Chirurgie Mini-Invasive dans la prise en charge des cancers pulmonaires

Dr JP ARIGON

Chirurgie thoracique - Nantes

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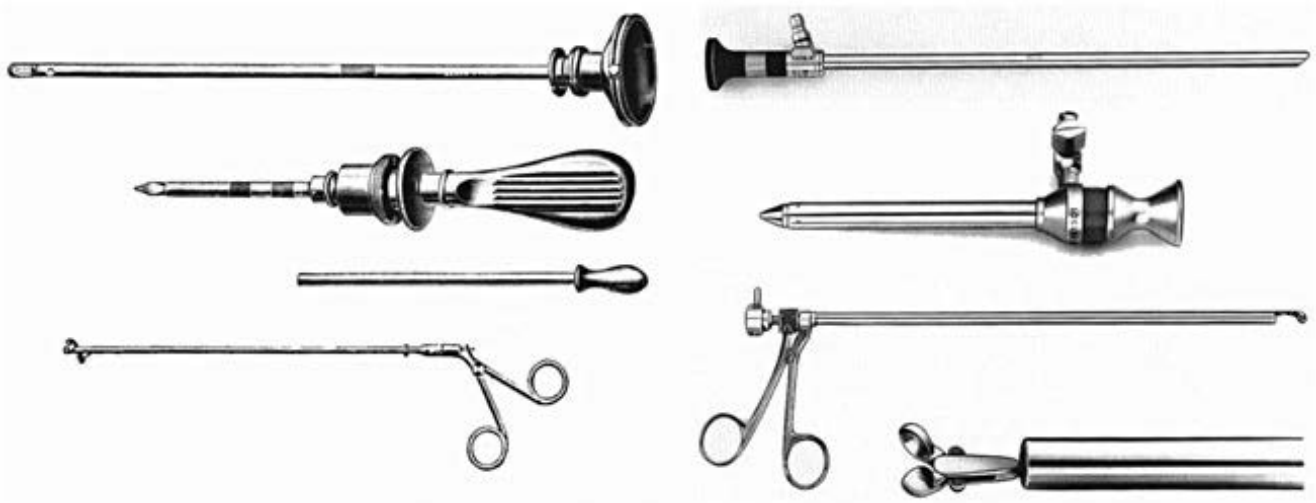
AUCUN CONFLIT

Jacobeus 1910

1ère pleuroscopie (diagnostique ss AL)

Jacobaeus demonstrating the thoracoscopic approach (c. 1920).

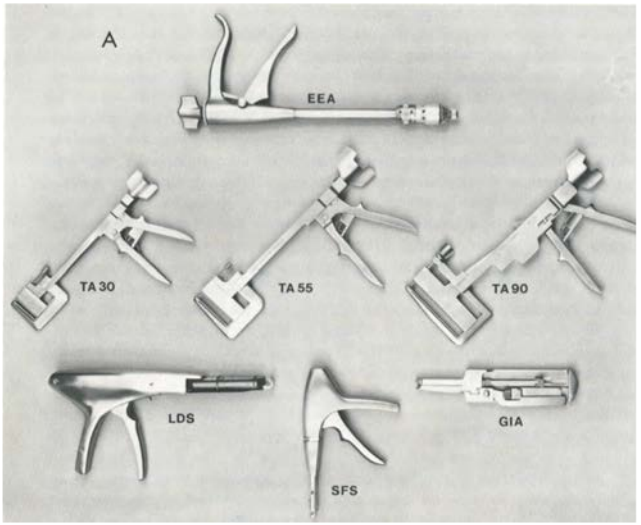


Jacobaeus instruments (cystoscope) for thoracoscopy (c. 1925; on the left)
Modern equipment, Boutin thoracoscope (on the right).

1er résection pulmonaire : Theodore **Tuffier** , résection partielle pour tuberculose en 1891, thoracotomie 2 EIC

Balbutiement de la Chirurgie thoracique → 2ème guerre mondiale (antibiotiques, ventilation en pression positive, technique de sutures bronchique, contrôles vasculaires…): spécialité à part entière…

1955 :1er agrafage mécanique pour résection (Androsov and Potechina)



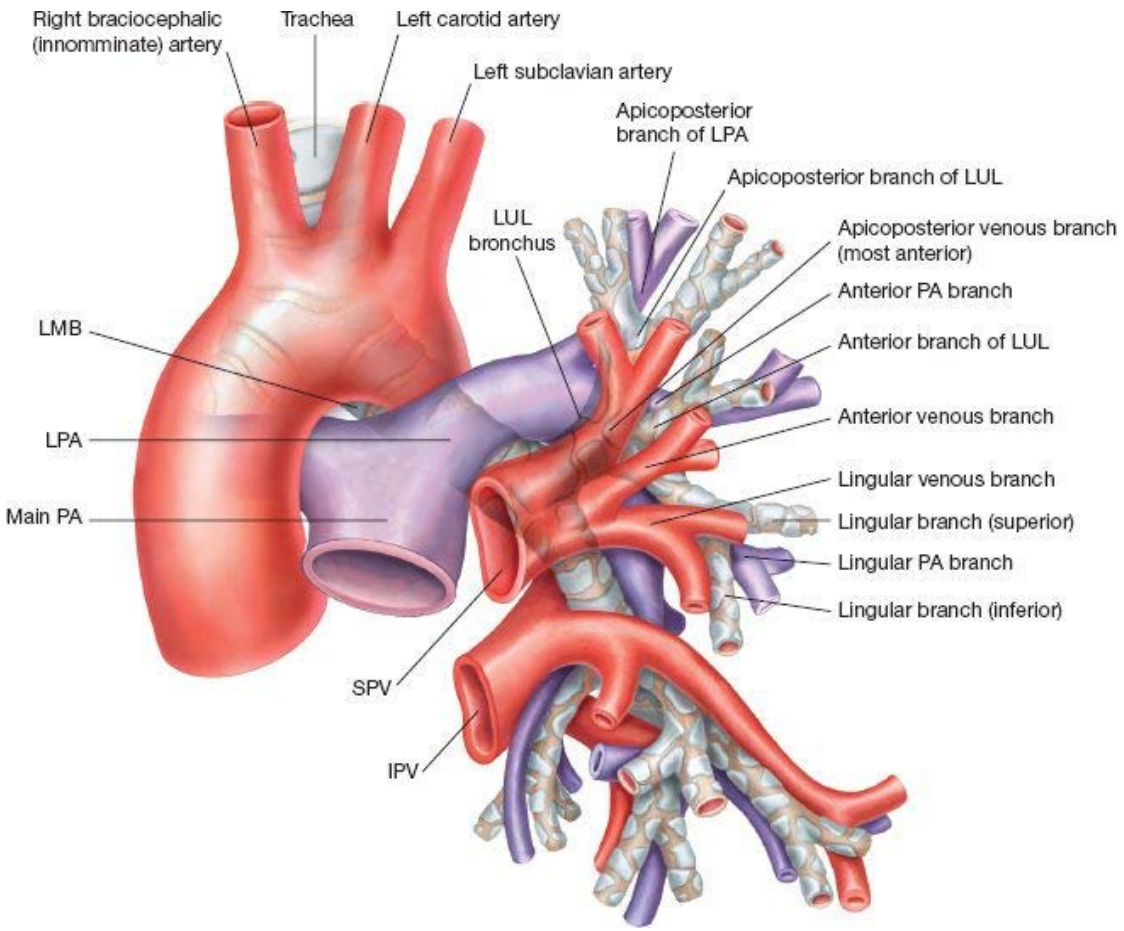
1er résection pulmonaire : Theodore **Tuffier** , résection partielle pour tuberculose en 1891, thoracotomie 2 EIC

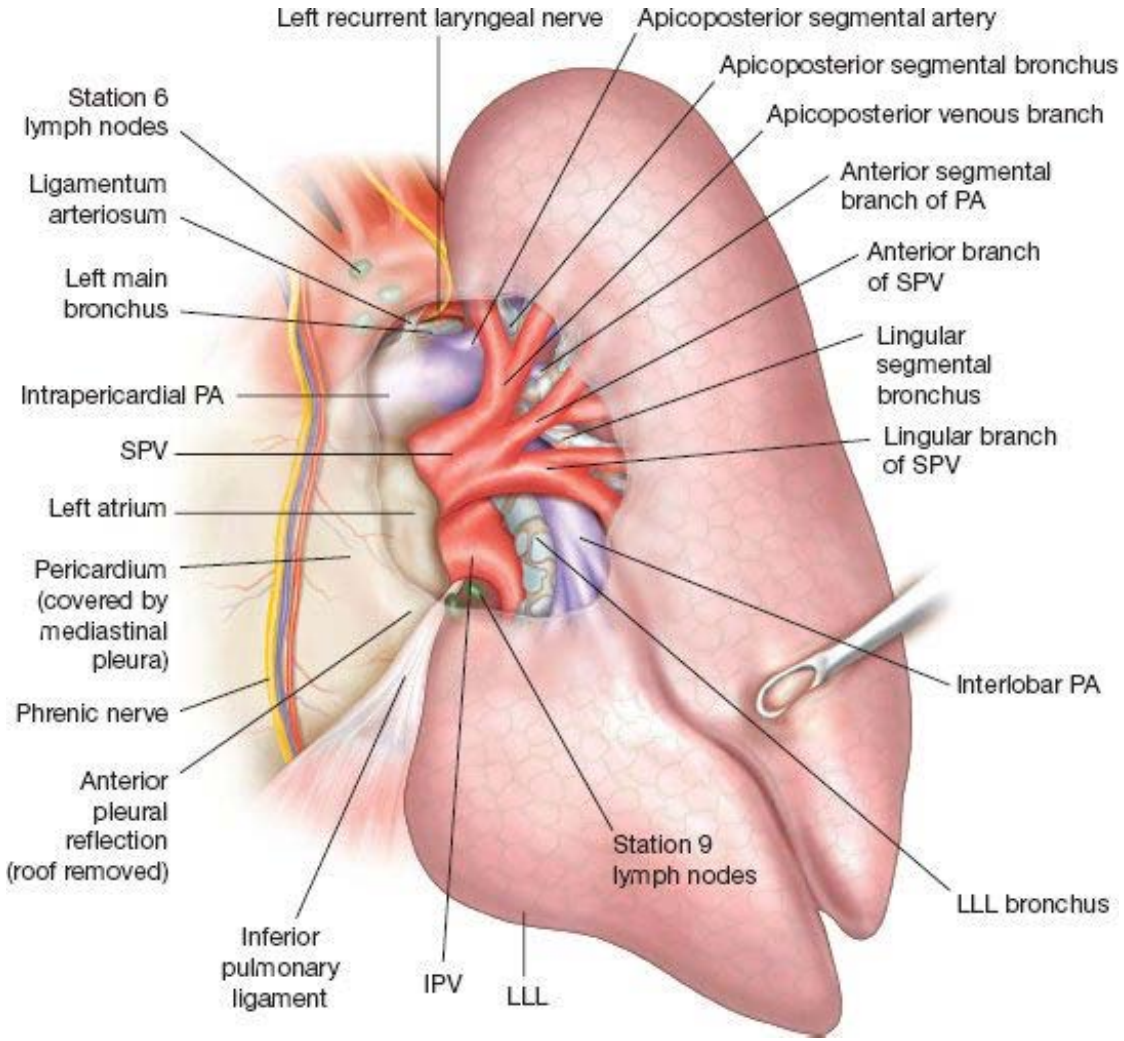
Balbutiement de la Chirurgie thoracique jusqu'après 2ème guerre mondiale (antibiotiques, ventilation en pression positive, technique de sutures bronchique, contrôles vasculaires…): spécialité a part entière…

1955 :1er agrafage mécanique pour résection (Androsov and Potechina)

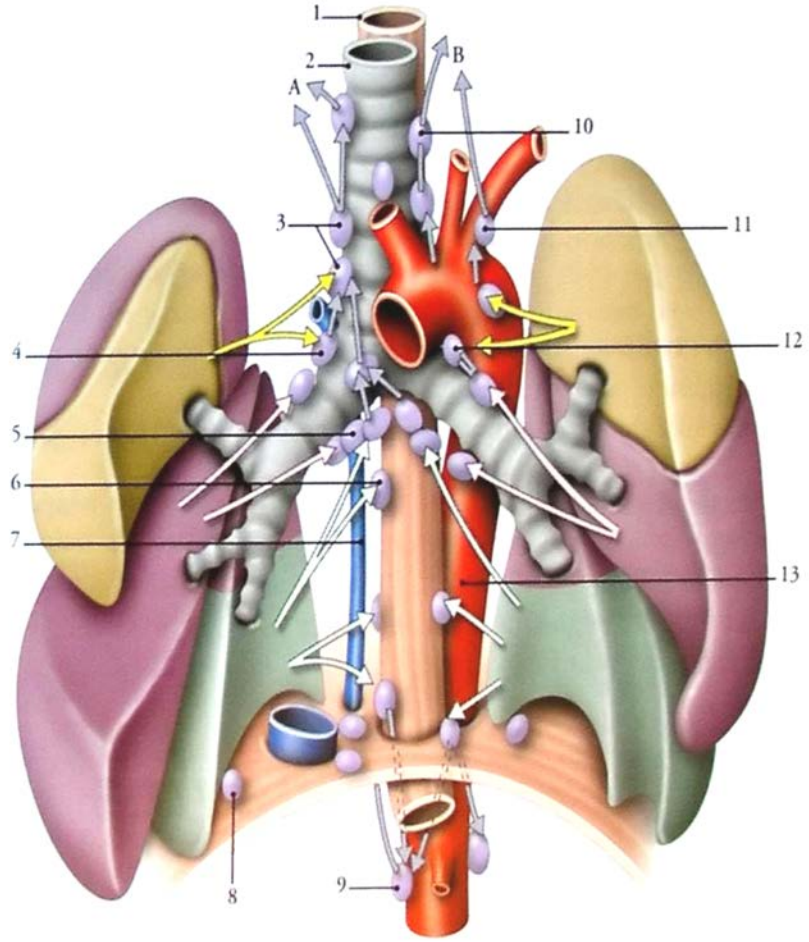
In 1962, Salzer montre que la lobectomie est équivalent à la pneumonectomie pour le cancer bronchique qui devient l'intervention de référence.

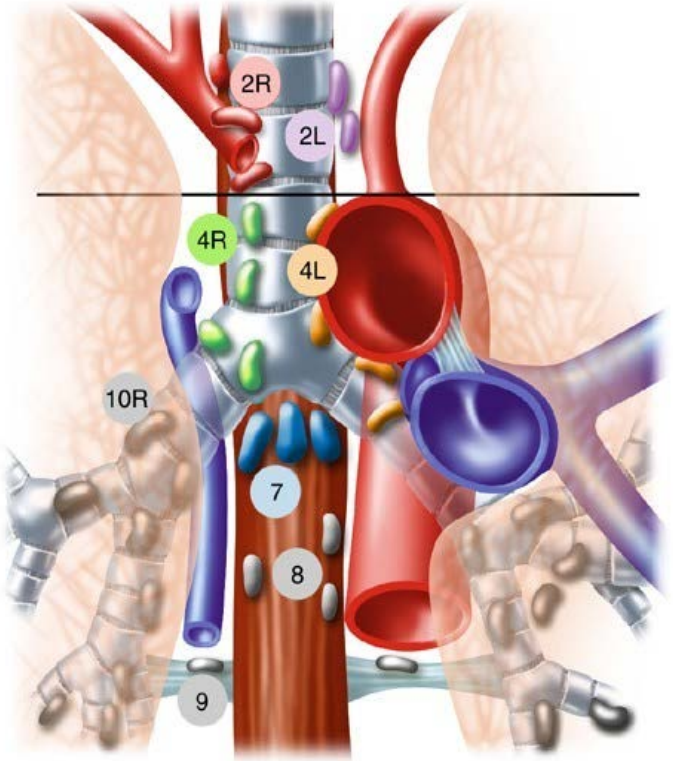
Challenge chirurgical : Contrôles vasculaires, bronchiques, parenchyme…



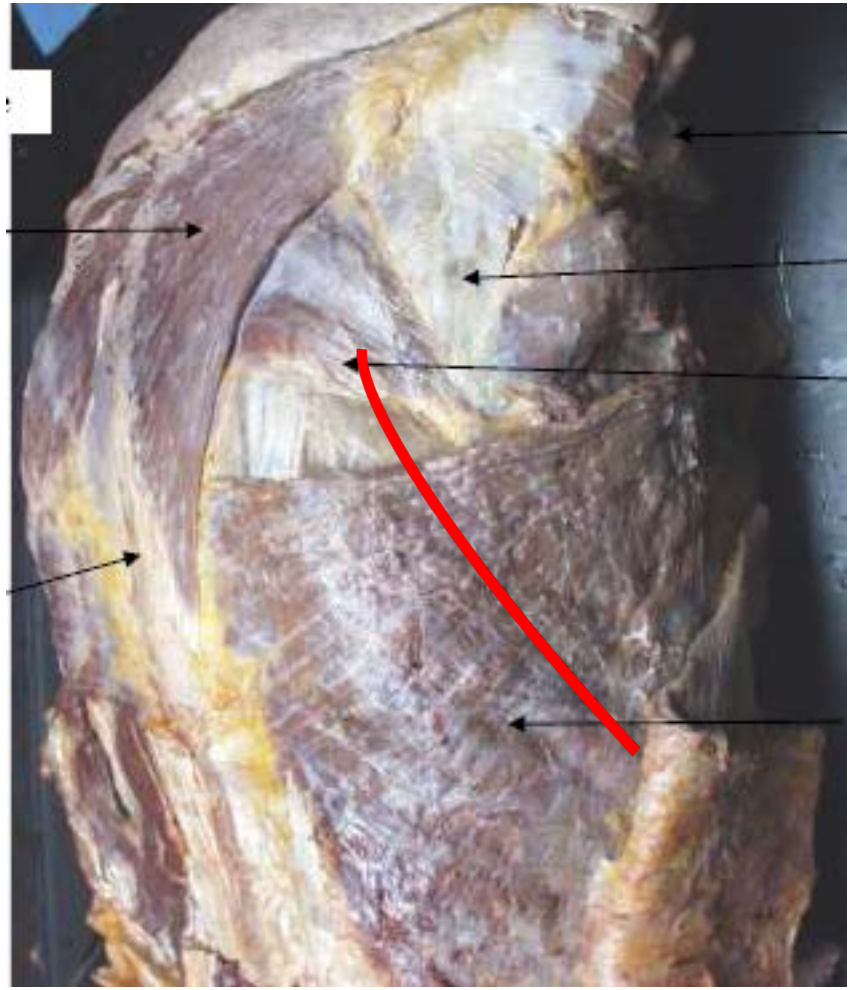


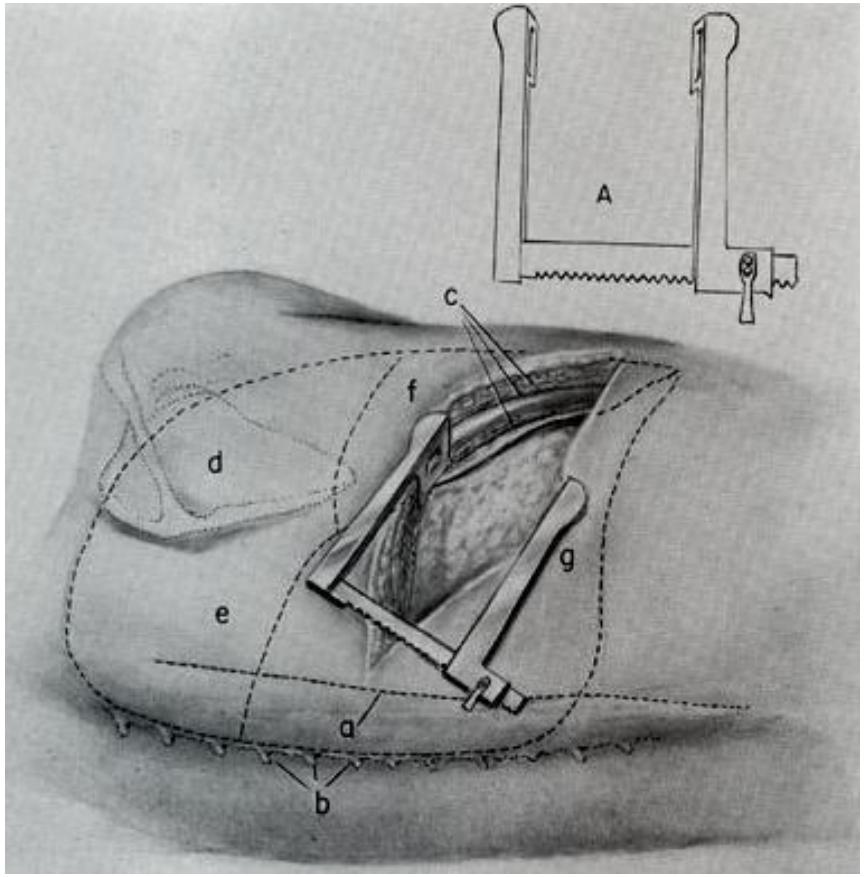
Challenge chirurgical : Curage ganglionnaire…

