SURGERY OF SARCOMA LUNG METASTASES

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DISCLOSURES

- Nothing to disclose relevant to this presentation

PROBLEM

- The majority of primary soft tissue and bone sarcoma can be cured by surgery +/- radiation
- About 30-50% of patients diagnosed with intermediate to high grade sarcoma develop metastatic disease
- Lung is the most common site of metastasis
- Metastases are rarely eradicated by chemotherapy
- If surgery can cure primary sarcoma, can it cure metastatic sarcoma?

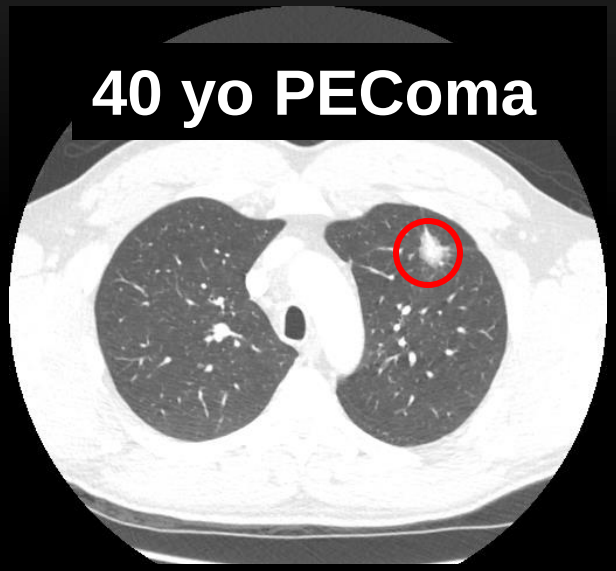
LIMITED DATA FOR RECOMMENDATIONS

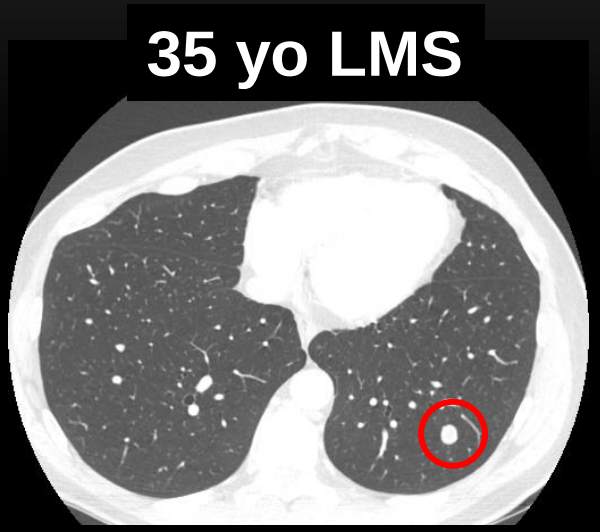
- Lack of prospective randomized trials
- Patient selection bias for thoracic surgery referral
- Outcome affected by disease heterogeneity
- Outcome bias regarding surgical expertise
- Outcome regarding surgical approach (open versus videoscopic)
- Limited long-term follow-up data is available
- Development of new technology (stereotactic radiation)
- Improvement in imaging resolution over past 20 years - impact on referral and outcome

