30° EACTS Annual Meeting
Barcelona, Spain 1-5 October 2016

SURGERY FOR TUMORS WITH INVASION OF THE APEX

Prof. Lorenzo Spaggiari
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Division of Thoracic Surgery
European Institute of Oncology

Istituto Europeo di Oncologia

…lung cancer of the apex of the chest involving any structure of the apical chest wall irrespective of symptoms…

……fewer than 5% of all bronchogenic carcinomas

Excluding: 2nd rib involvement and visceral pleura

Detterbeck. Ann Thorac Surg 2003

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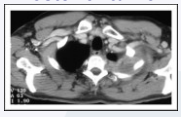
DIFFERENT TYPES and DIFFERENT APPROACHES

Posterior tumor

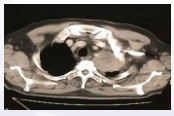


Posterior (Paulson) approach

Mixed type

Combined anterior and paulson approach

Anterior tumor



Anterior approaches

-trans-clavicular
-trans-manubrial
-trans-sternal
-trans-scapular
-hemiclamshell

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HISTORY

1. **Before 1950 (1st era)**, superior sulcus tumors were thought to be *incurable*
2. **Shaw and Paulson's group (2nd era)** → 30Gy in 10 fractions of *radiotherapy followed by surgical resection*, reporting a **30% 5-year survival**
3. **Late 1980s and 90s (3th era)** → development of *new surgical techniques (Dartevelle et all)* that enabled resection of tumors involving the spine and subclavian vessels
4. **The most recent era (4th era)**→ *large prospective multicenter phase-II trials (USA and Japan)* → *induction chemo-radiotherapy followed by resection, reporting around **50% 5-year survival***

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LITERATURE

the last 15 years

Author	n°	Treatment	5y OS	Morbidity	Mortality
Kwong 2005	44	CT/RT + surg	59%	45%	5%
Rusch* 2007	110	CT/RT + surg + CT	44%	52.9%	4.5%
Fisher 2008	44	CT/RT + surg	59%	n/a	4.5%
Kunito* 2008	76	CT/RT + surg	56%	15% major	5%
Yldizeli 2008	80	Surg + adj therapy	36.6%	n/a	0.8%
Bolton 2009	36	CT/RT + surg	50%	27%	2.7%
			53.6%	**41.6%**	**4.3%**

* Phase II trial

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Multimodality Treatment Strategies

Induction CT/RT + Surgery

SWOG 9416 Rusch VW. J Clin Oncol 2007
JCO 9806 Kunito H. J Clin Oncol 2008

Surgery + Adjuvant therapy

Yildizeli-Dartevelle P. Ann Thorac Surg 2008

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Induction CT/RT + Surgery

	SWOG-9416	JCO-9806
Years of recruitment	1995-1999	1999-2002
N centers	5 (76 surgeons)	19
N pts (pts/surgeon)	110 (1.44)	76 (n/a)
Completed CT/RT	104 (95%)	71 (95%)
Surgery	88 (80%)	57 (75%)
Surgical mortality	3 (2.6%)	2 (3.5%)
5 years OS	44%	56%
Relapse rate	54.8%	52%

SWOG 9416 Rusch VW. J Clin Oncol 2007
JCO 9806 Kunito H. J Clin Oncol 2008

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INTERNATIONAL GUIDELINES

According to the results of SWOG 9416 and JCO 9806 trials induction chemo-radiotherapy followed by resection is adopted as the standard of care for Pancoast tumors in the clinical guidelines published by the ACCP [2007] and the NCCN [2012]

…but

N pts/surgeon	110/76 → 1.44	SWOG-9416
N pts/center	76/19 → 4	JCO-9806

American College of Chest Physician. Chest 2007
NCCN clinical practice guidelines in oncology. Non-Small Cell Lung Cancer 2012

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Results of Primary Surgery With T4 Non–Small Cell Lung Cancer During a 25-Year Period in a Single Center: The Benefit is Worth the Risk

Bedrettin Yıldızeli, MD, Philippe G. Dartevelle, MD, Elie Fadel, MD, Sacha Mussot, MD, and Alain Chapelier, MD

