellular carcinoma (HCC).

Material and Methods: A total of 79 HCC patients who underwent TACE were enrolled they underwent contrast-enhanced MDCT before TACE and observed the hepatic artery origin anatomic variation and extrahepatic feeding arteries using maximum intensity projection (MIP) and volume-rendering technique (VR) in a CT workstation.

Results: The branch of hepatic artery and its origin was detected in all cases while second-order branches of hepatic artery and origin of hepatic artery were display well in VR

image third and fourth-order branches of hepatic artery and tumor feeding arteries were display well in MIP image the anatomic variation of hepatic artery was found in 16 patients furthermore there were 11 patients who had extrahepatic feeding arteries. All the results consistent with the results of DSA imaging.

Conclusion: MDCT three-dimensional vascular remodeling can provide preliminary image of HCC feeding arteries and its variation that should be facilitate the superselective catheterization to TACE reduce frequency of angiography reduce the dosage of contrast medium and reduce the radiation dose to physician and patient.

P-42

Balloon-occluded transarterial chemoembolization using polyethylene glycol embolizing microspheres (B-DEM-TACE) for hepatocellular carcinoma: a prospective monocentric study of safety, feasibility and early outcomes

G. Verset¹, A.-M. Bucalau², M. Pezzullo³, R. Leveque⁴, I. Tancredi⁴

¹Oncology, Erasme Hospital, Brussels, BE, ²Gastroenterology, Erasme Hospital, Brussels, BE, ³Radiology, Erasme Hospital, Brussels, BE, ⁴Interventional Radiology, Erasme Hospital, Brussels, BE

Purpose: The goal of the study was to evaluate the efficacy and safety of balloon-occluded (Occlusafe™) transarterial chemoembolization using 2 ml polyethylene glycol embolizing microspheres (Lifepearl™) loaded with 75 mg Doxorubicin (B-DEM-TACE).

Material and Methods: Patients for whom a selective DEM-TACE was proposed were prospectively included in this trial between April 2017 and September 2018. Baseline characteristics included demography, liver function and tumor load. The outcomes reported CTCAEv4 toxicities, complications and imaging response (mRECIST). The propensity matching analysis between B-DEM-TACE patients and patients treated with conventional catheter included in our historical database was performed in order to compare the best overall response between the 2 groups.

Results: B-DEM-TACE was performed in 26 patients (age 66.3±9.87 years, male 96.15%, Child-Pugh A cirrhosis 92%, alcoholic etiology 65.36%, BCLC-A 76.92%, median number of nodules of 1 (range 1–7), with a mean diameter of the biggest nodule 34.83±16,21 mm). Grade1/2 toxicities (0% > grade 2) were reported: 23% abdominal pain, 4% temperature, 4% nausea. No 30-day mortalities or liver decompensation were observed. The MRI performed 4 to 6 weeks after B-DEM-TACE showed 8% asymptomatic biloma/liver infarct in healthy liver. Best overall response rate (ORR) was 100% with 53.85% complete response, 30.77% partial response and 15.38% stable disease. For the matched population (n=20), complete response was 60% versus 45% with conventional catheter (p=0.348).

Conclusion: B-DEM-TACE is a safe and effective procedure for selective treatment of HCC nodules. A randomized controlled trial is mandatory to assess the superiority of B-DEM-TACE compared to DEM-TACE.

P-43

Pain scores during continuous and pulsed mode of microwave ablation in the liver: a comparative study

M. Tsitskari, D. Filippiadis, G. Velonakis, L. Reppas, A.D. Kelekis, E. Brountzos, N. Kelekis

Second Department of Radiology, Unit of Interventional Radiology, Attikon University Hospital, Athens, GR

Purpose: To compare self-reported pain scores of patients undergoing liver ablation with either continuous or pulsed mode of microwave ablation.

Material and Methods: During the last 6 months 24 patients underwent liver ablation; patients were prospectively evaluated and randomized into continuous mode (CM – 12 patients) and pulsed mode (PM – 12 patients) groups. All ablation sessions were performed under Computed Tomography-guidance and IV analgesia (paracetamol 1g + tramadol 100ml – same anaesthesia protocol in all 24 patients). Group CM included 6 HCC and 14 metastatic [colon(9), pancreatic (1), breast (2), bronchogenic (2) carcinoma] treated lesions; depending on location CM group included 6 sub-capsular and 14 lesions at least 2 cm away from liver capsule. Group PM included 6 HCC and 12 metastatic [colon(8), pancreatic (1), breast (2), bronchogenic (1) carcinoma] treated lesions; depending on location PM group included 8 sub-capsular and 10 lesions at least 2 cm away from liver capsule. Immediately upon completion of the ablation session all patients were asked to complete a pain score questionnaire with a 0-10 numeric pain scale.

Results: The mean pain score was 8.17±1.850 in CM group and 4.50±1.567 pain units in PM group. There was a statistically significant difference of 3.667±2.807 pain units (p=0.001). No complications were noted in CM group; there were two grade I complications according to the CIRSE classification system (small peri-hepatic haemorrhagic fluid collections).

Conclusion: Pulsed mode of microwave ablation seems to be less painful for patients undergoing liver ablation under IV analgesia, rendering this mode an attractive alternative whenever anesthesiologist is not present.

P-44

Y-90 radioembolization in advanced-stage HCC: does portal vein thrombosis affect survival?

F. Somma, V. Stoia, R. D'Angelo, F. Fiore

Interventional Radiology, Istituto Nazionale Tumori IRCCS Fondazione Pascale, Naples, IT

Purpose: Our purpose is to assess and compare the survival of patients with portal vein thrombosis (PVT) and patients without PVT after a Trans-arterial Radio-Embolization (TARE) using Y-90 microspheres of unresectable HCC, not responsive to other loco-regional treatments.

Material and Methods: Between November 2005 and November 2010, TARE was performed in 71 patients with unresectable HCC and bilirubine values up to 2.6 mg/dl, 29 of them had PVT. The remaining were elderly patients, resistant-to-TACE HCC and/or pre-resection therapies. All patients were studied with MDCT scans and angiography and the

embolization of the Gastro-duodenal artery was performed in most cases with micro-coils. In all cases, a previous study was performed with the injection of TC-99MAA through a 3F-microcatheter. Proton-Pump Inhibitors (PPI) were administered to prevent gastritis and ulcers.

Results: The average dose administered was 1.7GBq. After the treatment, fever and abdominal pain were found in 25 and 16 patients, respectively. No other side-effect was observed. According to the mRECIST criteria at least a partial response was found in 70% of patient three months after the procedure and in 90.5% at nine months. The mean survival of patients with PVT was similar to those without thrombosis. Moreover, a regression of PVT was registered in more than 50% of patients.

Conclusion: TARE using Y-90 microspheres showed to be a safe and effective technique even in patients with PVT. Among the loco-regional treatments of intermediate-advanced HCC, TARE is extremely useful in case of relapse after trans-arterial embolization (TAE) or chemoembolization (TACE) in improving the survival of these patients.

P-45

Portal vein embolisation (PVE) – anatomical considerations and embolisation techniques to achieve maximum FLR hypertrophy

C.L. Bent, A. Shawyer

Interventional Radiology, RBCH, Bournemouth, UK

Learning Objectives: To demonstrate: a) anatomy of the portal venous system b) rationale and clinical need for PVE using imaging and future liver remnant (FLR) calculations c) anatomical considerations when planning PVE d) published clinical outcomes dependent upon embolisation technique and novel techniques to improve hypertrophy.

Background: PVE is a procedure used prior to hepatic resection to induce re growth of the liver segments that will remain following surgery. Indications include primary liver malignancies such as cholangiocarcinoma or HCC, and metastatic liver disease primarily of colorectal origin. To allow safe hepatic resection, a FLR of at least 25% in healthy livers is required. In a diseased liver, treated with previous chemotherapy or due underlying liver cirrhosis, a FLR of 35–40% is required. PVE redirects all portal blood flow to the FLR to maximise the deposition of trophic/growth factors to encourage hypertrophy.

Clinical Findings/Procedure: Numerous techniques are available to complete PVE with differing embolic material. Currently, n-butyl-cyanoacrylate (NBCA) has been suggested as the most efficient of embolic materials and has been adopted worldwide. Additional use of vascular plugs and coils allow central branch vessel occlusion whilst offering a benefit of minimising non target embolisation. PVA can also be used. The technique used is often dependent upon anatomical factors. When adequate FLR hypertrophy has not been achieved, other options including hepatic vein embolisation can be utilised.

Conclusion: PVE is an effective procedure to permit major curative hepatic surgery in patients with a small FLR. Meticulous planning and an understanding of the behaviour of embolic materials is vital to avoid complications.

P-46

Holmium-166 radioembolization (Ho166-RE) in HCC: 12-month follow-up and outcome data

C.G. Radosa¹, J.C. Radosa², S. Grosche-Schlee³, K. Zöphel³, V. Plodeck¹, J.P. Kühn¹, R.-T. Hoffmann¹

¹Institut und Poliklinik für Diagnostische und Interventionelle Radiologie, Universitätsklinikum Carl Gustav Carus Dresden, Dresden, DE, ²Klinik für Frauenheilkunde, Geburtshilfe und Reproduktionsmedizin, Universitätsklinikum des Saarlandes und Medizinische Fakultät der Universität des Saarlandes, Homburg, DE, ³Klinik und Poliklinik für Nuklearmedizin, Universitätsklinikum Carl Gustav Carus, Dresden, DE

Purpose: Radioembolization with 166Ho-containing microspheres may be an alternative to the established 90Y-Radioembolization. The feasibility, early complication rates and short term outcome data of this novel treatment option for patients suffering from HCC have been described previously by our working group and showed promising results. Here we describe the 12 months follow-up analysis in terms of the three important clinical outcome parameters response rates, time to progression (TTP) and survival.

Material and Methods: Between March 2017 to April 2018 nine patients with advanced HCC and liver cirrhosis were included in this observational study. Indications for 166Ho-Radioembolization were confirmed by a multi-disciplinary tumor board. To evaluate tumor response rates the European Association for the Study of the Liver (EASL) guidelines were applied. TTP and one-year overall survival were estimated by the Kaplan Meier method.

Results: One patient has not reached his 12 months follow up yet and one patient died after 8 months. According to EASL criteria one patient showed a complete response, four patients showed a partial response, three patients a stable disease and one patient a progressive disease. Mean TPP was 10.9 months (95% confidence interval, 9.5–12.3). The mean one-year survival was 11.6 months (95% confidence interval, 10.7–12.4).

Conclusion: Radioembolization with 166Ho-containing microspheres in patients suffering from HCC seems to be an effective treatment and is comparable to the established 90Y-Radioembolization regarding response rates, TTP and overall survival. Randomized controlled trials between both therapies are needed to prove the superiority of one radionuclide.

P-47

Biopsy of suspect intrahepatic power of Lipiodol-enhancement in CT-guided biopsies of unspecified suspect intrahepatic lesions: improvement of accuracy and safeness

M.C. Langenbach, T.J. Vogl, A. Buchinger, L.M. Basten, R. Hammerstingl, T. Gruber-Rouh

Institute for Diagnostic and Interventional Radiology, University Hospital Frankfurt, Frankfurt, DE

Purpose: To evaluate the power of Lipiodol in improving the rate of successful biopsies of suspect intrahepatic lesion.

Localization of unclear lesion in native CT is often challenging, especially in small lesions or cirrhotic liver tissue. Using intravenous contrast agents is often not satisfying due to rapid wash-out. Lipiodol, commonly applied in angiography for tumor embolization, might improve the success rate.

Material and Methods: Six-hundred-seven patients with unclear suspect liver lesions were retrospectively evaluated. All patients received a CT-guided liver biopsy and results were histopathological analysed. Successful punctuations were defined by positive pathological findings. Data were ascertain regarding the use of contrast media, lipiodol or common intravenous contrast, or native performance. Lesion hitting rate and influencing factors like lesion size or liver cirrhosis were insulated. Correlation was calculated according to Spearman-Rho, results compared using Wilcoxon-Man-Whitney t-test and Chi-square-test. $P < 0.05$ was considered as statistically significant.

Results: Lesion hitting rate was significantly higher using Lipiodol (78.6%) compared to native biopsy (73.2%) or the use of intravenous contrast agent (65.2%) ($p = 0.038$). For lesions with a size < 20 mm, the benefit regarding the hitting rate was even higher for Lipiodol (71.2% vs 47.7% vs. 65.5%) ($p = 0.021$). For patients with an existing liver cirrhosis in comparison of all three groups were seen. ($p = 0.97$).

Conclusion: The use of Lipiodol as a contrast agent and pre-puncture marking in angiography increases the lesion hitting rate significantly, especially for small suspect liver lesions (< 20 mm), combines with a lower rate of re-biopsy and a higher safeness for the patient.

P-48

Treatment options for intermediate (3-5cm) unresectable colorectal liver metastases (CRLM): stereotactic ablative body radiotherapy (SABR) vs microwave ablation (MWA) – a comparative review

S. Nieuwenhuizen¹, R. Puijk¹, B. Geboers¹, A. Ruarus¹, N. Haasbeek², A. Bruynzeel², M.P. van den Tol³, M. Meijerink¹
¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Radiotherapy, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Surgery, Amsterdam UMC, location VUmc, Amsterdam, NL

Learning Objectives: To compare the safety and efficacy of local ablative treatment options with curative intent for unresectable intermediate-size colorectal liver metastases (CRLM) in current literature.

