superior sulcus tumours
the case for multidisciplinary approach

Dominique H. Grunenwald, MD, PhD
University of Paris VI. France
conflict of interest
none
superior sulcus tumor

complex disease
poor incidence
absence of randomized studies
clinical model for multimodal strategies
multiple challenges

• **local control**
  - muscles (sternomastoid, scalenes),
  - ribs,
  - vertebral body,
  - subclavian vessels, phrenic nerve, brachial plexus

• **multidisciplinary surgery**
  - thoracic surgeon
  - neurosurgeon, or spine surgeon
  - head and neck surgeon

• **limits for adjuvant rt**
  - chord
  - esophagus
  - brachial plexus

• **systemic control**
  - incidence of distant relapses (brain)
surgical history

1. 1932-1956: non curable, inoperable
2. 1956-1990: rt + surgery (posterolateral thoracotomy)
3. 1990-2000: progress in surgical technique
4. from 2000: induction rt-ct followed by surgery
Treatment of the Superior Sulcus Tumor by Irradiation Followed by Resection

ROBERT R. SHAW, M.D., DONALD L. PAULSON, M.D.,
JOHN L. KEE, JR., M.D.

From the Thoracic Surgery Section, Baylor University Medical Center and Department of Surgery, Southwestern Medical School, Dallas, Texas

Bronchogenic carcinomas that develop peripherally and invade the chest wall produce a painful syndrome that has been therapeutically difficult to control. The parietal pleura rather than being a barrier from embryonal epithelial rests of the last branchial cleft. He suggested that they be called superior sulcus tumors although he admitted that better knowledge of the histopathology of the growth “may change
cancer in the superior pulmonary sulcus

preoperative irradiation and extended resection

eligible patients 46
surviving over 5 years 34%

prognostic factors:
- nodal involvement
- extent of the tumor
- pathological effects of preoperative irradiation in the resected specimens

Dr. Donald L. Paulson (1912-1999)

1975

"carcinomas of the superior pulmonary sulcus can be treated with extensive and intensive external irradiation with results equivalent to those of resection with or without preoperative irradiation"  
R. Komaki 1981

(Milwaukee, Wisconsin)

5-yr survival = 23%
CANCERS PULMONAIRES DE L’APEX ENVAHISSANT LA PAROI


GRUNENWALD D., TOTY L. — Apical lung cancers invading the chest wall. The results of a survey of the members of the Society of French Speaking Thoracic and Cardiovascular Surgeons. (In French).

1984

RESULTATS DE LA CHIRURGIE DES CANCERS PULMONAIRES AVEC SYNDROME DE PANCOAST ET TOBIAS

L. TOTY1,2, D. GRUNENWALD1, H. BAKDACH1, A. COLCHEN1, M. LEROY2, C. PERSONNE2, P. HERTZOG2


Une série homogène de 76 opérés

76 patients

Surgery upfront!
Surgery upfront!

76 patients 5-yr survival → 4.2%
classical posterior "Paulson's approach"

the thoracotomy incision is extended posteriorly and superiorly
division of the trapezius and rhomboid muscles
elevation of the scapula
exposure of the apical chest wall
surgical absolute contraindications

supraclavicular vascular involvement

vertebral involvement

'control of locoregional disease remains the major challenge in treating lung cancers of the superior sulcus''

vw rusch, et al. 2000
1. 1932-1956: non curable, inoperable
2. 1956-1990: rt + surgery (posterolateral thoracotomy)
3. 1990-2000: progress in surgical technique
4. from 2000: induction rt-ct followed by surgery

- anterior approaches
- vertebral resections
anterior approaches allow vascular resections and reconstructions

transcervical approach (clavicle resection) 1993

transmanubrial approach (sparing clavicle) 1997


Grunenwald D, et al. JTCS 1997;113:958-61
vertebral resections 1996

Total Vertebrectomy for En Bloc Resection of Lung Cancer Invading the Spine
Dominique Grunenwald, MD, Christian Mazel, MD,

the section of the chest wall in tumor-free margins, together with a wedge resection in the left upper lobe. The “resected” lung was left attached to the chest wall and spine in the pleural cavity. A complementary dissection to free the posterior mediastinum from the spine was also performed, and the thoracotomy was closed.

The last step to a complete en bloc resection was vertebrectomy through an enlarged posterior approach (6) (Fig 1). Briefly, the first stage is a laminectomy at the

no effraction of the tumor block

Grunenwald D, et al.