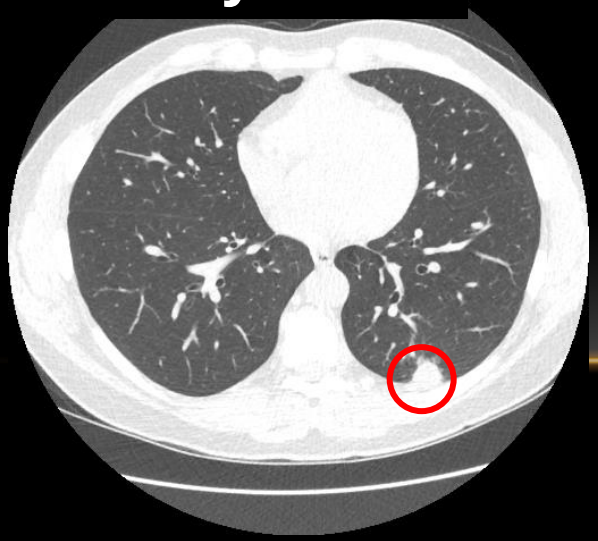
GOALS OF LUNG METASTASECTOMY

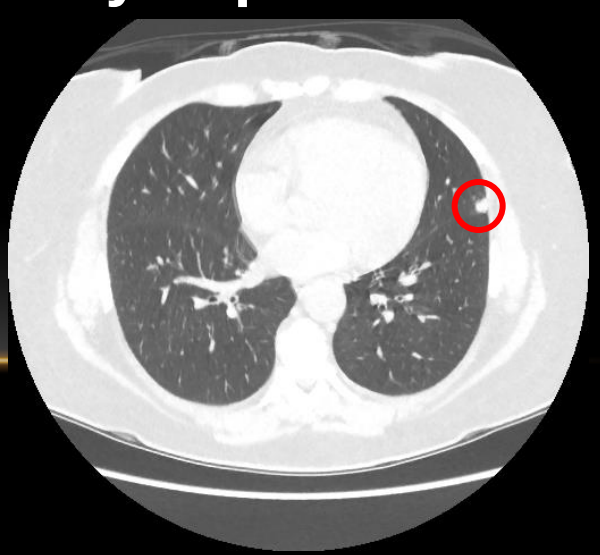
- Establish diagnosis
- Palliate symptoms
- Prolong survival
- Cure sarcoma

