Interventionell Radiologisches Olbert Symposium

# IROS 2020

# POSTER ABSTRACTS AND AUTHOR INDEX

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All accepted scientific abstracts and case reports will be presented as electronic posters on the **Poster-Terminals** throughout the congress.

In addition, selected posters will be presented orally in the **Poster Top Ten** session. The respective date and timing are displayed below:

**THURSDAY, JANUARY 16**

**PS 401 / Poster Top Ten** 12:40 – 13:40

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## P-1

### Adequate pre-interventional imaging is crucial for detection of aberrant bronchial arteries in patients with hemoptysis

*B. Simon, J. Neubauer, F. Bamberg, L. Maruschke; Freiburg/DE*

**Clinical history/Pre-treatment imaging:** A 61-years-old male patient with recurrent life threatening hemoptysis due to stage IV COPD was referred to our clinic from an external hospital. Previous bronchoscopy which had shown the bleeding source in the right upper lobe could not be treated endoscopically. Subsequent external angiography with proximal coil embolization of one proximal right bronchial artery (BA) could stabilize the patient but not permanently control the bleeding. As the patient arrived at our institution we decided primarily for an ECG-gated contrast-enhanced CT (CECT) which showed an accessory bronchial artery (BA) originating from the right internal mammary artery (IMA).

**Treatment options/Results:** The angiography was repeated and the accessory BA could be successfully embolized with microcoils. After the intervention the patient recovered and was free of hemoptysis and could be discharged home.

**Discussion:** The IMA as the origin of atypical or aberrant bronchial arteries is a rare clinical finding. In patients with hemoptysis and failed bronchoscopic bleeding control, ECG-gated CECT is mandatory for getting more information about anatomical features and for preparation of a successful endovascular treatment.

**Take-home points:** If first line interventional bronchoscopy fails to stop bronchial bleeding, angiographic embolization should be considered. Adequate pre-interventional imaging is crucial. When reporting on the CECT special attention should be paid not only to hypertrophied BAs but also to aberrant systemic supply of BAs, e.g. from subclavian, lateral thoracic and inferior phrenic arteries.

## P-2

### Sandwich technique for the treatment of distal sealing complications after EVAR

*S. Schotten, M. Pitton, C. Düber; Mainz/DE*

**Clinical history/Pre-treatment imaging:** Three male patients who underwent EVAR for infrarenal aortic aneurysms developed insufficient iliac sealing due to iliac artery dilatation. One of those patients presented with bilateral type Ib endoleak while the other two patients showed no perfusion of the aneurysm sack but aneurysm growth.

**Treatment options/Results:** All patients were evaluated for distal extension of the iliac limbs (bilateral in two and unilateral in one patient). We aimed to preserve the hypogastric arteries in order to prevent buttock claudication. Distal extension with a dedicated branched endograft was not feasible because of the narrow diameters of the iliac limbs and the short distance to the hypogastric arteries. Therefore, we performed the distal extension with parallel stentgrafts (sandwich technique). To avoid brachial access, we used a 10F steerable sheath to cross the Endograft bifurcation to place the stentgraft for the hypogastric artery. The procedure was technical successful in all three patients. There were no procedure-related complications. The iliac branches remained patent in the follow-up.

**Discussion:** Loss of distal sealing is not uncommon after EVAR. The preservation of the hypogastric artery can be challenging because branched devices are usually not feasible in this situation. The sandwich technique is a valid alternative to embolization of the hypogastric artery and the cross-over approach with a steerable sheath allows to perform the procedure from a femoral access only.

**Take-home points:** The cross-over sandwich technique is a valid treatment option for distal sealing complications after EVAR.

## P-3

### Endovascular repair of an accidental internal iliac artery puncture during a bone marrow biopsy

*B. Simon, J. Neubauer, F. Bamberg, L. Maruschke; Freiburg/DE*

**Clinical history/Pre-treatment imaging:** A 57-years old woman was admitted to our clinic for control bone marrow biopsy. The patient had the history of an AML, after ASCT one year ago the patient was currently in CR. After removal of the stylet of the puncture needle during the bone marrow puncture a pulse synchronous bleeding from the puncture needle suddenly occurred. A CT angiography was performed immediately. This showed the positioning of the tip of the puncture needle in the right internal iliac artery.

**Treatment options/Results:** An interdisciplinary team decided that an endovascular approach by the interventional radiology (IR) would be the best and most efficient way to treat the vessel injury. The hemodynamically stable patient was directly taken to the catheter laboratory. After creating an angiogram of the iliac arteries, a 6/22 mm V12-Stent-prosthesis was introduced via brachial artery access into the right IIA. Directly after removing the needle, the stent graft was inflated. Control angiogram showed a properly deployed stent-prosthesis and no bleeding. The patient could be discharged the next day without complaint.

**Discussion:** Stent grafts are well established in treating acute arterial injuries or bleeding of larger vessels. Vascular surgery is a much more invasive and time consuming procedure that would have involved a higher risk of morbidity for the patient.

**Take-home points:** Endovascular therapy proves to be a safe and efficient treatment option in certain accidental vessel injuries.

## P-4

### Focal treatment of prostatic carcinoma using MR-guided high intensity focused ultrasound (MRgFUS) – single site experience in Germany

*M. Düx, U. Witzsch; Frankfurt/DE*

**Purpose:** Feasibility of focal treatment of prostatic carcinoma using MR-guided high focused ultrasound (MRgFUS).

**Material and methods:** In June 2018 the MRgFUS center at Frankfurt, Germany, started focal therapy of prostate carcinoma. Men with prostate carcinoma of low/intermediate risk, Gleason score 6 or 7, have been offered focal ablation using MRgFUS as an alternative to active surveillance. Inclusion criteria: mpMRI of the prostate & MR fused biopsy of the prostate not older than 3 months, tumor board approval & considered fit for ITN.

**Results:** 11 patients with prostate carcinoma were considered for MRgFUS. For technical reasons 2 patients had two sessions of treatment, the remaining 9 patients were treated by one session only. 11/11 patients were successfully treated achieving homogeneous thermal necrosis covering the carcinoma. In all cases a minimum of 1 cm safety margin was planned and achieved as documented by post contrast MRI immediately after completion of focal treatment. Total table time was 5-6 hours in the beginning, dropping to a mean of 3,5 hours due to a learning curve. All patients did well after waking up from ITN, there was no haematuria, infection or pain that needed medical treatment. 10/11 patients reported no side effects during the hospital stay of 2-3 days post treatment. 1 patient suffered from right sided local thrombosis of gastrocnemius veins that was resolved by medical treatment. The urine catheter was routinely removed 2 days post treatment.

**Conclusions:** MRgFUS of prostate carcinoma is feasible, safe and achieves homogeneous thermal necrosis of the tumor and saftey margins.