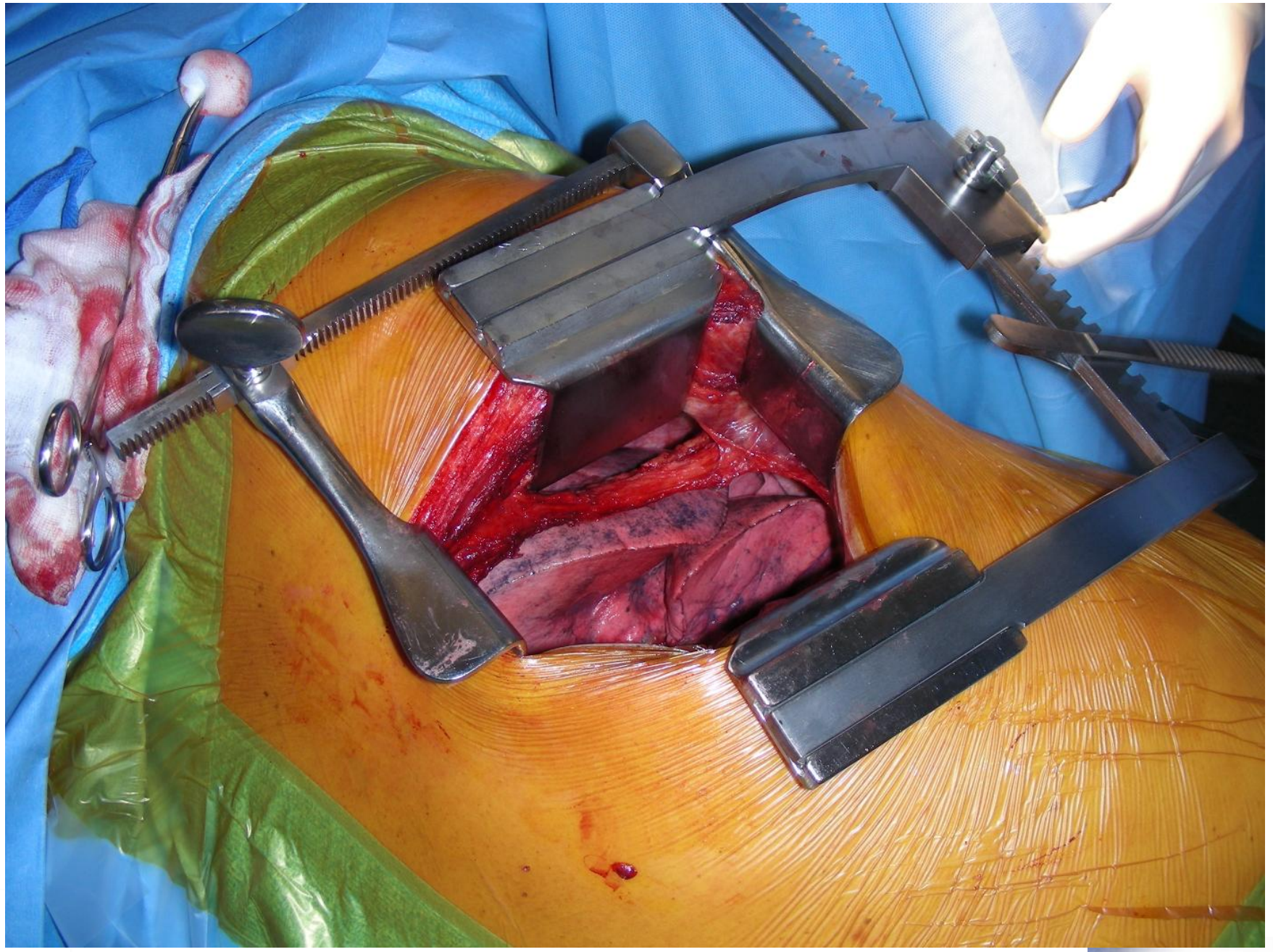


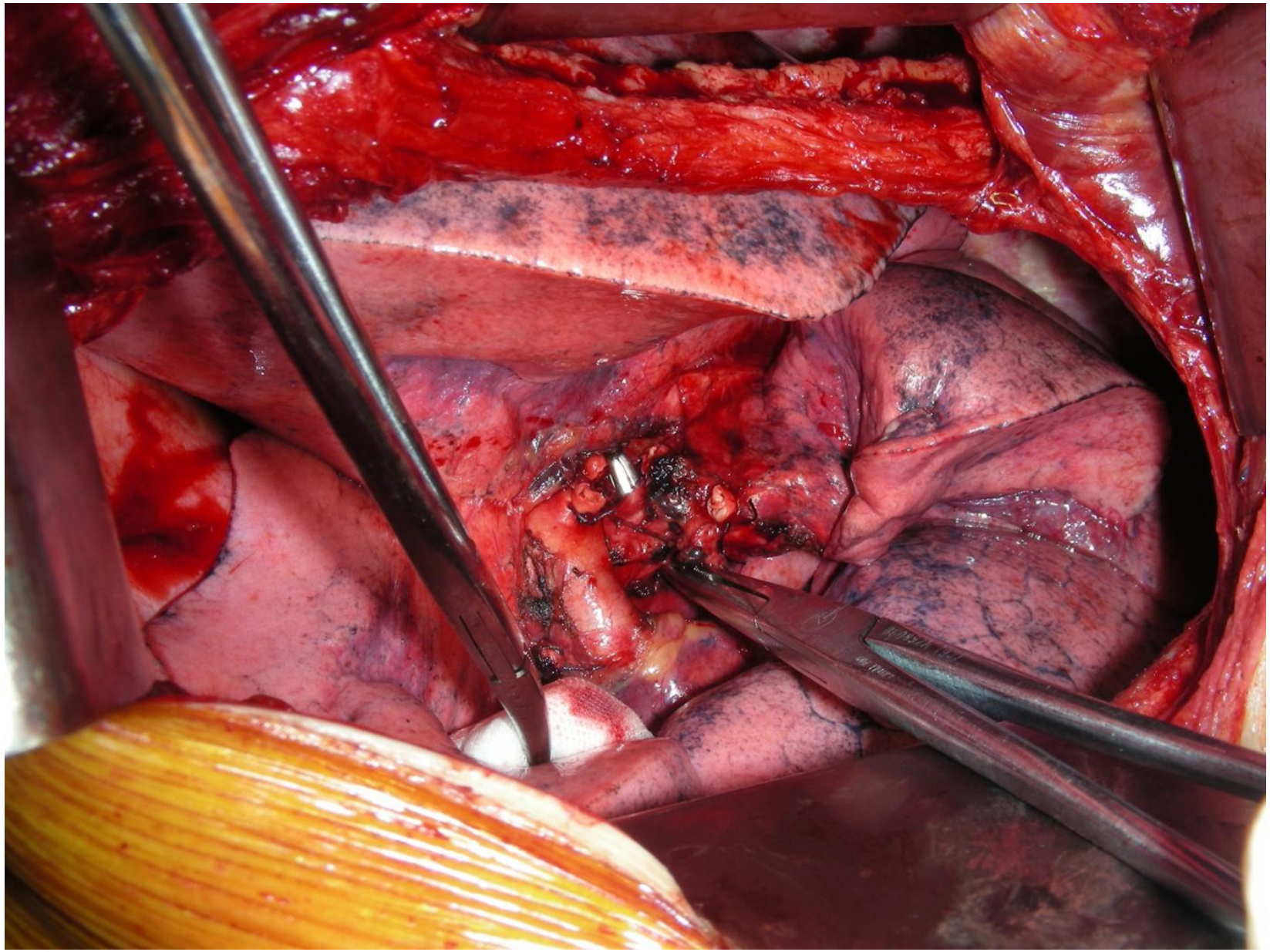


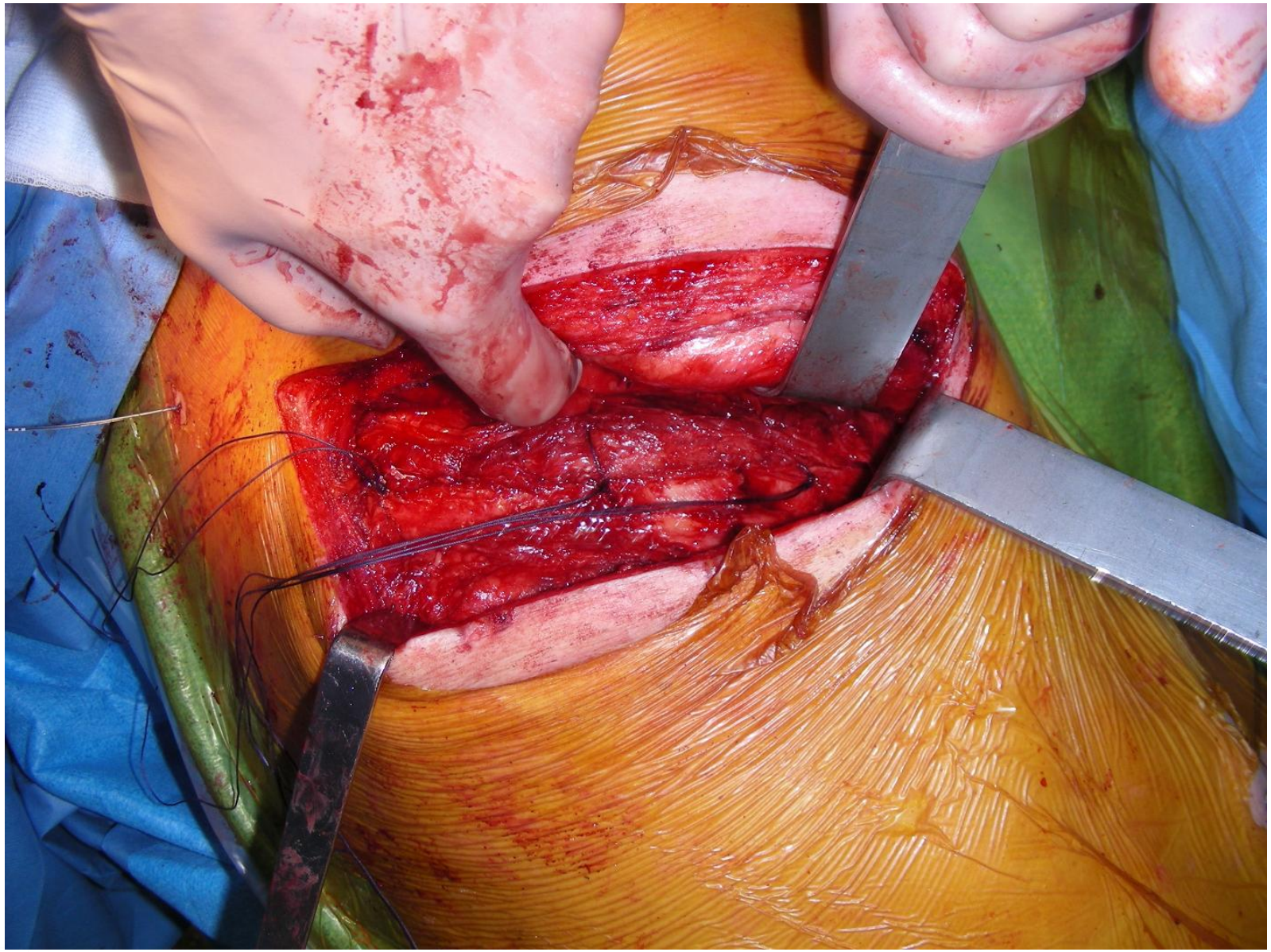
Thoracotomie postéro-latérale : le Gold Standart de la Xie…









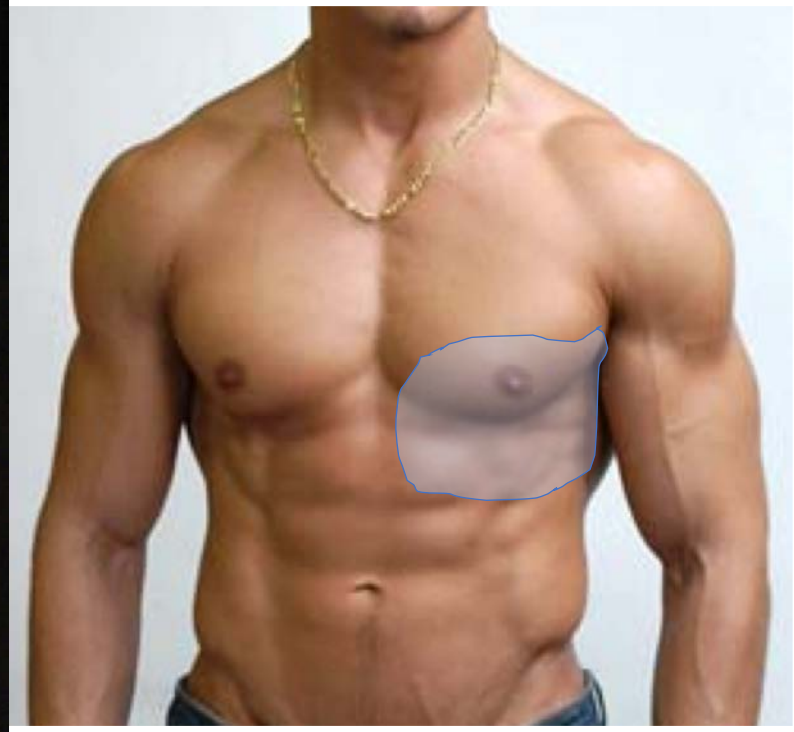


Morbidité:

- Bullages >7j : 5 -10 %
- Caillotages : 1à 2%
- PNPT : 5 – 20%
- Atélectasie (fibro) : 7 - 10 %
- Troubles Rythmes : 5 – 20%, ischémie : 2-4%
- Fistules : 1-2%
- DOULEURS +++ Durable : 50%

- **DMS : 8-11 jours**

Névralgie post-thoracotomie:



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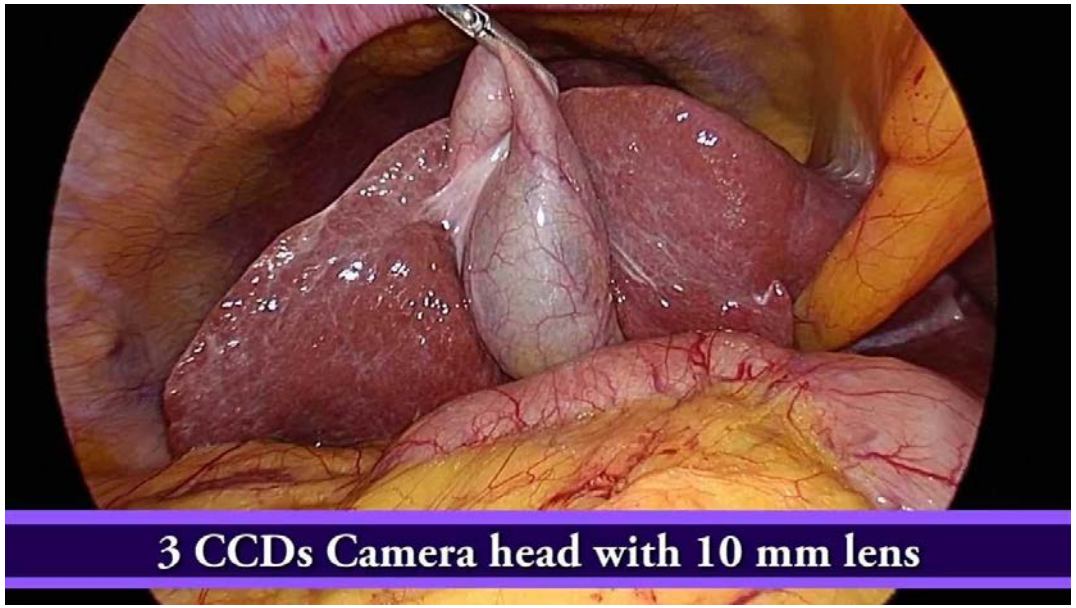
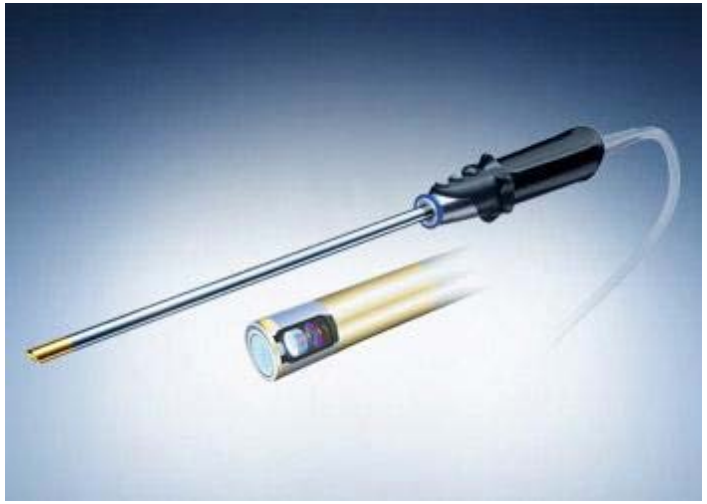
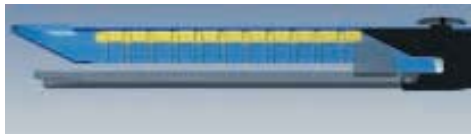
PEUT-ON FAIRE DIFFEREMENT ?

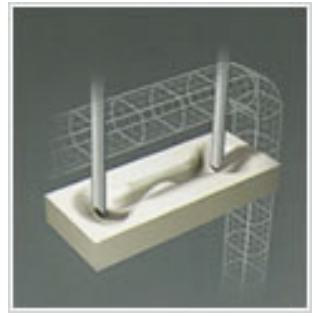


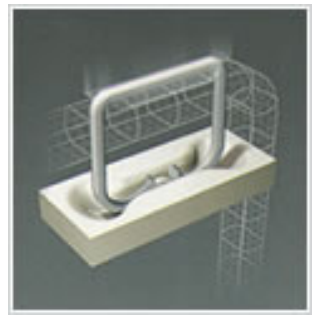


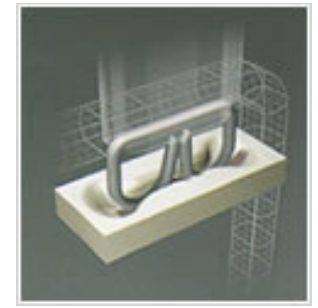
- **Pathologie pleurale**
- **Wedge**
- **Pneumothorax**

Les EndoGIA









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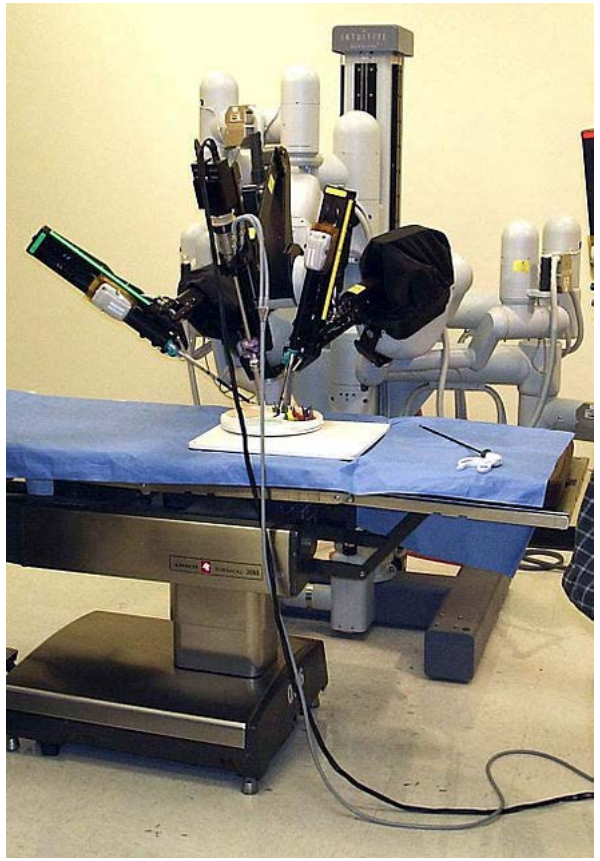
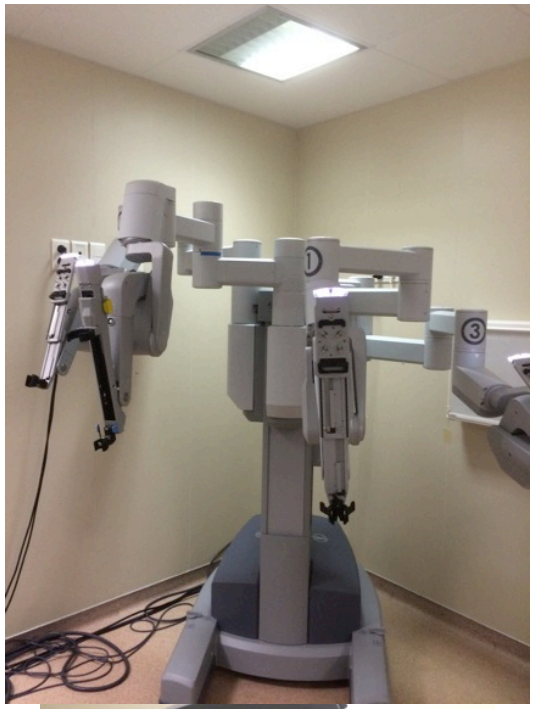
Bistouri : nouvelles générations



Achat clinique
2011 : 500000€
Entretien : 110000€/an



A négocier : 1800000€
Entretien : 250000 €

2015 : 750000€
Entretien : 150000€/an

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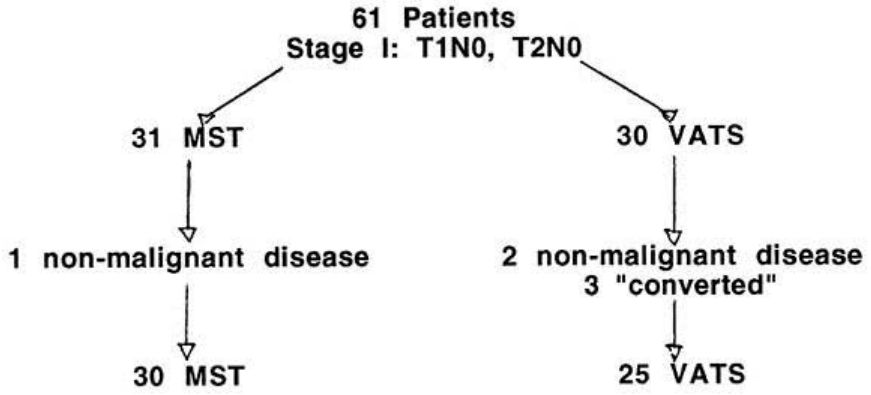
Videoendoscopic Pulmonary Lobectomy for Cancer

Roviaro, Giancarlo; Rebuffat, Carlo; Varoli, Federico;
Surgical Laparoscopy & Endoscopy. 2(3):244-247,
September 1992.

Lobectomy—video-assisted thoracic surgery versus muscle-sparing thoracotomy: A randomized trial

Thomas J. Kirby, Michael J. Mack, Rodney J. Landrenau, Thomas W. rice.
Volume 109, Issue 5, P997-1002, Mai 01, 1995



	MST	*VATS*
LSD	7	6
LID	11	3
LM	1	5
LSG	6	6
LIG	5	5

	MST	*VATS*
Operating room time (min)	**175 ± 93**	**161 ± 61**
Converted to MST	**—**	**3**
Intraoperative complications	**1**	**0**
Blood Loss		
<250 ml	**25**	**21**
250-500 ml	**2**	**4**
>500ml	**3**	**0**

	MST	*VATS*
Chest tube drainage (days)	6.5 ± 4.8	4.6 ± 3.3
Length of hospital stay (days)	8.3 ± 5.7	7.1 ± 5.5
Postthoracotomy pain	2	1

VATS lobectomy : **safe and technically feasible operation in the setting of early stage I and II non-small-cell lung cancer**

Unable to demonstrate significant short-term advantages of VATS in terms of length of stay, return to work, or significantly decreased postoperative pain as compared with MST.

Management of hemorrhage during any major pulmonary resection remains of concern, especially when the procedure is done in an essentially closed chest.

Last, insufficient time has elapsed to report on the 5-year survival of patients after VATS lobectomy, the ultimate criterion in the management of lung cancer.