Ann Thorac Surg 2008

Surgery + Adjuvant therapy (80/126 pts)

Long-Term survival affected by:
- Complete resection (p=0.01)
- Subclavian artery invasion (p=0.01)

Surgical mortality: 0.8%

50 patients died of distant metastasis, mainly brain

CR 92% OS 5- and 10-years 36.6% and 25.9%

Induction therapy should be considered for the patients with mediastinal lymph node involvement

Our Phylosophy

"The European Institute of Oncology Experience"

INDUCTION CHEMOTHERAPY + SURGERY

- **Less toxicity compare to CT/RT→ more pts to surgery**
- **Better local and distant control compare to surgery**

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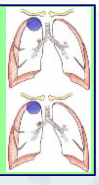
IEO EXPERIENCE: oncological indications

Surgery first

T3/4 N0

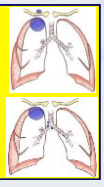
T3/4 N1 (minimal)



Induction chemotherapy

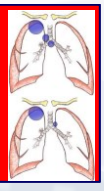
T3/4 N1 clavicular

T3/4 N2 minimal



Definitive CT/RT

T3/4 N2 (Bulky) or N3



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"In patients with Superior Sulcus Tumor, involving the subclavian artery or vertebral column, resection should be undertaken only in specialized center to achive a complete resection"

American College of Chest Physician. Chest 2007

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Surgical indications

Resectable and Operable Disease:

Patients (PS 0/1) with T3/4 N0/1

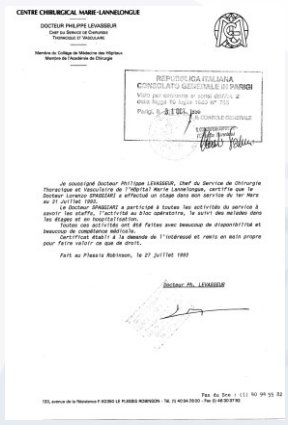
Absolute contro-indications to Surgery

- Distant metastases
- N2/N3
- >50% vertebral body involvement
- Brachial plexus involvement above T1 nerve
- Invasion of esophagus/trachea

Peedell, Clinical Oncology 2010

Our Background

"The European Institute of Oncology Experience"



CENTRE CHIRURGICAL MARIE-LANNELONGUE

DOCTEUR PHILIPPE LEVASSEUR

Chef du Service de Chirurgie Thoracique et Vasculaire

Membre du Collège de Médecine des Hôpitaux
Membre de l'Académie de Chirurgie

REPUBBLICA ITALIANA
CONSOLATO GENERALE DI PARIGI

Je soussigné Docteur Philippe LEVASSEUR, Chef du Service de Chirurgie Thoracique et Vasculaire de l'Hôpital Marie Lannelongue, certifie que le Docteur Lorenzo SPAGGIARI a effectué un stage dans mon service du 1er Mars au 31 Juillet 1993.

Le Docteur SPAGGIARI a participé à toutes les activités du service à savoir: les staffs, l'activité au bloc opératoire, le suivi des malades dans les étages et en hospitalisation.

Les gestes qu'il a pu effectuer ont été faites avec beaucoup de disponibilité et beaucoup de compétence médicale.

Certificat établi à la demande de l'intéressé et remis en main propre pour faire valoir ce que de droit.

Fait au Plessis Robinson, le 27 Juillet 1993

Docteur Ph. LEVASSEUR

Fax du Soir : 01 40 94 55 32

92, avenue de la Résistance F-92350 LE PLESSIS-ROBINSON - Tél. (1) 40 94 20 00 - Fax (1) 46 30 91 60

MEMOIRE

Ph. Dartevelle, Ph. Levasseur, A. Rojas-Miranda, M. Mercier, H. Le Brigand

Exérèse par voie combinée cervico-thoracique des tumeurs responsables de syndrome de Pancoast-Tobias

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Anterior transcervical-thoracic approach for radical resection of lung tumors invading the thoracic inlet