## P-5

### Is there a correlation between the decrease in the hepatic portal venous pressure gradient and the change in the intrahepatic portal venous arborisation after TIPS implantation?

*U. Teichgräber; Jena/DE*

**Purpose:** The purpose of our study is to determine the effect of the changes in the hepatic venous pressure gradient (HVPG) on the intrahepatic venous arborisation after TIPS implantation.

**Material and methods:** Pre- and post- interventional portal pressure gradients was recorded in 43 patients. The portal venous arborisation on portography was classified according to portal venous tree after injection of contrast agent. Data was correlated using Pearson's correlation coefficient.

**Results:** Analysis of the correlation between the changes in the HVPG and the arborisation in portography before and after TIPS implantation was performed. In our patient population the mean HVPG before TIPS was 22.5 mmHg; range 13-47 mmHg. After TIPS implantation the mean HVPG was 11.9 mmHg; range: 2-40 mmHg. According to our adopted classification of intrahepatic venous arborisation there was a mean arborisation of 2.6 before TIPS implantation, which declined to 0.72 after implantation.

**Conclusions:** The HVPG is not the only parameter responsible for determining the postinterventional intrahepatic venous arborisation. The presence of collateral circulation or varices which is a common finding in the studied population with portal venous hypertension

provides a secondary pathway for the blood circulation bypassing the liver. This might explain the lack of correlation between the changes in HVPG and arborisation before and after TIPS implantation. This emphasizes the importance of closure of varices by coiling or embolization. Also, the various degrees of cirrhosis of liver parenchyma will definitely affect the degree of arborisation before and after TIPS implantation. Further studies are required to assess the different factors affecting intrahepatic venous arborisation.

## P-6

### Embolization of a bronchopulmonary arteriovenous malformation in a 1-year-old patient with KCNT1-related epilepsy of infancy with migrating focal seizures (EIMFS): a case report

*R. Kaufmann, J. Spenger, A.-M. Schneider, P. Waldenberger; Salzburg/AT*

**Clinical history/Pre-treatment imaging:** Epilepsy of infancy with migrating focal seizures (EIMFS) is a rare genetic disease related with KCNT1-mutation, characterized by seizures in the first six months of life and associated with systemic to pulmonary collateral arteries (SPCA). A 14-month-old boy with genetically verified EIMFS who presented with recurring pulmonary hemorrhage and clinically relevant hemoptysis, was treated with selective embolization for extensive bronchopulmonary und bronchovenous shunts arising from bronchial arteries, intercostal arteries and the thyrocervical trunc.

**Treatment options/Results:** In general anesthesia and via ultrasound-guided right-femoral approach (4 Fr sheath and diagnostic catheters), selective angiography of left and right bronchial arteries showed massively widened, dysplastic bronchial arteries and pulmonary arteriovenous shunts on both sides. microspheres (700 µm), torpedoes of gelatin sponge and PVA-particles (250-355 µm) were used for selective embolization via a coaxial microcatheter-system (ID 0,018"). Selective angiography of the right subclavian artery further revealed extensive arteriovenous shunts from the thyrocervical trunc and intercostal arteries, involving all lobes of the right lung, also treated with selective embolization by microspheres and torpedoes of gelatin sponge. All relevant pulmonary shunts were successfully devascularized. Hemoptysis finally stopped and the patient clinically improved.

**Discussion:** Bronchopulmonary arteriovenous malformations with consecutive pulmonary hemorrhage and hemoptysis are a known side effect of genetic EIMFS. Embolization of such bronchopulmonary arteriovenous malformations is technically challenging but successful for treating hemoptysis, leading to clinical improvement.

**Take-home points:** Bronchopulmonary arteriovenous malformations in KCNT1-related EIMFS affecting small children can be treated effectively with super-selective embolization.

## P-7

### The Clinic of Radiology (CoR) with own patient ward and coding/billing responsibility: Key Economic Performance Indicators (KEPIs) on the example of a German hospital offering the full spectrum of interventional radiology (IR)

*C.M. Sommer[1,2], S. Kätzlmeier[3], T. Do[2], G.M. Richter[1]; [1]Stuttgart/DE, [2]Heidelberg/DE, [3]Erlangen/DE*

**Purpose:** To analyze Key Economic Performance Indicators (KEPIs) of a Clinic of Radiology (CoR) with own patient ward and coding/billing responsibility offering the full spectrum of Interventional Radiology (IR), and to compare those KEPIs with nationwide standard (In-EK-cost-matrix KEPIs).

**Material and methods:** The CoR offers a 24/7 IR service with all types of elective and emergency interventions. The IR team treats patients accomodated in the ten beds on a dedicated CoR ward. Referring physician management, case documentation, coding, controlling and billing are direct CoR responsibilites. The presented CoR KEPIs originate from our controlling and were processed in a master thesis.

**Results:** Between 2010 and 2013, the CoR case-mix-index increased steadily from 1.1 to 1.5, and accordingly the cases featured markedly increased complexity over time. In 2013 (2010), CoR KEPIs "staff, material and infrastructure costs" were -22.2% (-21.4%), +16.9% (-7.4%) and -30.5% (-21.8%) referred to the respective InEK-cost-matrix KEPIs. These outcomes resulted in an annual cost advantage of several hundred thousand Euros to the benefit of the CoR and generated important deadweight effects for the associated hospital and clinical partners.

**Conclusions:** Compared with nationwide standard, KEPIs of a CoR with own patient ward and coding/billing responsibility offering the full spectrum of IR are markedly better. We believe that major reasons for this phenomenon are the highly specialized CoR services ranging from diagnosis over treatment to aftercare provided by one hand with optimized workflow, information flow and transparency. In the future, more hospitals may utilize this economic superiority as adjustment screw to maintain competitive edge.

## P-8

### Report on outcomes of challenging dural arteriovenous fistulas using endovascular and complex surgical approaches

*N. Krug, S. Schob, K.-T. Hoffmann, U. Quäschling; Leipzig/DE*

**Purpose:** Present our single-center experience with treatment options for challenging cranial dural arteriovenous fistulas (DAVFs). In context of location, configuration and drainage patterns, DAVF were treated approaching different endovascular or combined surgical-endovascular strategies.

**Material and methods:** 35 patients were included. Depending on aforementioned criteria, patients were selected for treatment with coils, liquid embolic agents or open surgery.

**Results:** Transvenous embolization (TVE) was performed in 26%, transarterial embolization (TAE) in 57% and a combination of both in 14%. One DAVF was clipped amending former TAE. In 66% we obtained long-term follow-ups (FU) – permanent occlusion was achieved in 69% via TAE, in 100% via TVE and in two cases using a combined approach. One shunt was closed entirely by clipping after TAE. TAE showed clinical improvement in 78%. TVE was associated with improvement of symptoms in 100%. All TVEs were managed in 1 session. 67% of TAEs and 20% of cases treated in a combined fashion led to complete occlusion in 1 session. For open clipping a second session was necessary. Pearls:Remarkable access-routes were approached in 4 cases; 2xsuperior ophthalmic vein was used to occlude the cavernous sinus and 2xtransverse sinus was occluded directly after neurosurgical preparation.