This study is illustrative of the many controversies surrounding VATS procedures in general

Video-Assisted Thoracic Surgery Lobectomy: Report of CALGB 39802—A Prospective, Multi-Institution Feasibility Study

Scott J. Swanson, James E. Herndon II, Thomas A. D'Amico, Todd L. Demmy, Robert J. McKenna Jr, Mark R. Green, and David J. Sugarbaker

VOLUME 25 · NUMBER 31 · NOVEMBER 1 2007

CRITERES DE LA LOBECTOMIE THORACOSCOPIQUE :

- **Pas d'écarteur intercostal**
- **Incision d'utilité élargie au maximum à 8 cm pour retirer la pièce**
- **Dissection élective des veines, des artères, et de la bronche du lobe**
- **Curage ganglionnaire identique à la voie ouverte**
- **Retrait de la pièce sous couvert d'un sac imperméable**

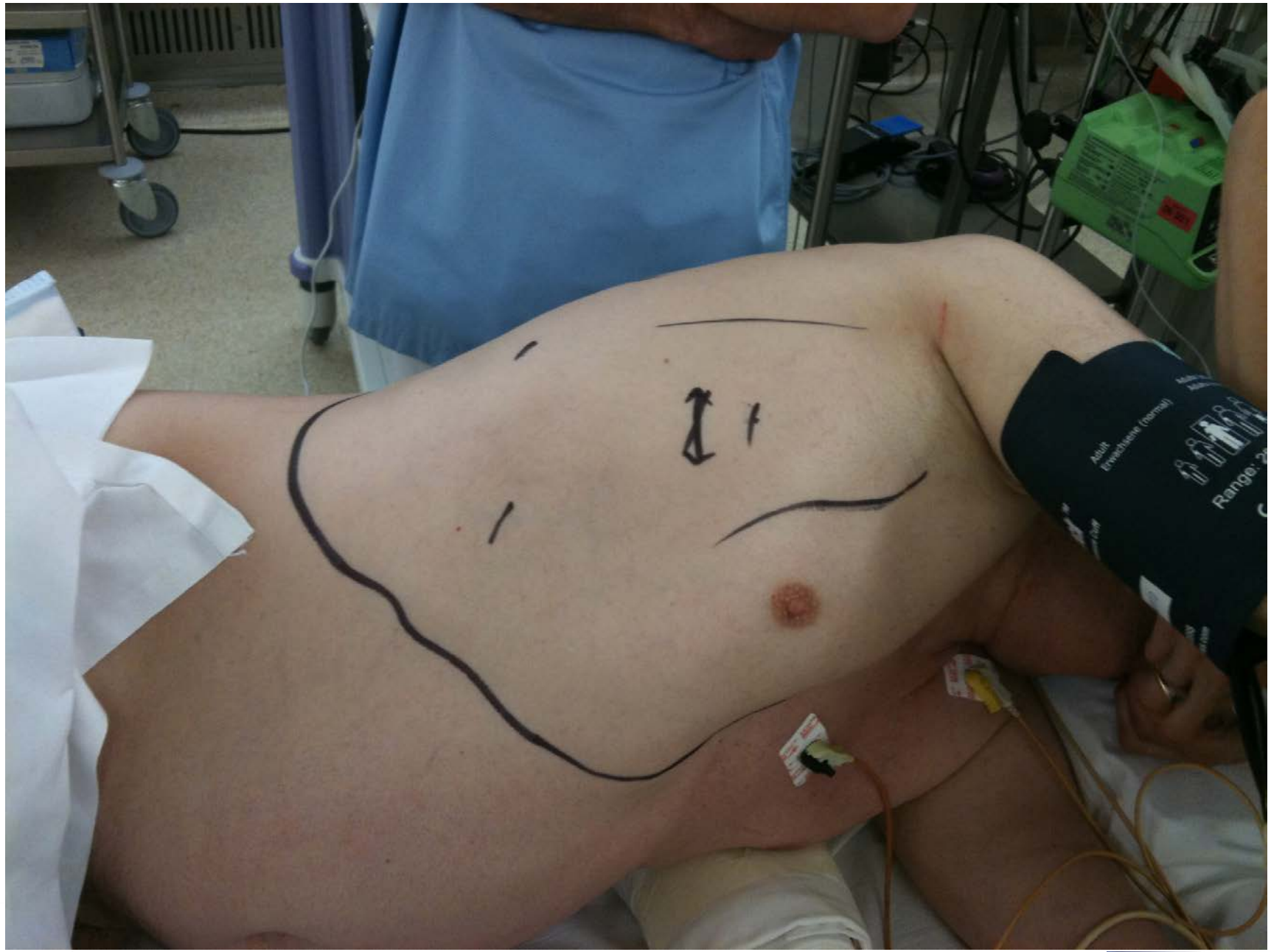
Consensus statement on definitions and nomenclature for robotic thoracic surgery

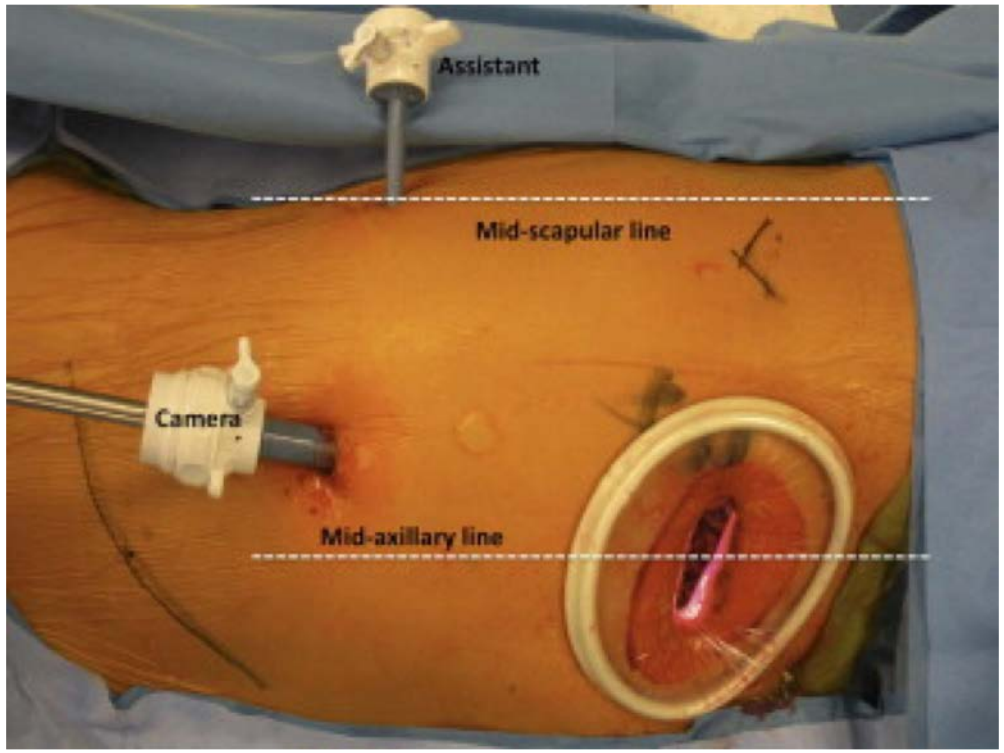
Robert Cerfolio, MD, MBA,[a] Brian E. Louie, MD,[b] Alexander S. Farivar, MD,[b] Mark Onaitis, MD,[c] and Bernard J. Park, MD[d]

The Journal of Thoracic and Cardiovascular Surgery, September 2017

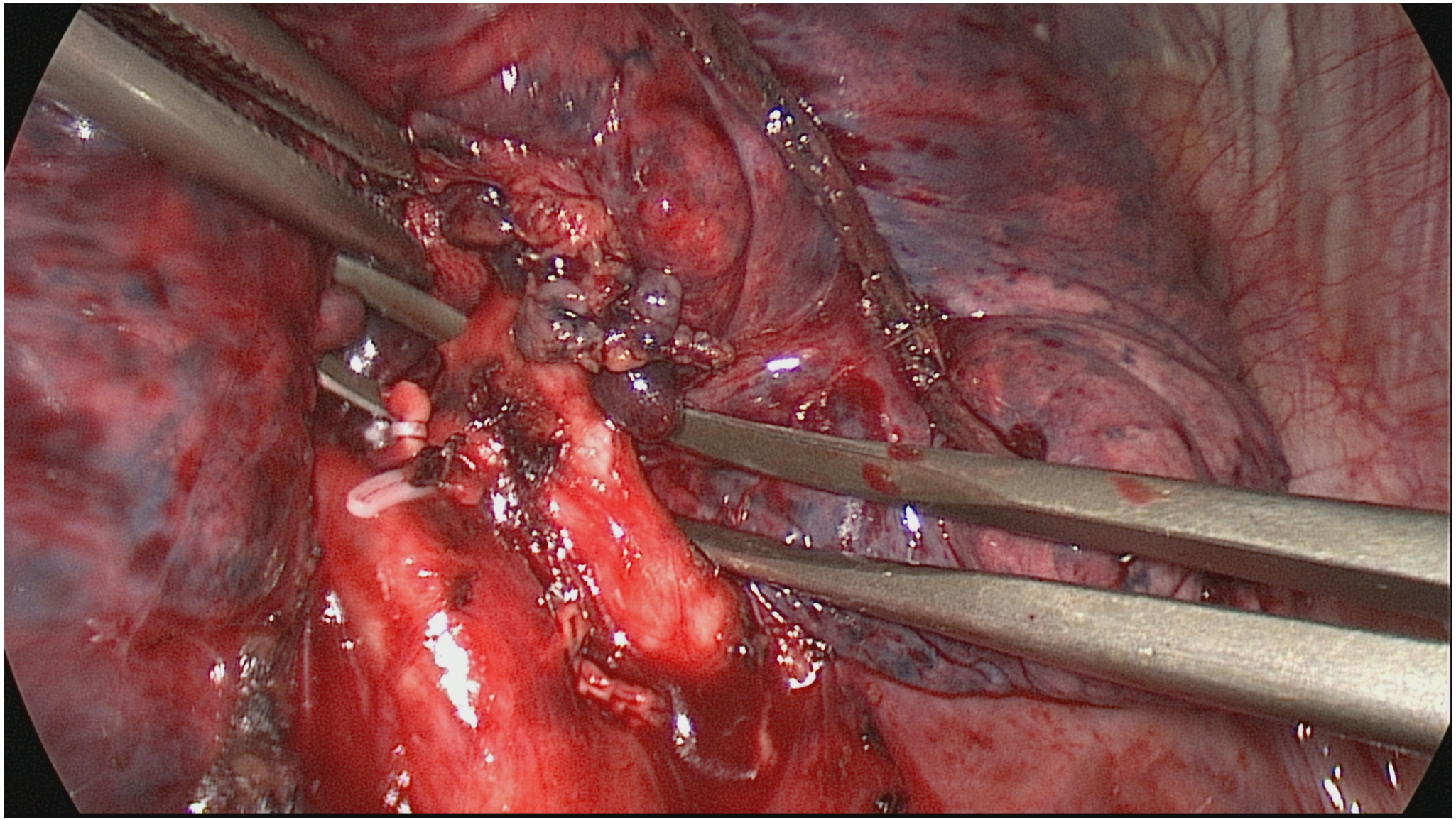
CRITERES DE LA LOBECTOMIE ROBOTIQUE :

- **Pas d'écarteur, pas de soulèvement de la paroi**
- **Utilisation de moniteur pour visualiser le champ opératoire (assistant)**
- **Manipulation des tissus principalement par des bras robotisés, simulant la main humaine, contrôlés par une interface informatisée (opérateur)**
- **Dissection élective des veines, des artères, et de la bronche du lobe**
- **Curage ganglionnaire identique à la voie ouverte**
- **Retrait de la pièce sous couvert d'un sac imperméable**