DIAGNOSIS: LUNG NODULES IN SARCOMA

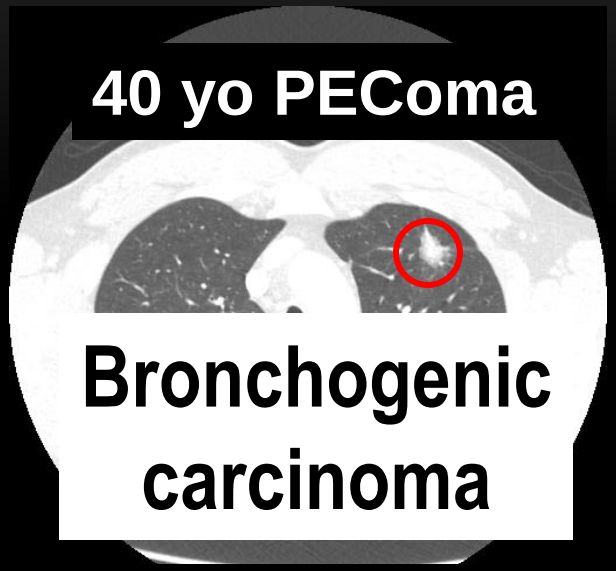


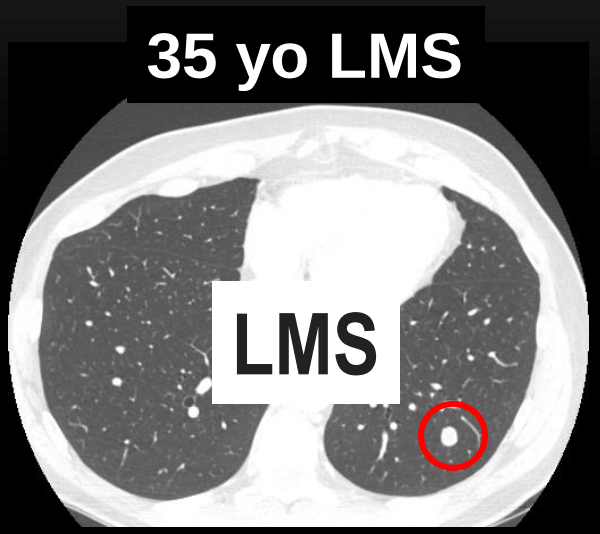


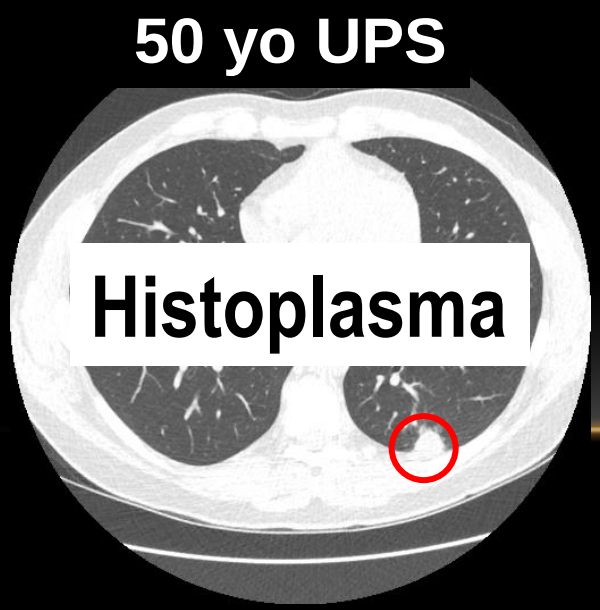


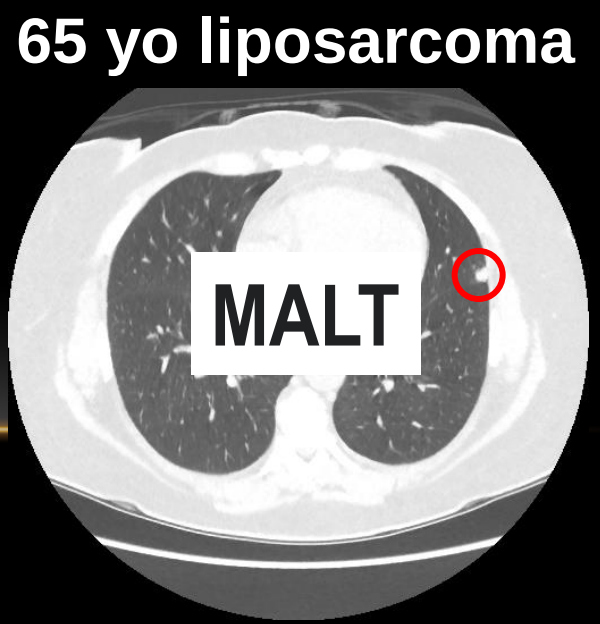


ARE NOT ALWAYS SARCOMA









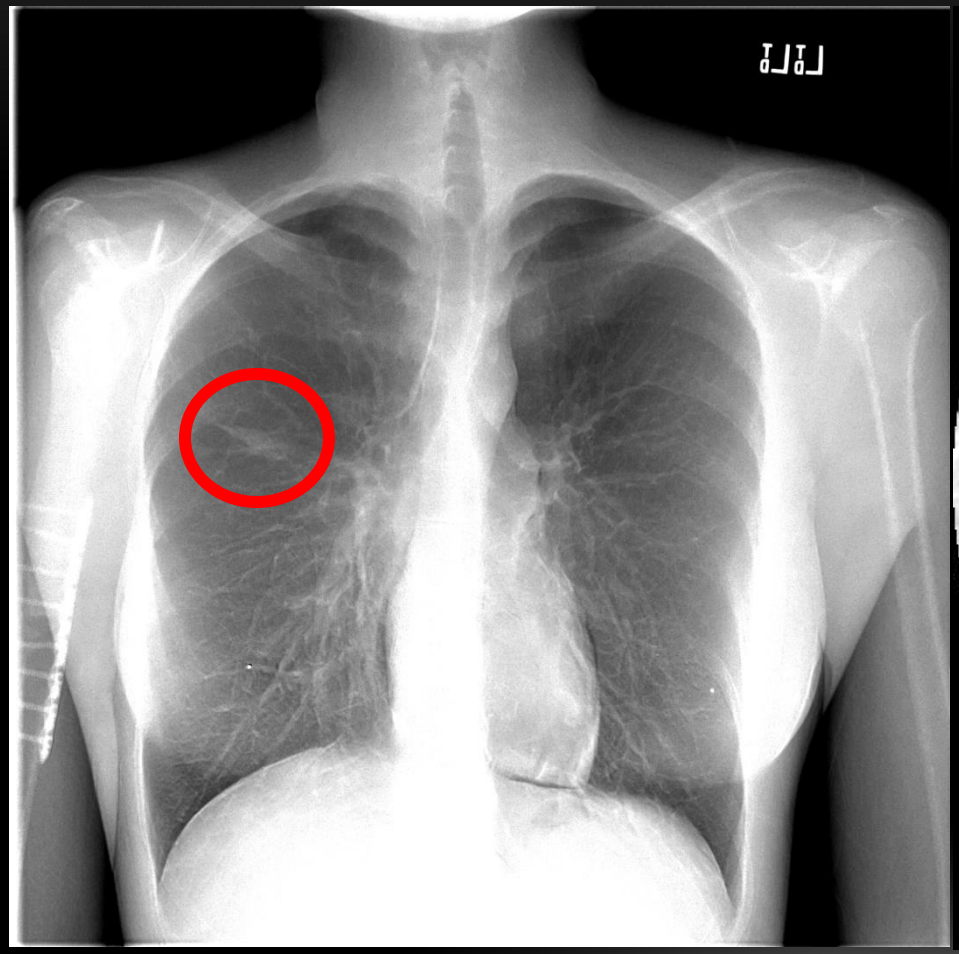
METASTASECTOMY IN SARCOMA

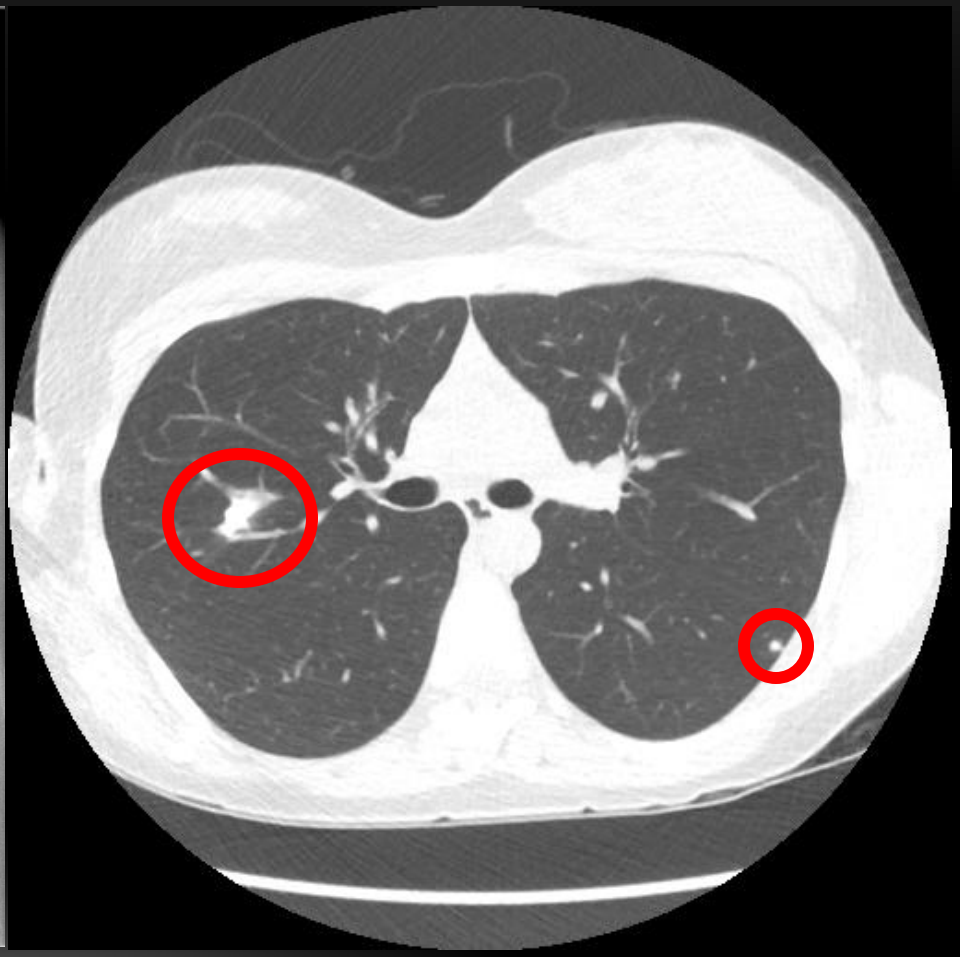
- Osteosarcoma
- Soft tissue sarcoma
- Ewing sarcoma (very little data)

METASTASECTOMY IN OSTEOSARCOMA

- 17 yo woman presented November 2007 with mass in proximal humerus
- Core biopsy demonstrated high-grade chondroblastic osteosarcoma
- 2 cycles MAP in EURAMOS-1
- Proximal humerus resection February 2008
  - 9 cm mixed osteoblastic/chondroblastic OS
  - 75-80% necrosis
- Randomized to 4 cycles MAP

IMAGING 38 MONTHS AFTER DIAGNOSIS





SURGERY RECOMMENDED

- February 2011 right upper lobectomy and left lower wedge resection
- 3.4 cm and 0.4 cm osteoblastic osteosarcoma, clear resection margins
- 5 cycles ifosfamide
- January 2016, no evidence of disease