Background: Multiple series have shown a good local control rate following microwave ablation (MWA) for CRLM smaller than 3cm, although control rates decrease significantly with increasing tumour size. The reported local control rate following stereotactic ablative body radiotherapy (SABR) is widely variable. Similar to MWA some studies do however suggest that size of the lesion also has an impact on local control rate. As of yet it is unclear what the preferred ablative treatment option for unresectable CRLM 3–5 cm should be. No randomized controlled trials have been performed comparing SABR to MWA.

Clinical Findings/Procedure: Most studies concerning MWA and SABR are retrospective or prospective cohort studies with a heterogeneous study population. For SABR the 1-year local control rate ranges 50-80%. For MWA the superior 1-year local control rate for CRLM ≤ 3 cm of around 95% also drops below 80% for CRLM > 3 cm. For both techniques the complication rate is low: major adverse events occur in 0–9% of patients receiving SABR and in approximately 2–4% of patients receiving MWA.

Conclusion: Further research is necessary to determine what treatment option is preferable for intermediate-size unresectable colorectal liver metastases, preferably in the setting of a randomized controlled trial comparing the safety and the longer-term local tumor progression rates.

P-49

Comparison of microwave and radiofrequency ablation for the treatment of liver metastases: randomized prospective study (MIRA study)

T.J. Vogl, Y. Jaraysa, S. Martin, A. Mehmedovic, N.-E. Nour-Eldin, T. Gruber-Rouh, R. Hammerstingl
Institute for Diagnostic and Interventional Radiology, University Hospital Frankfurt, Frankfurt, DE

Purpose: To prospectively compare therapy response and safety of microwave (MWA) and radiofrequency ablation (RFA) for the treatment of liver metastases.

Material and Methods: Fifty patients with liver metastases (27 females, 23 males, mean: 62.8 ± 11.8 years, range: 40–91) were randomly assigned to MWA or RFA for thermal ablation. MRI was acquired before treatment and 24h post ablation. The location of the liver metastases and the morphologic response to treatment regarding size, volume, necrotic areas, and diffusion characteristics were evaluated by MRI. During the follow-up period of one year, all patients were examined in three-month intervals.

Results: Overall, 50 hepatic lesions with a mean diameter of 1.6 cm (MWA 1.7 cm, RFA 1.5 cm) were treated with thermal ablation. Twenty-six patients received MWA and 24 patients RFA. Mean tumor volume 24 hours after ablation was 37.0 cm^3 (MWA 50.5 cm^3 , RFA 22.9 cm^3 , $p < 0.001$). Local recurrence rate was 0% (0/26) in the MWA group and 8.3% (2/24) in the RFA group during follow-up ($p = 0.09$). The recurrence rate for newly developed malignant formations in other locations than the ablated lesions was 38% (19/50) for both groups (MWA 38.4%, RFA 37.5%, $p = 0.07$). The mortality rate was 14.0% (MWA 19.2%, RFA 8.3%, $p > 0.16$). No major complications were reported.

Conclusion: In conclusion, MWA and RFA are both safe and effective methods for the treatment of liver metastases. No significant differences were found for mortality, development of malignant formations, or major complications between both groups. MWA generates greater volumes of ablation compared to RFA.

Lung

P-50

CT-guided pulmonary nodule microcoil localization

S.R. Alharbi

Radiology Department, King Saud University, Riyadh, SA

Purpose: To evaluate the safety and effectiveness of CT guided microcoil localization of pulmonary nodule prior to video assisted thoracoscopy surgery (VATS).

Material and Methods: From August 2015 to August 2018, 30 consecutive patients (17 men and 13 women; mean age, 56 years) underwent CT-guided micro coil localization of 42 pulmonary nodules (mean size, 7.3 mm; range, 4–18 mm). A 7 cm platinum microcoil was inserted into pulmonary nodules under CT guidance using a 21-gauge chiba needle. The technical details, surgical and pathologic findings associated with microcoil localizations were retrospectively evaluated.

Results: All nodules were localized by CT guided microcoil with 100% technical success and mean time 13.4 minutes (range 8–26 minutes). 6 patients developed Mild parenchyma lung hemorrhage along with needle tract and 7 patient developed mild pneumothorax all are asymptomatic and no intervention needed. 3 patients developed moderate pneumothorax for which needle aspiration was performed but not chest tube was inserted. No other complication occurred. All micro coils were identified during the surgery except one which was dislodged and attached to chest wall (41 out of 42 micro coils) 97.6 % clinical success and all nodule were surgically resected. Pathology revealed 28 metastatic pulmonary nodules, 1 primary adenocarcinoma-in-situ and 13 benign pulmonary nodules. Micro coils did not affect the histopathology examination.

Conclusion: CT-guided microcoil localization is an effective and safe pre-operative localization procedure prior to VATS, enabling accurate resection and diagnosis of pulmonary nodules.

P-51

CT-guided lung biopsy using a 20-gauge needle biopsy: is it possible to obtain sufficient material for genetic analysis?

C.A. Lima¹, J.R. de Andrade¹, L.G.M. Valle², P.M. Falsarella¹, L.L. Pinheiro¹, G.M. Gilberto², V.D.O. Carvalho², G.F. Mendes¹, P.R.B. Silverio¹, F.A.C. Vieira¹, A.R. Junior¹, L.R. Socolowski¹, R.G. Garcia¹

¹Interventional Radiology, Hospital Israelita Albert Einstein, São Paulo, BR, ²Centro Médico Intervencionista, Hospital Israelita Albert Einstein, São Paulo, BR

Purpose: To verify if the sample obtained with a 20-gauge needle biopsy is able to provide sufficient material for genetic analysis.

Material and Methods: For genetic analysis of the material collected through CT-guided lung biopsy we use the tests Oncoscreen and FoundationONE.

Results: Of the 97 cases biopsied, 75 didn't perform genetic analysis. Of the 22 cases submitted for analysis, 14 were referred to Oncoscreen and 8 to FoundationONE. Of the 14 patients who underwent the Oncoscreen test, 85% had adequate sample, 1 insufficient sample and 1 sub-optimal sample. Of the 8 cases sent to FoundationONE, 4 presented adequate material and the remaining sub-optimal material. The criterion used to classify the material as sub-optimal for the Oncoscreen test was the need to perform more than one extraction of DNA and RNA due to the small amount of material. The extraction of DNA and RNA is performed at the same time with a single kit and, in cases of small samples, DNA extraction may be impaired, requiring further extraction by another technique. The criterion used to classify the material as sub-optimal (Qualified) for FoundationONE was that the quality or quantity criteria of the sample received were not all present but allowed the test to be performed. There was only one case submitted to genetic analysis by the Oncoscreen test that wasn't possible to perform it due to insufficient amount of material.

Conclusion: Despite the small number of cases, we obtained a high success rate and performed the genetic analysis through the fragments obtained with a 20-gauge needle.

P-52

Interventional PET-CT for lung and mediastinal tumours biopsy planning

M. Cherkashin¹, N. Berezina², D. Puchkov², D. Kuplevatskaya²
¹Surgery, Medical Institute n.a. Berezin Sergey, St. Petersburg, RU,
²Radiology, Medical Institute n.a. Berezin Sergey, St. Petersburg, RU

Purpose: To evaluate diagnostic accuracy of PET-CT for tumors biopsy planning in hard-to-access or hard-to-target cases.

Material and Methods: In our study 96 lung (n=79) and mediastinal (n=17) tumors core needle free hand biopsies were performed. Mean patients age 54 y.o. In 35 patients (unclear target identification by primary CT) PET-CT/CT fusion was performed for biopsy planning. Images fusion was cognitive, on the scanner console. Samples undergo immunohistostaining and molecular genetic tests.

Results: Primary pathology verification success in CT group was 92% (56 patients). For 5 patients repeated biopsies were performed. Mean biopsy time was 24 min. In PET-CT group biopsies verification success was 100%, mean biopsy time 32 min. Complications rate in CT group was 11.4% (7 patients): 2 bleedings, 5 pneumothoraxes. In PET-CT group in 1 case (2.8%) small pneumothorax was detected. Mean samples were 4. In lung tumors patients primary (different types of lung cancer) or metastatic lesions (melanoma, adenocarcinoma, sarcoma) were detected. In mediastinal tumours patients lymphoma (n=11), Kaposi sarcoma (n=1) and lymph nodes metastatic lesions (n=5) were revealed.

Conclusion: In our study PET-CT arm characterized by lower complications rate (2.8% vs 11.4%), higher verification success (100% vs 92%), but mean biopsy time in PET-CT group was longer (32 min vs 24). Based on our results we suggest to accelerate fusion technologies implementation.

P-53**Pneumothorax and pulmonary hemorrhage after CT-guided lung biopsy: incidence, clinical significance and correlation**

V. Sabatino, U. Russo, F.V. D'Amuri, A. Bevilacqua, F. Pagnini, G. Milanese, R. Nizzoli, G. Pedrazzi, M. De Filippo
Department of Medicine and Surgery – Division of Radiology, University of Parma, Parma, IT

Purpose: To evaluate incidence and clinical significance of pneumothorax (PTX) and pulmonary haemorrhage (PH) after CT-guided lung biopsy (CT-LB). To test correlations of PTX and chest tube insertion (CTI) with PH and different imaging and procedural parameters.

Material and Methods: Pre-procedural CT and CT-LB scans of 904 patients were retrieved. Incidence of PTX and of PH (location: type-1 along needle track or type-2 perilesional; severity according to its thickness: low-grade <6mm or high-grade >6mm) were recorded. CTI was assessed by reviewing medical charts. PTX was considered clinically significant if treated with CTI, PH if treated with endoscopic/endovascular procedure. Evaluated parameters included: nodule-to-pleura distance (mm), emphysema (subjectively quantified in ≤25%, 25-50%, ≥50%) and procedure time (minutes). Binary logistic regression analyses tested whether PH and imaging and procedure parameters were associated with development of PTX and CTI.

Results: PTX occurred in 306/904 cases (33.8%); CTI was requested in 18/306 (5.9%). PH occurred in 296/904 cases (32.7%), of which 165/296 (55.7%) type-1 high-graded; no case requested treatment. Type-1 high-graded PH showed a protective effect against PTX and CTI (ORPTX=0.340; ORCTI=0.177). Nodule-to-pleura distance (ORPTX=1.046; ORCTI=1.057), emphysema (ORPTX=1.330; ORCTI=2.074) and procedure time (ORPTX=1.018; ORCTI=1.037) were associated with an increased risk for PTX and CTI.

Conclusion: Pneumothorax and pulmonary hemorrhage have similar incidence after CT-guided lung biopsy. Treatment was required only for pneumothorax (<6% of cases) while pulmonary hemorrhage was not clinically significant. Pulmonary hemorrhage along needle track >6mm may represent a protective factor against development of pneumothorax and against pneumothorax requesting chest tube insertion.

P-54

Withdrawn

P-55**Outcome of ablation of 5-7 ipsilateral lung metastases at a single ablation session**

A. Gillams¹, S. Smith²

¹*Imaging Dept, The London Clinic, London, UK,*

²*Imaging Dept, Ipswich Hospital, Ipswich, UK*

Purpose: Ablation has proven very effective in the eradication of small volume pulmonary metastases. Patients with one tumour fare better than those with multiple tumours. However, ablation provides the opportunity to treat many more metastases than can be treated with SBRT or surgery? We analysed outcome following ablation of 5–7 ipsilateral metastases at a single session.

Material and Methods: We reviewed our database and identified patients who had five or more ipsilateral metastases treated at a single session of thermal ablation. Technical details, complications and hospital stay were analysed. Follow-up CT scans were evaluated for local control.

Results: Thirty-one ablations were performed in 14 patients with multiple lung metastases. 5 lesions were treated in 22 sessions, 6 in 6 and 7 in 3. Chest drains were required to treat pneumothorax in 17/31 (55%). Mean duration of drainage 1 day (range 1–10 days). Only one pneumothorax lasted longer than 7 days and resolved without the need for surgery at 10 days. There was one delayed infection which responded to antibiotics and one pleural effusion that did not require drainage. There were 21/183 (11%) local recurrences on CT follow-up for a minimum of 12 months.

Conclusion: The incidence of pneumothorax requiring intercostal drainage increased to 55% and the local recurrence rate increased to 11%. Despite this there were no major long-term sequelae. In selected fit patients with normal lung function, ablation of 5 – 7 ipsilateral metastases at a single session is feasible, with the correct clinical support.

P-56**Comparison between CBCT and fusion PET/CT-CBCT guidance for lung biopsies**

A. Muollo¹, A. Beneventi¹, N. Casamassima¹, E. Macchi¹, F. Piacentini¹, F. Fontana¹, C. Floridi², C. Fugazzola¹, G. Carrafiello²

¹*Radiologia, Ospedale di Circolo di Varese – Università dell'Insubria, Varese, IT,* ²*Radiologia, Ospedale San Paolo, Milan, IT*

Purpose: To establish the feasibility of performing percutaneous biopsy of lung lesions guided by fusion PET/CT-CBCT and to evaluate whether the metabolic information provided by a prior PET/CT scan add incremental benefits for diagnosis.

Material and Methods: We retrospectively reviewed the data of 180 patients who underwent CBCT-guided lung biopsy (90) and PET/CT-CBCT-guided lung biopsy (90). Rates of diagnostic efficacy, sensitivity, specificity, diagnostic accuracy, positive predictive value (PPV) and negative predictive value (NPV) were calculated. Complications rate, radiation dose and procedure timing were reported.