**Conclusions:** If possible TVE should be preferred over TAE for DAVF-occlusion. Exceptionally, open surgery is essential to gain access to the venous target structure. TVE achieves higher occlusion-rates and usually requires only a singular session, bearing greater patient comfort. A combined approach is comparatively successful, but mostly requires repeated treatments.

## P-9

### Endovascular simulation training: a tool to increase enthusiasm for interventional radiology among medical students

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**Purpose:** Interventional Radiology (IR) is a growing field. However, in most medical schools it is underrepresented in the curriculum. Therefore, we aimed to test whether endovascular simulator training improves the attitude towards IR among medical students.

**Material and methods:** This prospective study was conducted at two university medical centers. In both a 90-minute course on IR was given to 4thyear medical students. The course was split into two halves: one theoretical part about IR and one practical part using endovascular simulators. Questionnaires were completed before the course, after the theoretical and after the practical part using smartphones/tablets. Students were asked to rate their interest in IR, knowledge in IR, the attractiveness of IR, and the likelihood to potentially work in IR in the future on a 7-point Likert scale. A crossover design was used to prevent position-effect bias.

**Results:** Seminar and simulator led to an improvement in all items: interest (pretest: 5.2 vs. post-seminar/post-simulator: 5.5/5.7), knowledge (pretest: 2.7 vs. post-seminar/post-simulator: 5.1/5.4), attractiveness (pretest: 4.6 vs. post-seminar/post-simulator: 4.8/5.0), and the likelihood to choose IR in the future (pretest: 3.3 vs. post-seminar/post-simulator: 3.8/4.1). Although both parts led to a significant improvement, the effect was significantly stronger for the simulator training compared to the seminar part regarding all items (all $p<0.05$).

**Conclusions:** Endovascular simulator training in medical school significantly increases the interest in IR, the knowledge about IR, the positive attitude towards IR, and the likelihood to potentially choose IR in the future. Hence, implementing dedicated IR-courses comprising practical simulator training can help to fight recruitment problems in IR.

## P-10

### Safety and efficiacy of ReoPro® in cerebral aneurysm coiling

*A. Grams, M. Wildauer, N. Gruber, R. Helbok, C. Freyschlag, E. Gizewski; Innsbruck/AT*

**Purpose:** A common complication during coil-occlusion of cerebral aneurysms is clot formation near the aneurysm neck. In many centres Abciximab (ReoPro®), a glycoprotein-IIb/IIIa receptor antagonist, is administered in such an event, in order to dissolve the clot, in addition to increasing the blood pressure. There is only few literature according safety and efficiacy of the application of ReoPro® in these interventions, which was the aim of this study.

**Material and methods:** We included 368 patients (266 female, 100 male; mean age 58.6 years), who received coil-occlusion of an intracranial aneurysm between 2012 and 2018, in our centre. In this cohort 177 suffered from subarachnoid haemorrhage due to aneurysm rupture and 191 were elective cases. In 82 of the interventions ReoPro® has been administered. In both groups volumes of cerebral infarctions and the presence of a new, post-interventional haemorrhage was registered. In addition, the presence of residual clots was registered in the ReoPro® cases.

**Results:** Number and volumes of postinterventional cerebral infarctions were significantly higher in patients who received ReoPro® (p=0.01), independent from the presence of a residual clot, at the aneurysm neck or peripheral to it, in the last angiography series. However, the presence of post-interventional hemorrhages was similar in both groups.

**Conclusions:** The administration of ReoPro®, if supposed to be necessary during coil-occlusion, seems to be a safe method, concerning the occurrence of postinterventional haemorrhages. Patients who received ReoPro® are more likely to develop postinterventional cerebral infarctions, as it was supposed. However, it cannot be estimated how large the infarcts would have been without ReoPro®.

## P-11

### Balloon occlusion catheter – extrahepatic experience

*P. Weberhofer, M. Gübitz; Leoben/AT*

**Clinical history/Pre-treatment imaging:** 80years old male patient was hospitalized due to frequent rectal bleeding and decrease of hemoglobin. As underlying disease an adenocarcinoma of the prostate Gleason 9 (4+5) with rectal infiltration is known. CT including CTA revealed massive rectosigmoid tumor infiltration with irregular peripheral tumor feeders, at the time of aquisition without acute bleeding. The volume of the expansion is approximately 220cm$^3$. The tumor was predominately supplied via inferior mesenteric artery (IMA).

**Treatment options/Results:** After peripheral intubation of the IMA via right femoral artery a dual phase conebeam -CT was performed. A balloon occlusion microcatheter (OcclusafeTM, Terumo) was inserted and the balloon was inflated to 4mm adapted to the vessel size. From this position embolisation with spherical particles (EmbozeneTM 400µm, Boston) followed by coil embolisation (Azur®CX, Terumo, IDCTM, Boston) was performed. No backflow was observed at any time.

**Discussion:** OcclusafeTM balloon occlusion microcatheter is regulary used in TACE procedures, on the other hand there is less experience in extrahepatic use of the device. In our case the utilisation was quick and safe. Our aim was to avoid backflow in side branches feeding parts of descendo-sigmoidal colon, which was successful. The limitiation of that microcatheter is that coils can only be applied to a maximal diameter of 2mm. The use of larger coils requires microcatheters with bigger internal diameter.

**Take-home points:** Extrahepatic use of temporary balloon occlusion catheter is a safe meassure for backflow prophylaxis especially in regions where non-target embolization can cause dangerous necrosis. Possible further application areas could be urogenital interventions like prostatic artery embolization.

## P-12

### Flow diversion beyond the circle of Willis: endovascular aneurysm treatment in peripheral cerebral arteries employing a novel low-profile flow diverting stent

*S. Schob, K.-T. Hoffmann, U. Quäschling; Leipzig/DE*

**Purpose:** Flow diversion (FD) has emerged as superior minimally invasive therapy for cerebral aneurysms. However, aneurysms of small peripheral vessel segments have not yet been adequately treatable. More specifically, currently established devices necessitate large microcatheters which impede atraumatic maneuvering. The Silk Vista Baby (SVB), a novel flow diverter, offers the as yet unique feature of deliverability via a 0.017 inch microcatheter. This study reports our first experience with the SVB in challenging intracranial vessels employing a vessel-specific tailored microcatheter strategy.

**Material and methods:** 25 patients (27 aneurysms) were prospectively included. A total of 30 SVBs were employed, predominantly targeting demanding aneurysms of the anterior communicating artery complex. The efficacy of the FD was assessed using two-dimensional vector-based perfusion and conventional digital subtraction angiography (DSA) after implantation and at the first follow-up at 3 months. The first follow-up was available in 22 patients.