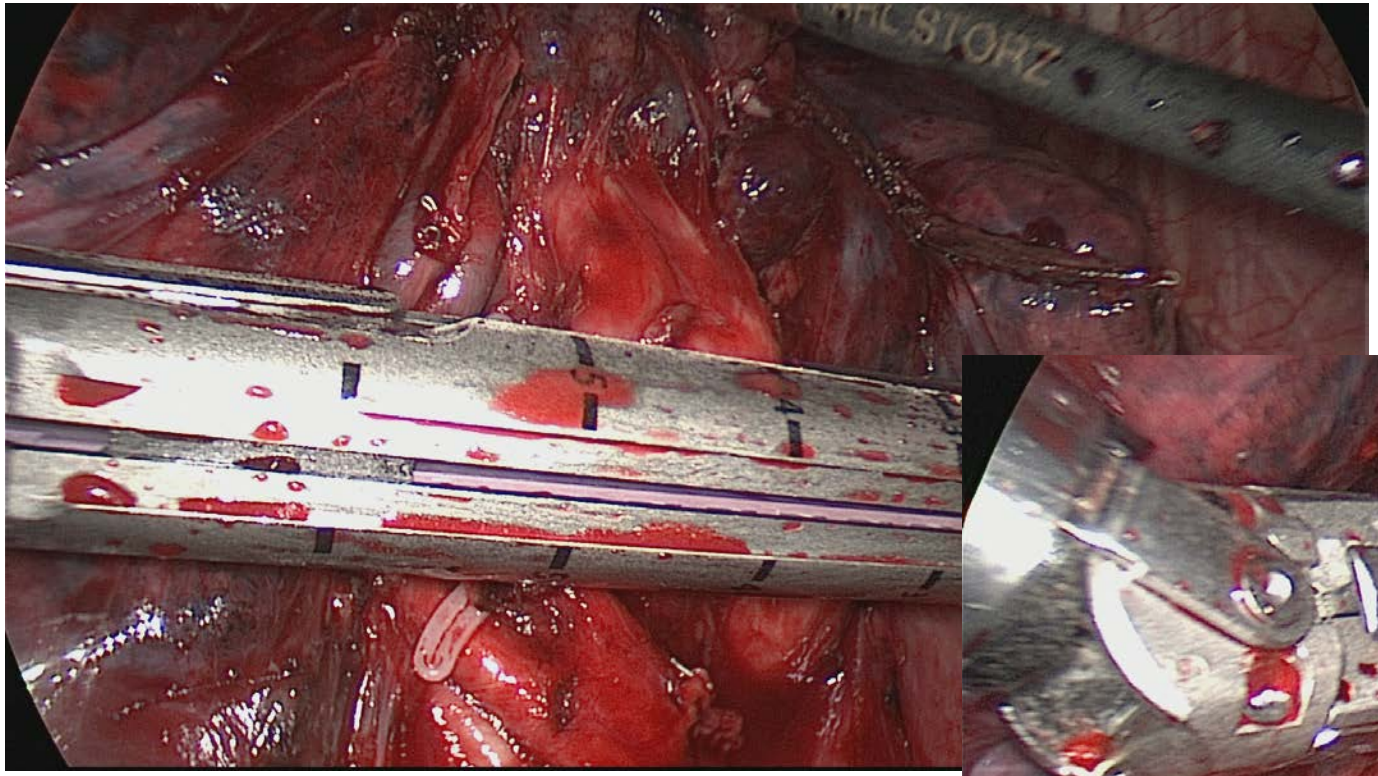


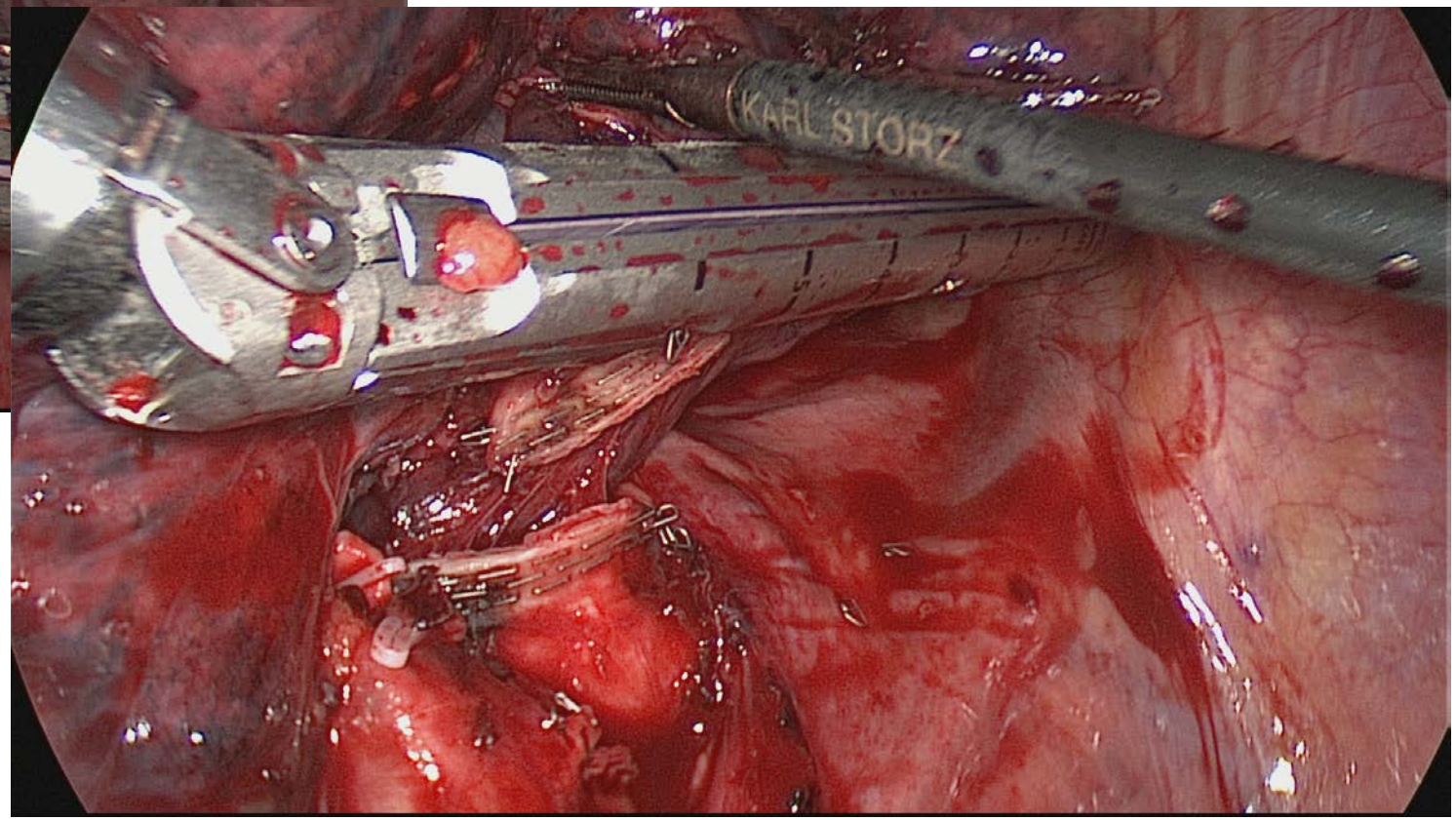

Assistant
Mid-scapular line
Camera
Mid-axillary line

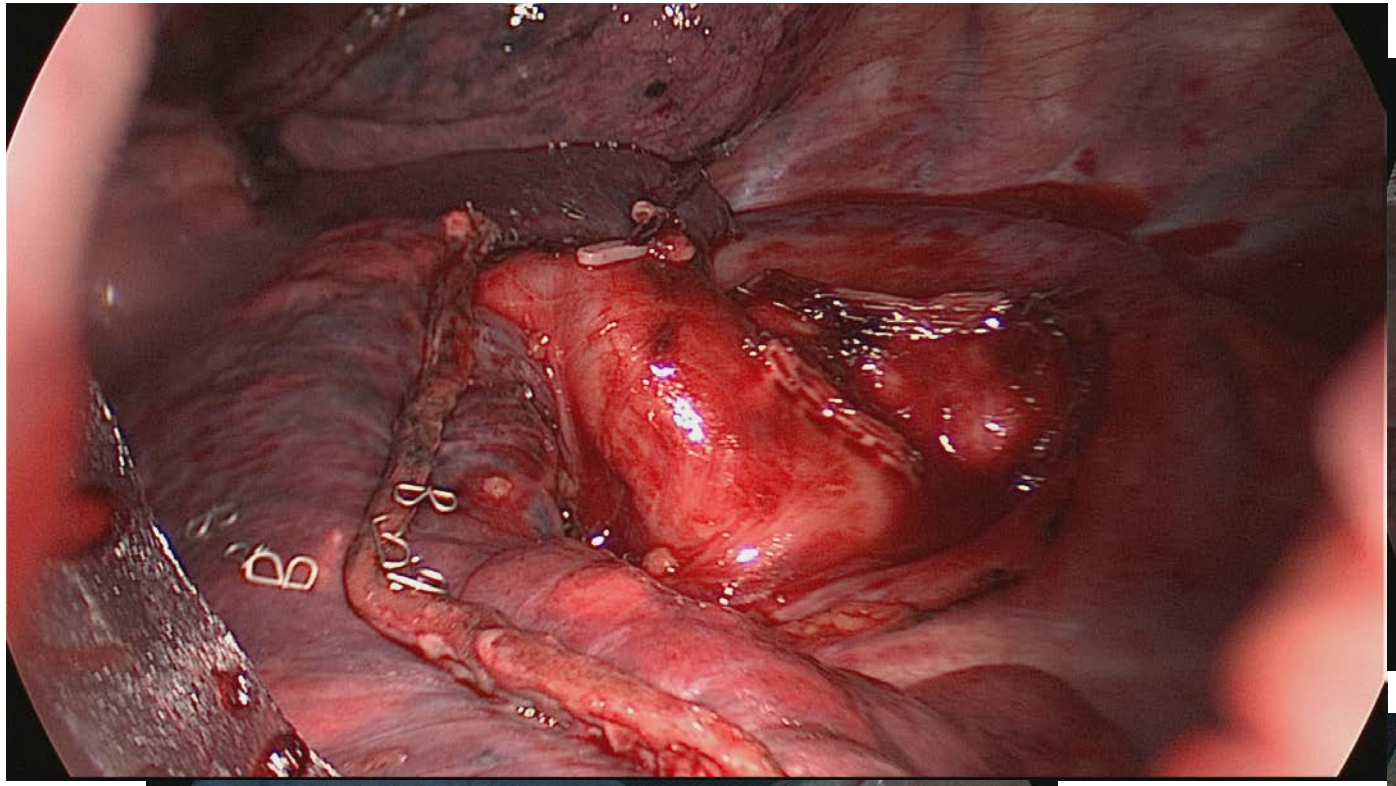
LSD

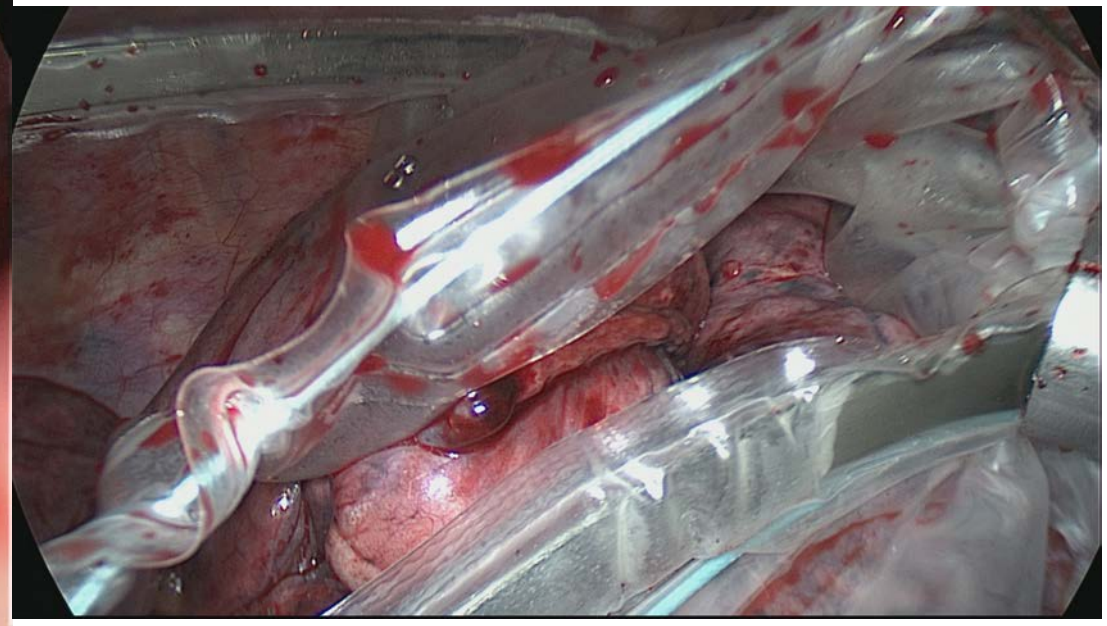


LSD

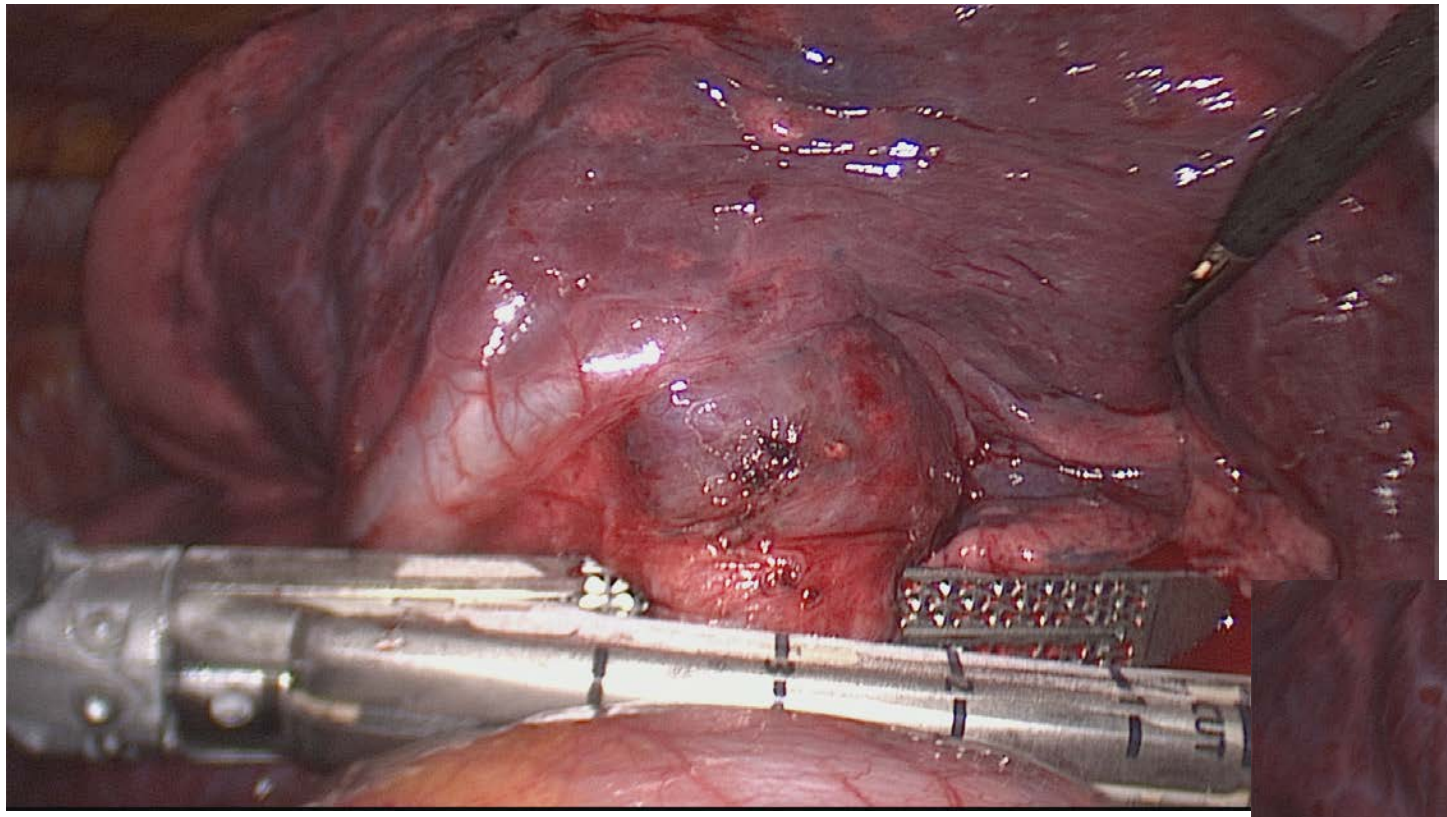




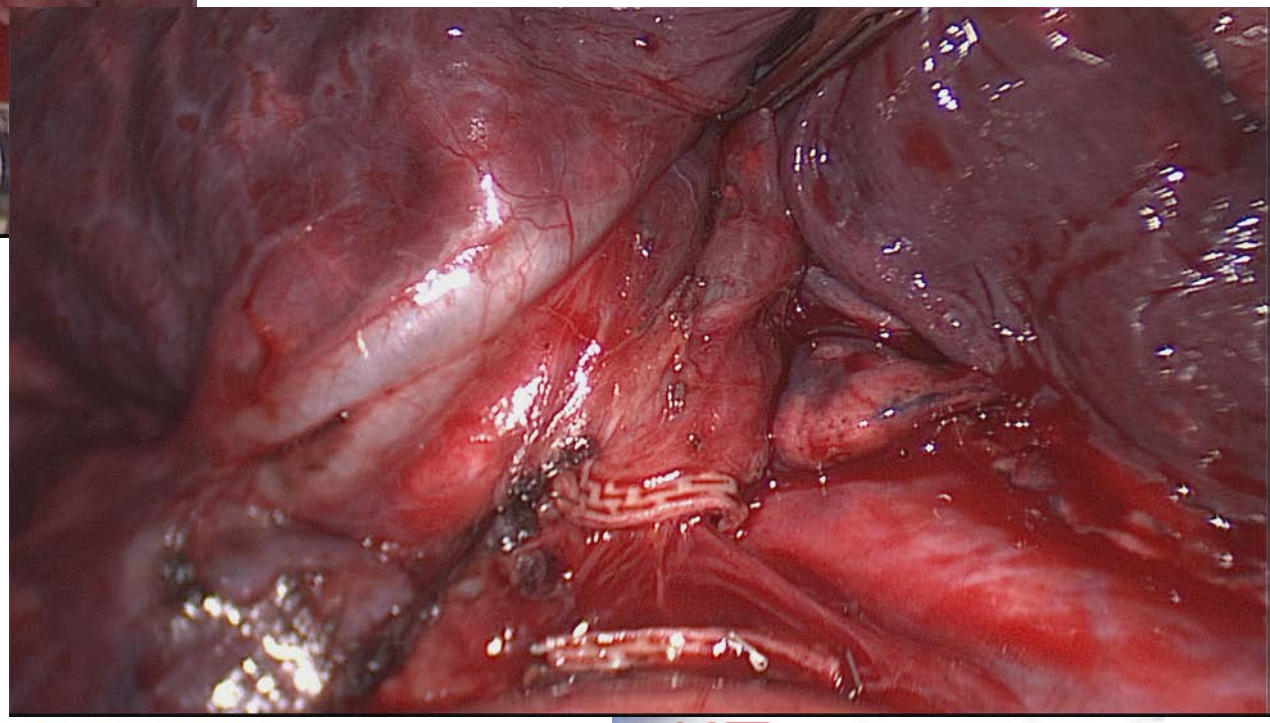


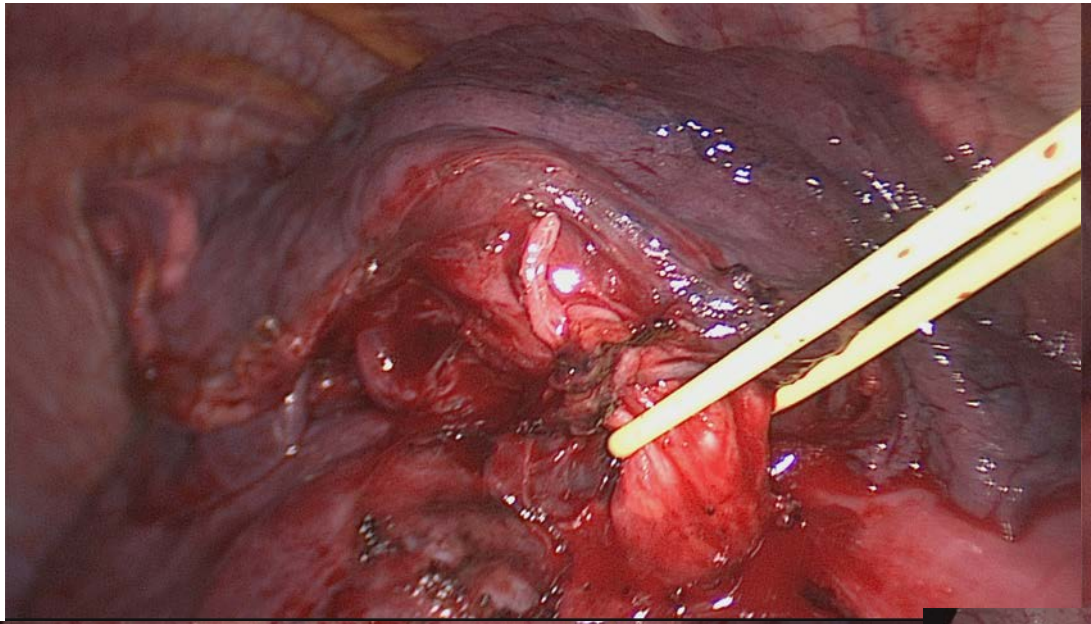


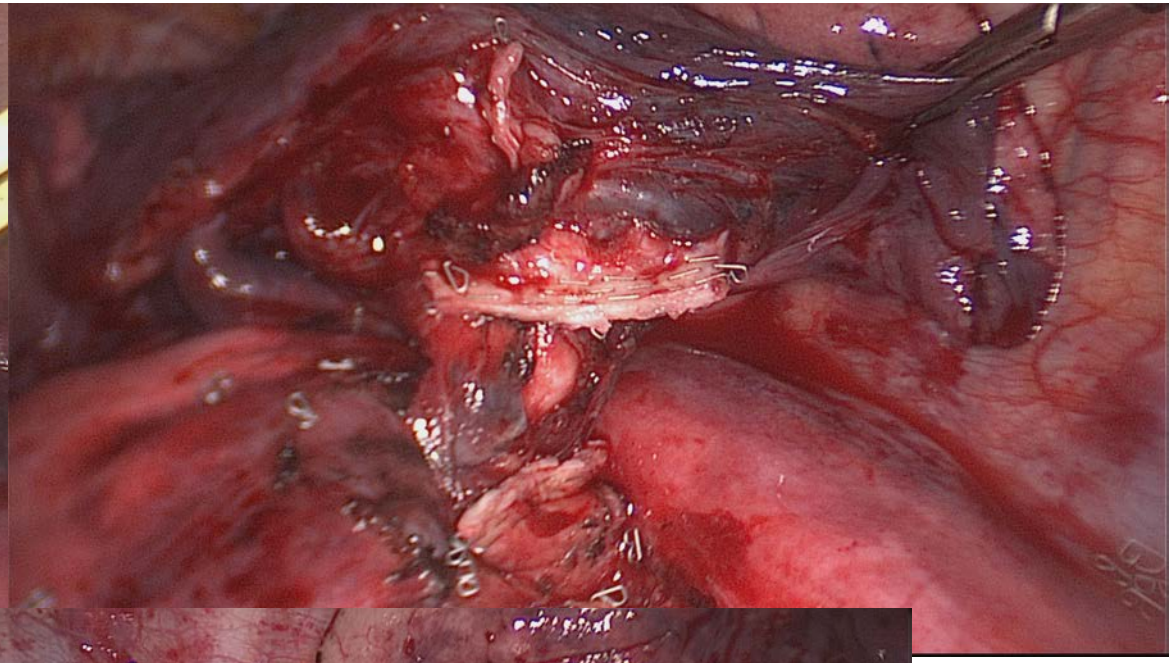
LSD



LIG







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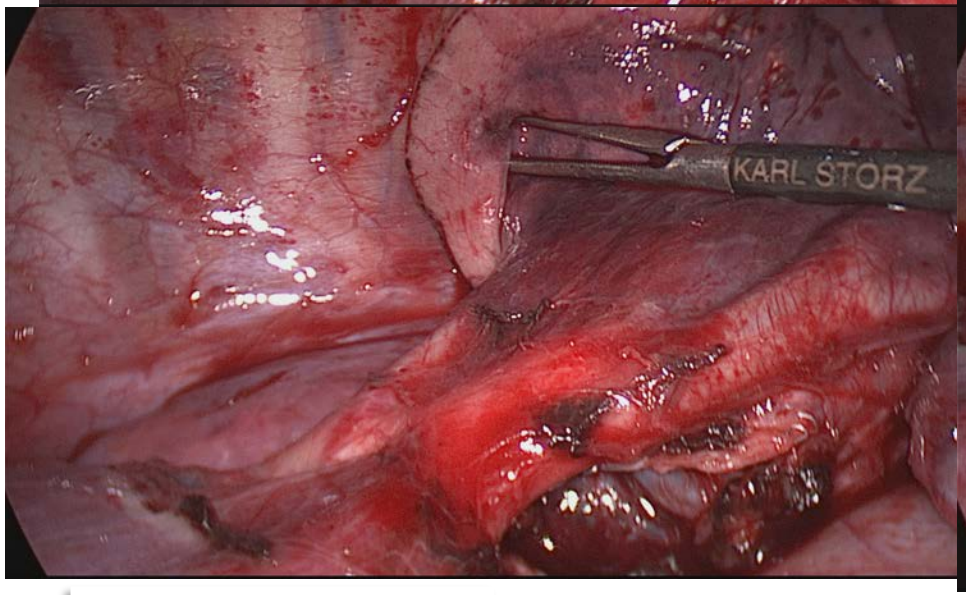
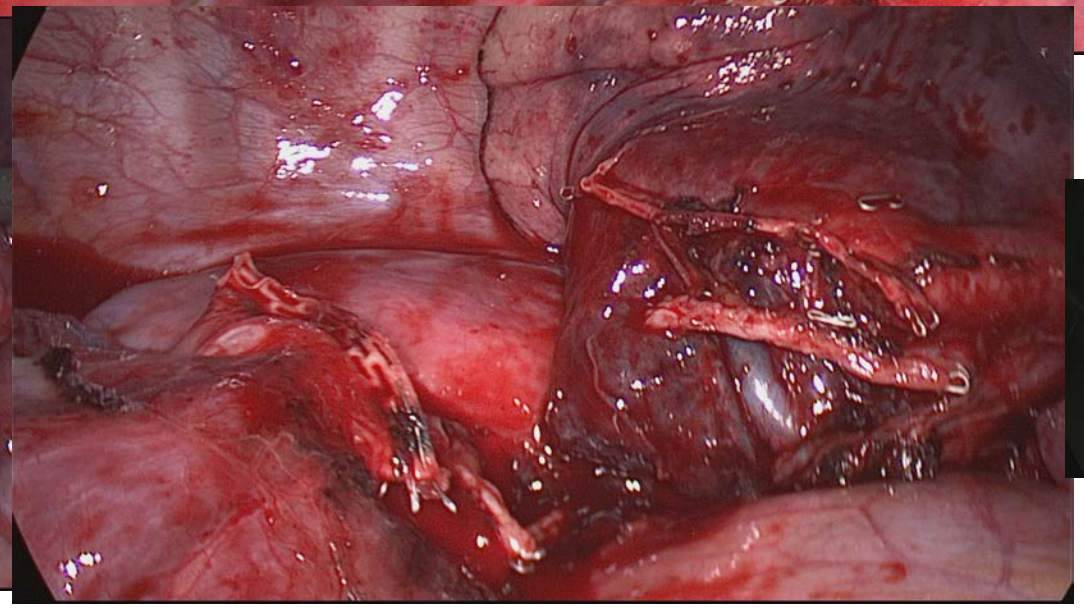
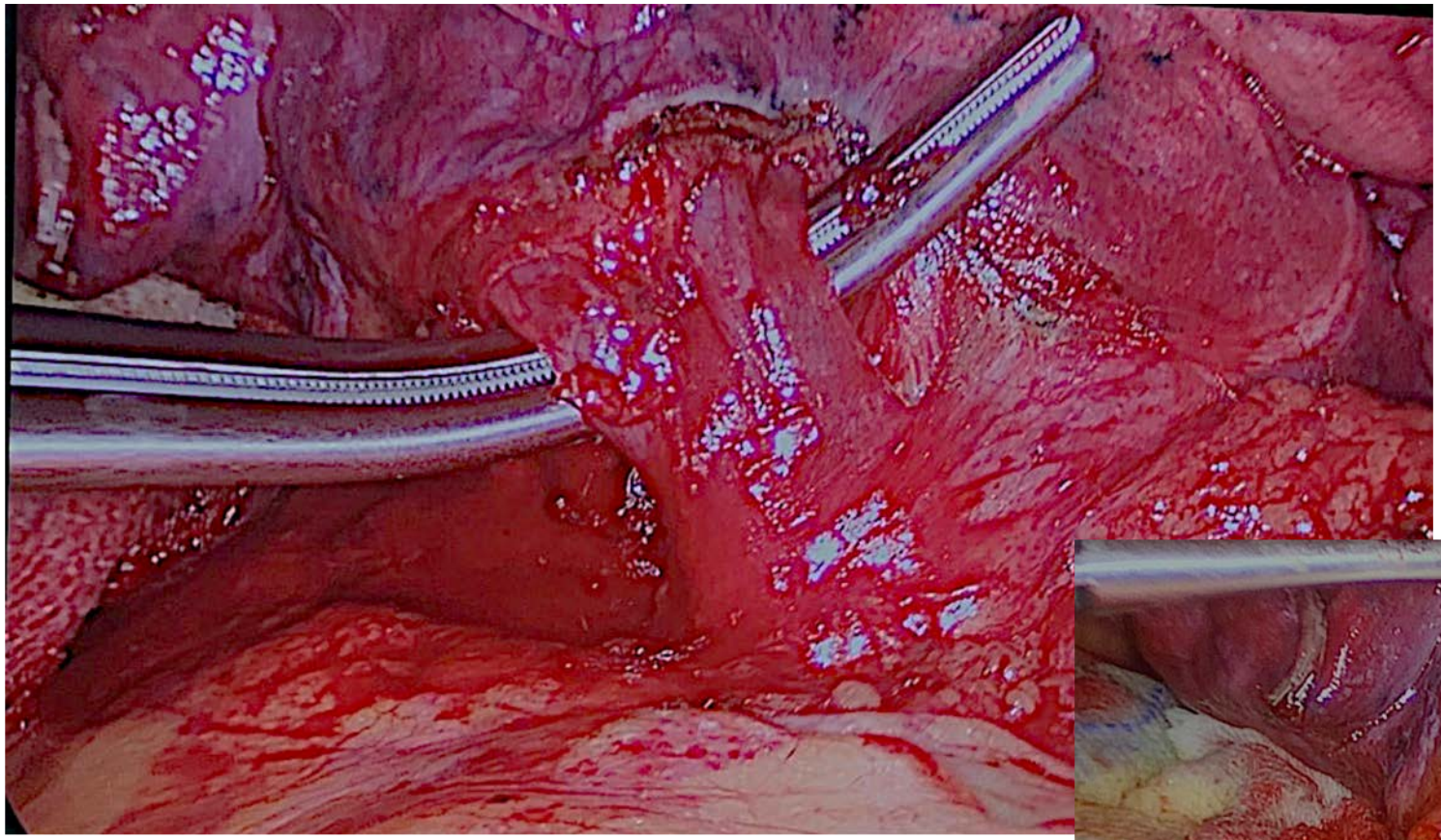
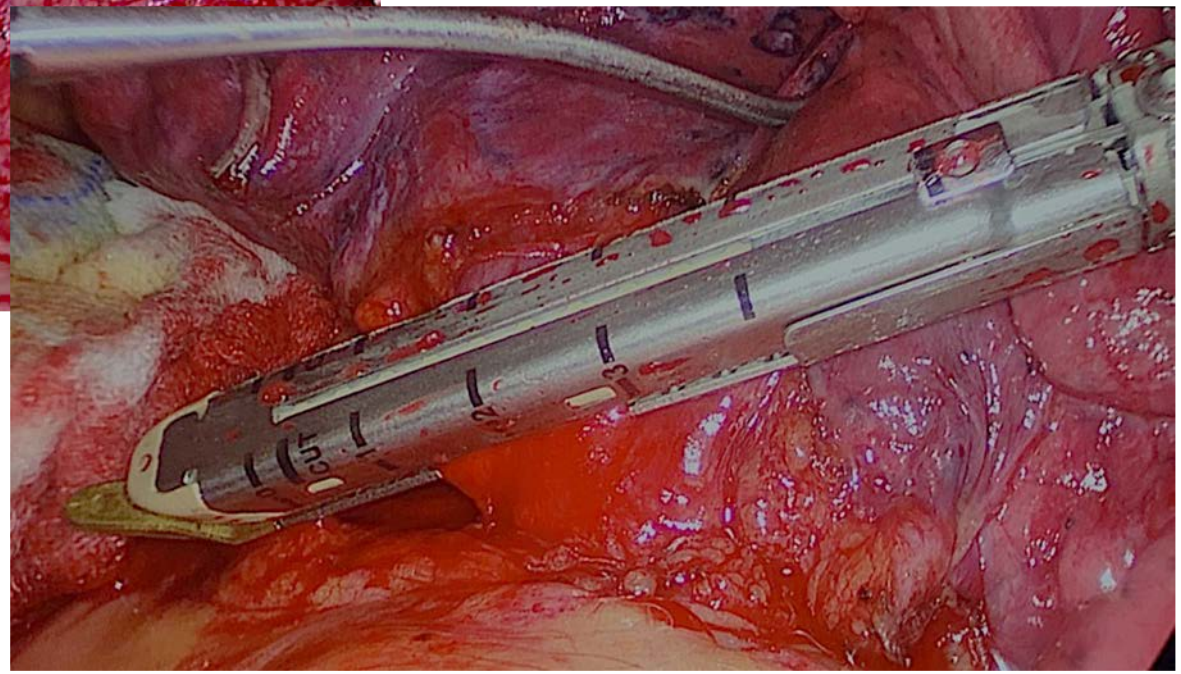
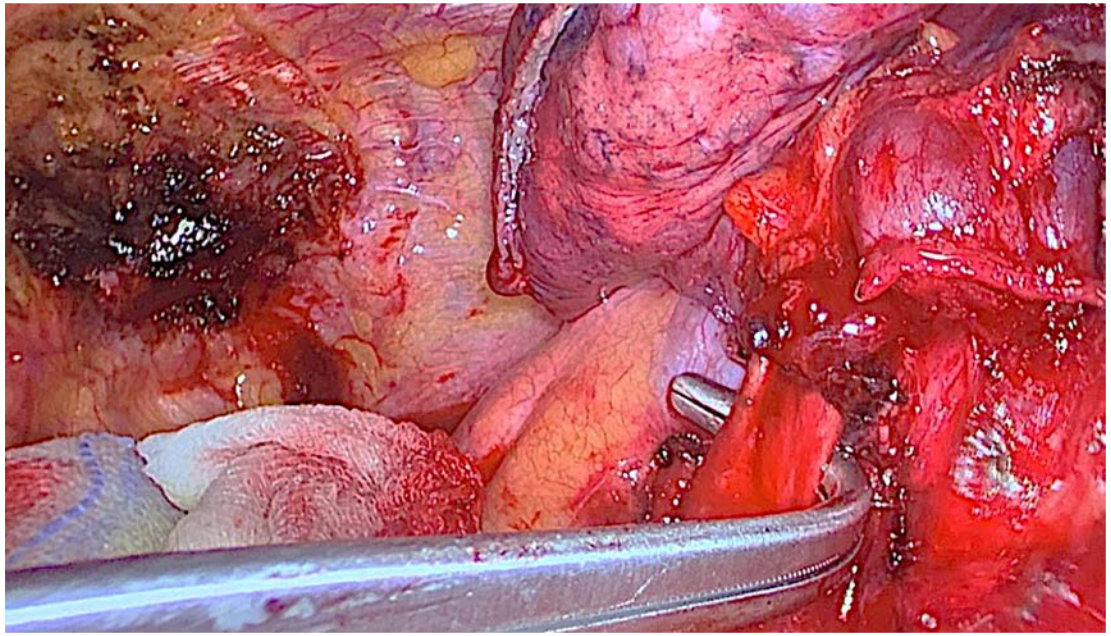