Grunenwald DH, et al.
JTCS 2002;123:271-9
superior sulcus tumor

outcomes from surgery?
results of induction therapy (predominantly rt) and surgical resection for nsclc of the superior sulcus

<table>
<thead>
<tr>
<th>Author (y)</th>
<th>No.</th>
<th>Preop. tt</th>
<th>Compl. res. (%)</th>
<th>Loc.rec. (%)</th>
<th>5-yr surv. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paulson (1975)</td>
<td>61</td>
<td>RT</td>
<td>NS</td>
<td>NS</td>
<td>26</td>
</tr>
<tr>
<td>Attar (1979)</td>
<td>73</td>
<td>RT</td>
<td>48</td>
<td>NS</td>
<td>NS</td>
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<tr>
<td>Ginsberg (1994)</td>
<td>124</td>
<td>RT</td>
<td>56</td>
<td>72</td>
<td>26</td>
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<tr>
<td>Maggi (1994)</td>
<td>60</td>
<td>RT</td>
<td>60</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Komaki (2000)</td>
<td>62</td>
<td>RT,RT-CT</td>
<td>53</td>
<td>NS</td>
<td>38</td>
</tr>
<tr>
<td>Hagan (1999)</td>
<td>34</td>
<td>RT</td>
<td>NS</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td><strong>Rusch (2000)</strong></td>
<td>225</td>
<td>RT,RT-CT</td>
<td>56</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>Martinod (2003)</td>
<td>139</td>
<td>None, RT</td>
<td>81</td>
<td>31</td>
<td>35</td>
</tr>
</tbody>
</table>
resection of T3 and T4 lung cancers of the superior sulcus

retrospective review of 225 patients (24 yr)

preoperative RT 55%

actuarial 5-year survival

   IIIB  46%
   IIIA  0
   IIIB  13%

Rusch VW, et al. JTCS 2000
The resection of T3 and T4 lung cancers of the superior sulcus was reviewed retrospectively for 225 patients (24 yr). Preoperative RT had a 55% actuarial 5-year survival. Staging IIB had a 46% survival, while IIIA was 0% and IIIB was 13%. Prognostic factors included nodal involvement, extent of the tumor, and pathological effects of preoperative irradiation in the resected specimens.

Rusch VW, et al. JTCS 2000

prognostic factors influencing survival

<table>
<thead>
<tr>
<th>Prognostic Factor</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>limited res. / lobectomy</td>
<td>.08</td>
</tr>
<tr>
<td>T4 / T3</td>
<td>.05</td>
</tr>
<tr>
<td>IR / CR</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>N1-2 / N0</td>
<td>&lt; .01</td>
</tr>
</tbody>
</table>

Rusch VW, et al. JTCS 2000
induction ct-rt and surgical resection for superior sulcus nsclc: long-term results of SWOG 9416 (Intergroup Trial 0160)

T3-4, N0-1 SS nsclc
cis-eto x 2 and concurrent 45 Gy radiation
stable or responding disease  thoracotomy

<table>
<thead>
<tr>
<th></th>
<th>80%</th>
<th>(n=88)</th>
</tr>
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<tbody>
<tr>
<td>thoracotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complete resection</td>
<td>76%</td>
<td>(n=83)</td>
</tr>
<tr>
<td>path. CR or min. micr. d.</td>
<td>56%</td>
<td>(n=61)</td>
</tr>
<tr>
<td>5-yr surv. all patients</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>compl. resection</td>
<td>54%</td>
<td></td>
</tr>
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induction chemotherapy, concurrent chemoradiation and surgery for Pancoast tumour

induction ct followed by concurrent ct-rt (45 Gy hfa) surgery 4-6 weeks post-radiation
31 consecutive patients
grade 3-4 toxicity 32%
eligible for surgery 94% (n=29)
complete resection 94%
post-operative mortality 6.4%
major complications 20.6%
median survival 54 months
5-yr survival 46%

2 cycles of ct (mitomycin, vindesine, cisplatin) concomittant radiotherapy (45 Gy) thoracotomy 2 to 4 weeks after completion (JCOG trial 9806)

surgical resection 57
pathol. compl. resection 51
pathol. compl. response 12
major postop. morbidity 8
treatment-related deaths 3
overall 5-yr survival 56%

induction concurrent crt compared with induction rt for superior sulcus nsclc: a retrospective study