LUNG METASTASECTOMY IN OSTEOSARCOMA

- PTS ≤55 yrs HG osteosarcoma extremity metastatic to lung 1985 – 2005 (Instituto Ortopedico Rizzoli)
  - 323 PTS (27%) of 1197 PTS treated
  - 235 later lung mets (73%)
  - 88 lung mets at presentation
- PTS HG osteosarcoma extremity or trunk who developed recurrence 1979 – 1998 (Cooperative Osteosarcoma Study Group)
  - 576 PTS (34%) with recurrence of 1702 PTS enrolled
  - 373 (22%) with lung only metastases
- PTS ≤40 yrs HG localized osteosarcoma extremity 1983 – 2002 (European Osteosarcoma Intergroup)
  - 564 PTS (53%) with recurrence of 1067 enrolled
  - 307 (29%) with lung only metastases

A Briccoli et al. 2010 Surgical Oncology 19:193-199
B Kempf-Bielack et al. 2006 JCO 23:559-568
H Gelderblom et al. 2011 EJC 47:895-902

LONG-TERM SURVIVAL ACHIEVABLE

B Kempf-Bielack et al. 2006 JCO 23:559-568

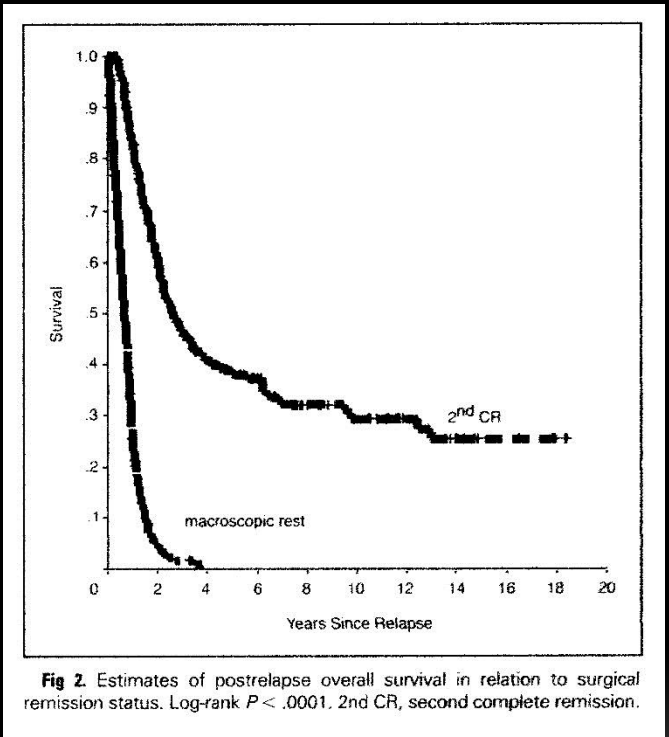
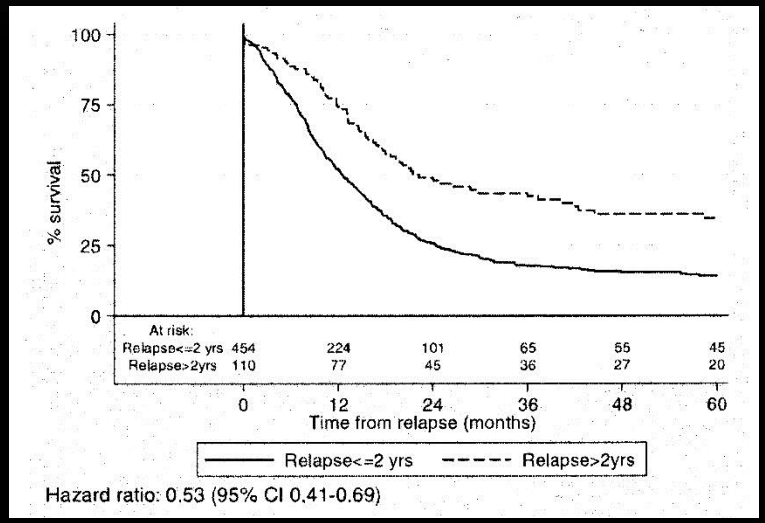
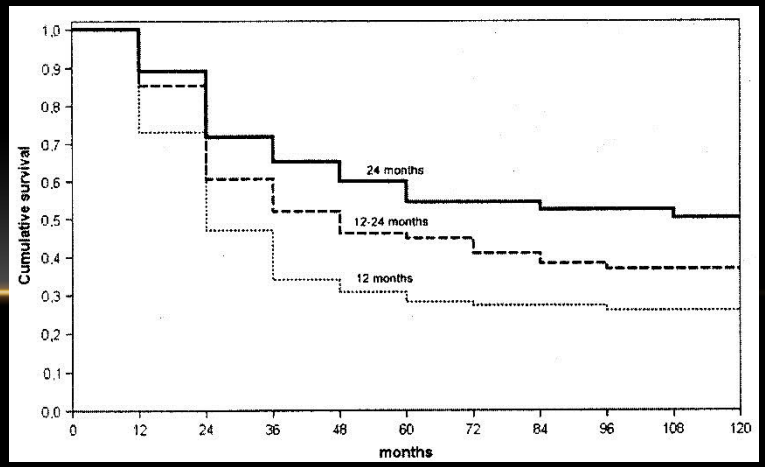