**Results:** All devices were implanted without technical or clinical complications. Eleven treatments were performed using the recommended Headway 17. In 14 interventions the even more maneuverable Excelsior SL10 was used, which was previously tried and tested for safety 'in vitro' as an alternative delivery system. Aneurysmal influx was strongly reduced after implantation. All parent vessels remained patent. 17/27 aneurysms were completely occluded at first follow-up (~2.7 months), 6/27 aneurysms showed decreased influx or delayed washout and one remained unchanged.

**Conclusions:** SVB provides enhanced controllability in small cerebrovascular segments. Smaller variants can safely be implanted via the superiorly navigable ExcelsiorSL10. Hence, the SVB represents the next evolutionary step in minimally invasive treatment of cerebral aneurysms.

## P-13

### Direct sac puncture (DSP) and embolization of type II endoleak (T2EL) after EVAR

*L. Kara, M. Schmidt; Zürich/CH*

**Clinical history/Pre-treatment imaging:**
♂ *1940
09/2012: Infrarenal abdominal aortic aneurysm
03/2015: EVAR due to progressive growth
08/2016 – 07/2017: Multiple transarterial embolizations with N-butyl-cyanoacrylate (NBCA) and lipiodol of type II endoleaks via inferior mesenteric artery, iliolumbal and lumbal arteries
12/2018: DSP and embolization of a persistent dorsolateral T2EL due to progressive sac growth
03/2019: No aneurysm growth, no evidence of persisting endoleak.

**Treatment options/Results:** Type II endoleaks are a prevalent issue following EVAR and need to be treated if persisting and resulting in aneurysm sac growth. There are several options, including transarterial, transcaval, transabdominal or translumbar embolization as well as endoscopic ligation of feeder vessels or open surgical treatment. After multiple unsuccessful transarterial embolizations of a dorsolateral T2EL it was decided to try a direct sac puncture via translumbar approach. The intervention was performed under general anesthesia in an angiography suite. A needle was inserted into the sac with the help of a "needle guidance" software and the use of a Dyna-CT and 3-D rotational angiography. After obtaining a pulsatile, arterial flashback of blood a mixture of lipiodol and NBCA (4:1) was inserted into the aneurysm sac. The post-procedure contrast-enhanced CT showed a complete embolization of the involved arteries and no sac growth.

**Discussion:** Since T2EL is a frequent problem after EVAR it is important to establish quick, effective and safe treatment options. DSP is an option with low morbidity and mortality as well as short radiation time.

**Take-home points:** DSP is a minimally invasive and effective treatment option in T2EL.

## P-14

### Treatment of intrapancreatic false aneurysm in hemorrhagic pancreatitis with mesenteric vein compression using coils – a rare cause of acute abdominal pain

*N. Verloh, L. Beyer, W. Uller, V. Teusch, A. Schicho, C. Stroszczynski, H. Goessmann; Regensburg/DE*

**Clinical history/Pre-treatment imaging:** A 57 year old male patient presented to our emergency ward with acute colicky upper abdominal pain. CT and MRI-Scans revealed prepancreatic hematoma with compression of the superior mesenteric vein in addition to a 6mm false aneurysm in the pancreas head that was most likely the source of the bleeding, although no active bleeding was detected. The patient had no history of pancreatitis or elevated pancreas enzymes.

**Treatment options/Results:** Since open surgery with pancreatic resection has the potential of considerable postoperative complications, we performed angiography showing arterial inflows to the aneurysm via the superior and inferior gastroduodenal artery as well as the dorsal pancreatic artery. Using a 0.021'' microkatheter and a 0.014'' guide wire we were able to intubate the feeding arteries and superselectively embolize those using 1.5 and 2 mm coils. Postinterventional CT scan performed 5 days after the intervention confirmed full occlusion of the false aneurysm. The patient recovered well from the intervention and was discharged the day after the CT scan. No recurrent bleeding has occurred since. The patient has not experienced sings of pancreatitis postprocedurally.

**Discussion:** In the hands of experienced interventional radiologists superselective embolization is a safe and effective treatment option. Thorough angiography of the pancreas arcades should be performed to fully detect the feeding vessels to the source of bleeding.

**Take-home points:** Hemorrhagic pancreatitis is a very rare cause of acute abdominal pain. Full knowledge of the pancreatic arteries anatomy is extremely helpful to detect and embolize the site of bleeding in small false aneurysms.

## P-15

### Catheter radiofrequency ablation of malignant biliary stenosis

*M. Gübitz; Leoben/AT*

**Clinical history/Pre-treatment imaging:** 75 yr male patient, 2016 histologically verified cholangiocarcinoma (6,5cm diameter) in the right liver lobe. Due to comorbidities the patient received best supportive care and was followed up with MRT exams of the liver which showed no tumor growth or signs of cholestasis for two years. In 2018 the patient was hospitalized with signs of cholestasis. The CT scan showed a tumor infiltration of the common hepatic duct expanding into both distal intrahepatic ducts, this was confirmed in a cholangiogram.

**Treatment options/Results:** Endoscopic stent insertion did not successfully decrease cholestasis, subsequently we inserted biliary drainage catheters via percutaneous access of the left and the right peripheral biliary tract as internal-/external drainage. Following an initial decrease of cholestatic parameters, they increased again due to progressive tumorous infiltration of the central biliary ducts. Two weeks later we removed the drainage catheters and performed overlapping catheter radiofrequency ablations (TawWoong Medical, ELRA) from the distal left and right ducts into the common hepatic duct via bilateral access. Following the RFA two biliary stents (TaeWoong Medical, LCD) were inserted in kissing technique reaching from both distal intrahepatic ducts into the common bile duct. Finally a drainage catheter was placed in the right biliary system. 3 weeks later the catheter was removed with now signs of residual cholestasis. Since our interventions in 09/2018 no recurrence of cholestasis so far.

**Discussion:** Catheter RFA of the biliary ducts is a feasible and minimal invasive method to delay tumorous re-occlusion.

**Take-home points:** Biliary RFA can be performed before or after stent placement.

## P-16

### Efficacy and safety of a novel paclitaxel-nano-coated balloon for femoropopliteal angioplasty: 2-year results of EffPac trial

*U. Teichgräber; Jena/DE*

**Purpose:** Paclitaxel drug-coated balloon (DCB) angioplasty is an endovascular technology for inhibiting restenosis. We conducted a randomized-controlled trial to assess a novel DCB with an innovative nanotechnology coating.

**Material and methods:** We compared a DCB catheter to non-coated plain-old-balloon-angioplasty (POBA) in stenotic or occlusive lesions of the femoropopliteal artery. In total, 171 subjects were treated in 11 German study centers. Primary endpoint is late lumen loss (LLL) at 6 months. Secondary endpoints at 6, 12 and 24 months are primary patency, target lesion (TLR) and vessel (TVR) revascularization, quality of life (EQ-5D), change of Rutherford-Becker classification (RBC), ankle-brachial index (ABI), major and minor amputation rate, and others.