Results: Diagnostic efficacy was equal to 93,3% (6/90 nondiagnostic) for the first group and 98,9% (1/90 nondiagnostic) for the second group. The values of sensitivity, specificity, diagnostic accuracy, PPV and NPV were respectively 94,5%, 100%, 95,2%, 100% and 73,3% for the CBCT guided biopsies and 98,6%, 100%, 98,9%, 100% and 94,4% for the PET/CT-CBCT guided biopsies. No major complications were observed.

Conclusion: PET/CT-CBCT-guided lung biopsy is feasible and safe as well as CBCT-guided biopsy. It can improve diagnostic efficacy's value, reducing the number of nondiagnostic samples and false negative cases and can be used to obtain more helpful informations from tissue sampling.

P-57

Radiofrequency and microwave ablation of soft-tissue sarcoma lung metastases: safety and oncological outcomes

T. Glover¹, N. Butterfield¹, N. Khan¹, C. Benson², J. McCall¹, R. Jones², N. Fotiadis¹

¹Radiology, The Royal Marsden Hospital, London, UK, ²Oncology, The Royal Marsden Hospital, London, UK

Purpose: To assess efficacy and safety of percutaneous ablation of soft-tissue sarcoma lung metastases. To compare outcomes between radiofrequency ablation (RFA) and microwave ablation (MWA).

Material and Methods: A retrospective study of consecutive metastatic sarcoma patients who underwent percutaneous RFA or MWA treatment of lung metastases at our institution was conducted using electronic medical records and PACS. Data describing the type of procedure, tumour type, grade, location, disease free interval, prior resection/chemotherapy, number and site of lung lesions, local recurrence, survival and complications were collected. Data were analysed using standard statistical tests.

Results: Ninety-two lung metastases in 50 patients with soft-tissue sarcoma were treated with RFA and/or MWA over 71 sessions (48 RFA, 23 MWA) from 1st September 2007 to 15th January 2018. The median clinical follow up period was 24 months (3–75 months). Overall, 1-year survival from first percutaneous intervention was 82%, while 3-year survival was 50%. There was no statistically significant difference in 1-year survival or local recurrence rate between the MWA and RFA groups. There were 19/71 (27%) cases of post-procedure pneumothorax, 7 of which required drainage (10%). Haemoptysis occurred in 7/71 (10%) cases. There were no procedure-related deaths.

Conclusion: We present one of the largest series of percutaneous ablation of sarcoma lung metastases. RFA and MWA are both safe and effective minimally invasive treatments with similar outcomes and low complication rates. Appropriate patient selection will maximize the clinical benefit and avoid unnecessary operations.

Musculoskeletal

P-58

Overview of percutaneous radiofrequency ablation for the treatment of osteoid osteomas

M.A.O. Kasem

Radiology, Cairo University, Cairo, EG

Learning Objectives: Identify the clinical presentation and age group of osteoid osteoma. Distinguish the specific imaging criteria on plain radiography, CT and MRI; and to be able to differentiate from other similar looking bone pathologies. Recognize the technical steps and advantages of radiofrequency ablation over surgery in terms of long-term success rate and complications.

Background: Osteoid osteoma is a benign tumor that commonly arises from long bones and typically presents with nocturnal pain in young children relieved by non-steroidals. Computed Tomography is considered to be the best imaging modality in detecting the nidus and planning for the ablation procedure. Traditionally complete surgical excision of the nidus was the treatment of choice. However; the surgical approach has many drawbacks and carries more complications rate in comparison to the percutaneous ablation approach which is a very safe minimally invasive procedure with high success rates in alleviating the pain completely.

Clinical Findings/Procedure: The radiofrequency ablation procedure is performed under CT guidance with spinal or general anesthesia. A bone needle is used to form a tract through the bone reaching the nidus; and then the radiofrequency probe is inserted through an outer co-access needle into the lesion. The electrode is then connected to the RF generator which is turned on till complete ablation of the nidus in one or more ablation cycles.

Conclusion: Percutaneous radiofrequency ablation is a very safe and effective treatment for osteoid osteomas with high clinical success rate and low incidence of complications as compared to the traditional surgical approach.

P-59

Osteoid osteoma treated with radiofrequency ablation in non-operating room anesthesia: our experience in 61 cases

A. Paladini¹, F. Cappelli², D. Beomonte Zobel², G.E. Vallati², G. Pizzi²

¹Diagnostic and Interventional Radiology, "Maggiore della Carità" Hospital, Novara, IT, ²Diagnostic and Interventional Radiology, IFO, Rome, IT

Purpose: Purpose of this study is to verify the effectiveness and complications occurrence of Radiofrequency Ablation (RFA) in the treatment of Osteoid Osteoma (O.O.) in non operating room anesthesia (N.O.R.A.).

Material and Methods: From 2015 to 2018, 61 Patients affected by Osteoid Osteoma (O.O.) (40 men and 21 women) with an age of 20.7 years on average (range, 4–51 years;

12 Patients aged 20 years or younger) underwent Computed Tomography-guided percutaneous Radiofrequency Ablation (RFA) in N.O.R.A. (Non Operating Room Anesthesia). Lesion sites treated were: femur (27), tibia (22), pelvis (2), talar bone (3), distal radius (1) and humerus (6). Mean follow-up time was 36 months. RFA was performed under conscious sedation. In each case, anesthesiologic support followed a new protocol (N.O.R.A.), approved from our Institute. Primary success rate, complications, symptom-free intervals and follow-up results were evaluated.

Results: Pain relief was significant in 97% of Patients; it disappeared within 24 hours after procedure in 44 Patients, within 3 days in 10 Patients, and within 7 days in 7 Patients. Within 36 months observation time, 60 of 61 Patients were successfully treated and had no more complaints. In 2 Patients, two major complications were found: infection of the site treated, healed with antibiotics, and a nervous lesion, healed with steroid therapy. No other complications were observed.

Conclusion: RFA is a highly effective, efficient, minimally invasive and safe method for the treatment of O.O following non operating room anesthesia (N.O.R.A.) protocol.

P-60

Rapid pain improvement in patients treated for painful bone metastases with the Medtronic OsteoCool RF ablation system: the OPuS One study

S. Bagla¹, J. Levy², T. Hopkins³, F. Massari⁴, A. Vogel⁵, A. Bress⁶, R. Dixon⁷, J. Mitchell⁸, P. Sunenshine⁹, J. Barr¹⁰, N. Tran¹¹, J. Morris¹², H. Berrier¹³, T. Brelje¹³, **K. Schwartz**¹³

¹Interventional Radiology, Vascular Institute of Virginia, Woodbridge, VA, US, ²Interventional Radiology, Northside Hospital, Cumming, GA, US, ³Anesthesiology, Duke University Medical Center, Durham, NC, US, ⁴Radiology, 4 University of Massachusetts Memorial Medical Center, Worcester, MA, US, ⁵Radiology, Renown Regional Medical Center, Reno, NV, US, ⁶Radiology, St. Jude Medical Center, Fullerton, CA, US, ⁷Interventional Radiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, US, ⁸Radiology, Emory University School of Medicine, Atlanta, AL, US, ⁹Radiology, Banner – University Medical Center, Phoenix, AZ, US, ¹⁰Radiology, University of Texas (UT) Southwestern Medical Center, Dallas, TX, US, ¹¹Neurosurgery, Moffitt Cancer Center, Tampa, FL, US, ¹²Radiology, Mayo Clinic, Rochester, MN, US, ¹³Interventional Pain, Medtronic, Fridley, MN, US

Purpose: To report the preliminary outcomes from the prospective, nonrandomized, multicenter study of Medtronic's OsteoCool Radiofrequency Ablation (RFA) system used for the palliative treatment of patients with painful bone metastases (OPuS One Study).

Material and Methods: Subjects were prospectively enrolled from October 2017 through August 2018. Inclusion criteria were: 2 or less painful target sites involving the thoracolumbar spine, pelvis and/or sacrum, with a worst pain $\geq 4/10$ measured by the Brief Pain Inventory (BPI) within the previous 24 hours. RFA was performed with the OsteoCool device. Subjects were evaluated prior to RFA and post operatively. Device-, procedure- and/or therapy-related adverse events (AEs) were collected.

Results: Thirty seven subjects at 8 US centers underwent RFA. The mean age was 64 years and 68% were female. Mean baseline BPI worst pain was 8.6. Thirty-one subjects (84%) were treated for lesions involving the thoracolumbar spine, while 6 subjects (16%) were treated for lesions located in the pelvis and/or sacrum. Of the 14 subjects presenting at the 3-month visit, 93% did not undergo radiation therapy at the targeted site(s) between baseline and 3 months. Seventy-four percent (25/34) of subjects at 1 week and 93% (13/14) of subjects at 3 months reported a clinically significant change from baseline in worst pain of ≥ 2 points. One AE, drug hypersensitivity, resolved without intervention. All eleven deaths reported were not related to RFA.

Conclusion: The preliminary results of the OPuS One study show rapid pain improvement at 1 week and sustained long-term relief through 3 months in patients with metastatic bone disease.

P-61

Effect of transarterial bland embolization of renal cell carcinoma bone metastases on systemic biomarkers of tumor immunity: can tumor embolization affect immunotherapy response?

R. AlHalawani, R. Sheth, S. Yevich
Diagnostic and Interventional Radiology, UT Houston MD Anderson, Houston, TX, US

Purpose: Locoregional therapies may potentiate systemic immunotherapies by modulating immunosuppressive tumor microenvironment. We evaluate the influence of embolization for renal cell carcinoma (RCC) bone metastases on neutrophil-to-lymphocyte ratio (NLR), as increased NLR has been associated with poor response to immune checkpoint inhibitor therapy.

Material and Methods: Retrospective analysis of all adult patients (age > 18 years) from 2015-2018 treated with trans-arterial bland embolization for pain palliation of RCC bone metastases. Immunotherapy administration within 6 months of embolization was documented. Baseline NLR was calculated 1 week prior to embolization, and compared to NLR within 1 week, 1 month, and 6 months after embolization.

Results: A total of 31 patients (20:11 Male:Female, mean age 60, average lesion size 72.2 cm \pm 7.3) were included with treatment locations in the thorax (1), spine (11), pelvis (12), and extremities (7). Nineteen patients received the immune checkpoint inhibitor nivolumab (8 before, 6 after, 5 before and after embolization), of which eight patients were within 1 month of embolization (7 within 1 week). Overall, univariate analysis confirmed a significant NLR increase relative to baseline at 1 week ($P=0.02$) and 1 month ($P=0.03$), but not 6 months ($P=0.08$) post-embolization. For patients who received nivolumab prior to embolization, there was no significant change in NLR.

Conclusion: In checkpoint inhibitor-naïve patients, trans-arterial bland embolization of RCC bone metastases results in increased NLR, suggesting embolization in this patient population may result in a predominantly non-specific inflammatory response. No NLR change was identified in patients already receiving checkpoint inhibitors.

Novel therapies

P-62

Tunnelled, non-cuffed internal jugular catheter in oncological patients for short- to mid-term vascular access: an interim report of an off-label application of the PICC

X.Z. Low¹, C.W. Too¹, A. Patel¹, A. Gogna¹, R. Lo¹, K. Damodharan¹, S. Chan¹, S. Chandramohan¹, S. Leong², N. Kumar², J. Chua², K.D. Zhuang², F.G. Irani²

¹Department of Vascular and Interventional Radiology, Singapore General Hospital, Singapore, SG, ²Interventional Radiology, Singapore General Hospital, Singapore, SG

Purpose: The usual short to mid-term vascular accesses for oncologic patients include the peripherally inserted central catheter (PICC) and the non-tunnelled subclavian catheter. The former can be restrictive in active patients while the latter may involve difficult transpectoral punctures. This pilot study aims to evaluate an off label use of the PICC.

Material and Methods: 10 patients were recruited for this prospective pilot study. A non-cuffed, power-injector compatible PICC was inserted via a short subcutaneous tunnel into the internal jugular vein using no additional consumable. Puncture wounds were closed with tissue glue. The patients were prospectively followed up for subjective and objective comfort scores, dwell time and complications.

Results: At present, the median catheter dwell time is 110 days. One catheter was removed due to systemic fungemia, resulting in an acceptable complication rate of 0.9 per 1000 catheter days. Patient-reported mean comfort score was 17 (out of 20); with a preference for our novel technique in patients with prior alternative central lines. 7 catheters have been used with pressure injections for CT scan without complications.

Conclusion: Despite limited numbers, this method appears to be safe and preferred technique with acceptable low complication rates. This modified vascular access is low profile, easily concealed, readily removable and compatible with pressure injector and uses a common catheter easily found in most interventional radiology suites. Prospective randomised controlled trials will be needed to ascertain if it can be a standard of care for oncological patients.

P-63

A phase I/II study of direct injection of Bromelain and Acetylcysteine in patients with inoperable mucinous peritoneal tumours

S.J. Valle¹, J. Akhter¹, D. Glenn², M.A. Power², S. Lohd², W.S. Liauw³, K.H. Altoukhi¹ **D.L. Morris**¹

¹Department of Surgery, St George Hospital, Sydney, NSW, AU, ²Department of Radiology, St George Hospital, Sydney, NSW, AU, ³Cancer Care Centre, St George Hospital, Sydney, NSW, AU

Purpose: Many patients with mucinous peritoneal tumours achieve long-term survival by cytoreductive surgery and intraperitoneal chemotherapy, however recurrence occurs

frequently. Repeat interventions have an increasing negative impact on quality of life and high risk of complications with minimal benefit. The aim of this study is to determine whether an injection of Br/NAC directly into mucinous peritoneal tumour dissolves the tumour and allows it to be aspirated via a drain.