Fig 2. Estimates of postrelapse overall survival in relation to surgical remission status. Log-rank $P < .0001$. 2nd CR, second complete remission.

H Gelderblom et al. 2011 EJC 47:895-902





A Briccoli et al. 2010 Surg Onc 19:193-199

PATIENT SELECTION FOR SURGERY

- Prognostic variables
  - Ability to obtain complete resection
  - Number of metastases (fewer is better)
  - Number of surgeries (fewer is better)
  - Time from diagnosis to lung metastases (longer is better)
- Impact uncertain
  - Surgical modality – open thoracotomy vs videoscopic
  - Addition of chemotherapy

METASTASECTOMY IN SOFT TISSUE SARCOMA

- 48 yo man presented April 2012 with 6 cm mass in left thigh
- Core needle biopsy demonstrated grade 3 Undifferentiated Pleomorphic Sarcoma (UPS)
- Stage 3
- Pre-operative doxorubicin and ifosfamide
- R0 resection, 90% necrosis
- Post-operative radiation

IMAGING 18 MONTHS AFTER DIAGNOSIS

SURGERY RECOMMENDED

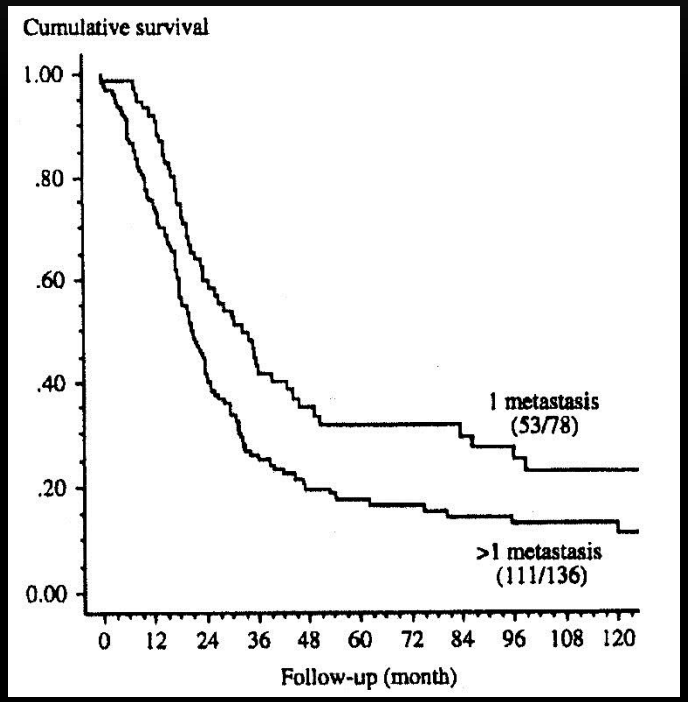
- November 2013 left lower lobe wedge resection
- 1.5 cm UPS, resection margin clear of sarcoma
- December 2015, no evidence of sarcoma