**Results:** At six months the LLL was on average 0.92mm lower in the DCB-group than in the POBA-group (95% CI: -1.36mm; -0.49mm, p<0.001). Significantly more patients showed a walking improvement after DCB treatment at 6 months (p=0.021). 44.6%/50% of the patients in the DCB-group improved by 3 stages after 6/12 months (POBA: 27.8%/36.8%). Only one patient needed a TLR in the DCB-group whereas did 14 patients in the POBA-group after 12 months (TLR DCB vs. POBA: 1.3% vs. 18.7%, relative risk (RR) =0.08, 95% CI: 0.01; 0.53, p<0.001).

**Conclusions:** The 12-months results showed that the investigational DCB catheter is highly effective and safe in inhibiting restenosis. It demonstrated a walking improvement in change of RBC compared to POBA.

## P-17

### Comparison of low dose CT and standard dose cone-beam CT for periprocedural planning of TIPSS gudiance

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**Purpose:** The objective of this study was to compare intraprocedural full dose (FD)- versus low dose (LD)-Cone-beam CT (CBCT) for transjugular intrahepatic portosystemic shunt (TIPSS)-guidance with regard to image quality, radiation dose as well as technical success in low dose-imaging.

**Material and methods:** A total of 31 patients were included in this retrospective study. Patients received a CBCT for guidance of portal venous puncture during TIPSS procedure. Quantitative evaluation of image quality of CBCT was performed with contrast-to-noise-ratio (CNR) measurement of the portal vein and the liver as background parenchyma. Qualitative evaluation of image quality was performed using a 5-point-vessel visualization score (VVS), ranging from non-diagnostic to optimal while a 3-point-Lickert-scale was used for motion artifacts. Streak artifacts were rated based on resulting image quality. Technical success of the procedure and radiation dose area product (DAP) were evaluated separately.

**Results:** In all cases TIPSS could be placed successfully. The median number of puncture attempts was the same for FD as well as for LD- CBCT and therefore not significantly different (n=3). The mean DAP of the LD-CBCT was significantly lower compared to FD-CBCT (p<0.0001). Total dose of the procedure also was significantly lower using LD-CBCT (p=0,049). Objectively evaluation of image quality resulted lower image quality of LD-CBCT, however not statistically significant (p=0,331). The VVS did not show any statistically significant difference.

**Conclusions:** Both CBCT allow a technically successful TIPSS-guidance and subsequent placement and have no significant difference in terms of image-quality and number of puncture attempts while the radiation dose is significantly reduced when using LD-CBCT.

## P-18

### Tibio-pedal and distal femoral retrograde vascular access for challenging chronic total occlusions: technical success and complications data in a large singe center cohort

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**Purpose:** To investigate the technical success rate and complications of retrograde revascularizations in patients with chronic total occlusion (CTO) of the superficial femoral artery (SFA), the popliteal artery (PA) or below the knee (BTK) after a failed antegrade approach.

**Material and methods:** This HIPAA-compliant, IRB-approved retrospective study included 154 patients (111[72%] men, mean age 74.5±11.1 years) between 01/2015 and 02/2019. Risk factors were prevalent in most patients (diabetes mellitus 54%, arterial hyper tonus 76%, chronic renal failure 44%, coronary heart disease 54%, smoking 40% and adipositas 20%). Stages of disease were Fontaine grade IIb, III, and IV in 33%, 8%, and 69%. TASC classifications were A, B, C, D and BTK N/A in 0, 10, 11, 55, and 77 patients, respectively. Lesion length ranged from <5cm, 5-10cm, 10-15cm, 15-20cm, and >20cm in 64, 23, 23, 21, 21, and 64 patients, respectively. Data was analyzed for technical success rate, change of clinical management, rate of complications and time needed for the revascularization.

**Results:** The technical success rate was 80.7% with 86% in the SFA and P1, 71% BTK, and 67% for SFA/PA plus BTK. Serious adverse events occurred in 14% with 5% relating to distal access approach. CIRSE SAEs were grade II, III, and IV in 3, 2, and 3 cases, respectively. Clinical success rate was 78% with data available in 92 patients. Mean times of the revascularization and to distal puncture were 162±64min and 76±41min, respectively.

**Conclusions:** Distal puncture with a retrograde approach is safe and effective in complex CTO after failed antegrade revascularization.

## P-19

### Ten years of DEB-TACE. Experience from a real-life cohort with hepatocellular carcinoma following transarterial chemoembolization at a tertiary referral center.

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**Purpose:** DEB-TACE is a widely used alternative to cTACE in patients with HCC. This work provides a current overview on results from a western cohort treated at our institution, a tertiary referral center, where DEB-TACE has been introduced as a standard for more than 10 years.

**Material and methods:** 228 HCC-patients undergoing DEB-TACE with 100-500 µm drug-eluting-beads were retrospectively analyzed. Dedicated software was used to acquire tumor characteristics and response rates. Outcome-evaluation, excluding patients with subsequent liver transplantation, was based on Kaplan-Meier method and log-rank tests.

**Results:** Mean age: 77.1 y (±9.0 y). A main proportion was male (87%) and in BCLC stage B (49%) with Child Pugh A liver cirrhosis (76%). Underlying liver diseases were abuse of alcohol (31%), HCV (28%) and HBV (10 %). Median number of DEB-TACE n=3 (IQR: 2 – 3). According to mRECIST response was CR in 20%, PR in 37% ,SD in 33% and PD in 6% after first DEB-TACE. Mean OS was 35.9 months. 1-, 2-, 3-, 4-, and 5- year survival rates were 80%, 58%, 41%, 25% and 16%.

**Conclusions:** DEB-TACE is a safe and successful therapeutic option in a real life cohort of patients suffering from hepatocellular carcinoma. Even though guidelines suggest transarterial embolization only for patients in BCLC-stage B, real life cohorts consist also of patients in BCLC-stage A, due to individual therapeutic decisions. As such DEB-TACE is a well-tolerated, safe and successful treatment with good survival rates outperforming historical c-TACE data with regard to response and OS in a HCC cohort not suitable for transplantation.

## P-20

### Prevalence of visceral artery involvement in patients with peripheral artery disease and lower leg symptoms on run-off MRA

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**Purpose:** To investigate the prevalence of visceral artery involvement in patients with peripheral artery disease (PAD) and lower leg symptoms examined with run-off MR angiography (MRA).

**Material and methods:** In this retrospective study, we analyzed a cohort of 145 patients (median age 66.2 years, range 27 to 91) with known or suspected PAD who underwent MRA at our institution between 2012 and 2018. MRA datasets were re-evaluated for visceral artery stenosis. Electronic charts were reviewed to determine cardiovascular risk factors, kidney function and Fontaine stage of PAD.