We describe an original anterior transcervical-thoracic approach required for a safe exposure and radical resection of non-small-cell lung cancer that has invaded the cervical structures of the thoracic inlet. Through a large L-shaped anterior cervical incision, after the removal of the internal half of the clavicle, the following steps may be performed: (1) dissection or resection of the subclavian vein; (2) section of the anterior scalenus muscle and resection of the cervical portion of the phrenic nerve, if involved; (3) exposure of the subclavian and vertebral arteries; (4) dissection of the brachial plexus up to the spinal foramen; (5) section of invaded ribs; and (6) en bloc removal of chest wall and lung tumor, either directly or through an extension of the cervical incision into the deltopectoral groove. An additional posterior thoracotomy may be required for resection of the chest wall below the second rib. Between 1980 and 1991, 29 patients underwent radical en bloc resection of the inlet tumor, chest wall (ribs 1 and 2), and underlying lung, either through the anterior transcervical approach alone (n = 9) or with an additional posterior thoracotomy (n = 20). The inferior root of the brachial plexus, either alone (n = 11) or with the phrenic nerve (n = 4), was involved and resected in 15 patients (52 %). Twelve patients (41 %) had a vascular involvement that included the subclavian artery alone (n = 3); subclavian artery and subclavian vein (n = 3); subclavian artery, subclavian vein, and vertebral artery (n = 2); subclavian artery and vertebral artery (n = 1); subclavian vein alone (n = 1); vertebral artery alone (n = 1); or subclavian artery and vertebral artery (n = 1). The subclavian artery was revascularized either with a prosthetic replacement (n = 7) or an end-to-end anastomosis (n = 2), and the median graft patency was 18.5 months (range, 6 to more than 73 months); only 1 patient had postradiotherapy graft occlusion in the revascularized artery 6 months after operation. We performed 14 wedge resections, 14 lobectomies, and 1 pneumonectomy. There were no operative or hospital deaths. Postoperative radiotherapy (median, 56 Gy) was given to 25 (86 %) patients, either alone (n = 14) or in combination with adjuvant systemic chemotherapy (n = 11). With a median follow-up time of 2.5 years, overall 2- and 5-year survivals were 50 % and 31 %, respectively. This transcervical-thoracic approach affords a safe exposure and radical resection of non-small-cell lung cancer involving the thoracic inlet and results in encouraging long-term survival. (J Thorac Cardiovasc Surg 1993;105:1025-34)

Philippe G. Dartevelle, MD, Alain R. Chapelier, MD, Paolo Macchiarini, MD, Bernard Lenot, MD, Jacques Cerrina, MD, François Le Roy Ladurie, MD, François J. F. Parquin, MD, and Denise Lafont, MD, *Le Plessis-Robinson, France*
Sponsored by Jean Deslauriers, MD, *Sainte-Foy, Quebec, Canada*

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"...ANTERIOR LESIONS ARE BEST TREATED USING AN ANTERIOR APPROACH RATHER THAN THE CLASSIC SHAW-PAULSON POSTEROLATERAL APPROACH..."

"...FOR ANTERIOR SITUATED APICAL TUMORS, WHERE ADHERENCE TO THE SUBCLAVIAN VESSELS IS SUSPECTED, AN ANTERIOR APPROACH IS OFTEN PREFERRED..."

R.J.Ginsberg ,
Chest Surg Clin North Am 1995

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"...ONE OF THE PROBLEMS WITH THE TRANSCERVICAL APPROACH IS THE CLAVICULAR RESECTION..."

"...NOT SURPRISINGLY, POSTOPERATIVE ALTERATIONS IN SHOULDER MOBILITY AND CERVICAL POSTURE ARE TYPICAL..."

R.J. Ginsberg
Year Book of Thorac Cardiovasc Surg 1998

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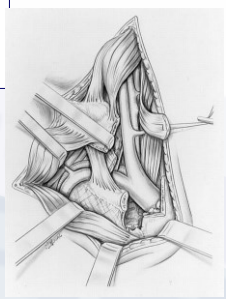
Transmanubrial Osteomuscular Sparing Approach for Apical Chest Tumors

Dominique Grunenwald, MD, and Lorenzo Spaggiari, MD

Department of Thoracic Surgery, Institut Mutualiste Montsouris, Paris, France

Ann Thorac Surg; 1997



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Transmanubrial Approach With Antero-Lateral Thoracotomy for Apical Chest Tumor

Lorenzo Spaggiari, MD, PhD, and Ugo Pastorino, MD

Department of Thoracic Surgery, European Institute of Oncology, Milan, Italy

Transmanubrial osteomuscular sparing approach (TMA) has been recently proposed for the treatment of apical chest tumor to allow a safer subclavian artery control with a less invasive procedure for the patient. The present technique combines the antero-lateral muscle-sparing thoracotomy with TMA for lung cancer patients in whom extended resection of cervico-thoracic structures as well as anatomic lung resection and radical lymph nodes dissection are required.