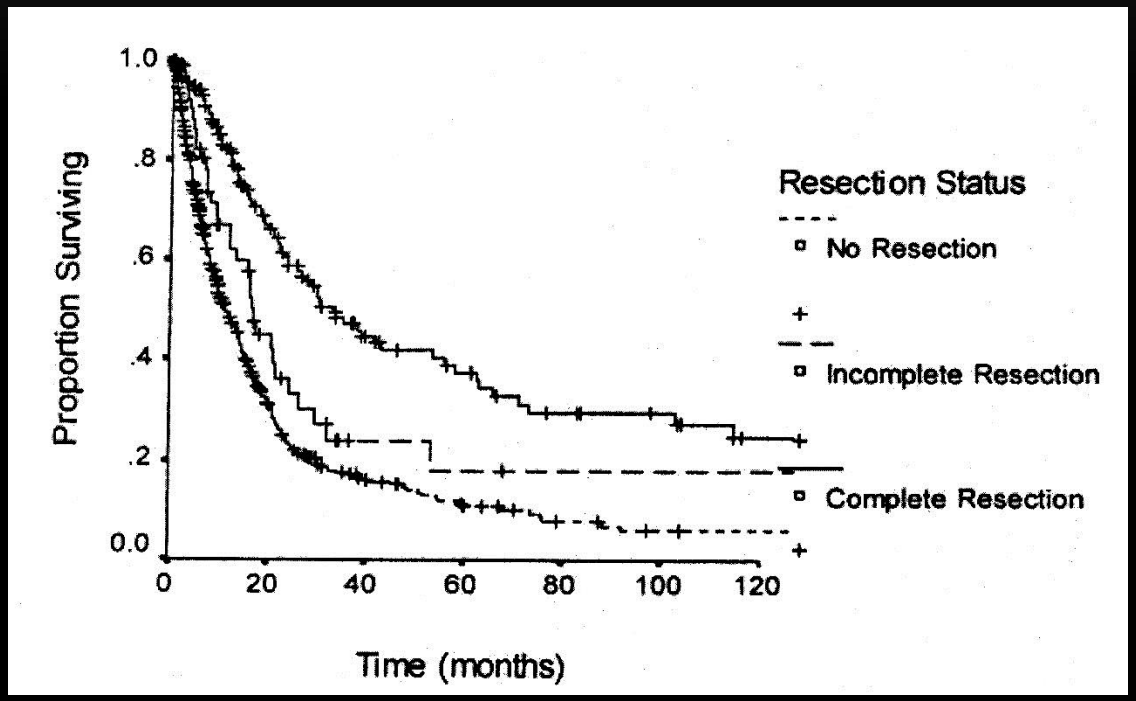
LUNG METASTASECTOMY IN SOFT TISSUE SARCOMA

- MDA series 15,744 patients seen 1998-2006 (all sarcoma)
  - 4,355 (28%) with lung metastases
    - 234 (5.6%) had lung metastasectomy
    - 147 had single operation
      - 22% osteosarcoma, 16% MFH, 15% SS, 12% leiomyosarcoma, 35% other
- Mayo Clinic series 1216 patients seen 1976-1991 (extremity/trunk STS)
  - 274 (23%) with lung metastases
    - 214 had lung metastasectomy
      - 40% MFH, 29% SS, 13% liposarcoma, 10% fibrosarcoma, 6% leiomyosarcoma
- MSKCC series 3149 patients seen 1982-1997 (STS sarcoma)
  - 719 (23%) with lung metastases
    - 213 had lung metastasectomy

SH Blackmon et al. 2009 Ann Thorac Surg 88:887-85
P Choong et al. 1995 Acta Orthop Scand 66:561-68
KG Billingsley et al. 1999 Ann Surg 229:602

SURVIVAL AFTER LUNG METASTASECTOMY





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5-YR SURVIVAL - THAMES CANCER REGISTRY

Author (published)	# of patients	5-yr survival	Median date of series
Gadd 1993	78	18%	1987
Smith 2009	94	18%	1989
Rehders 2007	61	25%	1997
Sardenberg 2010	77	35%	1999
Chen 2009	23	44%	1999
Garcia Franco 2009	22	23%	2002
Metastasectomy pts	355	25%	
TCR (total stage IV)	5615	13%	1985-1994
TCR (total stage IV)	6256	15%	1995-2004

T Treasure et al. 2012 BMJ Open 2012;2:e001736

WHEN TO CONSIDER SURGERY FOR SARCOMA LUNG METASTASES

- Primary sarcoma definitively treated
- Limited metastatic disease that can be removed by surgery
- Medically fit with adequate pulmonary reserve
- Patient survival best when:
  - Disease-Free Interval between diagnosis of primary and metastasis >12 months
  - Fewer than 4 metastases
  - Complete resection of metastases

CONCLUSIONS

- Lung metastasectomy in selected patients can be curative
- Impact in osteosarcoma likely greater than soft tissue sarcoma
- Thoughtful patient selection and cooperation from thoracic oncology are needed