Material and Methods: Under radiological guidance, a drain is placed into the tumour. The drug is injected in 5% dextrose. The patient is monitored for 4 hours. The drain is clamped and the patient is discharged. The patient returns 24 hours post procedure for drain aspiration. Volume of tumour removed is calculated. Repeat treatment via the drain is considered if the patient is clinically stable.

Results: Ten patients with mucinous tumours have been treated. Mean prior operations, tumour volume, aspirated volume and drug treatments were 2.75 (2–6), 281ml, 167ml (59%) and 2.4 doses, respectively. RECIST partial response was seen in 7/10 patients (n=2 generalised intraperitoneal tumour without a target lesion, n=1 drain dislodgement). Side effects included grade III pain (n=2, managed with PCA), pyrexia (n=2). There was a significant rise in CRP from 68-7102% which returned to baseline between 5 and 7 days. No other effects of treatment were seen.

Conclusion: Based on these preliminary results and our preclinical data, direct injection of Br/NAC into mucinous tumours may provide a new and minimally invasive treatment for inoperable patients. Our ongoing study aims to enrol 60 patients.

P-64

Withdrawn

P-65

Pulsed electrical fields in oncology: reversible and irreversible electroporation, electrochemotherapy, electrogenotherapy and electrotransfection

B. Geboers¹, H. Scheffer¹, A. Ruarus¹, S. Nieuwenhuizen¹, R. Puijk¹, T. de Gruijl², D. Miklavčič³, B. Rubinsky, R.V. Davalos, M. Meijerink³

¹Radiology and Nuclear Medicine, Amsterdam UMC, location VUmc, Amsterdam, NL, ²Medical Oncology, Amsterdam UMC, location VUmc, Amsterdam, NL, ³Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, SI

Learning Objectives: This review outlines various aspects of pulsed electrical fields in oncology covering reversible and irreversible electroporation, electrochemotherapy, electrogenotherapy and electrotransfection. Development and background, active working mechanism, preclinical and clinical findings, technical obstacles and future research directions will be addressed per application.

Background: Electroporation is a non-thermal phenomenon that disrupts the cell membrane integrity of target tissue while sparing the extracellular matrix of surrounding structures when exposed to pulsed electrical fields. Depending on electrical pulse amplitude and number of pulses, applied

electroporation can be reversible with membrane permeability recovery or irreversible, leading to cell death. Reversible electroporation is used to introduce drugs or genetic material into the cell without affecting cell viability and irreversible electroporation is used as ablative therapy to induce apoptosis in tumour cells. The preservation of tissue integrity makes electroporation an attractive treatment option for inoperable tumours in the vicinity of vital structures like big vessels and nerves.

Clinical Findings/Procedure: A new research path is focusing on combining pulsed electrical fields with immune enhancing therapies. Electroporation has shown an abscopal effect by initiating the systemic immune response and inhibiting metastatic spreading. The hypothetical synergistic effect of exposing cancers to pulsed electrical fields and hereby inducing a systemic abscopal effect in combination with immune-cascade enhancing drugs is currently under investigation

Conclusion: The use of pulsed electrical in clinical oncology offers a new treatment paradigm that is rapidly gaining attention. Several electroporation based applications, developed for the treatment of solid tumours, will be discussed.

This imILT was repeated 24 months and 40 months later due to progressive disease after stopping the second line chemotherapy protocol.

Conclusion: In order to verify this effect a randomized pilot study with a control arm was designed. One study arm with laser thermotherapy and standard chemotherapy plus another arm with chemotherapy only. Recruitment is undergoing and results are potentially promising.

P-66

Abscopal effect of immunostimulating laser thermotherapy on liver metastasis in pancreatic cancer: a case report and study protocol for a randomised controlled trial

B. Gonçalves, M.J. Sousa, M. Machado, L. Santos
Interventional Radiology, Portuguese Oncology Institute of Porto, Porto, PT

Learning Objectives: The abscopal effect is a rare phenomenon observed in the treatment of metastatic cancer, where localized irradiation causes a response in non-irradiated and non-target tumor sites. Due to the recent immunotherapies, this effect has received a renewed clinical interest. However there is no knowledge regarding that effect in patients with pancreatic carcinoma.

Background: Our study reports the case of a 53-year-old male patient, who presented ad initio with pancreatic carcinoma and liver metastasis (stage IV), associated with jaundice.

Clinical Findings/Procedure: After PTC with a covered stent placement he started a first regimen of chemotherapy, with stable in the primary and the liver (FOLFOXIRI 16 cycles). Progression was documented after 12 cycles. Due to intolerable toxicity, the patient switched to a second regimen with gemcitabine and nab-paclitaxel. After 16 cycles partial response was achieved. PET-CT control documented uptake in a single liver metastasis (19mm) and around the previous placed biliary stent without clearly visible tumour. This active lesion was chosen for laser thermotherapy in May 2015 by a percutaneous CT-guided placement of a laser fiber and a temperature probe. Partial response was achieved in the liver and complete response in the pancreas (Feb 2017).

Other organs

P-67

Percutaneous endobiliary radiofrequency ablation (PE-RFA) combined with biliary stenting for palliation of malignant biliary obstruction: feasibility, safety and early results

C. Sallemi¹, L. Monfardini¹, M. Calandri², E. Soncin², D. Righi², P. Fonio²

¹Radiology, Istituto Ospedaliero Fondazione Poliambulanza, Brescia, IT, ²Radiology, Ospedale Molinette, Turin, IT

Purpose: To evaluate feasibility, safety and efficacy of PE-RFA followed by biliary stenting with self-expanding metal stents (SEMS) for palliative treatment of biliary obstruction due to unresectable cancer.

Material and Methods: between February 2017 and October 2018, 13 patients with inoperable biliary duct malignant obstruction (9 Klatskin tumor, 1 intrahepatic cholangiocarcinoma, 2 colorectal metastasis, 1 pancreatic NET metastasis) underwent 15 procedures of PE-RFA followed by insertion of up to three SEMS. Technical success, pre- and post-procedural bilirubin level, procedure-related morbidity and mortality, and SEMS patency at follow up were evaluated.

Results: PE-RF with SEMS placement was successfully achieved in 100% of cases. Mean bilirubin levels before and after the procedure were 9,3 mg/dL \pm 8 and 3,7 mg/dL \pm 2, respectively. No procedure-related deaths occurred. The only complication was an hepatic abscess. In two cases the procedure was repeated because of stent(s) occlusion (respectively, at 5 and 8 months). Four patients died of causes unrelated to the procedure, with patency of SEMS. One patient was lost during follow up. The remaining 8 patients are still alive, with patency of SEMS at the time of analysis.

Conclusion: in this preliminary cohort PE-RFA combined with SEMS was a feasible and safe palliative treatment. It seems to be able to prolong the stent patency and overall survival in patients with malignant biliary obstruction due to inoperable tumor.

P-68

Radiofrequency ablation of primary parathyroid adenoma: preliminary results for patients ineligible for surgery

E.J. Ha

Radiology, Ajou University School of Medicine, Suwon, KR

Purpose: To retrospectively evaluate the outcomes of US-guided RFA of parathyroid adenoma in patients who were ineligible for surgery.

Material and Methods: Between October 2010 and June 2016, six parathyroid adenomas (mean diameter, 2.0 cm; range, 1.2-3.8 cm) in six patients with primary hyperparathyroidism were treated with US-guided RFA. The inclusion criteria were (1) primary hyperparathyroidism, (2) pathologically confirmed parathyroid adenoma on US-guided FNA, and (3) refusal- or ineligibility- for surgery. The hydrodissection technique

using the 5% dextrose water was applied in all patients. The medical records were reviewed and analysed, focusing on the procedural profiles of RFA, symptoms and complications during and after RFA, and changes in hormone levels on follow-up US.

Results: The initial nodule volume was 1.0 \pm 0.5 mL. The PTH level was 210.4 \pm 283.9 pg/mL and Ca+ level was 10.4 \pm 0.9 mg/dL. At 1- and 6- month follow-up after RFA, a significant reduction in the volume (78.4 \pm 3.7% and 89.1 \pm 8.4 %) was noted and five ablation zones (5/6, 83.3%) near completely disappeared (\leq 0.1mL). The PTH level was decreased to the normal range (50.9 \pm 6.5 pg/mL) at 1-month follow-up and were progressively decreased at 6-month follow-up in 5 patients (40.1 \pm 7.3 pg/mL). The PTH level in one patient was re-increased from 48 pg/mL to the 241 pg/mL at 6-month follow-up. The mean Ca+ level was decreased to 9.3 \pm 0.8 mg/dL at 6-month follow-up. There was no immediate complication.

Conclusion: RFA might represent an effective and a safe alternative for managing parathyroid adenomas, especially in patients ineligible for surgery.

P-69

Pancreaticoduodenal arcade as a challenging but effective alternate route for performing TACE in patients with unfavorable celiac axis anatomy

A. Johri, B.J. Amos, A. Burdette

Cardiovascular & Interventional Radiology, Penn State Health, Hershey Medical Center, Hershey, PA, US

Learning Objectives: 1. To show 4 successful and 1 unsuccessful case of hepatic trans-arterial chemoembolization (TACE) via the alternative pancreaticoduodenal arcade (PDA). 2. To review current literature on TACE via the PDA. 3. To review identification of favorable cases, as well as proper equipment and procedural techniques for successfully performing TACE via the PDA.

Background: TACE is the standard of care for treatment of many unresectable hepatic tumors. TACE is most commonly administered through the hepatic arteries via the celiac artery. When celiac anatomy is unfavorable, such as with an occlusion or tortuous route, an alternative pathway may be utilized. PDA is the most commonly utilized alternative pathway. We report our experience of five TACE cases via the PDA seen in the past 10 years at our institution and review current literature.

Clinical Findings/Procedure: Hepatic TACE via the PDA was attempted in five cases where hepatic arteries could not be accessed via the celiac artery. In four cases, TACE was successfully performed via the PDA. One case was unsuccessful. In the four successful cases, a long vascular sheath or recurved catheter provided stable access to the tortuous course of the PDA. In all four cases a micro-wire with a shapeable steep curve negotiated the acute angle at the gastroduodenal artery (GDA)-PHA junction. In one case the micro-catheter loop technique was also required to negotiate this angle.

Conclusion: Hepatic TACE via the PDA is a challenging but effective alternative in patients with unfavorable celiac anatomy when proper equipment and technique are utilized.

P-70**Intrahepatic Mitomycin C infusion in liver dominant metastatic breast cancer: factors influencing outcome**

B.M. Aarts¹, E.G. Klompenhouwer¹, R.C. Dresen², A. Laenen³, R.G.H. Beets-Tan¹, K. Punie⁴, P. Neven⁴, H. Wildiers⁴, G. Maleux²
¹Radiology, The Netherlands Cancer Institute, Amsterdam, NL, ²Radiology, University Hospitals Leuven, Leuven, BE, ³Biostatistics and Statistical Bioinformatic, KU Leuven Universiteit Hasselt, Leuven, BE, ⁴Oncology, University Hospitals Leuven, Leuven, BE

Purpose: The aim of this study was to determine the safety and efficacy of Mitomycin C (MMC) infusion in chemo resistant liver dominant metastatic breast cancer patients (LMBC) and to determine factors influencing overall survival.

Material and Methods: We retrospectively analysed 176 LMBC patients treated with MMC infusion between 2000 and 2017. Local response was measured with CT follow-up by RECIST 1.1 criteria after 1–3 cycles. Toxicities were registered by the CTCae version 5.0. Overall survival (OS) and hepatic progression free survival (hPFS) were evaluated using Kaplan Meier methodology. After univariate analysis, a stepwise forward multivariate (MV) prediction analysis was performed to select independent pre-treatment factors associated with OS.

Results: RECIST evaluation (n=132) showed a partial response rate of 20%, stable disease of 57% and progressive disease in 23%. Toxicity grade 3 and 4 levels were reported in 17.5%. Median PFS was 5.5 months (CI;4.5-6.8) and median OS was 7.8 months (CI;6.1-9.8). Significant independent baseline predictors of worse OS on MV analysis included amount of prior systemic chemotherapy (HR=1.2 CI;1.1-1.3), prior liver ablation (HR=5.9 CI;1.8-19.4), higher liver tumour burden (HR=2.4 CI;1.5-3.7), elevated levels of bilirubin (HR=2.18 CI; 1.3–3.8) and ALT (HR=1.5 CI;1.01-2.09).

Conclusion: MMC infusion was safe and effective in LMBC patients. MV analysis showed a worse OS in patients with increased amount of prior systemic chemotherapy, prior liver ablation, higher liver tumour burden and elevated levels of bilirubin and ALT.

P-71**Prospective, monocentre pilot study of intrahepatic Mitomycin C infusion after radioembolization with Y-90 in chemo refractory liver dominant metastatic breast cancer patients**

B.M. Aarts¹, E.G. Klompenhouwer¹, R.C. Dresen², C. Deroose³, A. Laenen⁴, R.G.H. Beets-Tan¹, P. Neven⁵, H. Wildiers⁵, G. Maleux²
¹Radiology, The Netherlands Cancer Institute, Amsterdam, NL, ²Radiology, University Hospitals Leuven, Leuven, BE, ³Nuclear Medicine, University Hospitals Leuven, Leuven, BE, ⁴Biostatistics and Statistical Bioinformatic, KU Leuven Universiteit Hasselt, Leuven, BE, ⁵Oncology, University Hospitals Leuven, Leuven, BE

Purpose: In this pilot study we evaluated the safety of intrahepatic Mitomycin C (MMC) infusion after radioembolization with Yttrium (Y90)-labelled microspheres in chemo resistant LMBC patients.