**Results:** Involvement of at least one visceral artery with ≥50% diameter stenosis was found in 72 (50%) patients. There were no differences in age, gender, indication for MRA, Fontaine stage, cardiovascular risk factors or vas-

cular comorbidities between patients with and without visceral artery involvement. Renal artery involvement with ≥50% diameter stenosis was found in 28 (20%) of patients. Patients with renal artery involvement were more likely to suffer from hypertension (79 vs. 54%, p=0.019) and reduced renal function (glomerular filtration rate 70 vs. 88 mL/min/1.73m2, p=0.014).

**Conclusions:** Visceral artery stenosis can be seen in half of patients with known or suspected PAD and lower legs symptoms on run-off MRA. Investigating for renal artery stenosis in patients with PAD and hypertension and/or impaired renal function may have high diagnostic yield.

## P-21

### Selective internal radioembolization therapy with yttrium-90 resin microspheres in unresectable metastatic colorectal cancer: results of 63 patients

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**Purpose:** Overall survival depending on the location of unresectable metastatic colorectal patients treated with Y-90 radioembolization.

**Material and methods:** 63 patients (range 38-83 years) with biopsy proven metastatic colorectal cancer were treated with Y-90 resin mircospheres. 16 (25,4%) the tumor was a right side colon while in fortythree (68,3%) the tumor was on the left side. kRAS Status was wildtype for fortyseven (74,6%) and mutation in 16 patients (25,4%). All patients treated with Y90 resin spheres had were approved by the gastrointestinal tumor board. Partition model was used for dose calculation. Clinical, laboratory and MR imaging follow-ups where scheduled 12 weeks after treatment. Radiological response was evaluated via CT or MRI imaging using the RECIST criteria.

**Results:** Thirtyone (49,2%) had a tumor burden 25-50%, two (3,2%) had a tumor burden more than 50% and thirty patients (47,2%) had a tumor burden below 25%. Twenty three (36,5%) were treated on the right lobar, while forty patients (63,5%) were treated bilobar. The median overall survival was 6,2 (range 5,9-6,6) months for patients with a kRAS Mutation in the right colon. For kRAS wildtype the overall survival was 5,9 months (range 4,6-7,3 months). If the tumor was located in the left colon and had a kRAS mutation the overall survival was 11,1 months (range 3-28,6 months). If it was a kRAS wildtype the overall survival was 10,6 months (3-22,4 months).

**Conclusions:** We conclude that Y-90 radioembolization with resin microspheres in unresectable metastatic colorectal patients treated with Y-90 has survival benefits, especially for patients having tumors in the left colon.

## P-22 (401.1)

### INTACT-Lymph: interventional approach to lymphatic leakage – current results

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**Purpose:** To visualize lymphatic vessels and detect lymphatic leakage. To evaluate therapeutic potential of intranodal and CT-guided lymphatic embolization.

**Material and methods:** In this prospective study 14 patients suffering from lymphatic leakage resistent to conservative treatment have been included. Intranodal lymphography using lipiodol and in case of non-responding, a second intervention via CT-guided embolization using lipiodol and/or histoacryl was performed. Successful technical outcome was defined as visualization of the lymphatic system and visualization of a leakage site. Clinically successful outcome was defined as significant reduction of chylus collected via drainage (>90% reduction) with no significant increase of lymphatic leakage in control exams and an improvement in quality of life (Karnofsky index).

**Results:** Lymphatic system visualisation and detection of lymph fistula was successful in 93% of patients (13/14). The intervention was clinically successful in 86% of cases (12/14). One patient showed only 25% reduction of chyle flow and was treated by kidney transplant. The second patient had thoracic chyle leakage without visualisation of site of leakage. Therapeutic embolization using lipiodol alone was successful in 64% of cases (9/14). In 6 patients CT-guided embolization was performed, four were fully clinically successful, one was partially successful (chyle flow reduced by less then 90%) and one patient showed no significant improvement. Mean Karnofsky-Index improved from 73(range=20-100) to 90(range=70-100) in all patients.

**Conclusions:** Direct intranodal lymphography is safe and effective for visualisation and therapeutic occlusion of lymphatic leaks. In 40% of cases additional CT-gui-

ded embolisation using lipiodol and/or histoacryl was necessary. CT-guided embolisation improved the clinical outcome in all cases but one.

## P-23 (401.2)

### Delayed ischemia after flow diverter therapy – prolongated vasospasm triggered by endovascular implants

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**Purpose:** Flow Diversion (FD) has become the preferential treatment for a wide range of cerebral aneurysms. However, delayed ischemia despite sufficient anti-platelet-medication, remains a concern. Also, stringent guidelines regarding a specific follow up regimen are lacking. This study reports the occurrence of delayed, device-induced vasoconstriction in patients investigated with a suitable follow-up-strategy designed for FD.

**Material and methods:** 36 patients were included. Inclusion criterium was the availability of early follow-up-imaging less than 6 months post implantation. Flow-diverter-stents(FDS) included were Silk-Vista-Baby(n=26), p48(n=7), p64(n= 1) and PED2(n=2). Vasospasm causing stent compression and additional intimal-hyperplasia(IH) were assessed via device-radiography and/or DSA. Statistics were created with SPSS24.0.

**Results:** 86%of all patients showed significant deformations of the implanted FDS. 56%revealed compressions causing more than 25%stenosis of the segment. 80%of those showed additional IH. Only 13%exhibited deformations causing >50%stenosis of the respective segment. Solitairy IH was detectable in 8%. One patient suffered aphasia related to vasospasm well-responsive to intra-arterial spasmolysis.

**Conclusions:** FDS induced vasosconstriction and IH are sequential, partially overlapping ramifications of variable extent within the first months after FDS implantation. The combination of both can cause symptomatic hypoperfusion of the downstream parenchyma, and in rare cases infarction. A considerate standard follow-up strategy is important to identify patients at risk for ischemia, requiring intensified monitoring and potentially anti-vasospastic treatment. Therefore, early plain radiography of the FDS 3-4 weeks after implantation as well as DSA 3 + 9 months post intervention are crucial. In case of moderate-severe device compression in the radiogram, additional imaging allowing the assessment of the hemodynamic situation at hand is advised.

## P-24 (401.3)

### Liver hypertrophy inductied by unilobar Y-90 radioembolisation versus portal vein embolization: a prospective comparative animal study

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**Purpose:** To compare the hypertrophy induction of the contralateral liver lobe achieved by unilobar radioembolisation (RE) with 90Y resin microspheres vs portal vein embolization (PVE) in a swine model.