39 pts (induction followed by surgery)

two groups

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<tr>
<th></th>
<th>rt</th>
<th>crt</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>complete resection (%)</td>
<td>65</td>
<td>91</td>
<td>0.024</td>
</tr>
<tr>
<td>pCR from induction (%)</td>
<td>12</td>
<td>45</td>
<td>0.032</td>
</tr>
<tr>
<td>5-yr survival (%)</td>
<td>12</td>
<td>36</td>
<td>0.007</td>
</tr>
<tr>
<td>tumor-free surv. (mo.)</td>
<td>17</td>
<td>40</td>
<td>0.007</td>
</tr>
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<td>40</td>
<td>0.007</td>
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complete pathological response is predictive for clinical outcome after tri-modality therapy for carcinomas of the superior pulmonary sulcus

<table>
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<tr>
<th>pCR</th>
<th>70%</th>
<th>$p=0.001$</th>
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<tbody>
<tr>
<td>residual tumour</td>
<td>20%</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>vital tumour cells</th>
<th>&lt; 10%</th>
<th>65%</th>
<th>$p&lt;0.001$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;10%</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>

a modification of the pathological staging system after radiotherapy, incorporating the percentage of vital tumour cells, is proposed.

carcinomas in the superior pulmonary sulcus

preoperative irradiation and extended resection
eligible patients 46
surviving over 5 years 34%

prognostic factors:
- nodal involvement
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- pathological effects of preoperative irradiation in the resected specimens

1975

Pancoast tumor: a modern perspective on an old problem

"with a multidisciplinary approach and the use of trimodality therapy this entity has evolved from a universally fatal disease to one that is treatable with outcomes similar to those of other stage-matched nsclc"

en bloc vertebrectomy / intralesional approach
upfront surgery / induction rt-ct

<table>
<thead>
<tr>
<th>yr</th>
<th>pers.</th>
<th>MDA</th>
<th>Toronto</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006*</td>
<td></td>
<td>2009</td>
<td>2013</td>
</tr>
<tr>
<td>induction</td>
<td>none, ct</td>
<td>none</td>
<td>ct-rt</td>
</tr>
<tr>
<td>surg. technique</td>
<td>en bloc</td>
<td>intralesional</td>
<td>en bloc</td>
</tr>
<tr>
<td>pts</td>
<td>34</td>
<td>31</td>
<td>48</td>
</tr>
<tr>
<td>partial vert.</td>
<td>28</td>
<td>16</td>
<td>38</td>
</tr>
<tr>
<td>total vertebr.</td>
<td>6</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>R0 res. (%)</td>
<td>88</td>
<td>56</td>
<td>88</td>
</tr>
<tr>
<td>mortality (%)</td>
<td>3</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5-yr surv. (%)</td>
<td>24</td>
<td>27</td>
<td>61</td>
</tr>
</tbody>
</table>

* unpublished

in patients with a Pancoast tumor, a multimodality approach appears to be optimal, involving chemoradiotherapy and surgical resection, provided that appropriate staging has been carried out

Kozower BD1, Larner JM, Detterbeck FC, Jones DR. Chest 2013;143(5 Suppl):e369S-99S
trimodality therapy in Pancoast tumours
unresolved questions:

1) role of PET-CT in restaging tumors

2) significance and implications of ipsilateral supraclavicular lymph node disease: N3 or "N1"?

3) downstaged N2 disease (trimodality treatment)

4) role of prophylactic cranial irradiation

5) role of high dose of RT (up to 60 Gy)

6) role of adjuvant postoperative chemotherapy

Parissis H, Young V. J Cardiothorac Surg 2010;5:102
"carcinomas of the superior pulmonary sulcus can be treated with extensive and intensive external irradiation with results equivalent to those of resection with or without preoperative irradiation"  

R. Komaki 1981

(Milwaukee, Wisconsin)

5-yr survival = 23%

1981
Carcinomas of the superior pulmonary sulcus can be treated with extensive and intensive external irradiation with results equivalent to those of resection with or without preoperative irradiation.

R. Komaki 1981

Surgical resection should be used whenever possible for superior sulcus tumor.

R. Komaki 1990

(Houston, Tx)
CHAIRMAN'S ADDRESS

HENRY K. PANCOAST, M.D.

PHILADELPHIA

Medicine is not and cannot be an exact science because of the complexity of the human element involved. Roentgenology is the youngest branch of the specialties and is a study of living pathology. Even pathology is subject to many changes through experience, progress in investigation and study. This is one