Material and Methods: Sixteen LMBC patients were included in this pilot study from 2012-2018 and first received Y90. The response after Y90 was evaluated with MRI, PET and laboratory

tests. After assessment of no progression of disease, Mitomycin C infusion was administered in different dose cohorts; A: 6 mg in 1 cycle, B: 12 mg in 2 cycles, C: 24 mg in 2 cycles and D: max 72 mg in 6 cycles. In cohort D the response was again evaluated after every 2 cycles and continued after assessment of no progression of disease. Toxicities were measured according to common toxicity criteria adverse events (CTCae) version 5.0.

Results: Sixteen patients received Y90 treatment. Three patients showed disease progression and 1 patient had serious side effects of Y90, and consequently, were excluded for further intra-arterial therapy. The intended dose of MMC was adjusted in 5 out of the 12 patients due to progressive disease (n=3) and biochemical toxicity (n=2). No grade 3 toxicity levels or higher were reported after MMC infusion. Three grade 2 toxicities were reported consisting of thrombocytopenia (n=1), leukopenia (n=1) and increase in bilirubin levels (n=1).

Conclusion: The combined treatment of intrahepatic infusion of MMC after Y90 therapy is safe with a low toxicity profile when MMC is administered in different escalating dose cohorts and adjusted based on clinical, radiological and biochemical parameters.

P-72**Gastric cancer bleeding: treatment with arterial embolization**

M.G. Song, T.-S. Seo, S.-J. Park
 Radiology, Korea University Guro Hospital, Seoul, KR

Purpose: To evaluate effectiveness of the embolization to treat bleeding from gastric cancer.

Material and Methods: Total 29 session of arterial embolization was performed in 24 gastric cancer patients (mean age, 62.7; range, 31-85 years) to treat cancer bleeding by superselection of each artery with microcatheter from August 2014 to June 2018. Medical records were reviewed to evaluate types of the cancer, initial symptoms, presence of extravasation, embolic materials, embolized arteries, technical and clinical success rate, bleeding free time after embolization, and complications.

Results: Types of gastric cancer were adenocarcinoma (n=20), poorly cohesive carcinoma (n=3), and sarcomatoid carcinoma (n=1). Among 29 cases, initial symptoms were hematemesis (n=17), melena (n=11), and hematochezia (n=1). Extravasation of contrast media was detected in 3 cases. Embolic materials were gelfoam only (n=24), microcoils with gelfoam (n=3), and polyvinyl alcohol with gelfoam (n=2). Total 51 gastric arteries were embolized such as left gastric artery (n=26), right gastric artery (n=8), right gastroepiploic artery (n=11), left gastroepiploic artery (n=1), short gastric artery (n=4), and right inferior phrenic artery (n=1). Embolization of gastric artery was technically successful in all cases. Also, it was clinically successful in 27 cases except 2 cases. In 2 cases of clinical failure, further treatments were gastrectomy and additional embolization at next day, respectively. Repetitive embolizations due to recurred bleeding were performed in 3 patients. The only one complication was gastro-bronchial fistula in one patient.

Conclusion: Embolization in patients with bleeding from gastric cancer was useful treatment with high technical and clinical success.

P-73**The diagnostic role of omental biopsy and guidance in the management of patients with suspected gynaecological malignancy: a single-center experience****O. Sarioglu¹**, H. Sahin², A.E. Capar¹, U. Belet¹¹*Interventional Radiology, Tepecik Training and Research Hospital, Izmir, TR*, ²*Radiology, Tepecik Training and Research Hospital, Izmir, TR***Purpose:** To assess the efficacy and the guidance of ultrasound (US)-guided omental biopsy in the management of suspected gynaecological malignancy.**Material and Methods:** Patients who were consulted from gynaecologic oncology with pelvic mass, omental involvement, and underwent percutaneous US-guided omental biopsy between January 2017 and August 2018 were reviewed. Omental abnormality was divided into three groups depending on Magnetic Resonance Imaging (MRI) characteristics: omental cake, nodule, and heterogeneity. The thickest part of the omentum, the size of omental nodules, the needle entry site, the presence of ascites, and histopathological results were evaluated. The intervals from the consultation to biopsy, and from biopsy to the first cycle of neoadjuvant chemotherapy (NAC) were recorded.**Results:** Biopsies were performed on 47 patients (mean age 57.23 ± 13.22 years). 45 (95.7%) of the specimens were diagnostic (41 malignancy, 3 tuberculosis, 1 chronic inflammation). US or MRI showed ascites on 45 patients. 37 of the biopsies were gained from omental cake, 8 were from omental nodule, and 2 were from omental heterogeneity. The mean thickest part of the omentum was 29.74 ± 7.86 mm. The average maximum diameter of the omental nodules which underwent biopsy was 40.75 ± 15.42 mm. The mean time from consultation to the biopsy was 2.80 ± 1.63 days, from the biopsy to the first cycle of NAC was 25.97 ± 9.65 days.**Conclusion:** US-guided omental biopsy in patients with a high suspicion of malignancy is a safe, effective, and practical technique that can be used for both getting a specific diagnosis and deciding the management plan quickly.**P-74****Stent performance in palliative transhepatic treatment of malignant biliary obstruction: covered vs uncovered metallic stents****A. Elkilany^{1,2}**, M. Al-Warraky², D. Geisel¹, T. Denecke¹¹*Department of Diagnostic and Interventional Radiology and Nuclear Medicine, Charité University of Medicine Berlin, Campus Virchow Clinic, Berlin, DE*, ²*Department of Diagnostic and Interventional Medical Imaging, National Liver Institute, Menoufia University, Menoufia, EG***Purpose:** To compare trans-hepatic covered versus uncovered metallic stents for palliative treatment of malignant biliary obstruction regarding stent patency, complications, stent dysfunction and patient survival.**Material and Methods:** This prospective randomized single-center study included 66 patients with irresectable malignant biliary obstruction. Covered stent was inserted in31 patients (26 males, 5 females, mean age 63.8 ± 7.96 years) and uncovered stent in 35 patients (26 males, 9 females, mean age 62.3 ± 11.7 years).**Results:** Stent placement was successful in all cases. No statistical difference regarding stent patency, complications, stent dysfunction or patient survival. Mean primary stent patency duration was 120.5 ± 96.1 days in covered stent vs. 139.3 ± 78.5 days in uncovered ($P=0.139$). Complications occurred in 15 patients (48.4%) in covered stent and 13 (37.1%) in uncovered ($P=0.356$). Stent occlusion occurred in 4 patients (12.9%) in covered group and 5 (14.3%) in uncovered ($P=0.870$). Stent migration occurred in 3 patients in covered stent (9.7%) and one patient (2.9%) in uncovered ($P=0.113$). Tumor overgrowth occurred in one patient in covered stent ($P=0.235$) while tumor in-growth occurred in two patients in uncovered ($P=0.151$). Hemobilia occurred in 5 patients with covered stent vs. 3 patients in uncovered ($P=0.456$) and bile leakage in one patient in each group despite the larger introducer diameter with covered stent (9F vs. 7F). Mean survival time was $200.57 \pm SE42$ days for covered stent and $219.10 \pm SE30.91$ days for uncovered ($P=0.231$).**Conclusion:** No significant difference between covered and uncovered stents in palliative treatment of malignant biliary obstruction. However, considering the higher cost and larger introducer diameter for covered stents, uncovered stents are preferred.**P-75****Effectiveness and security of CT-guided percutaneous implantation of radioactive I-125 seeds in locally advanced pancreatic carcinoma****Z. Liao***Department of Oncology, West China Hospital, Sichuan University, Chengdu, Sichuan Province, CN***Purpose:** Assess the effectiveness and security of CT-guided percutaneous implantation of 125 i seeds in locally advanced pancreatic carcinoma.**Material and Methods:** A total of 17 locally advanced pancreatic cancer patients (12 males and 5 females) with an average age of 58 years (range, 35–86 years) were enrolled, there were 11 tumors in the pancreatic head and 6 tumors in the pancreatic body or tail.**Results:** 1–5 punctures were performed for each patient, seeds were implanted with an average of 48.6 (range, 38–126) in patients, and the success rate was 100%. The activity of each seed ranged from 0.6 to 0.8mCi. No procedure-related main adverse event occurred in all patients, only minor events in 5 patients. No significant relationships between the punctures or adverse events was identified. No serious complications were detected after the implantations during follow-up visits. All patients had their pain improved (100%), local control rate 100%, 11 (64.7%) patients still survive in one year follow-up, five patients died from distant metastases, one patient died from massive stomach bleeding.**Conclusion:** This study suggested that CT-guided percutaneous implantation of 125 i seeds was relatively safe and effective for treatment of locally advanced pancreatic carcinoma.

P-76**Clinical efficacy and safety of transarterial chemotherapy in the treatment for recurrent or persistent ovarian cancer****Y.S. Jeon***Interventional Radiology, G-SAM Hospital, Gunpo, KR*

Purpose: About 70-80% of patients with ovarian cancer will relapse after chemotherapy. The prognosis is poor and the management of relapsed ovarian cancer remains a difficult problem. Treating them is challenging and many controversies remain. The purpose of this study is to evaluate the clinical efficacy and safety of transarterial chemoembolization in the treatment for recurrent or persistent ovarian cancer.

Material and Methods: Transarterial chemoembolization was tried in total 32 patients (Sep.2014~Sep.2018) with recurrent or persistent ovarian cancer. Evaluation before treatment includes CA125 and imaging with CT or MRI or PET-CT. Transarterial infusion via feeding arteries using chemoagents (gemcitabine, oxaliplatin, cisplatin, abraxane, bevacizumab, ifosfamide, adriamycin, glycirrhizinic acid) was repeated every 4~8 weeks, according to the patients' response and clinical condition. Additional embolization with imipenem-induced microparticles(40~50 μ m) was performed when the lesions were highly vascular and safe for embolotherapy. CA125, imaging study and changes in symptom were evaluated again after every treatment.

Results: Technical success was achieved in all of the 32 patients. Improvement of symptoms and decrease in CA125 level was demonstrated in 27 patients. The time to max clinical improvement ranged 3~7 days. The duration maintaining clinical improvement ranged 4~7 weeks. And decline in CA125 level is well correlated with the target lesion response by RECIST. Procedure related complications were not demonstrated in all patients.

Conclusion: Transarterial chemoembolization in the treatment for recurrent or persistent ovarian cancer achieves a high local response and good symptom control. It is safe and can be a meaningful treatment option for relapsed ovarian cancer patient to control disease progression and symptom palliation.

P-77*Withdrawn***P-78***Withdrawn***P-79****The right innominate vein as a safe and viable alternative to the right internal jugular vein for ultrasound-guided totally implantable venous access devices in adult patients with cancer****S. Xingwei, J. Yong***Department of Intervention, The Second Affiliated Hospital of Soochow University, Suzhou, CN*

Purpose: To evaluate the efficacy and safety of US-guided right innominate vein (INV) puncture for totally implantable venous access devices (TIVADs) in adult patients with cancer.

Material and Methods: In this single-center, retrospective cohort study, clinical data from consecutive adult patients undergoing ultrasound-guided TIVADs were retrieved from the department database between January 2016 and January 2018. Patients managed via the right INV and the right internal jugular vein (IJV) approaches were then compared in terms of first attempt success rate and complications.

Results: Overall, 619 patients were involved, 339 in right innominate vein INV group and 280 in right IJV group. The mean operation time was 25.24 \pm 6.37 min (range: 20–38 min). The first attempt success rate was slightly higher in the INV group (98.64 vs 95.34%, P=0.020, 0.05), difference was statistically significant. The incidence of perioperative and long-term complications in the right INV group were 1.18% (4/339) and 3.54% (12/339). The incidence of perioperative complications and long-term complications were 1.43% (4/280) and 3.93% (11/280) in the right IJV group. The difference in the incidence of complications between the two groups was not statistically significant (P=0.785, P=0.799, P> 0.05, respectively). Notably, there were no catheter malposition or catheter fracture happened in the right INV group.

Conclusion: US-guided right INV puncture for TIVADs improved first attempt success rate, it is a safe and viable approach alternative to US-guided right IJV approach in adult patients with cancer. A large randomized clinical trial is warranted to confirm our results.

P-80**Efficacy and safety of ultrasound-guided totally implantable venous access ports via the right innominate vein in adult patients with cancer: our single-center experience and protocol****S. Xingwei, J. Yong***Department of Intervention, The Second Affiliated Hospital of Soochow University, Suzhou, CN*

Purpose: Evaluate the feasibility and safety of implantation of ultrasound (US)-guided totally implantable venous access ports (TIVAPs) via the right innominate vein (INV) for adult patients with cancer.

Material and Methods: This study reviewed the medical records of 283 adult patients with cancer who underwent US-guided INV puncture for TIVAPs between September 2015 and September 2017. It also analyzed technical success rate, operation time, and short-term and long-term surgical complications.

Results: The technical success rate was achieved in all patients (100%). The mean operation time was 28.31 ± 7.31 min (range: 23–39 min), and the puncture success rate for the first time was 99.30% (281/283). Minor complications included artery punctures during the operation in one patient, while no was encountered. The mean TIVAP time was 304.16 ± 42.54 days (range: 38–502 days). The rate of postoperative complications was 2.83% (8/283), including poor healing of the incision in one patient, catheter-related infections in three patients, part thrombosis in one patient, and fibrin sheath formation in three patients, while no catheter malposition, pinch-off syndrome, catheter fracture, or other serious complications were observed.

Conclusion: TIVAPs are widely employed for chemotherapy. The present study recommends that this novel approach of using US-guided INV puncture to implant TIVAPs in adult patients with cancer is both feasible and safe.