(Ann Thorac Surg 1999;68:590–3)
© 1999 by The Society of Thoracic Surgeons

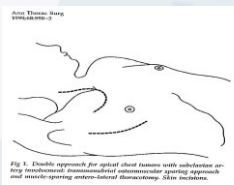

Fig 1. Double approach for apical chest tumors with subclavian artery involvement: transmanubrial osteomuscular sparing approach and muscle-sparing antero-lateral thoracotomy. Skin incisions.

Characteristics of the various anterior approaches

Approach	Advantages	Disadvantages
Trans-cervical	-Excellent exposure -All type of lung resection feasible without accessory thoracotomy	-Resection of the clavicle -Risk of scapula alata
Trans-manubrial	-Excellent exposure -Leaves in situ the clavicle without muscular sacrifice	- Needs an accessory thoracotomy or resection of the first two ribs to perform the lung resection
Hemiclamshell	-Excellent exposure	-Difficult posterior dissection -Risk of fail chest
Trans-scapular	- Adequate exposure	-Very long ischemic incision -Increased shoulder girdle dysfunction of impairment of pulmonary function

IEO EXPERIENCE: type of approach

- Transmanubrial + posterolateral thoracotomy (Paulson's incision)
- Transmanubrial + anterolateral thoracotomy
- Transmanubrial alone
- Hemiclamshell

Anterior Approach

(TMA alone)

Anterior + Midline Posterior Approach for Hemivertebrectomy

IEO experience from 1998 to 2013

Patients	94 (6pts/yr); 3 surgeons
Male	79 (84%)
Median age	62 yrs (44-80)

LS →57
PGS →9
UP →28

94/3=31

pTx	3	3,19 %
pT0	5	5,32 %
pT1	0	0,00 %
pT2	7	7,44 %
pT3	65	69,15 %
pT4	14	14,89 %

Adenocarcinoma	40 (42,5%)
Squamous	29 (31%)
Adeno-squamous	7 (7,4%)
Pleomorphic	5 (5,3%)
Large cell neuroendocrin	5 (5,3%)
Other	8 (8,5%)

pT3:

pN0	40	61,5%
pN1	12	18,4%
pN2	7	10,8%
pN3	3	4,6%
pNx	3	4,6%

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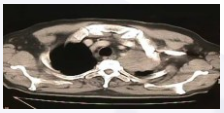
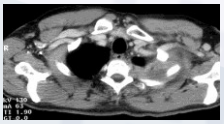
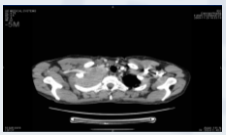
European Insitute of Oncology Experience : Type of apical chest tumor

anterior  N=45 (47.9%)

posterior  N=39 (41,5%)

mixed type  N=10 (10,6%)

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ANTERIOR SURGICAL APPROACH (Including Combined Approach)

TMA

Alone (n=6)

\+

Thoracotomy

-Lateral (n=21)

-Posterior (n=13)

HEMICLAMSHELL

\+ Both (n=4)

Alone (n=15)

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Induction treatments

- Yes n=48 (51%)
  - – ***Chemotherapy*** ***n=38 (79,2%)***
  - – CT/RT n=9 (18,8%)
  - – RT n=1 (2,1%)

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Adjuvant treatments

- Yes n=33(38.8%)
  - Chemotherapy n=1 (1,3%)
  - CT/RT n=3 (4%)
  - ***RT*** ***n=29 (37.2%)***
  - Not specified n=5 (6.4%)

RESECTIONS

Right (n=48, 51.3%) vs Left (n=46, 48.7%)

lung		extended
Lobectomy	***78 (83%)***	Vascular 21 (22,5%)
Pneumonectomy	3 (3%)	(anterior approaches 37%)
Sleeve lobectomy	6 (6.5%)	
Wedge	7 (7.5%)	