**Material and methods:** After approval by the animal care authorities, we conducted a prospective trial on 20 pigs. After a dose escalation study in the first 4 animals, 16 consecutive pigs were treated by either unilobar 90Y-RE, or unilobar PVE using lipiodol/cyanoacrylate. Liver volume was measured on contrast-enhanced CT/MRI before treatment and one, three and six months thereafter. After euthanasia, livers were evaluated histopathologically. Independent t-test ($p < 0.05$) was used to compare the hypertrophy rate.

**Results:** At one month after the intervention, a significantly different degree of hypertrophy was observed for the PVE-group vs the 90Y-RE group, with a volume gain of +51% (IQR: +47%; +69%) for PVE, compared to +29% (IQR: +20%; +50 %) for 90Y-RE. At follow-up after three and six months, degrees of hypertrophy in the two different groups converged, with a volume gain of +103% (IQR: +86%; +119%) for PVE, vs +82% (IQR: +70%; +96%) for 90Y-RE after three months, and of +115% (IQR: +70%; +146%) for PVE, vs +86% (IQR: +58%; +111%) for 90Y-RE, after six months.

**Conclusions:** Hypertrophy-inducing effects of unilobar 90Y-RE and of PVE follow a different time course. PVE causes a fast, strong volume gains within 4 weeks after the procedure, followed by a steady-state. Effects of 90Y-RE are slower, but persist until 3 months after the procedure, at which time the hypertrophy is similar to PVE.

## P-25 (401.4)

### In vitro characterization of radiopaque and non-radiopaque drug-loaded microspheres

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**Purpose:** To compare material characteristics between radiopaque and non-radiopaque drug-loaded microspheres.

**Material and methods:** DC-Bead-LUMI™-70-150 (radiopaque), Embozene-Tandem™-100-Microspheres and DC-Bead™-M1 (non-radiopaque), and the prototype V-100 (radiopaque) were analyzed. Applying different methodologies, microspheres in different suspensions (aqua pure or aqua/iodixanol 320) were compared before and/or after doxorubicin-loading (37.5mg doxorubicin/1ml microspheres). Qualitative, semi-quantitative and/or quantitative CT, light and phase-contrast transilluminati-on/fluorescence microscopy, laser diffraction/light scattering, and/or rheometry were performed. Study goals included radiopacity, doxorubicin-loading, and morphology, size distribution, time-in-suspension, rheological properties and stability after doxorubicin-loading.

**Results:** DC-Bead-LUMI™-70-150 featured a density of 2433±3HU and adverse imaging artifacts (blooming and splay artifacts) comparable with iodixanol 320 25%. V-100, Embozene-Tandem™-100-Microspheres and DC-Bead™-M1 featured densities of 480±3HU, 118±3HU and 20±2HU, respectively, and no adverse imaging artifacts. Fastest relative doxorubicin-loading featured DC-Bead™-M1, followed by Embozene-Tandem™-100-Microspheres, DC-Bead-LUMI™-70-150, and V-100, with relative doxorubicin-loading of >99% for DC-Bead-LUMI™-70-150, Embozene-Tandem™-100-Microspheres and DC-Bead™-M1 as well as >98% for V-100 after 24hr. For doxorubicin-loaded microspheres in suspension with aqua pure, there were intact and spherically-shaped microspheres with narrow size calibration for DC-Bead-LUMI™-70-150, V-100 and Embozene-Tandem™-100-Microspheres and with non-narrow size calibration for DC-Bead™-M1. The type of suspension had a marked impact on morphology (not for DC-Bead™-M1), size distribution (only for DC-Bead™-M1), time-in-suspension, rheological properties (not for DC-Bead™-M1), and stability after doxorubicin loading.

**Conclusions:** Radiopaque microspheres create excellent radiopacity but potential imaging artifacts. Because other material characteristics such as doxorubicin-loading and rheological properties vary also between the different types of microspheres, not only embolization technique but microsphere preparation must be adapted specifically.

## P-26 (401.5)

### CBCT assisted guidance during TACE – negative impact on radiation exposure?

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**Purpose:** To evaluate the impact of cone-beam CT (CBCT) assisted guidance on radiation exposure during trans-arterial chemoembolization (TACE).

**Material and methods:** In this prospective, randomized, IRB approved two-arm trial, 57 consecutive liver cancer patients underwent TACE. In the control group (n=29), only DSA was used for guidance, in the study group (n=28), additional CBCT was acquired with the catheter tip in the common hepatic artery to render a 3D-overlay of tumor-feeding arteries. Dose area product (DAP) of fluoroscopy (F), DSA and CBCT were recorded, in addition to number of DSA series and DSA frames as well as fluoroscopy time (FT) and body mass index (BMI). Normal distribution was tested with Shapiro-Wilk test. Statistical differences were assessed with unpaired t-test and Mann-Whitney-U test.

**Results:** There was no significant difference in BMI (mean 27.7 vs 27.9; p=0.875), FT (mean 21.3 vs. 23.7 min; p=0.461) and F-DAP (median 54.2 vs 60.4 Gy*cm²; p=0.544) between the two groups, respectively. Mean CBCT DAP in the study group was 72.6 Gy*cm². In the study group, a significantly lower amount of DSA series (mean 8.4 vs 11.7; p=0.022) and DSA frames (mean 163.7 vs. 247.3; p=0.003) were acquired compared to the control group, respectively, resulting in a significant reduction of DSA-DAP (mean 130.1 vs. 192.4 Gy*cm²). Looking at the cumulative DAP, there was no significant difference between the two groups (305.0 vs 260.0 Gy*cm²; p=0.231).

**Conclusions:** CBCT assisted guidance facilitates a reduction of DSA series during TACE. Thus, the additional use of CBCT during TACE has no negative impact on radiation exposure.

## P-27 (401.6)

### High-intensity focused ultrasound (HIFU) in advanced pancreatic cancer: German experience

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**Purpose:** Pancreatic cancer is a highly malignant, late-stage diagnosed, early metastatic and life-limiting tumor with a wide range of incapacitating symptoms such as cancer pain and local symptoms reducing substantially patient's quality of life (QoL). Cancer-related symptoms are found in more than 80% of patients with advanced disease. Our observational studies addresses the clinical effectiveness of ultrasound(US)-guided high-intensity focused ultrasound (HIFU) with respect to pain perception, tumor volume, and survival.

**Material and methods:** More than 100 patients with late-stage pancreatic cancer underwent HIFU in our center in Bonn during the past 5 years. Clinical assessment included cancer imaging (MRI, CT US) for evaluation of changes in tumor volumes as well as assessment of pain burden via standardized questionnaires. Kaplan-Meier analysis was used to estimate median overall survival, progression-free survival and time to local progression.

**Results:** In 85% of patients, a significant early pain relief was achieved by US-guided HIFU independent of metastatic status which persisted during follow-up. Furthermore, 50% of patients did not require any analgesic treatment 6 weeks post-ablation. Tumor volumes could be considerably reduced over time in 80% of patients, with a mean tumor volume reduction of about 60% after 6 months in HIFU-treated pancreatic tumors. There were no severe or long-lasting HIFU-related complications.