P-81

PSMA-PET/CT and diffusion MRI targeting for cone-beam CT-guided bone biopsies of castration resistant prostate cancer patients

T.R.F. van Steenberg¹, M. Smits², T.W.J. Scheenen¹, J. Nagarajah¹, I.M. van Oort³, M.M. Rovers⁴, N. Mehra⁵, J.J. Fütterer¹

¹Radiology and Nuclear Medicine, Radboud University Medical Center, Nijmegen, NL, ²Medical Oncology, Radboud University Medical Center, Nijmegen, NL, ³Urology, Radboud University Medical Center, Nijmegen, NL, ⁴Operating Rooms, Radboud University Medical Center, Nijmegen, NL, ⁵Medical Oncology, Radboud University Medical Center, Nijmegen, NL

Purpose: Precision medicine for metastatic castration resistant prostate cancer (mCRPC) works by targeting genetic aberrations of tumor cells. These genetic aberrations can be detected by molecular analysis of metastatic tissue. Around 40–50% of mCRPC patients only have bone metastases, necessitating a bone biopsy. The success rate of molecular analysis on bone biopsies is low, ranging from around 25–60% for unguided biopsies to around 60–80% for CT-guidance. Our aim was to increase the success rate of molecular analysis by performing biopsy target planning on functional imaging and using advanced image-guidance.

Material and Methods: Ten mCRPC patients received 68Ga PSMA-PET/CT and diffusion MRI, which were fused for biopsy planning. An area with high PSMA uptake and diffusion restriction was marked as biopsy target. Biopsies were taken under cone-beam CT (CBCT)-guidance: an initial CBCT was made and fused with the planning datasets, and the planned path was subsequently visible on C-arm fluoroscopy images during needle guidance. Control CBCT scans were taken when necessary. Two 13G biopsy cores were taken. The first was analyzed with a 40 gene panel and the second with whole genome sequencing.

Results: Nine of the ten biopsies were positive for prostate cancer. One biopsy was negative because the cortical bone was too compact for the drill to penetrate. Molecular analysis could successfully be performed in eight of the nine positive biopsies (89%).

Conclusion: Target planning on functional imaging and advanced needle guidance increased the bone biopsy molecular analysis success rate as compared to standard biopsy methods.

P-82

Hemostatic endovascular embolization of branches of the external carotid artery in patients with the nasopharyngeal tumors

A. Pankov, A. Shelesko, N. Zakaryan, E. Molokhoev, A. Davtyan, V. Kirakosyan

Interventional Angiology, Clinical Hospital No1 of Department of the President Affairs, Moscow, RU

Purpose: To evaluate safety and efficacy of endovascular embolization of external carotid artery branches in patients with the nasopharyngeal tumors.

Material and Methods: The paper presents the experience of endovascular interventions in 21 patients with nasopharyngeal tumors, who underwent embolization of branches of the external carotid artery in our clinic for the period from 2010 to 2018. The age of patients ranged from 18 to 64 years. Cancer of the nasopharynx was observed in 11 patients, also treated patients with 4 hemangiomas, 3 esthesioneuroblastomas and 3 angiofibromas of the nasopharynx. The diagnosis was made on the basis of complaints, anamnesis, as well as data of computed tomography, magnetic resonance imaging and selective angiography. In 8 patients the embolization was performed as a first step before the open surgery to reduce blood loss, in the remaining 13 patients, embolization was performed to stop recurrent bleeding. In 16 patients we used embospheres sized of 300–500 nm, and in some of that cases we performed additional occlusion of the arterial trunks with coils. In 5 patients embolization performed with Trufill or Onyx adhesive compositions.

Results: Angiographic success achieved in 100% patients. All patients with recurrent bleeding achieved stable hemostatic effect. Also all the patients who were further performed to remove the tumor, have significant reduction of blood loss during open surgery. Complications during in-hospital period was not observed.

Conclusion: Endovascular embolization of branches of the external carotid artery is an effective and safe intervention in patients with nasopharyngeal tumors.

P-83

Withdrawn

P-84**Experience in five years of retinoblastomas management through intra-arterial chemotherapies in three health institutions of Lima, Peru**

P.A. Teran Chávez, **M.A. Bedriñana Gomez**, D. Quiroz Cerna, C.R. Pascual Morales, G.A. Rojas Salinas, J.C. Tan Kuong, G. Araujo Almeyda, S.C. Alfaro Ita
Radiology, Hospital Guillermo Almenara, Lima, PE

Purpose: Describe results, complications, adverse effects and toxicity of intra-arterial chemotherapy in patients diagnosed with retinoblastoma, evaluating the response according to initial stage and number of sessions.

Material and Methods: Retrospective and descriptive study with descriptive statistical analysis for the presentation and analysis of the results obtained from 19 patients diagnosed with retinoblastoma undergoing intra-arterial chemotherapy treatment in a period of five years in 03 health centers from Lima, Peru. The degree of the disease was determined according to the Reese-Ellsworth classification, having as variables the age, sex, stage, bilaterally, number of therapies. The average number of sessions was 7.

Results: 100% of the patients responded to intra-arterial chemotherapy. In our series, currently 47% are in inactive state (cured), 21% received enucleation (4 patients, for residual tumor adjacent to the optic nerve and 1 due to progression of the disease) and the remaining 32% continues in treatment.

Conclusion: Intraarterial chemotherapy had a positive effect in the treatment of retinoblastoma in 100% of our patients, without distant metastasis. Ocular preservation (favorable evolution and / or cured) was achieved in 79% within 2 to 24 months of follow up. We also observed limited toxicity and no major complications after procedure. Nevertheless, we recommend to continue with studies and control of the follow up to report long-term results of the therapy.

Pre-clinical and experimental**P-85****Embolization of rabbit renal arteries to test feasibility and effects of CT-visible doxorubicin-eluting montmorillonite microparticles**

F. Nurili¹, G. Bekaroglu², S. Isci², I. Caymaz³, A. Bas⁴, I. Yurdaisik⁵, O. Aras¹
¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Dept. of Physics, Istanbul Technical University, Istanbul, TR, ³Radiology, Istanbul Medeniyet University, Istanbul, TR, ⁴Radiology, Istanbul University, Istanbul, TR, ⁵Radiology, Istinye University, Istanbul, TR

Purpose: To develop CT-visible doxorubicin (DOX)-eluting montmorillonite microparticles for transarterial embolization.

Material and Methods: DOX-loaded montmorillonite particles were synthesized by adsorption method and dispersed in diatrizoate to enable visualization on CT and to achieve a sustained drug-release profile. Rabbits were used to determine CT imaging properties and DOX release kinetics. Sustained release of the particles into the kidney was accomplished with 1 mg of montmorillonite containing 39.2 ± 0.14 mcg of DOX. In the transarterial DOX-loaded montmorillonite embolization group, embolization was performed following selection of the renal artery. Control groups were use of DOX and montmorillonite particles alone in separate groups. DOX levels in the blood were periodically measured. Kidney tissue was isolated 24 hours after injection and DOX levels in the tissue were measured.

Results: Particles were successfully visualized with CT. Manufactured microparticles were compatible with microcatheters. DOX blood levels in the Chemo-embolization group briefly increased 30 min after embolization but remained low until 24 hours after embolization. DOX blood levels in the TAI group rapidly reached a peak more than 30 minutes after injection and then was undetectable in further timepoints. DOX levels in the tissue was significantly higher in the Chemo-embolization group compared to the TAI group. Pathology revealed swelling of entire embolized kidney, infarction and necrosis in the renal cortex, embolization and chemo-embolization groups. Vascular injury observed in only the Chemo-embolization group.

Conclusion: CT visible DOX-loaded montmorillonite maintained high local concentrations but low blood levels of the anticancer drug, showing promise for transarterial embolization.

P-86**Multifunctional iron oxide nanoparticle-embedded PVP-HEC microparticles as a drug-eluting embolic material**

F. Nurili¹, G. Bekaroglu², S. Isci², A. Bas³, I. Caymaz⁴, S. Ozkanli⁵, O. Aras¹

¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Dept. of Physics, Istanbul Technical University, Istanbul, TR, ³Radiology, Istanbul University, Istanbul, TR, ⁴Radiology, Istanbul Medeniyet University, Istanbul, TR, ⁵Pathology, Istanbul Medeniyet University, Istanbul, TR

Purpose: To develop MRI imageable novel HEC-PVP-magnetic embolic particles intended for transcatheter arterial chemoembolization and magnetic ablation.

Material and Methods: MRI imageable novel HEC-PVP-magnetic embolic microparticles were prepared from iron oxides linked with PVP using a bridging flocculation process and HEC were incorporated (coated) onto the particles to load doxorubicin (DOX). 16 rabbits were used in a rabbit renal embolization model. Sustained release was accomplished with 1 mg of HEC-PVP-magnetic embolic microparticles containing 16 mcg of DOX. In the Chemo-TAE group, embolization was performed after catheterization of the renal artery with microcatheters. In the control TAI group, 4 mg DOX alone was injected through the renal artery. Imaging and magnetic ablation were performed after embolization using a 1.5-T high-field MR scanner equipped with high-performance gradients and fast receiver hardware.

Results: All synthesized particles calibrated in the 40-500 microns range and were easily injectable through a microcatheter. The particles exhibited no cytotoxicity against hFOB cells ($P > 0.05$). In vivo, the particles were capable of occluding the arteries, and imageable with MRI. In the Chemo-TAE group, DOX levels in kidney tissue detected after embolization were significantly higher than that in the control group ($P < 0.001$). Infarction and necrosis in the renal cortex were observed in the Chemo-TAE group and TAE group. The maximum temperature achieved within the rabbit kidney was $48 \pm 1^\circ\text{C}$ after 20 min with radiofrequency exposures at 25 kW.

Conclusion: These novel microparticles can be loaded with an anticancer drug to be useful for embolization therapies with traceability and magnetic ablation properties.

P-87**Effectiveness and safety of transarterial embolization with Bleomycin-loaded PLA/PLGA microspheres for treatment of vascular malformation using a porcine spleen model**

F. Nurili¹, T. Acar², S. Derman², A. Bas³, I. Caymaz⁴, S. Ozkanli⁵, H. Cakiroglu⁶, I. Yurdaisik⁷, O. Aras¹

¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Bioengineering, Yildiz Technical University, Istanbul, TR, ³Radiology, Istanbul University, Istanbul, TR, ⁴Radiology, Istanbul Medeniyet University, Istanbul, TR, ⁵Pathology, Istanbul Medeniyet University, Istanbul, TR, ⁶SÜDETAM, Sakarya University, Adapazari, TR, ⁷Radiology, Istinye University, Istanbul, TR

Purpose: To prospectively study the effectiveness and safety of Bleomycin-loaded PLA/PLGA microparticles in the porcine spleen model.

Material and Methods: Bleomycin-loaded PLA/PLGA microspheres were manufactured using the double emulsion solvent evaporation method. The porcine spleen was chosen as a vascular malformation model and eleven pigs were assigned to either the embolization group (n=7) or control group (n=4). Selective angiography was performed in all animals and Bleomycin-loaded PLA/PLGA microspheres (800–1000 micron in diameter) were administered into the splenic artery in the embolization group. 0.5mg/kg of bleomycin was used per procedure. After 30 days, porcine spleens were acquired to evaluate for the volumes of organ, presence or absence of microspheres, intraluminal reaction to bleomycin, vessel wall changes and extent of sclerosis.

Results: Newly manufactured microsphere formulations showed sustained long-term in-vitro release performance. Transcatheter arterial embolization was technically successful in all animals. Toxicity monitoring showed no hematologic, pulmonary, hepatic or renal toxicities. Microspheres induced significant shrinkage in volume of spleens. The mean spleen volume after embolization was significantly ($P < 0.001$) reduced compared with the mean volume for the group control. Pathology showed apoptosis/vasculitis of endothelial cells and disconfiguration of the spleen without systemic side effect in the experimental group.

Conclusion: Embolization of the spleen with Bleomycin-loaded microspheres with slow release properties can induce strong sclerosis of the spleen locally and promote apoptosis and vasculitis of splenic endothelial cells without systemic side effects. This study shows that transcatheter embolization with Bleomycin-loaded microspheres has the potential to be an alternative treatment for vascular malformations in humans.

P-88**Catheter-directed gastric artery embolisation with octreotide acetate-loaded PLA/PLGA (poly(lactide-co-glycolide) acid) microspheres with slow sustained release properties**

F. Nurili¹, T. Acar², S. Derman², A. Bas³, I. Caymaz⁴, I. Yurdaisik⁵, H. Cakiroglu⁶, O. Aras¹

¹Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, US, ²Bioengineering, Yildiz Technical University, Istanbul, TR, ³Radiology, Istanbul University, Istanbul, TR, ⁴Radiology, Istanbul Medeniyet University, Istanbul, TR, ⁵Radiology, Istinye University, Istanbul, TR, ⁶SÜDETAM, Sakarya University, Adapazari, TR

Purpose: The objective of the present work was to formulate slow and sustained release octreotide acetate-loaded PLA/PLGA (polylactide) (poly (Lactic-co- Glycolic) acid) microspheres and prospectively test the effects of catheter-directed gastric artery administration of these microspheres on plasma ghrelin levels and body weight in swine. Octreotide is an octapeptide with pharmacologic properties mimicking those of the natural hormone somatostatin. In the GI system it inhibits secretin, gastrin, vasoactive intestinal peptide, motilin and ghrelin. Slow-release local high-dose therapy might significantly decrease all these hormones, especially ghrelin.