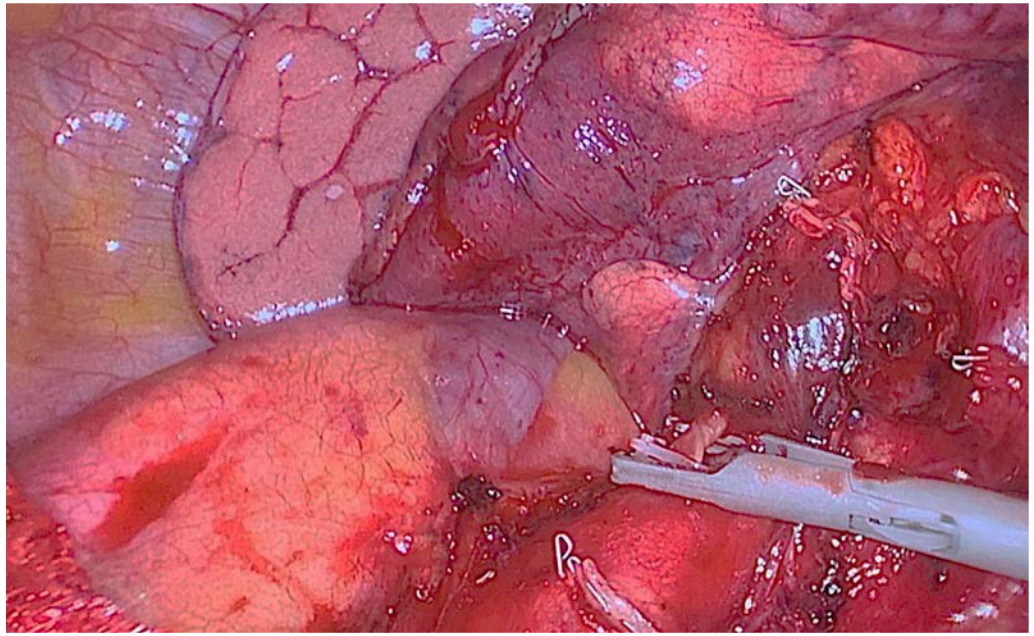


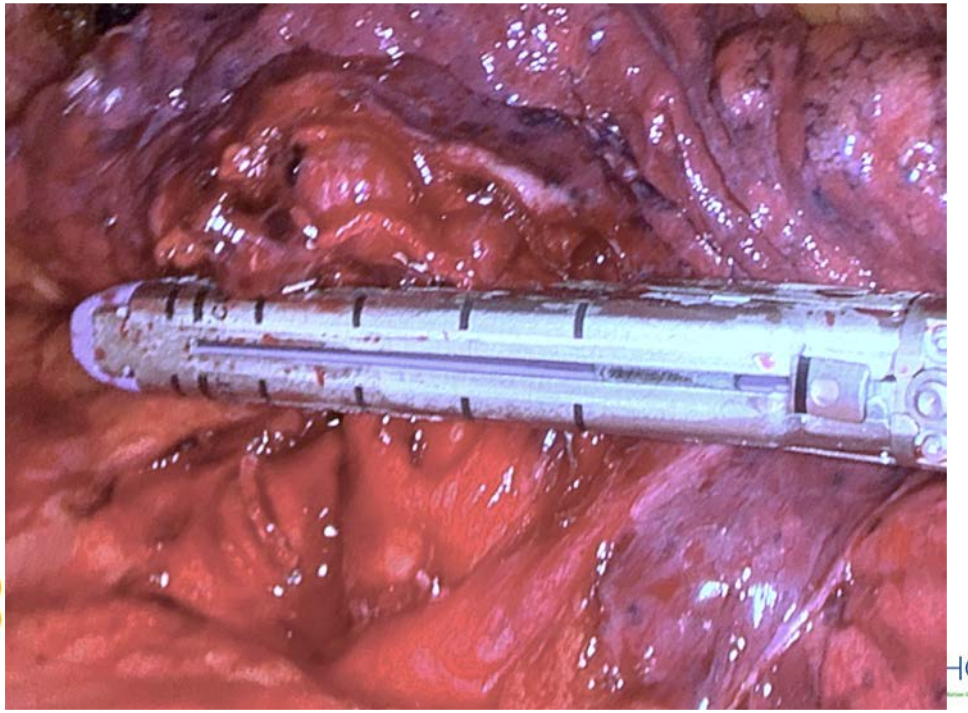


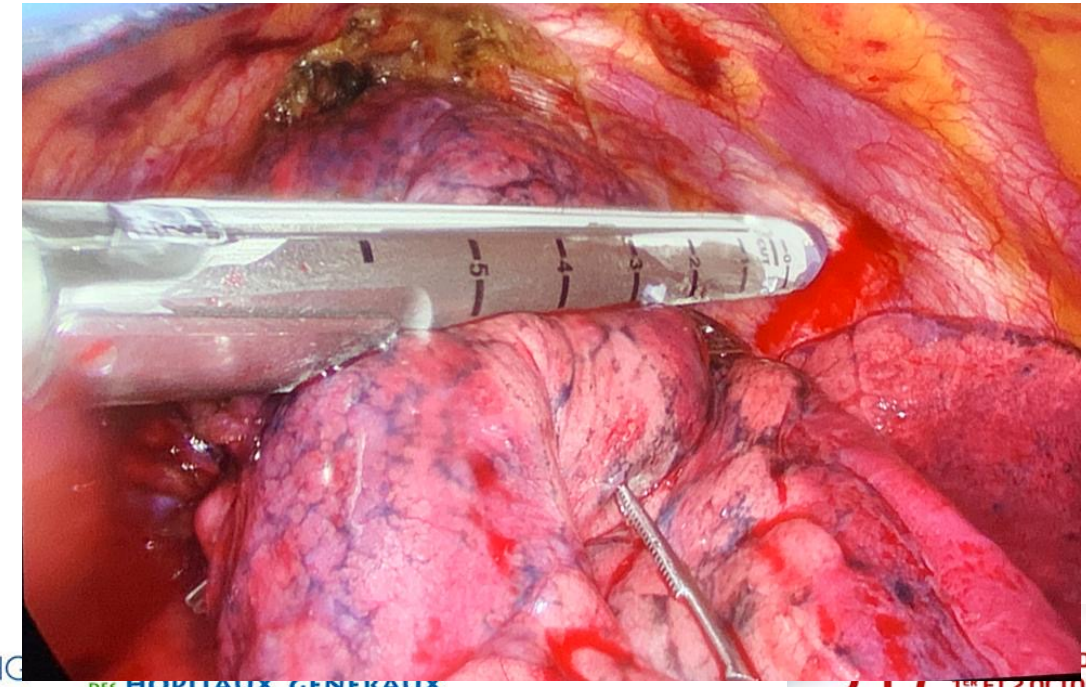


Culmen

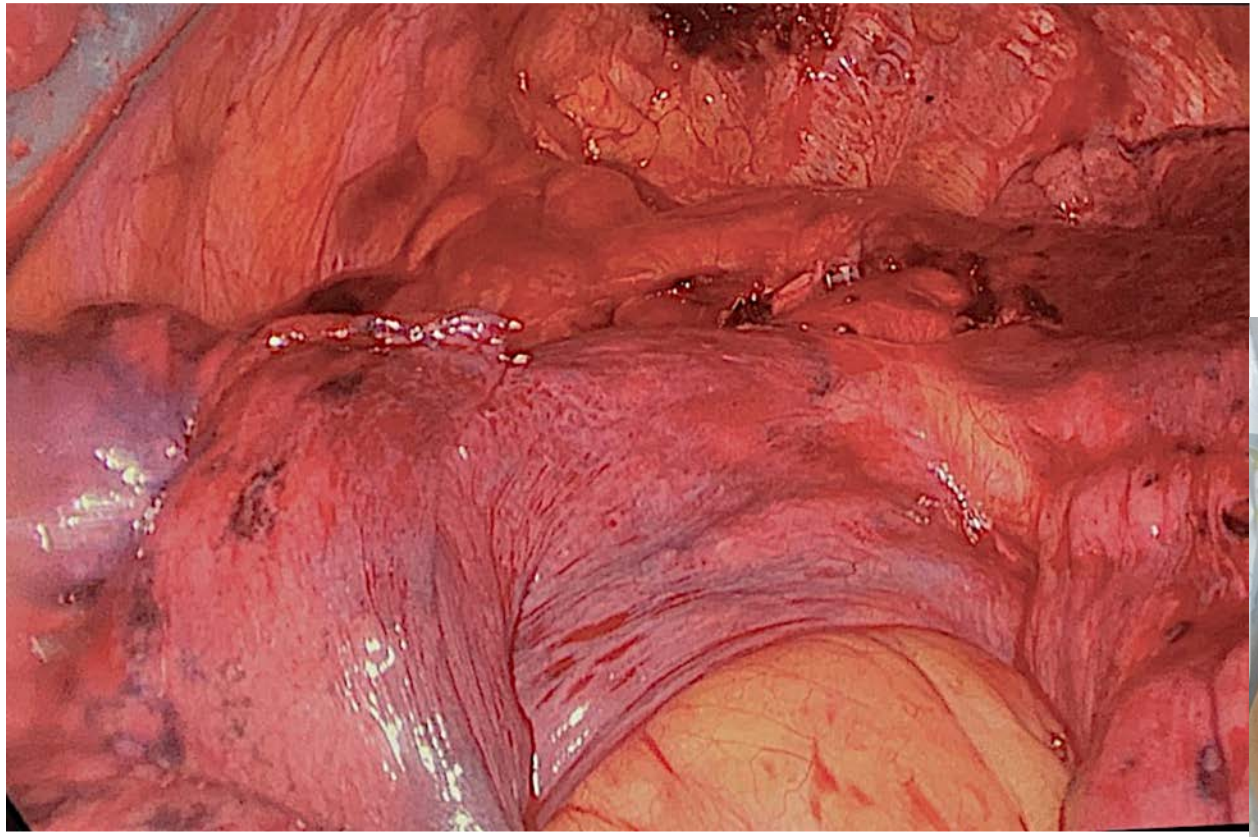






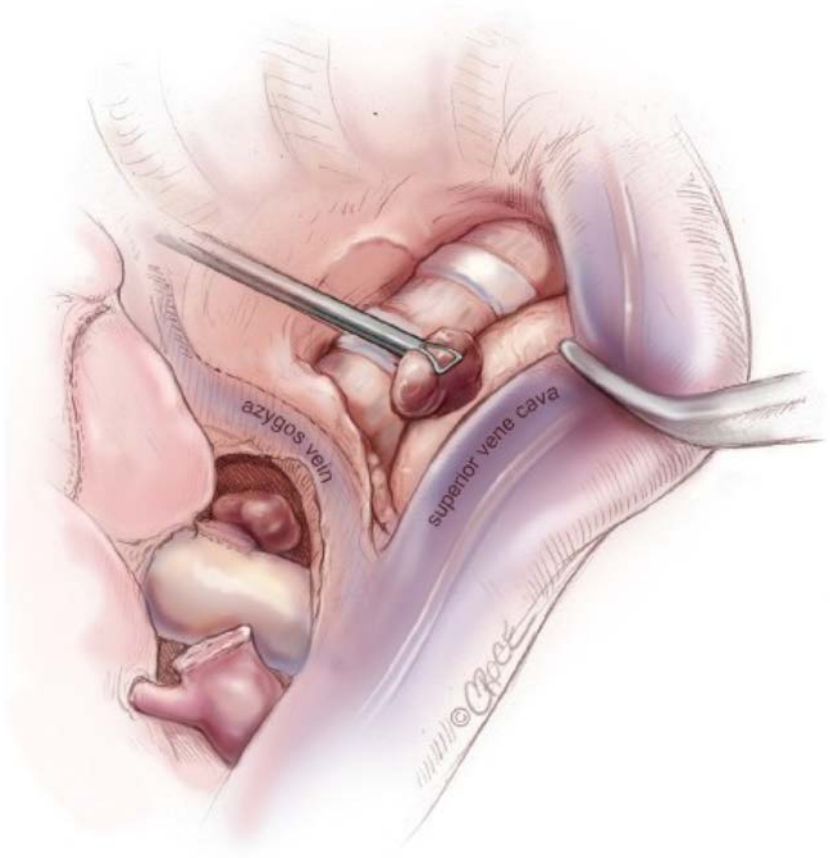


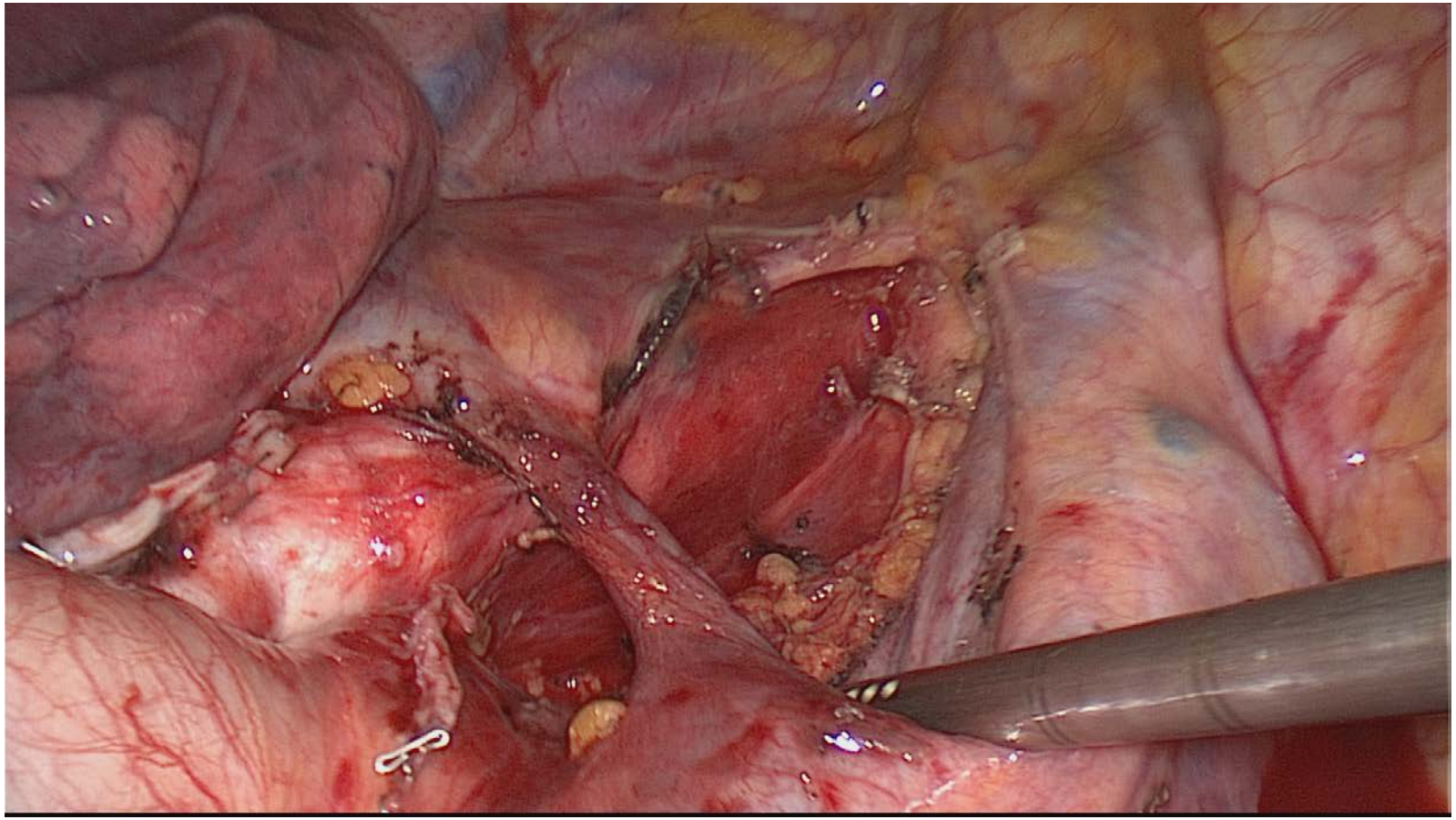
Culmen



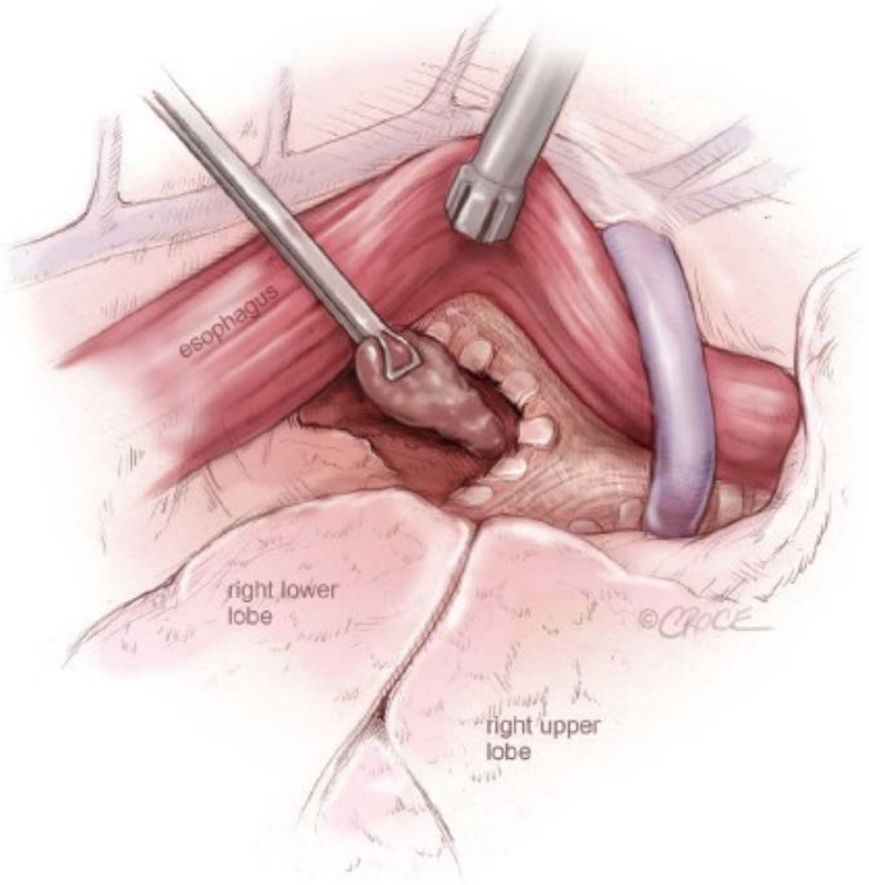
Culmen

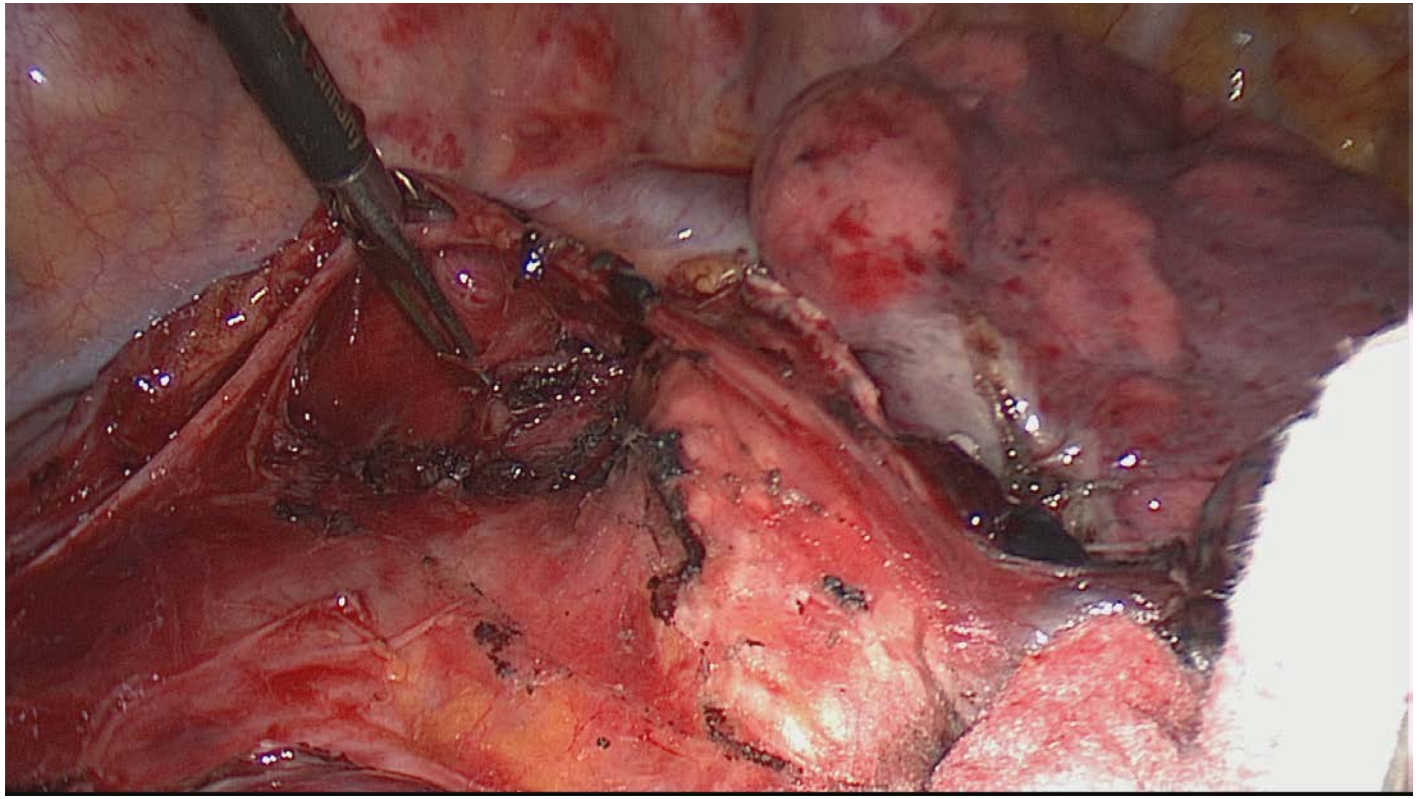
Chaine IV – III - II



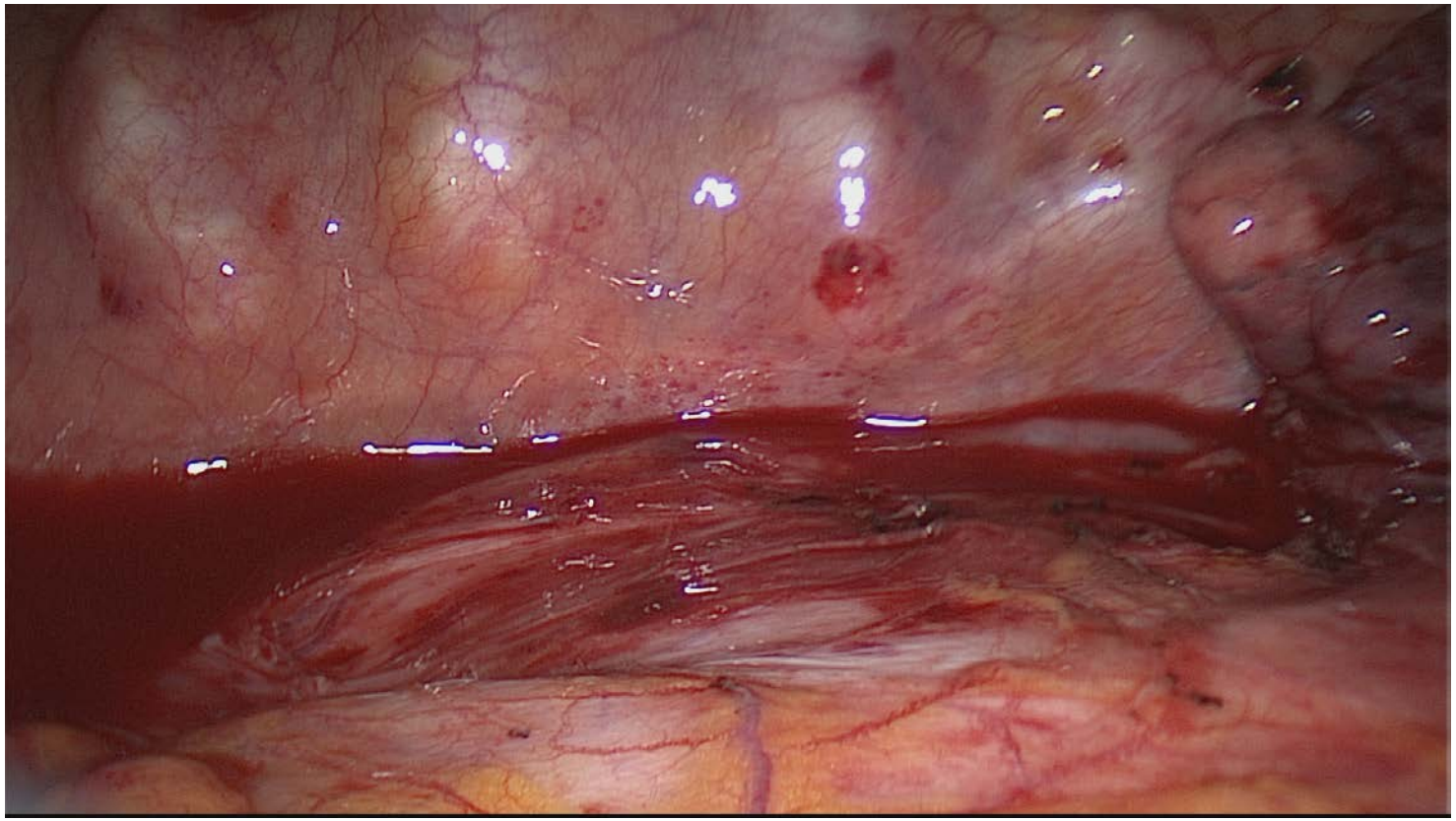


Chaine VII

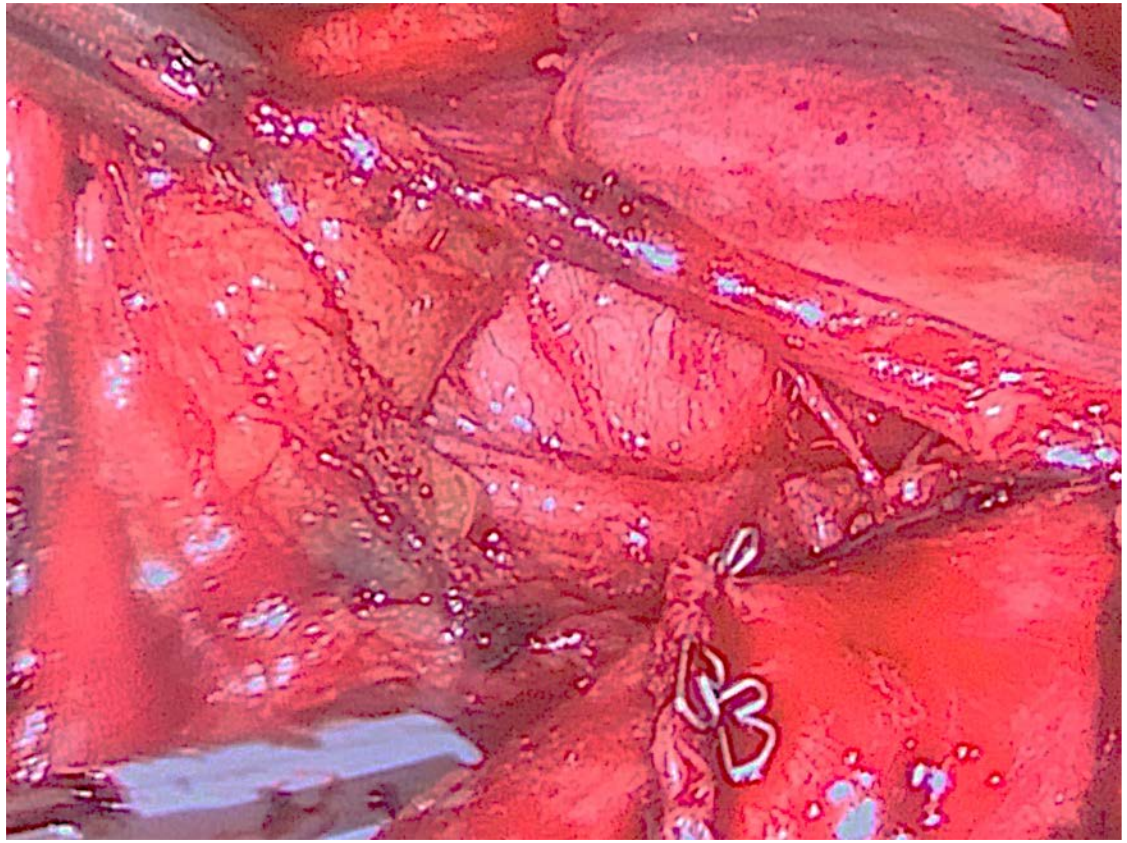


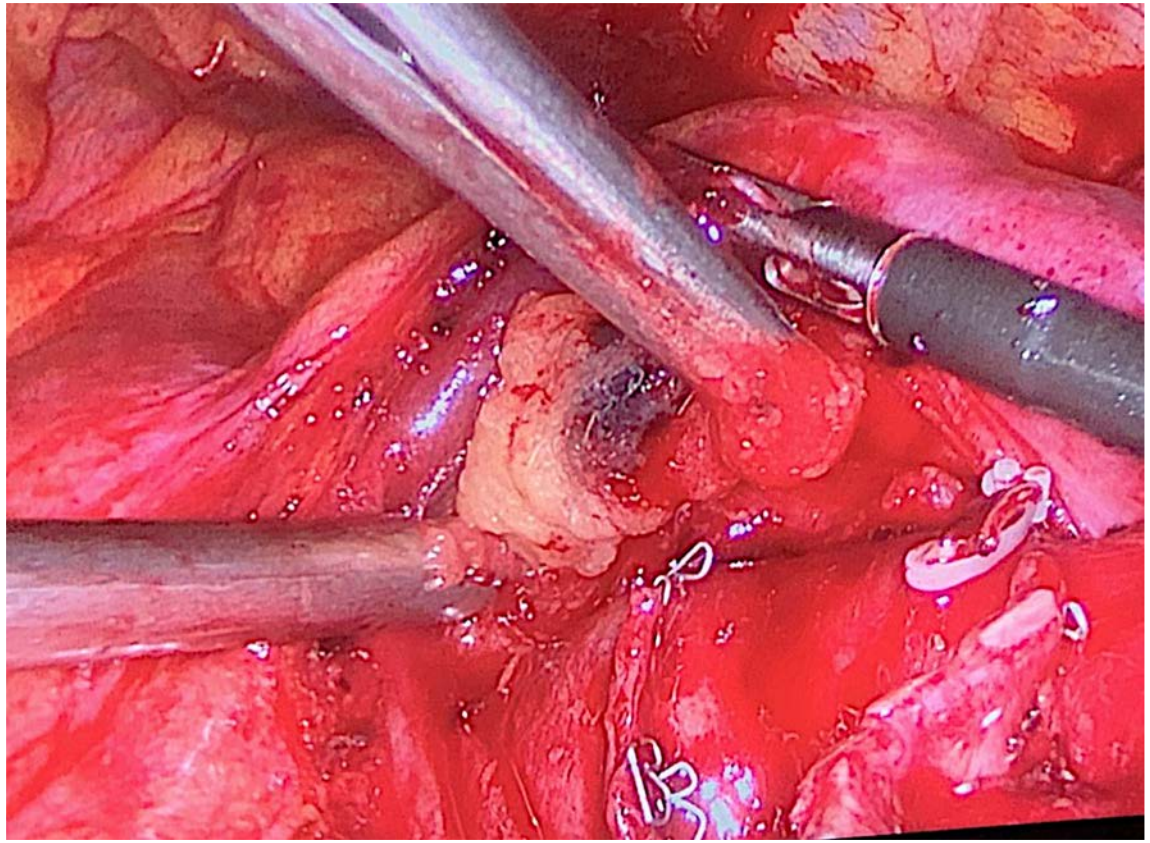


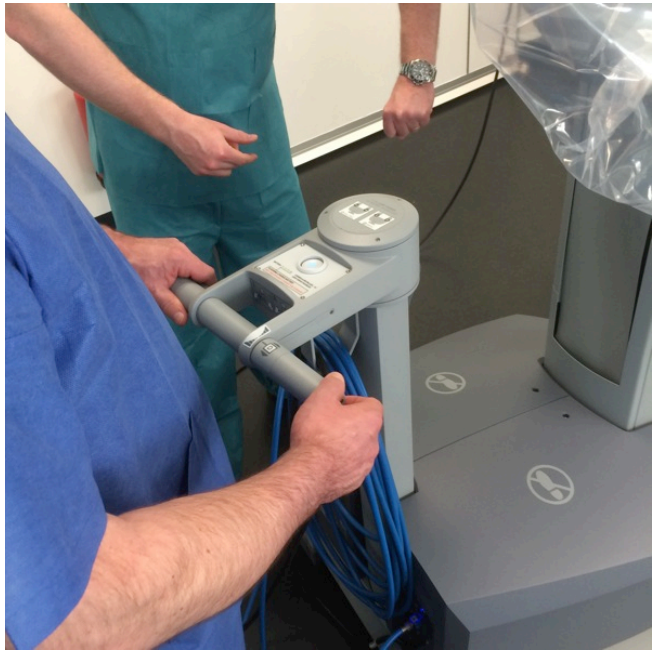
Chaine VIII-IX



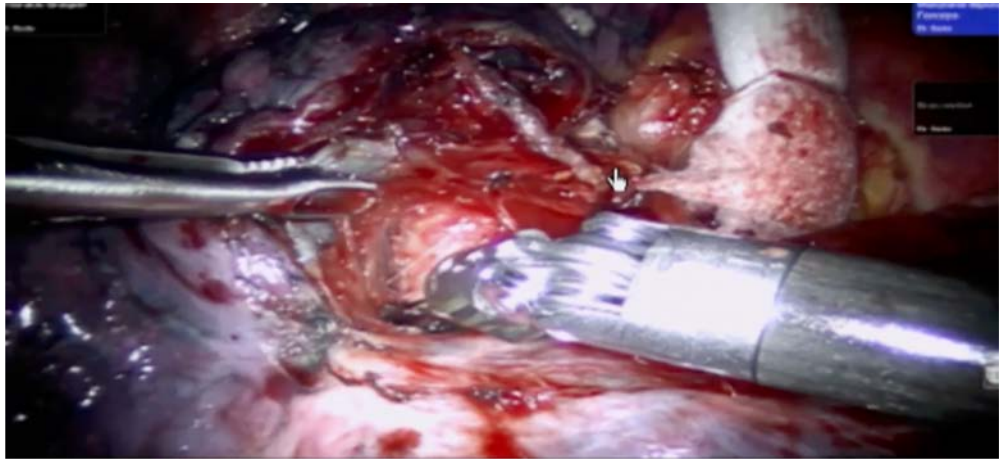
Chaine V-VI








da Vinci S



RECOMMANDATIONS DES PRATIQUES CHIRURGICALES EN 2020?

→ VOIE D'ABORD ?

Chirurgie du cancer bronchopulmonaire : recommandations de la SFCTCV

P. Thomas, pour la Société Française de Chirurgie Thoracique et Cardio-Vasculaire

Pages 359-364, **Cours du GOLF 2009** (écrites en décembre 2008)

Comment choisir la voie d'abord ?

La thoracotomie postéro-latérale avec section des muscles larges de la paroi thoracique est la voie d'abord de référence (**grade B**).

Les **abords vidéothoracoscopiques** comportant une mini-thoracotomie avec ou sans écartement intercostal sont une **alternative à la thoracotomie** conventionnelle pour l'exérèse par lobectomie ou résection infra-lobaire d'une tumeur de stade cIA (**grade C**).
L'exérèse par un abord vidéo-assisté de tumeurs de stades plus avancés n'est pas recommandée, hors essai thérapeutique. La réalisation d'une pneumonectomie par un abord vidéo- assisté n'est pas recommandée en dehors d'un essai thérapeutique.

→ VOIE D'ABORD ?

Treatment of stage I and II non-small cell lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines

Volume 143, Issue 5, Supplement, **May 2013**, Pages e278S-e313S

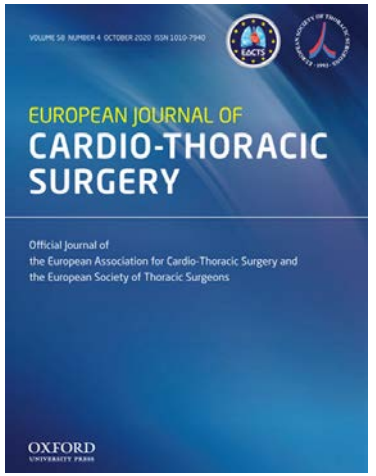
3.2.1. For patients with clinical stage I NSCLC, a minimally invasive approach such as video-assisted thoracic surgery (thoracoscopy) is preferred over a thoracotomy for anatomic pulmonary resection and is suggested in experienced centers (Grade 2C).

→ VOIE D'ABORD ?

Guidelines for enhanced recovery after lung surgery: recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS)

Timothy J P Batchelor, Neil J Rasburn, Etienne Abdelnour-Berchtold, Alessandro Brunelli, Robert J Cerfolio, Michel Gonzalez, Olle Ljungqvist, René H Petersen, Wanda M Popescu, Peter D Slinger, Babu Naidu

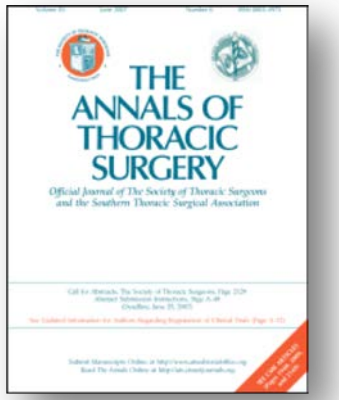
European Journal of Cardio-Thoracic Surgery, Volume 55, Issue 1, January 2019, Pages 91–115

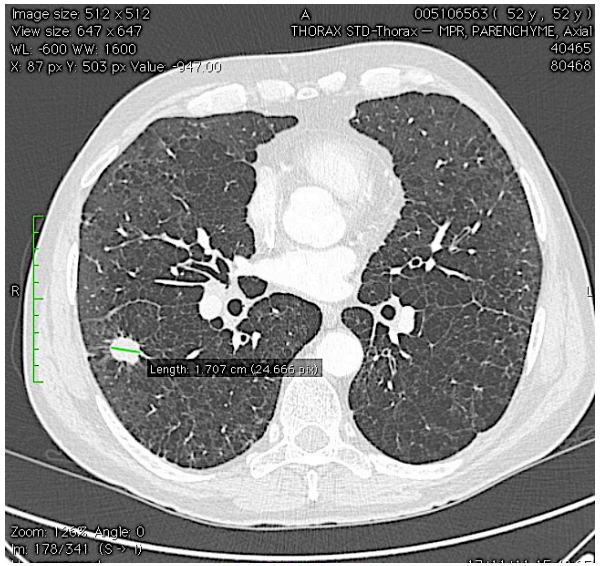


A VATS approach for pulmonary resections is recommended for early-stage lung cancer. The benefits are even more marked in patients with poor respiratory reserve. The number of ports used does not appear to affect outcomes, and so, one VATS approach cannot be recommended over another.
Data to support the routine use of robotic surgery are lacking.

Evidence level: **VATS lung resection for early-stage lung cancer: High.**
Recommendation grade: **VATS lung resection for early-stage lung cancer: Strong.**

→ TYPE de RESECTION ?





Consensus établi en 1995 :

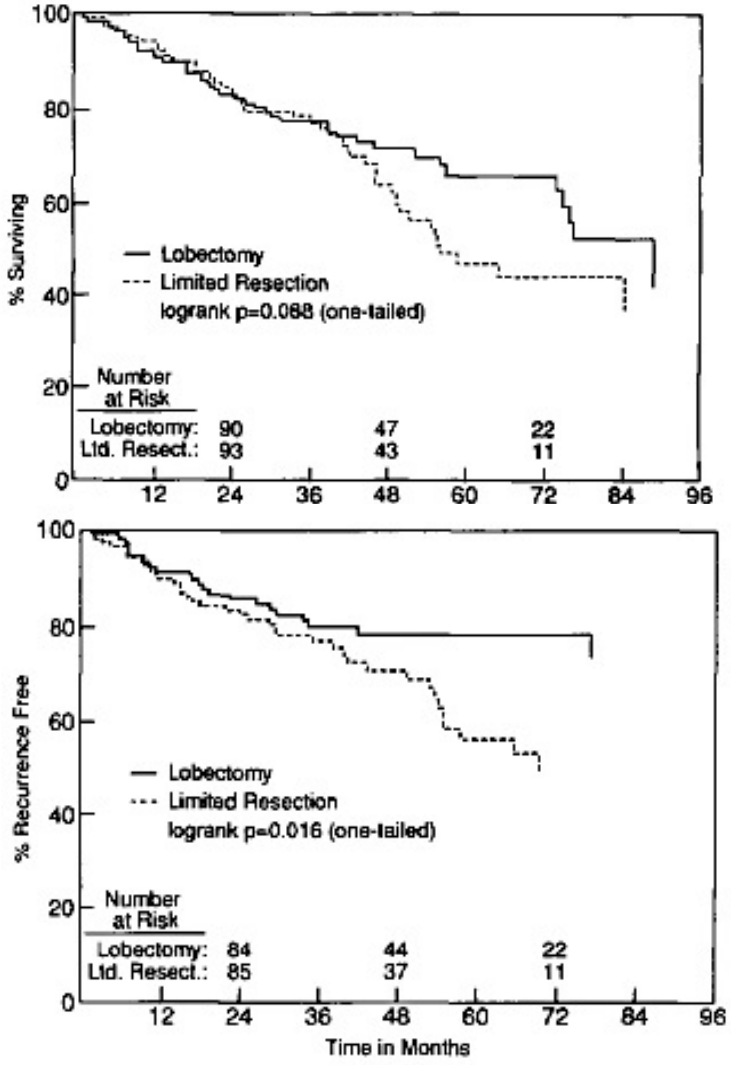
Randomized Trial of Lobectomy Versus Limited Resection for T1 N0 Non–Small Cell Lung Cancer

Lung Cancer Study Group (Prepared by Robert J. Ginsberg, MD, and Lawrence V. Rubinstein, PhD)

→ TYPE de RESECTION ?