Complete resection 90.4%

POSTOPERATIVE OUTCOME

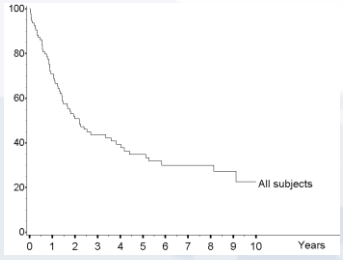
30 and 90-day MORTALITY → 5.3% (5/94) and 9.6% (9/94)

- **Anterior** 6,4% (6/94)
- **Posterior** 1,1% (1/94)
- **Combined anteriore and Posterior** 2,1% (2/94)

POSTOPERATIVE COMPLICATIONS **16% (15/94) (MAJOR)**

ICU stay (median)	**1 days (0-160)**
Hospital Stay (median)	**9 days (5-116)**

OVERALL SURVIVAL

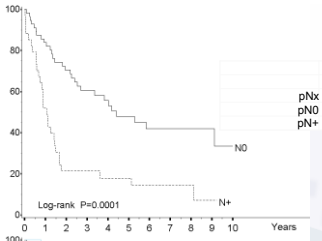


Overall survival (95% CI)

	1-year	2-year	5-year	10-year
ALL	71 (32-80)	51 (40-61)	35 (25-45)	23 (11-35)

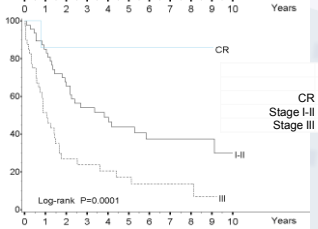
Follow-up 36 months (median)(range 6-146)

N STATUS



	Overall survival (95% CI)			
	1-year	2-year	5-year	10-year
pNx	50 (1-99)	25 (0-67)	-	-
pN0	84 (74-93)	70 (58-83)	48 (33-62)	35 (18-53)
pN+	52 (35-69)	22 (7-36)	18 (5-31)	-

p STAGE



	Overall survival (95% CI)			
	1-year	2-year	5-year	10-year
CR	85 (57-100)	85 (57-100)	85 (57-100)	-
Stage I-II	85 (75-95)	66 (52-79)	49 (34-64)	31 (14-48)
Stage III	51 (36-67)	27 (13-41)	17 (4-30)	-

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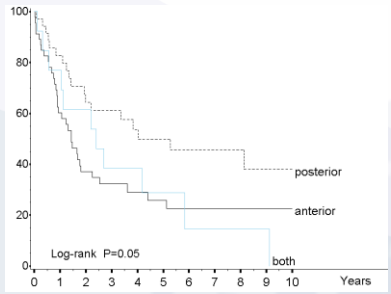
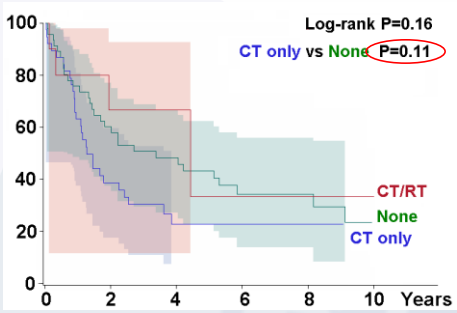
Type of Pancoast



	Overall survival (95% CI)			
	1-year	2-year	5-year	10-year
Anterior	60 (46-74)	37 (23-51)	26 (12-40)	22 (9-36)
Posterior	83 (70-95)	64 (48-81)	50 (32-68)	36 (15-58)
Both	77 (54-100)	62 (35-88)	28 (1-54)	14 (0-37)

Induction Treatments



Not significant….

….but patients underwent induction CT had higher stage

Conclusions

- N status significantly influence survival results
- Best candidate T3N0 (5-yr 50%, 10-yr 35%)
- Induction treatment should be indicated on case-by-case basis according to the T extension and N status
- High percentage of radical resection (97%) and the prevalence of systemic recurrence may hypothesizes a role to the adjuvant chemotherapy

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Thank you!