Material and Methods: Twelve healthy growing swine were tested. Trans-catheter embolisation with Octreotide-loaded microspheres was performed selectively into the gastric arteries that supply the fundus and corpus. Six

swine underwent embolisation with Octreotide-loaded microspheres, while six control animals underwent a sham procedure with saline. 18 mg of total octreotide per procedure was used. Weight and fasting plasma ghrelin levels were obtained in the animals at baseline and at weeks 1-8. Necropsy was performed to assess mucosal integrity, fibrosis and ghrelin-expressing cells.

Results: Ghrelin levels over time was significantly decreased in experimental animals ($P < 0.001$). Weekly ghrelin levels were measured in control and experimental animals as a change from baseline ghrelin values. The average post-procedure weight loss in experimental animals was significantly ($P < 0.001$) higher than that in control animals. The ghrelin-immunoreactive mean cell density was significantly lower in the fundus in the embolised animals compared with control animals.

Conclusion: Gastric artery embolisation with biodegradable Octreotide-Loaded PLA/PLGA microspheres with sustained release properties can significantly suppress ghrelin and significantly affect weight loss.

P-89

The effects of different administration regimens of Apatinib in suppressing the carcinogenesis of VEGF in rats

N. Li, H.Y. Huang

The Department of Interventional Radiology, The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, CN

Purpose: To investigate the optimal starting time-point of apatinib therapy in suppressing the tumor-promoting effects of increased expression of VEGF post-TACE.

Material and Methods: 40 SD rats bearing hepatic tumor were randomly divided into four groups with apatinib in different patterns: (A) receiving VEGF injection; (B) starting apatinib 72 h prior to VEGF injection; (C) starting apatinib simultaneously with VEGF injection; (D) starting apatinib 72 h post VEGF injection. The growth speed of tumors, median survival time, and the expression of VEGF and MVD were compared.

Results: The results revealed the tumor growth and median survival time had significantly difference in apatinib groups as compared to the control ($P < 0.01$). Median survival time were 19.6 ± 1.78 d, 31.2 ± 6.99 d, 27.4 ± 4.9 d, 26.5 ± 4.6 d in group A, B, C and D. Tumors were collected for IHC examination. The expression levels of VEGF in B, C, D were 42.8 ± 7.96 , 71.9 ± 15.73 , 73.6 ± 13.73 , and all of them were significantly lower than control group (88.3 ± 13.61). The levels of MVD were 109.2 ± 8.98 in control group, which were the peak value compared to apatinib groups (45.7 ± 16.92 , 77.1 ± 16.29 , 93.6 ± 12.87 , all $P < 0.05$).

Conclusion: The best regimen of administration apatinib is taking apatinib before the increased expression of VEGF, which makes the most survival benefit for liver cancer rats via inhibiting VEGF-receptor expression via the bifunction of VEGF, and reducing tumor angiogenesis.

P-90

Intratumoral treatment of a pituitary adenocarcinoma in a Jack Russell Terrier using radioactive holmium-166 microspheres

N.C. Morsink¹, N.J.M. Klaassen², B.P. Meij¹, J. Kirpensteijn¹, G.C.M. Grinwis¹, J.W. Hesselink¹, J.F.W. Nijsen², S.A. van Nimwegen¹

¹*Veterinary Medicine, Utrecht University, Utrecht, NL,*

²*Radiology and Nuclear Medicine, Radboud University Medical Center Nijmegen, Nijmegen, NL*

Purpose: An image-guided microbrachytherapy is being developed for brain malignancies using radioactive holmium-166 microspheres (166HoMS). Experimental treatment of inoperable soft tissue tumors in companion animals showed promising results and minimal morbidity. The short Beta-radiation penetration depth allows a high, tumor-ablative radiation-absorbed dose in a single treatment, without extensive damage to surrounding tissues. In this case study a Jack Russell Terrier with a pituitary adenocarcinoma was experimentally treated by intratumoral injection of 166HoMS.

Material and Methods: A 10-year old male Jack Russell Terrier was referred to the University Veterinary Center Utrecht with complaints of behavioral changes, restlessness, stiff gait and compulsive circling. MRI revealed an inoperable space-occupying lesion at the pituitary gland. After one year of prednisone treatment, symptoms of the central nervous system were observed and MRI showed basisphenoid bone invasion. To reduce tumor volume, radioactive 166HoMS were administered in the tumor center through a trans-sphenoidal CT-guided approach. In total, 1097 MBq was delivered, resulting in an estimated absorbed dose of 1500 Gy. CT imaging was performed preoperatively to assess cranial anatomy and tumor volume, intraoperatively to confirm proper needle positioning, and postoperatively to evaluate tumor response to treatment.

Results: Tumor volume measured on CT at time of treatment, after 4 weeks and after 4.5 months were 10.6 cm³, 6.2 cm³ and 5.6 cm³, respectively, revealing a total tumor volume reduction of 47%. Histopathological analysis confirmed a low-grade pituitary adenocarcinoma.

Conclusion: The feasibility and acute safety of intratumoral 166HoMS treatment of a space-occupying pituitary adenocarcinoma was demonstrated, with rapid and significant tumor volume reduction, and minimal side effects.

P-91**Effect of irreversible electroporation parameters and the presence of a metal stent on the electric field distribution visualized in a static electric field**

A.M. Hogenes¹, C.G. Overduin¹, C.J.H.M. van Laarhoven², C.H. Slump³, J.J. Fütterer^{1,3}, M.W.J. Stomme²

¹Radiology and Nuclear Medicine, Radboud University Medical Center, Nijmegen, NL, ²Surgery, Radboud University Medical Center, Nijmegen, NL, ³Robotics and Mechatronics, University of Twente, Enschede, NL

Purpose: Irreversible electroporation (IRE) is used to ablate tumors near vital structures. Thermal effects can be observed and the influence of IRE nearby a metal stent is currently unknown. Visual insight in the electric field distribution could offer a profound understanding of thermal effects, the influence of IRE-parameters and a metal stent on the ablation zone. The purpose of this study was to visualize the effects of IRE-parameters and a metal stent on the electric field distribution and were correlated to electrical models.

Material and Methods: Experiments were performed in a static electric field using a high-voltage generator connected to two needle-electrodes in a transparent tube, filled with castor oil and semolina, to visualize electric field lines in three-dimensions. Variations in inter-electrode distance, voltage/cm and presence of a metal stent on the electric field distribution were studied.

Results: A 3D-visualization of the electric field distribution was demonstrated. The highest electric field line density was observed adjacent to the needles. Furthermore, experimental findings were in line with observations from electrical models. Redistribution of the electric field towards the stent was observed; regular field lines were absent in a triangular area between needles and stent.

Conclusion: Visualization of the electric field provided insight in IRE-parameters and indicated thermal effects most likely occur directly around the needles. Redistribution of the electric field towards the metal stent indicates a potential ineffective tumor ablation. Further research on effective and safe IRE-ablation near a stent is required before the contraindication to perform IRE in patients with a metal stent can be discarded.

Technical developments**P-92****Clinical significance and approach of using 3D slicer vessel segmentation and enhancement in Y-90 mapping or TACE pre-treatment planning**

Z. Badar¹, S. Nair², K. Ogden¹

¹Radiology, SUNY Upstate Medical Center, Syracuse, NY, US, ²Interventional Radiology, McMaster University, Hamilton, ON, CA

Learning Objectives: Step-by-step approach to vessel segmentation and vessel enhancement by 3D slicer technology. Clinical Significance of 3D slicer in Yttrium 90 (Y90) mapping or Transarterial chemoembolization (TACE) pre-treatment planning.

Background: Extraction of vessels in 3D Slicer prior to procedures can provide crucial information aiding in pre-treatment planning for Y90 or TACE procedures. Using 3D Slicer technology, providing a step-by-step approach on how the software provides a visual 3D reconstructed representation will demonstrate anatomical hepatic vascular variants and vasculature adjacent to hepatic lesions.

Clinical Findings/Procedure: A brief tutorial and flow chart of the vascular modeling toolkit (VMTK) and vessel enhancement in 3D slicer tools will be presented. Each subsection of the VMTK including Slicer module, Vessel enhancement, easy level set segmentation and centerlines will be discussed as part of the tutorial. Furthermore, parameters for segmentation of hepatic vasculature will be discussed. Vessel enhancement filters for evaluation of aneurysms, arteries and veins will also be presented. Retrospectively, hepatic vasculature of patients who underwent either Y90 microsphere radio embolization or TACE procedure will be analyzed to demonstrate segmentation and vascular enhancement. Visualization and quantification of vessels with regards to clinical significance of the above mentioned integration would be discussed for the above mentioned cases.

Conclusion: Tutorial on VMTK and Vessel enhancement in 3D Slicer will be discussed. Retrospective analysis of Y90 or TACE cases with use of segmentation and vessel enhancement will be presented to highlight its clinical significance.

P-93**Pulmonary nodule CT-guided microcoil localization: tips and tricks**

S.R. Alharbi

Radiology Department, King Saud University, Riyadh, SA

Learning Objectives: To demonstrate and illustrate microcoil preparation and placement. To demonstrate and illustrate tips and tricks to avoid common misplacement errors. To review and illustrate microcoil localization in challenging nodule locations.

Background: Recently video assisted thoracoscopy surgery (VATS) is the best workup choice for suspected malignant small pulmonary nodules. It is can be diagnostic and therapeutic with decrease sampling errors in compare to percutaneous

needle biopsy. Due to inability of surgeon to palpate and identified the nodule more than 50% of surgery convert to open thoracotomy with high morbidity and mortality rate. For that reason, multiple preoperative localization techniques were adapted using different materials. CT guided microcoils localization improved the success rate of VATS up to 97%.

Clinical Findings/Procedure: CT guided pulmonary nodule localization is done using 7 cm long platinum micro coil loaded in 21 Gauge chiba needle. Trailing technique is used to have one end of the micro coil deeper to the pulmonary nodule and another end visible for the surgeon at the pleural surface. Although it looks straight forward and simple technique, multiple tips and tricks were adapted for proper placement and to avoid dislodgment.

Conclusion: CT guided pulmonary nodule microcoil localization is done preoperatively to fluoroscopic guided video assisted thoracoscopic surgical resection. This exhibit will teach viewers the tips and tricks of microcoil localization technique to avoid various microcoil placement errors.

P-94

Local thrombolysis for venous port occlusion recovery

M. Cherkashin¹, N. Berezina², D. Puchkov², E. Naperov³, P. Yablonsky⁴
¹Surgery, Medical Institute n.a. Berezin Sergey, St. Petersburg, RU,
²Radiology, Medical Institute n.a. Berezin Sergey, St. Petersburg RU,
³Intensive Care, Medical Institute n.a. Berezin Sergey, St. Petersburg, RU, ⁴Surgery, Saint-Petersburg State University, St. Petersburg, RU

Purpose: To evaluate local thrombolysis efficacy for venous ports occlusions.

Material and Methods: In our analysis 325 patients with implanted central venous port were included. Mean patients' age was 45 y.o. Access distribution: subclavian n=298, jugular n=22, femoral n=5. After intervention all patients were included in an observational program: visits to surgeon (1, 3, 6 and 12 months), subclavian and superior caval vein ultrasound examination and echocardiography. In case of pulmonary embolism suspicion – chest CT and pulmonary CT angiography were performed. In case of device occlusion – X-Ray scopy by C-arm with contrast enhance.

Results: In 39 patients (13.5%) venous thrombosis or device occlusions were revealed. All these patients received low-molecular weight heparin (LMWH). In 11 cases anticoagulation was ineffective and local thrombolysis with active thrombotic masses aspiration was performed. On the first step by C-arm X-ray investigation devices occlusions were confirmed, then thrombolytic agent was injected into the system with mean 20 min exposition and after good blood aspiration patency was confirmed by venography. Initial success was achieved in 9 patients (81.8%). In 2 patients we have performed device explanation due to absence of recanalization and risk of thrombosis progression.

Conclusion: Based on our study results we suggest to timely use of local thrombolysis in patients with vascular access devices occlusions. Local thrombolysis is well tolerated and characterised by good patency recovery.

P-95

Picc-port: a better quality of life

F. Incandela, I. Di Gesu, C. Genova, D.G. Castiglione, M. Midiri, T.V. Bartolotta
 Radiological Sciences – Dibimed, AOUP Paolo Giaccone-Palermo, Palermo, IT

Purpose: To compare the satisfaction of oncologic patients who underwent chemotherapy, by using picc-port (central catheters peripherally inserted via basilic vein with subcutaneous brachial pocket) compared with those who had a central port (inserted via jugular vein with subcutaneous chest pocket).

Material and Methods: We prospectively followed up 80 patients requiring chemotherapy, after undergoing implantation of port, between November 2016 and November 2017. The procedures were performed in the angiosuite by the same IR team, by using ultrasound-guided venipuncture and fluoroscopic control. We divided patient into two group: A (41 patients underwent central port implantation), B (39 patients underwent picc-port implantation). The evaluation of patient satisfaction was based on a specific questionnaire, focussing on their personal experience and quality of life.

Results: 10 patients died for disease progression (6 of a.group, 4 of b.group). The questionnaire showed that the patient of A group perceived a more traumatic experience during the implantation and the removal of the central port, with pain in the 7 days following the intervention, and complains for aesthetical results; instead of B group which perceived less traumatic experience, with pain after intervention felt only in the 20% of case, and gratifying aesthetical results. Only 50% of patients interviewed of A group would recommend the device to other patients, while the 90% of patients of B group recommend the picc-port.

Conclusion: Brachial port is a good option for oncological patients, since it have been showed low intraoperative risk and postoperative complications which behave better quality of life, so that they would recommend it to others.