247 pts (125 lobectomies vs 40 wedges / 82 segments)

- Morbi-mortalité identique…
- Mortalité liée au cancer accrue de 50%
- Récidive triplée : par an
  - R=0,022 lobectomie
  - R=0,044 segment
  - R=0,086 wedge
- Impact sur la fonction pulmonaire:
  - VEMS amélioré les 6 premiers mois
  - Pas de différences à 12-18 mois.



Gold Standard =

LOBECTOMIE avec CURAGE GANGLIONNAIRE

→ TYPE de RESECTION ?

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P. Thomas, pour la Société Française de Chirurgie Thoracique et Cardio-Vasculaire

Pages 359-364, **Cours du GOLF 2009** (écrites en décembre 2008)

Quelle type de résection ?

L'étendue de l'exérèse parenchymateuse dépend du volume de la tumeur, de sa topographie et de ses éventuelles extensions ganglionnaires et aux structures de voisinage. Elle est aussi conditionnée par la réserve fonctionnelle respiratoire, l'âge et les éventuelles comorbidités (grade A).

Chez les patients à risque opératoire standard**, l'exérèse parenchymateuse est au moins une lobectomie, car une résection infra-lobaire expose le patient à un risque plus élevé de récidive locale** (grade A).

→ TYPE de RESECTION ?

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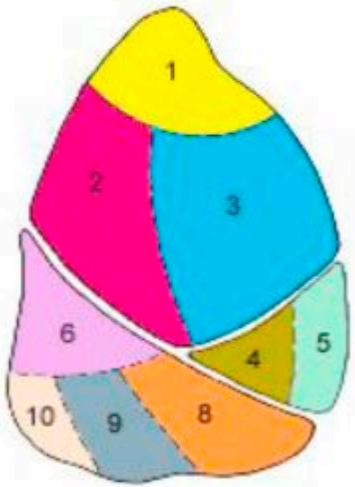
La segmentectomie anatomique est une alternative à la lobectomie pour le traitement chirurgical des **tumeurs de 2 cm et moins**, en **l'absence de métastase ganglionnaire scissurale et/ou hilaire**, et dans certaines **situations topographiques favorables** (segment apical des lobes inférieurs S6, culmen S1-2 G, lingula S4-5 G, bi-segment apicodorsal S1-2 D),

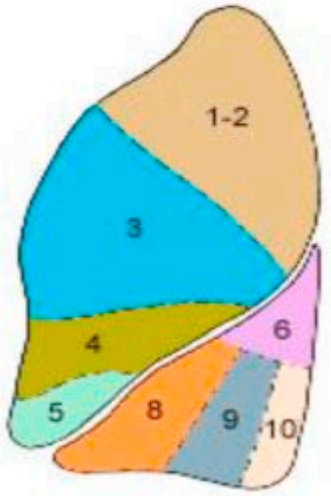
dans les situations cliniques suivantes **: risque opératoire élevé** (mortalité attendue pour une lobectomie > 5%), **tumeurs multifocales synchrones ou métachrones** (grade B).

Anatomical lung segments



- *Right lateral view* -

Upper lobe	1. Apical	1-2. Apical-posterior	Upper lobe
	2. Posterior	3. Anterior	
	3. Anterior	4. Superior	Lingula
Middle lobe	4. Lateral	5. Inferior	
	5. Medial	6. Superior	Lower lobe
Lower lobe	6. Superior	7-8. Ant. basal	
	7. Med. basal	9. Lat. basal	
	8. Lat. basal	10. Post. basal	
	9. Lat. basal		
	10. Post. basal		



- *Left lateral view* -

La segmentectomie anatomique est une alternative à la lobectomie pour le traitement chirurgical des **tumeurs de 2 cm et moins**, en **l'absence de métastase ganglionnaire scissurale et/ou hilaire**, et dans certaines **situations topographiques favorables** (segment apical des lobes inférieurs S6, culmen S1-2 G, lingula S4-5 G, bi-segment apicodorsal S1-2 D),
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Report from the European Society of Thoracic Surgeons Database 2017: patterns of care and perioperative outcomes of surgery for malignant lung neoplasm

Michele Salati [1], Alessandro Brunelli [2], Herbert Decaluwe [3], Zalan Szanto [4], Marcel Dahan [5], Gonzalo Varela [6], Pierre-Emmanuel Falcoz [7], ESTS DB Committee

Eur J Cardiothorac Surg. 2017 Dec 1;52(6):1041-1048.

Lung cancer pts (62774) type of resection

	Primary (51931) %	Secondary (10843) %	p value*
WEDGE	8.2	63.2	
SEGMENTECTOMY	5.1	10.5	
LOBECTOMY	71.8	24.2	<0.0001
BILOBECTOMY	4.6	1	
PNEUMONECTOMY	10.4	1.1	

Période 2007-2016

	Cardiopulmonary complications, yes (%, CI)	*P*-value[a]	30-day mortality, yes (%, CI)	*P*-value[a]
Type of resection				
Lobectomy (40 066 patients)	17.6 (17.3, 18)	<0.0001	2 (1.9, 2.1)	<0.0001
Pneumonectomy (5444 patients)	26.4 (25.2, 27.6)		6.7 (6, 7.3)	
Bilobectomy (2457 patients)	26.5 (24.7, 28.2)		4.4 (3.6, 5.3)	
Segmentectomy (3785 patients)	11.5 (10.5, 12.6)		1.6 (1.2, 2)	
Age				
≥75 years (7639 patients)	23.9 (22.9, 24.8)	<0.0001	4.6 (4.2, 5.1)	<0.0001
<75 years (44 113 patients)	17.6 (17.3, 18)		2.3 (2.1, 2.4)	
Cardiac comorbidity				
Yes (18 084)	21.1 (20.5, 21.7)	<0.0001	3.2 (2.9, 3.4)	<0.0001
No (33 668)	17.2 (16.8, 17.6)		2.3 (2.2, 2.5)	
$ppoFEV_1$				
$ppoFEV_1$ <70% (19 877)	24.5 (23.9, 25.1)	<0.0001	3.5 (3.2, 3.7)	<0.0001
$ppoFEV_1$ ≥70% (23 282)	15.2 (14.7, 15.6)		1.8 (1.6, 2)	
Surgical approach				
Open (43 351)	19.9 (19.4, 20.1)	<0.0001	2.9 (2.7, 3)	<0.0001
VATS (8401)	12.1 (11.4, 12.8)		1.1 (0.9, 1.4)	

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→ TYPE de RESECTION ?

CHIRURGIE FACTUELLE · VOL. 23 SEPTEMBRE 2019

LOBECTOMIE OU RÉSECTION INFRALOBAIRE POUR CANCER PULMONAIRE DE STADE LOCALISÉ ?

Pascal Alexandre Thomas [1,2*]

Remise en question du dogme de 1995 ???

Essai randomisé nord-américain en 2007 et Essai japonais en 2009 :
Hypothèse de non infériorité oncologique des résections infralobaires par rapport aux lobectomies
Tumeurs périphériques de petites tailles (< 2 cm) et sans atteinte ganglionnaire clinique (cN0).
inclusion de 697 et 1106 patients, clos respectivement en 2017 et 2014.

Les résultats oncologiques (survie sans récidive pour l'essai nord-américain, survie globale pour l'essai japonais): dispo en 2020-2022.

Les résultats intermédiaires, en termes de morbidité et de mortalité, récemment rapportés :

VOLUME 6, ISSUE 12, P915-924, DECEMBER 01, 2018

L'essai nord-américain : **357 lobectomies VS 340 résections infralobaires** (cunéiforme dans 60% des cas, segmentectomie anatomique dans 40%).
Technique mini-invasive vidéo-assistée 80% des cas, dans les 2 groupes. Les taux de mortalité à 30 jours et à 90 jours ont été respectivement de 0,9% (1,1% vs. 0,6%), et de 1,4% (1,7% vs. 1,2%). Les taux de complications sévères (grade 3 et plus de la classification de Clavien) étaient respectivement de 15% et 14%. **Aucune différence entre les deux groupes vis à vis du risque chirurgical.**

L'essai japonais : **554 Lobectomie à 552 patients résections infralobaires** (segmentectomie anatomique dans 100% des cas).
Technique mini-invasive vidéoassistée, mais incluant parfois une mini-thoracotomie, dans 89% des cas, dans les deux groupes. La mortalité à 30 jours a été nulle dans les deux groupes. Les taux de complications sévères (grade 3 et plus de la classification de Clavien) étaient très inférieurs à 1%. **Aucune différence entre les deux groupes vis à vis du risque chirurgical, à l'exception de fuites aériennes prolongées plus fréquentes après segmentectomie (6,5% vs. 3,8%, p=0,04)**

VOLUME 158, ISSUE 3 P895-907, SEPTEMBER 01, 2019

→ TYPE de RESECTION ?

Treatment of stage I and II non-small cell lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines

Volume 143, Issue 5, Supplement, **May 2013**, Pages e278S-e313S

4.3.1. For patients with clinical stage I and II NSCLC who are medically fit for surgical resection, a lobectomy rather than sublobar resection is recommended (Grade1B)

4.8.1. For patients with clinical stage I NSCLC who may tolerate operative intervention but not a lobar resection due to decreased pulmonary function or comorbid disease, sublobar resection is recommended over nonsurgical therapy (Grade 1B). **Sublobar resection should involve an anatomic segmentectomy whenever possible**

4.8.2. During sublobar resection of solid tumors in compromised patients, it is recommended that margins greater than the maximal tumor diameter for lesions less than 2 cm should be achieved; for tumors larger than 2 cm at least 2 cm gross margins should be sought to minimize the likelihood of a positive margin and/or local recurrence(Grade 1C).

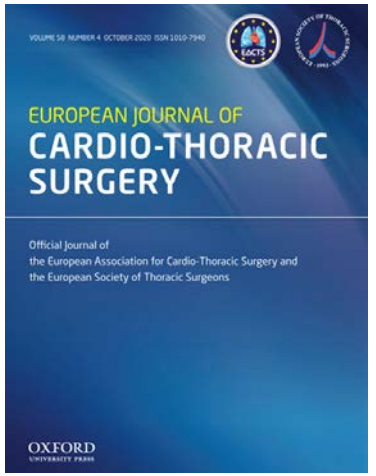
4.12.1. For patients with a clinical stage I predominantly ground glass opacity (GGO) lesion ≤ 2 cm, a sublobar resection with negative margins is suggested over lobectomy (Grade 2C).

→ TYPE de RESECTION ?

Recommendations from the European Society of Thoracic Surgeons (ESTS) regarding computed tomography screening for lung cancer in Europe

Jesper Holst Pedersen, Witold Rzyman, Giulia Veronesi, Thomas A D'Amico, Paul Van Schil, Laureano Molins, Gilbert Massard, Gaetano Rocco

European Journal of Cardio-Thoracic Surgery, Volume 51, Issue 3, March 2017, Pages



Treatment of invasive carcinoma even in stage I-II should be VATS lobectomy with systematic lymph node dissection. Recent research from Japan has shown that some GGO lesions with low-consolidation/tumour ratios may be treated by sublobar resections. However, **final recommendations with regards to this must await results of the Japan Clinical Oncology Group.**

In case of suspicious lung lesions less than 2 cm with no preoperative diagnosis, resectable in the volume of an anatomical segmentectomy, it can be acceptable to perform a diagnostic and therapeutic minimally invasive segmental resection using both VATS or Robotics, while diagnostic lobectomy should be avoided or limited to extremely rare cases.

The resection of an adenocarcinoma in situ, minimally invasive adenocarcinoma and a lepidic-predominant adenocarcinoma have almost 100% 5-year survival rate : These figures can influence the surgical treatment of such patients in the near future as candidates for sublobar resection.

→ Contre - Indications ?

Contraindications of video-assisted thoracoscopic surgical lobectomy and determinants of conversion to open

Jennifer M. Hanna, Mark F. Berry, and Thomas A. D'Amico

J Thorac Dis. 2013 Aug; 5(Suppl 3): S182–S189.

CI Absolues

Impossibilité de réaliser une ventilation unipulmonaire, symphyse bloquant l'espace pleural
Impossibilité de réaliser une résection R0
Tumeur T4
Atteinte N3
Pas de définition de critères de taille de la tumeur mais les énormes tumeurs qui réclament un élargissement massif de la paroi tend à diminuer l'avantage d'une chirurgie mini-invasive.

→ Contre - Indications ?

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J Thorac Dis. 2013 Aug; 5(Suppl 3): S182–S189.

CI Relatives :

Traitement d'induction
Atteinte ganglionnaire N1 – N2 (pas formelle si curage semble identique…)
ATCD de Xie thoracique
Dissection vasculaire difficile, Sleeve résection, atteinte < 2 cm Bronche souche
Pneumonectomie

Dépend de l'expérience du chirurgien !!!

Outcomes of minimally invasive sleeve resection

Raul Caso1, Thomas J. Watson1,2, Puja G. Khaitan2, M. Blair Marshall1

J Thorac Dis 2018;10(12):6653-6659

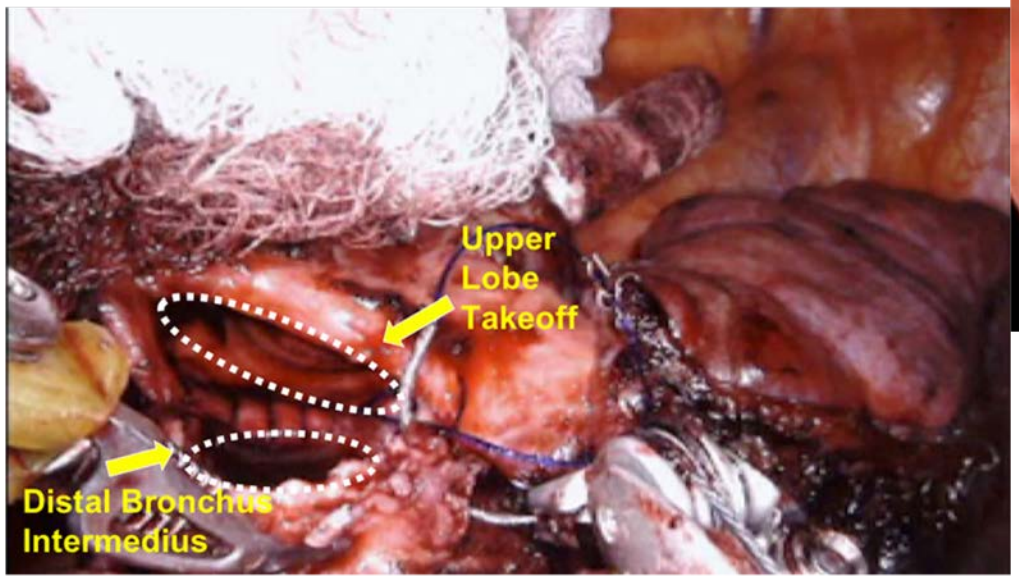
Table 1 Patient characteristics

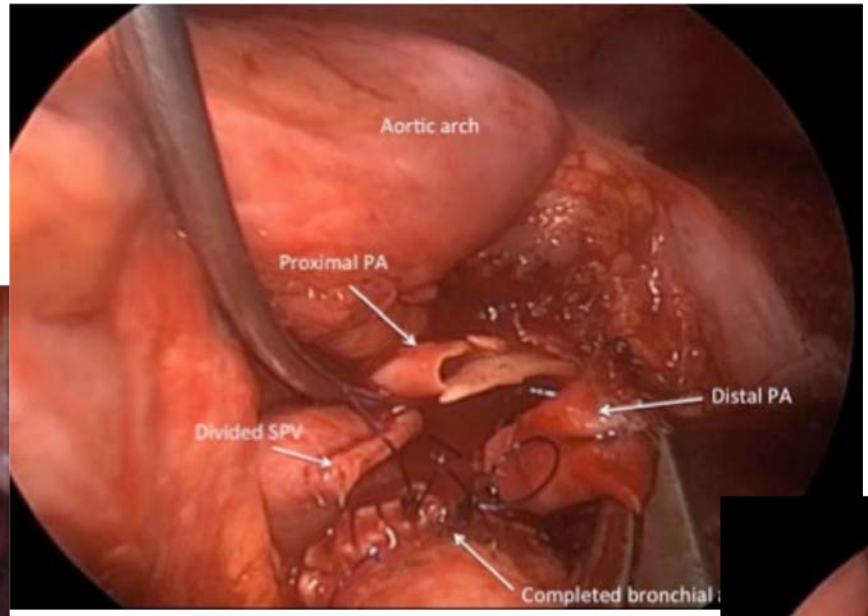
Case	Age	Sex	Neoadjuvant therapy	Approach	Procedure	LN stations sampled	Histology
1	57	Female	Yes	VATS	LUL, PA plasty	5,6,7,8,10L,11L	Adenocarcinoma
2	76	Female	No	VATS	LUL, PA plasty	5,6,10L,11L	Adenocarcinoma
3	68	Female	No	VATS	RUL	4R,7,10R,11R	Adenocarcinoma
4	53	Male	Yes	VATS	LUL, PA plasty[a]	4L,5,7,11L,12	Adenocarcinoma
5	82	Female	No	VATS	RUL	2R,4R,7,10R,11R	Adenocarcinoma
6	14	Male	No	VATS	RML	10R,11R	Atypical carcinoid
7	13	Female	No	VATS	RUL	4R,7,10R,11R	Carcinoid
8	32	Male	No	VATS	LLL SS	5,7,11L	Carcinoid
9	57	Female	No	VATS	RML	8,10R,11R	Carcinoid
10	10	Male	No	VATS	LUL	5,6,7,11L	Carcinoid
11	82	Male	Yes	VATS	RUL, PA plasty	4R,7	Colon cancer
12	67	Female	Yes	VATS	RUL	4R,7,10R	SCC
13	7	Female	No	VATS	RUL, carina	4R,7,11R,10R	IMT
14	17	Female	No	Robotic	Carinal, LMS, ECMO	4L,7,10L	Granular cell
15	69	Female	No	Robotic	BI	4R, 7, 11R, 12	Adenoma

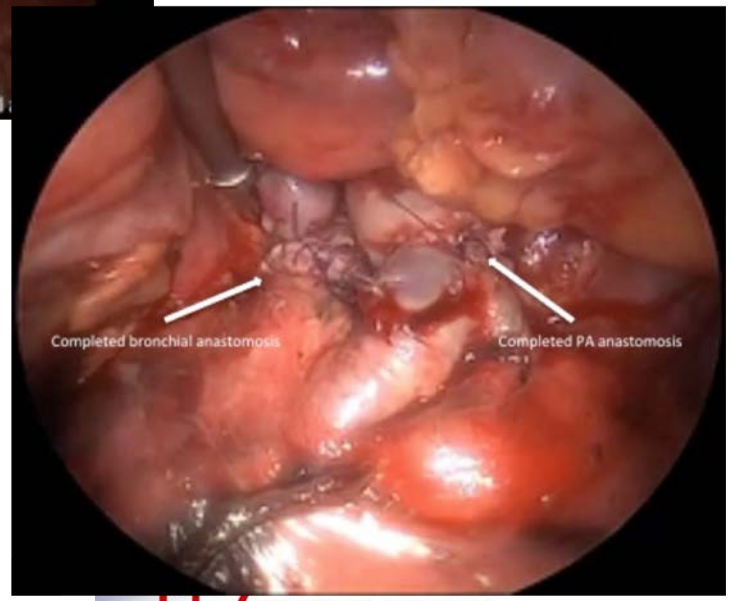
Outcomes of minimally invasive sleeve resection

Raul Caso1, Thomas J. Watson1,2, Puja G. Khaitan2, M. Blair Marshall1

J Thorac Dis 2018;10(12):6653-6659







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CPHG COLLÈGE DES PNEUMOLOGUES DES HÔPITAUX GÉNÉRAUX

J17 LES SABLES-D'OLONNE
1ER ET 2 OCTOBRE 2020

Outcomes of minimally invasive sleeve resection

Raul Caso1, Thomas J. Watson1,2, Puja G. Khaitan2, M. Blair Marshall1

J Thorac Dis 2018;10(12):6653-6659

Table 2 Postoperative patient characteristics

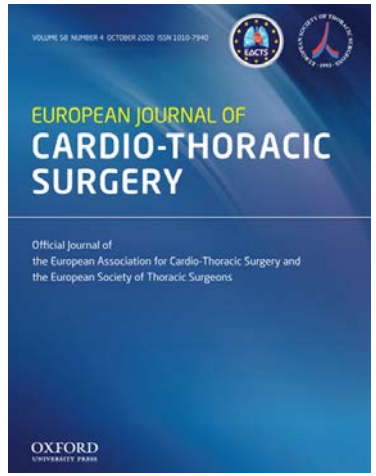
Case	Stage	LOS	Complication	Complication grade (Clavien-Dindo)	Follow-up duration (months)	Status at last follow-up
1	T3N0	10	Air leak	II	96	DOD
2	T2N0	6	–	–	86	NED
3	T3N2	5	–	–	65	DOD
4	T1bN2	4	–	–	50	AWD
5	T2aN0	4	Atrial fibrillation	II	12	NED
6	T1bN2	4	–	–	68	NED
7	T1bN0	5	Brachial plexopathy	I	98	NED
8	T1bN0	4	–	–	24	NED
9	T1bN0	3	–	–	19	NED
10	T2aN0	3	–	–	7	NED
11	M1	10	Atrial fibrillation	II	30	NED
12	T3N0	5	Pericardial effusion, drain	IIIa	67	NED
13	–	10	Air leak, return to OR	IIIb	76	NED
14	–	5	–	–	2	NED
15	T3N0	6	–	–	7	NED

LOS, length of stay; DOD, died of disease; NED, no evidence of disease; AWD, alive with disease.