**Conclusions:** US-guided HIFU of late-stage pancreatic cancer resulted in significant early and long-lasting improvement in pain perception providing an effective local therapy in palliative setting. Besides of the clinical benefit, preliminary survival data are encouraging in terms of overall survival, progression-free survival and time to local progression.

## P-28 (401.7)

### Transpedal Lipiodol-based lymphangiography as essential radiological tool for visualization, characterization, treatment and cure of therapy-refractory lymphatic fistula after inguinal lymphadenectomy in patients with malignant melanoma of the lower extremity

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**Purpose:** To analyze transpedal lipiodol-based LymphAngiography (LA) with or without percutaneous ScleroTherapy (ST) performed with intention to cure therapy-refractory Lymphatic Fistula (LF) after radical inguinal lymphadenectomy in patients with malignant melanoma.

**Material and methods:** Our institutional prospective digital databases were reviewed. All consecutive patients undergoing LA with or without ST with intention to cure therapy-refractory LF after radical inguinal lymphadenectomy in patients with malignant melanoma were analyzed. Patient demographics and technical and clinical results were analyzed.

**Results:** Between 10/2014 until 06/2019, 14 patients met the inclusion criteria. Patient age and interval between radical inguinal lymphadenectomy and LA were 66.4 years (46.8-83.4) and 17.8 days (7-34), respectively. Amount of lipiodol used to perform LA was 15.4 ml (6-22). In 9 patients, LA alone was performed with technical success. In 4 patients, LA in combination with ST (at an interval of 10 days [0-23]; ST was performed either with ethanol 95% [3-5 ml] or with a glue/lipiodol 1:5 mixture [6-8 ml] under fluoroscopy [n=1] or CT guidance [n=4]). Minor and major procedure-related complication and clinical success rates and interval between LA and cure were 0%, 0%, 78% and 23 days (4-47) for LA alone and 25%, 0%, 100% and 29 days (24-33) for LA in combination with ST, respectively.

**Conclusions:** LA with or without ST is an essential tool to cure therapy-refractory LF after radical inguinal lymphadenectomy in patients with malignant melanoma. LA in combination with ST seems to result in higher clinical success rates but also in higher complication rates when compared with LA alone.

## P-29 (401.8)

### Benefits of DEB post stenting in diabetic patients and males – subgroup analysis of the randomized Freeway Stent Study

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**Purpose:** The prospective randomized multicenter Freeway Stent Study evaluated the possible hemodynamic and clinical benefits of primary stent insertion followed by percutaneous transluminal angioplasty (PTA) with drug eluting balloons (DEB) over post-stent insertion PTA with standard balloons in the treatment of symptomatic femoro-popliteal arteriosclerotic lesions.

**Material and methods:** 204 patients were randomized for postdilatation by either DEB (FREEWAY™) or plain balloon (PTA) of primary implanted stents. The choice of commercially available nitinol stents was on the physician's decision. Primary endpoint is clinically driven target lesion revascularization (TLR) at 6 months; secondary endpoints include patency rate, shift in Rutherford classification, ABI and MAE at 6 and 12 months.

**Results:** The 12 months follow up overall results highly favor the use of FREEWAY™ DEB over PTA postdilatation. The subgroup of diabetic patients comprises approximately one quarter of the total population. In terms of 12 months primary patency, diabetic patients seem to profit more from a DEB treatment compared to non-diabetic patients. The subgroup analysis on gender shows that male patients perform better in 12 months TLR and primary patency rate after DEB treatment compared to females.

**Conclusions:** The Freeway Stent Study demonstrated that the usage of DEB as a restenosis prophylaxis seems to be safe and feasible. Subgroup analyses underline the beneficial effects of DEB postdilatation with an advantage for diabetic and male patients.

## P-30 (401.9)

### Indispensable role of X-ray safety glasses in complex vascular interventions – preliminary results from a multi-centric multidisciplinary study

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**Purpose:** The annual permissible radiation ocular lens dose has been reduced to 20 mSv in the current European directive 2013/59/Euratom and was implemented from January 2019. The aim of this multicentric, mutlidisplinary study was to evaluate the protected and unprotected personal radiation occular dose for complex vascular interventions.

**Material and methods:** From July 2018 to August 2019 personal radiation doses in five interventional departments with 7 interventional radiologists, 1 neuroradiologist and 1 cardiologist were prospectively recorded during complex interventional procedures.The position of the interventionalist, type of intervention and fluoroscopy time were recorded. Parameters evaluated were effective total body dose measured by film dosimeter placed under the 0.5-mm lead apron, and ocular lens dose measured by thermoluminiscent dosimeters (TLD) placed in front and behind the safety glasses.

**Results:** The total body dose for the 9 interventionalists ranged from 0 to 1 mSv and the unprotected ocular lens doses from 0 to 52 mSv. The protected ocular dose measured behind the safety glasses ranged between 0 to 17 mSv. Ocular dose was observed to be relatively high for those with complex interventions requiring DYNA-CTs as well as those with frequent left side position in relation to the patient.

**Conclusions:** The yearly ocular lens dose, for interventionalists dealing with complex interventions could cross the permitted yearly limit set by the new Euratom directive. X-ray safety glasses are effective in the reduction of the actual radiation ocular dose in daily practice and would become mandatory for complex radiological vascular interventions.

## P-31 (401.10)

### Radiation dose distribution of a radiologist's head using different radiation protection devices

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**Purpose:** To assess the effect of different radiation protection devices on the dose distribution of an interventionalist's head should be determined.

**Material and methods:** For assessing the dose distribution standardized measurements were performed using different radiation protection devices. All exams were performed on a clinical angiography system using a standardized fluoroscopy protocol aiming at adose area product of 3000 µGy*m². An anthropomorphic chest-phantom was used as a scattering object. For each measurement, 26 OSL dosimeters were attached to the head of an Alderson phantom. Two measurements were carried out with radiation protection glasses. For the third measurement, radiation protection glasses were combined with an overhead ceiling mounted acrylic shield. In addition, the phantom was fitted with a radiation protection cap during the fourth measurement.

**Results:** Without protective measures, the maximum dose value is 0.13 mGy. This was measured on the left side of the face, the side facing the X-ray tube, of the interventionalist. The comparison of the eye dose with and without protective glasses shows a reduction of the dose by up to 0.04 mGy. Using the overhead ceiling mounted acrylic shield, a predominantly homogeneous distribution at the head phantom is measured. The maximum value is 0.02 mGy, whereby predominantly values of 0.01 mGy are measured. If the head phantom is fitted with the radiation protection cap in addition to the radiation protection glasses, the measured dose is reduced in the covered areas.

**Conclusions:** Radiation protection devices are effective for protecting an examiner from exposure to scatter radiation.

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