P-96

A planning software (pre-alpha-stage) for automated calculation/visualization of optimized overlapping ablation zones (optOAZs) for percutaneous thermal ablation (TA) of large (>40mm) renal tumors

C.M. Sommer¹, J. Roeser², F. Pan¹, B. Schmidberger², T.D. Do¹, B.J. Mittmann², P.L. Pereira³, G.M. Richter⁴, H.U. Kauczor¹, A. Franz⁵

¹Diagnostic and Interventional Radiology, University Hospital Heidelberg, Heidelberg, DE, ²Institute of Medical Engineering and Mechatronics, Ulm University of Applied Sciences, Ulm, DE, ³Radiology, Minimally Invasive Therapies and Nuclearmedicine, SLK-Clinics GmbH Heilbronn, Ruprecht-Karls-University Heidelberg, Heilbronn, DE, ⁴Clinic for Diagnostic and Interventional Radiology, Stuttgart Clinics, Stuttgart, DE, ⁵Institute of Computer Science, Ulm University of Applied Sciences, Ulm, DE

Purpose: Presentation of a planning software (pre-alpha-stage) for automated calculation/visualization of optimized Overlapping Ablation Zones (optOAZs) for percutaneous thermal ablation (TA) of large (>40mm) renal tumors.

Material and Methods: Interdisciplinary cooperation resulted in programming of a MITK Plug-In (www.mitk.org) for software-based automated definition of optOAZs for percutaneous TA. Workflow steps of the software were (I) segmentation/visualization of the tumor on DICOM images, (II) definition/visualization of intended safety margin, (III) definition of ablation zone diameter (spherical ablation), (IV) definition of a model for geometrical distribution of the ablation zones, and (V) definition of Ulm-Heidelberg-Uncertainty-principles (UHUs): "Tolerance non-ablated tumor volume (%)" (UHU-1) and "shrinkage ablation zone (%)" (UHU-2). The final workflow step (VI) consisted of automated calculation/visualization of optOAZs on DICOM images.

Results: Four differently configured renal tumors with diameters of 45-70mm underwent evaluation. A 5mm safety margin, a 30mm ablation zone diameter and a model based on automatic selection from a large number of randomized geometrical distributions were selected for all evaluations. After tumor segmentation, the remaining workflow steps were realized within 4 minutes for different T1b tumors and within 60 minutes for a T2a tumor. Automatic calculation/visualization with UHU-1=3% and UHU-2=20% resulted in 13 (45mm), 5 (50mm), 14 (60mm), and 21 (70mm) optOAZs. Conventional planning of an expert radiologist for comparison yielded 10/8/14/18 optOAZs.

Conclusion: The presented planning software is promising. Implementation of ellipsoid ablation zones, differently sized spherical and ellipsoid ablation zones, dedicated visualization/manipulation tools (e.g. simulation/adaptation of needle tracts), and optimized UHUs are next steps of on-going further development.

P-97

Effectiveness of automated tumor-feeder detection software (ATDS) in super-selective transarterial embolization (TAE)

T. Kubo¹, Y. Arai², M. Sone², S. Sugawara², T. Magara²
¹Radiology, The University of Tokyo Hospital, Tokyo, JP,
²Department of Diagnostic Radiology, National Cancer Center Hospital, Tokyo, JP

Learning Objectives: To explain the mechanism and function of ATDS. To show how to use ATDS in super-selective TAE. To discuss the usefulness of ATDS in super-selective TAE.

Background: Super-selective arterial intervention is an effective therapeutic option for some tumors and arterial bleedings. Super-selective catheterization into the feeders of target lesion is essential to improve treatment effect and reduce adverse events. Therefore, identification of the feeders is crucial. However, detecting the feeders is sometimes difficult with digital subtraction angiography (DSA) because of the size, location and vascularity of the target lesion.

Clinical Findings/Procedure: We use an ATDS (Embolization Plan, CANON MEDICAL SYSTEMS, Ohtawara, Japan) to detect the feeders. First, we perform CT arteriography. Second, we mark the tumor and the catheter tip on CT arteriography images using the software. Then, the software automatically detects the feeders and visualizes them on VR images. The whole process completes within approximately 5 minutes. Our initial experience showed the promising results of accuracy of the detected feeders and shortening of the procedural time.

Conclusion: The ATDS is useful for super-selective TAE.

P-98

Technical success and safety profile of balloon-occluded transcatheter arterial chemoembolization (b-TACE) for hepatocellular carcinoma performed with polyethylene-glycol Epirubicin-loaded drug-eluting microsphere

P. Lucatelli, G. de Rubeis, L. Ginanni Corradini, B. Rocco, A. Cannavale, P. Nardis, M. Corona, M. Bezzi
 Radiological Sciences, Sapienza University of Rome, Rome, IT

Purpose: To report the technical success, safety profile of balloon-occluded trans-catheter-arterial-chemoembolization (b-TACE) performed with using polyethylene-glycol epirubicin-loaded drug-eluting microspheres in patients with hepatocellular carcinoma (HCC).

Material and Methods: Prospective, single centre, single arm study. 16 patients were treated (mean age 67.2±14.0 years; 14 males; 24 naïve lesions; 1.5 tumor/patient) in 20 procedures. Technical success was defined as a composite endpoint: ability to place the micro-balloon catheter inside the required vascular segment, balloon-occluded arterial stump pressure (BOASP) drop and qualitative assessment of microsphere deposition in the target tumour (at non-enhanced-Cone-beam-CT performed at the end of the procedure). Safety was assessed by categorizing adverse events (AEs) according to CIRSE classification, laboratory analysis changes according to the Common-Terminology-Criteria-for-Adverse-Events v5.0.

Results: Planned feeder artery was reached in all cases. BOASP drop from 111.9±27.8 mmHg to 62.2±14.8 mmHg (drop average of 49.8±18.8 mmHg). Inverse correlation was found between BOASP drop and tumor volume reduction ($r=-0.52$, $p<0.05$). This inverse correlation remained significant considering the pre-procedural diameter of the tumor ($r=-0.54$, $p<0.05$). Subgroups (<3 or >3cm) correlational analysis showed no differences between the two curves ($r <3\text{cm} = -0.81$ and $r >3\text{cm} = -0.59$; $p>0.05$). Microsphere deposition showed qualitative tumor contrast retention in 13/20 (65%) and qualitative defect of tumor contrast retention in 7/20 (35%). Ten procedures presented an extra-nodule microsphere deposition, among these only 3 were significative. Three AEs (15%), were reported, a pseudo-aneurism (grade 3) of the HCC's feeder, a liver abscess (grade 2) and an asymptomatic segmentary biliary tree dilatation (grade 2); all laboratory analyses modification were of grade 1.

Conclusion: b-TACE is a safe and effective procedure for HCC treatments.

P-99**Technical efficacy of balloon microcatheter assisted drug-eluting beads trans-arterial chemoembolization for treatment of hepatocellular carcinoma: our preliminary experience**

E. Yong, S.N. Babawale, A. Jhamb
Radiology, St Vincent's Hospital, Melbourne, VIC, AU

Purpose: This study aimed to prospectively evaluate technical efficacy of balloon micro-catheter assisted drug eluting beads trans-arterial chemoembolization (BDEB-TACE) in the treatment of hepatocellular carcinoma (HCC).

Material and Methods: No stringent inclusion criteria was established for this study design, however all the patients fulfilled the criteria for trans-arterial chemoembolization (TACE) in accordance with the Barcelona Clinic Liver Cancer (BCLC) guidelines. A total of 10 HCC (sizes ranging from 8-41mm) were treated in 6 patients (age range; 64 -75 years). In each case, the common hepatic artery was catheterized with a cobra 2 catheter and the segmental hepatic arterial branch supplying the tumour of interest was selected with an occlusive balloon micro-catheter (OcclusafeR, Terumo). A mixture of doxorubicin drug eluting beads (100- 300µ) and iodinated contrast was infused into the tumour through the occlusive balloon catheter under digital subtraction fluoroscopic guidance following the measurements of the segmental arterial stump pressures before and after inflating the balloon. The Modified Response Evaluation Criteria in Solid Tumours (mRECIST) guideline was utilized as a benchmark for interpreting follow-up imaging performed 4-6 weeks after BDEB-TACE.

Results: This preliminary study showed impressive responses following a single treatment with BDEB-TACE. 70% and 30% of tumours respectively demonstrated complete and partial responses. No progressive disease was identified.

Conclusion: BDEB-TACE is an effective HCC treatment, however further research is required in this nascent therapy.

P-100**Pre-operative marking guided by image: how I do it**

R.N. Zangiaco, D.T. Setuguti, M.R. Liberato, P.C.C. Viana, D.S. Oliveira, L.T.B. Siqueira, M.R. Menezes
Interventional Radiology, Radiology Institute of University of São Paulo, São Paulo, BR

Learning Objectives: The present study aims to demonstrate the techniques and the fundamental materials to encourage interventionists to carry out the marking of small preoperative lesions.

Background: The pre-surgical marking has been described and used to reduce surgical times, less morbidity and favoring a more targeted surgical resection and consequently a better prognostic and a personalized therapy. Although these procedures are well known in some specialties, there is still a wide field to be explored for the entire surgical and interventional community.

Clinical Findings/Procedure: This case based pictorial review aims to show the tips and tricks that every interventional radiologist needs to know before performing marking lesions procedures. We selected five educational cases based on different medical areas. 1. Charcoal suspension tattooing of hypercaptive PET-CT mesorectal lymph node after radical prostatectomy; 2. Marking of small liver colorectal metastasis tumor before chemotherapy; 3. Marking of small pulmonary colorectal metastasis preoperatively; 4. Hookwire preoperatively marking of cervical lymph node metastasis from squamous cell carcinoma of oropharynx; 5. Coil preoperatively marking of small peripheral lung colorectal metastasis.

Conclusion: An effective communication with the referral physician is crucial to deliver a personalized marking lesion procedure. At the end of presentation, the IR will be familiar with marking lesions techniques and indications.

P-101**IR techniques for ischaemic biliary strictures**

C.L. Bent¹, J. Phillips², A. Shawyer¹
¹*Interventional Radiology, RBCH, Bournemouth, UK,*
²*Urology, RBCH, Bournemouth, UK*

Learning Objectives: To demonstrate:

1. Indications for percutaneous biliary interventional procedures
2. Techniques to treat intra and extra hepatic biliary stones when endoscopic techniques are not an option
3. Techniques to treat biliary strictures when endoscopic techniques cannot be utilized
4. Outcomes following such procedures

Background: Despite advancements in operative technique and postoperative care following pancreaticoduodenectomy, postoperative complications remain frequent. Biliary stricture and subsequent biliary stone formation are two of such complications. This educational poster demonstrates IR techniques that can be utilized to manage such complications.

Clinical Findings/Procedure: Biliary strictures: PTC is performed with insertion of an 11F sheath. Via the sheath and prior to stricture balloon dilatation, direct intra ductal visualization is performed using an Olympus URF-P5 flexible fibre ureteroscopy (8.4F diameter). This allows assessment of disease and direct brushings and forcep biopsies of any abnormality. If cytology/histology is normal, a retrievable biliary stent graft is placed adapted with a percutaneous 2-0 prolene for an interval of 8-10 weeks. During placement, balloon dilatation from within the stent graft to 10mm is performed. The stent graft is removed percutaneously once the indwell time has elapsed. Biliary stones: The procedure as above would be performed followed by laser lithotripsy with a Cook Medical H-30 holmium laser system with a 273 micron laser fibre (2.5-20W power). Once the stones were fragmented, a compliant balloon was used to perform antegrade trawling into the bowl to clear the ducts.

Conclusion: Biliary stricture and stone formation following pancreaticoduodenectomy can be managed successfully with percutaneous IR techniques as described.

P-102**The value of a metal artefact reduction algorithm for monitoring and assessing ablation zones during cone-beam CT-guided pulmonary microwave ablation: a quantitative and qualitative analysis**

M. Ozturk, S. Shafer, E. Meram, C. Brace, P. Laeseke
*Department of Radiology, University of Wisconsin Madison,
Madison, WI, US*

Purpose: To assess the value of metal artefact reduction (MAR) algorithm for monitoring and assessing ablation zones during cone-beam computed tomography (CBCT) guided pulmonary microwave ablation in an ex vivo porcine model.

Material and Methods: Six microwave ablations were performed in ex vivo porcine lungs using a single 17-gauge antenna under CBCT guidance. Ablations were performed for 5 minutes at 65W. Ablation zone growth was monitored at 1 minute-intervals using CBCT. An immediate post-procedure CBCT scan was obtained after the probe was removed. Images acquired during the ablations with the probe in place were reconstructed using a MAR algorithm. Unprocessed images were compared to MAR-processed images using a subjective image quality assessment scale from 0 (severe artifact, no ablation zone visible) to 4 (minimal artifact, ablation zone clearly visible) and by comparing image noise around the ablation probe on MAR-processed and unprocessed images.

Results: Mean image quality score of MAR-processed images (2.96) was significantly higher than the mean image quality score of unprocessed images (1.2, $p < 0.001$). Image noise of MAR-processed images was significantly lower at the tip of the probe ($p = < 0.001$). Image noise at either side of the ablation probe was lower at MAR-processed images but it was not statistically significant ($p = 0.295$ and $p = 0.102$).

Conclusion: A metal artifact reduction algorithm decreased image noise around the ablation probe and subjectively improved image quality during cone-beam CT guided pulmonary microwave ablation in an ex vivo porcine model. Growing ablation zones were more conspicuous on MAR-processed images, particularly at early timepoints.

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