Video-assisted thoracoscopic surgery lobectomy at 20 years: a consensus statement

Tristan D. Yan, Christopher Cao, Thomas A. D'Amico, Todd L. Demmy, Jianxing He, Henrik Hansen, Scott J. Swanson, William S. Walker, on behalf of the **International VATS Lobectomy Consensus** Group, Gianluca Casali, Joel Dunning, Michael Shackcloth, Rajesh Shah, Sasha Stamenkovic, Tom Routledge, William Walker, Edwin Woo, Steve Woolley, **Jean-Marc Baste**, **Dominique Gossot**, Giancarlo Roviaro, Luciano Solaini, Jesus Loscertales, Diego Gonzalez-Rivas, Herbert Decaluwe, Georges Decker, Frederic De Ryck, Youri Sokolow, Jan Wolter Oosterhuis, Jan Siebenga, Thomas Schmid, Johannes Bodner, Henrik Dienemann, Gunda Leschber, Didier Schneiter, Henrik Hansen, Peter Licht, René Horsleben Petersen, Cezary Piwkowski, Tommy D'Amico, Todd Demmy, Claude Deschamps, John Howington, Mike Liptay, Robert McKenna, John Mitchell, Bryan Meyers, Bernard Park, Scott Swanson, Hyun-Sung Lee, JianXing He, Yun Li, Zhidong Liu, Nan Wu, Anthony Yim, Weicheng Yu, Tadasu Kohno, Gavin Wright, Tristan D. Yan

European Journal of Cardio-Thoracic Surgery, Volume 45, Issue 4, April 2014, Pages 633–639



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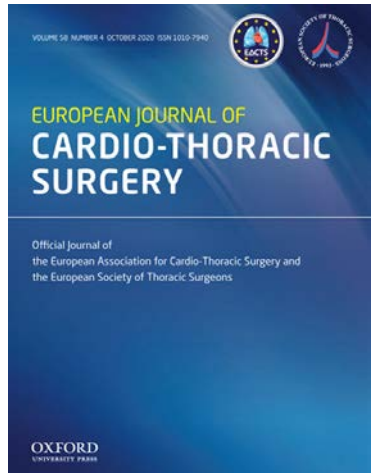
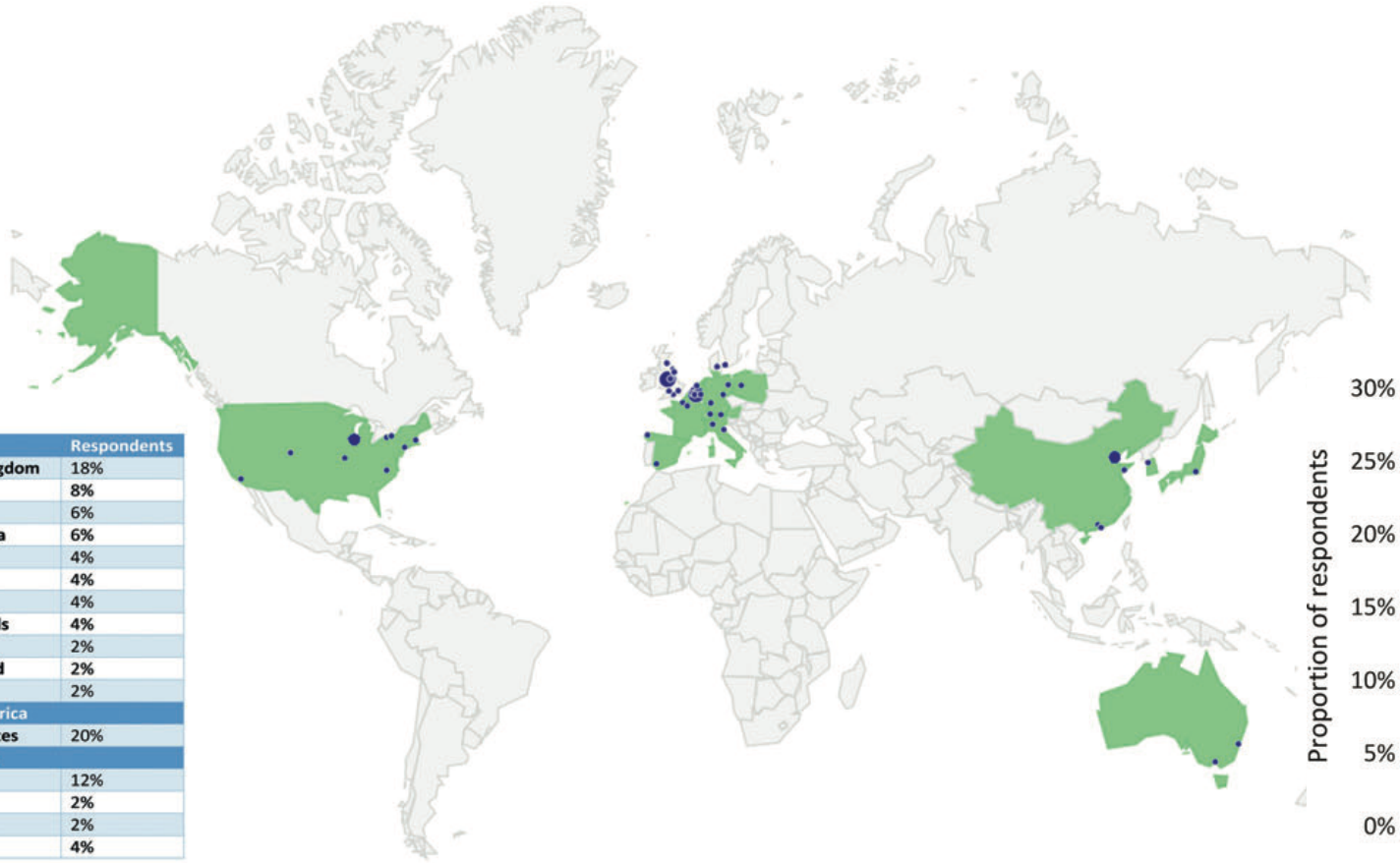
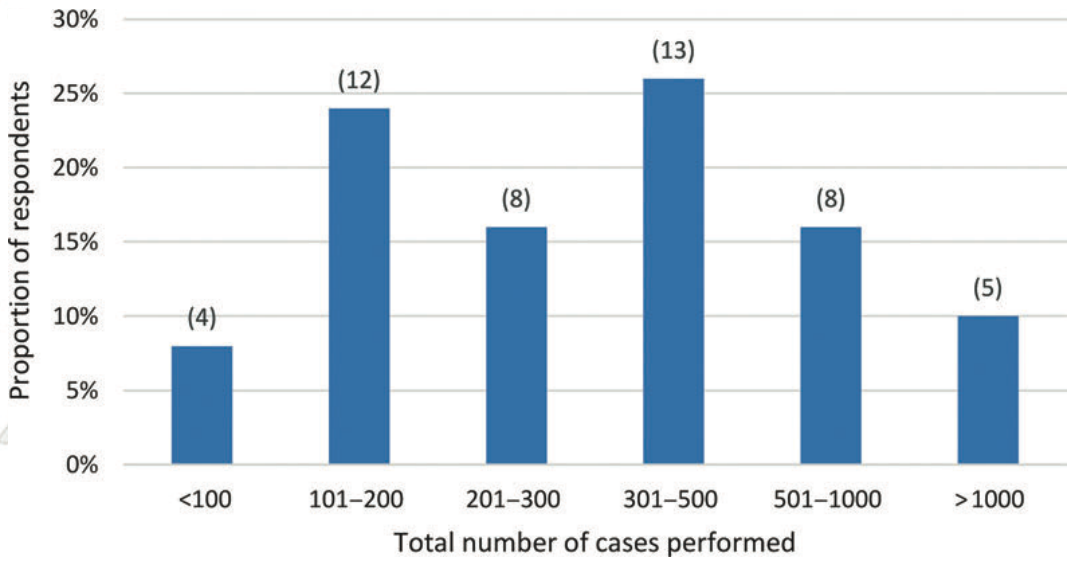




Europe	Respondents
United Kingdom	18%
Belgium	8%
Germany	6%
Scandinavia	6%
France	4%
Italy	4%
Spain	4%
Netherlands	4%
Austria	2%
Switzerland	2%
Poland	2%
North America	
United States	20%
Australasia	
China	12%
Japan	2%
Korea	2%
Australia	4%



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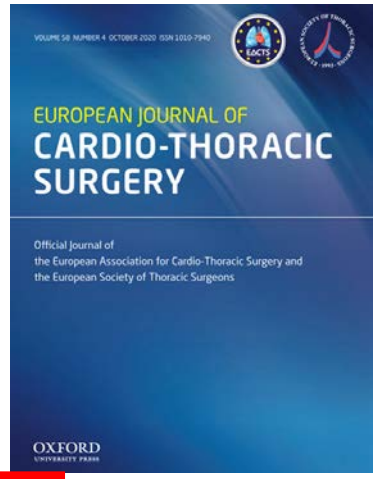
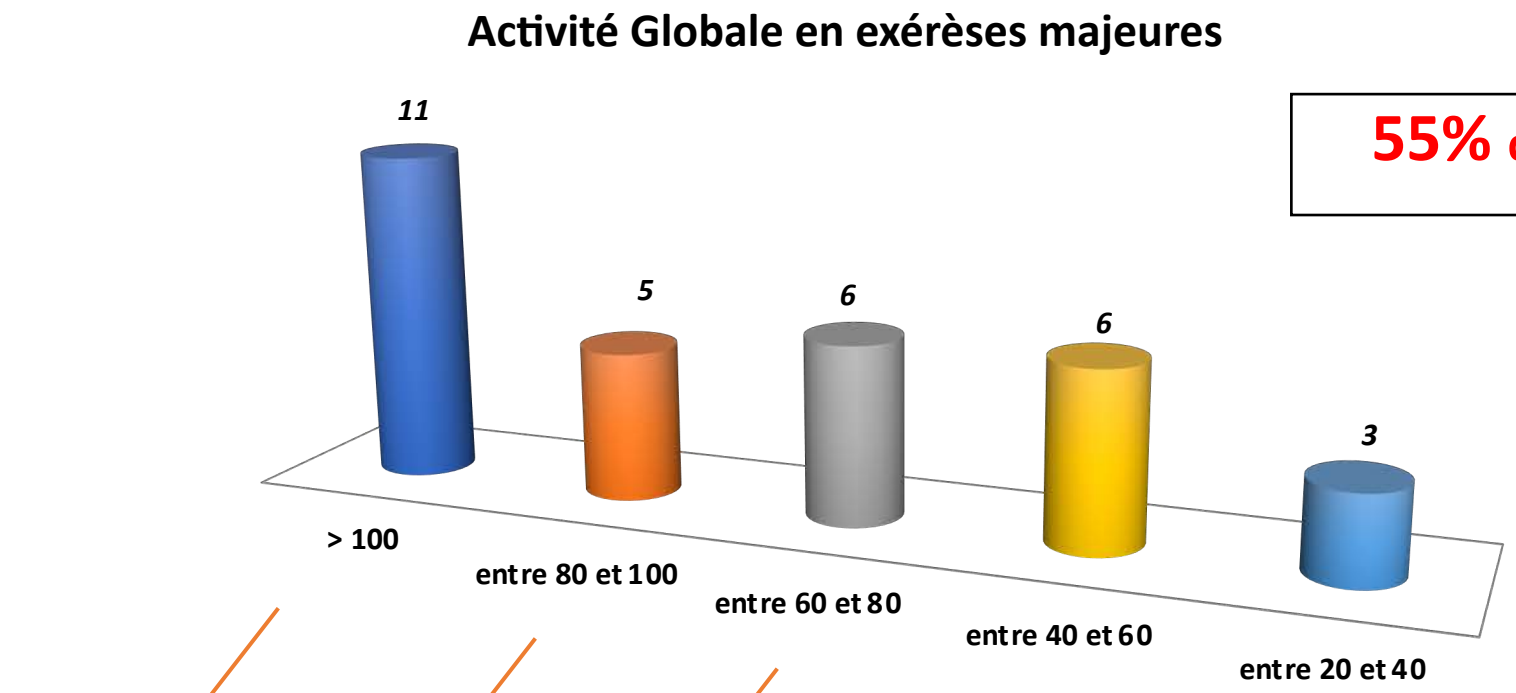


Indications and contraindications for VATS lobectomy	Number of respondents (%)
T status for tumour	
≤5 cm (T1 and T2a)	16 (32)
≤7 cm (T1, T2a and T2b)	31 (64)
None of above	3 (6)
N status for tumour	
N0 only	1 (2)
N0 + N1	28 (56)
N0 + N1 + N2	21 (42)
Chest wall involvement is	
A contraindication if involving parietal pleura	3 (6)
A contraindication if involving rib(s)	31 (62)
Not a contraindication for VATS lobectomy	16 (32)
Centrality of tumour is	
An absolute contraindication if invading hilar structure(s)	12 (24)
A relative contraindication if invading hilar structure(s)	32 (64)
Not a contraindication	6 (12)
Previous thoracic surgery/pleurisy is	
An absolute contraindication	0
A relative contraindication	10 (20)
Not a contraindication	40 (80)

Recommandations d'experts…

Under which of the following clinical situation(s), would you recommend conversion to open thoracotomy?[a]	
Pneumonectomy	17 (34)
Bronchial sleeve	27 (54)
Vascular sleeve	48 (96)
Broncho-vascular sleeve	48 (96)
Pleural adhesions	2 (4)
Absence of fissure	1 (2)
Poor lung deflation	12 (24)
Major bleeding	46 (92)
Broncho-pleural fistula	18 (36)
Chest wall involvement	30 (60)
Operating theatre time pressure	2 (4)
None of above	0

31 Chirurgiens « VATS experts » - étude française 2015



55% de VATS

30% de VATS Epithor 2016

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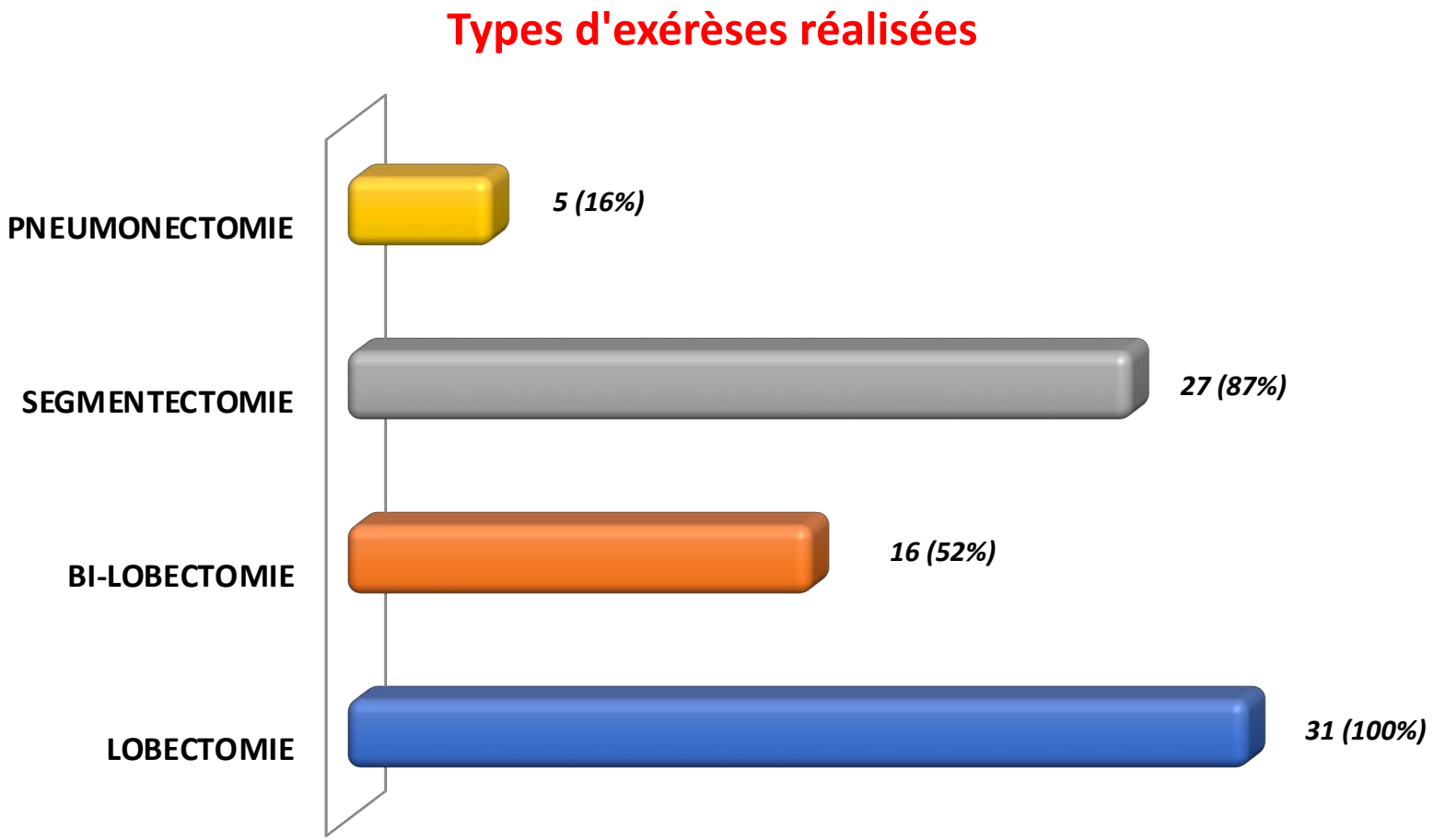
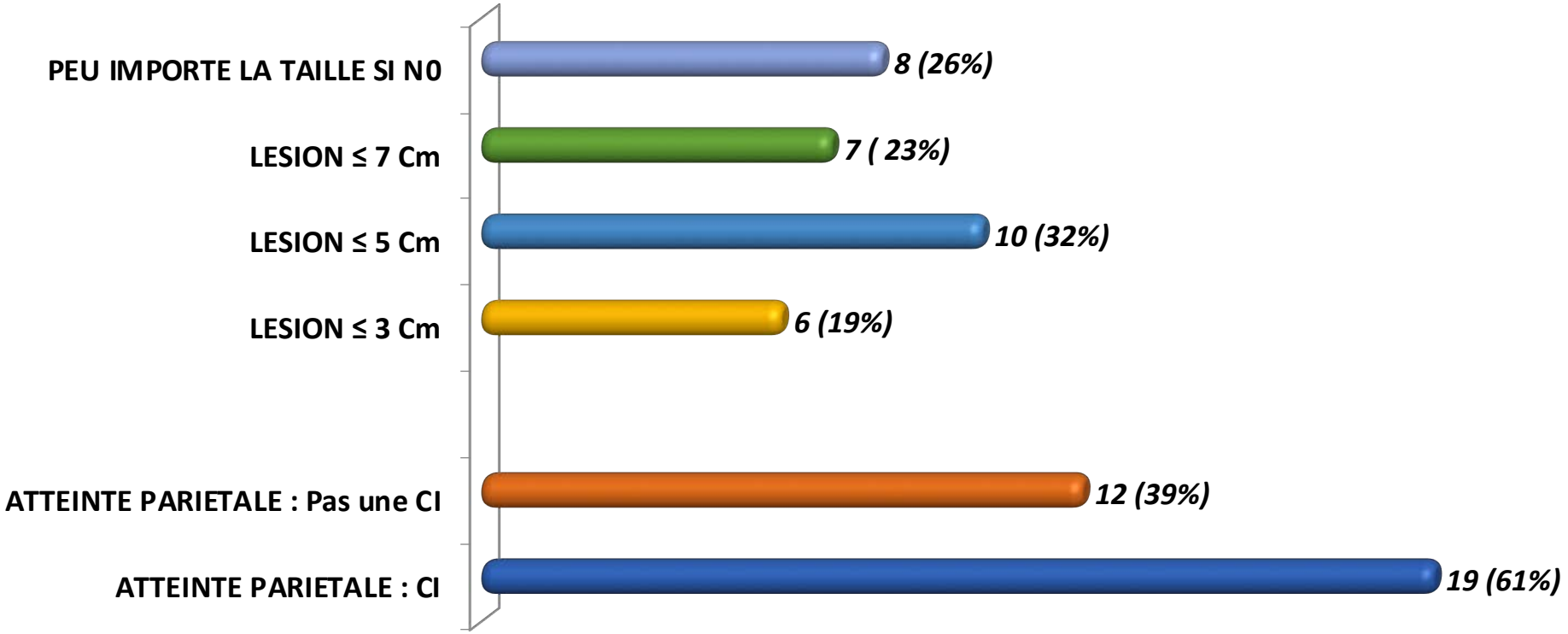


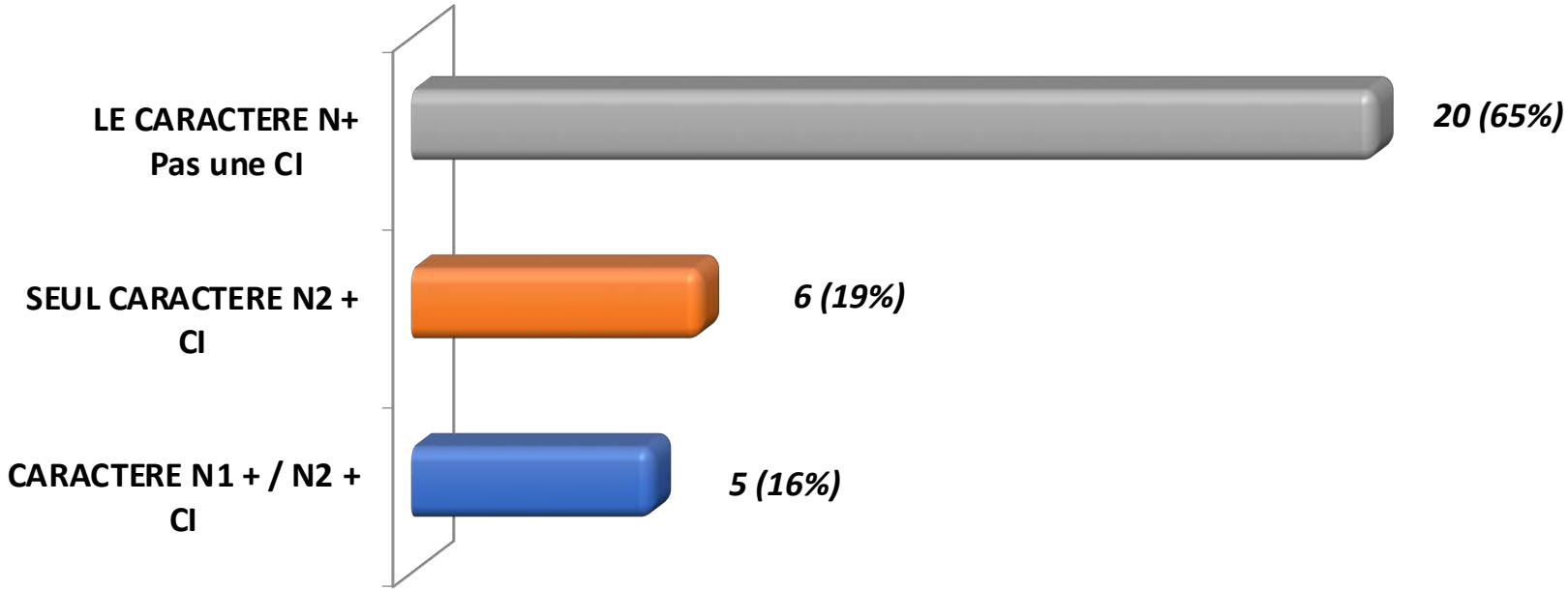
Indications et CI de la VATS?

CRITERE de TAILLE de la TUMEUR ?



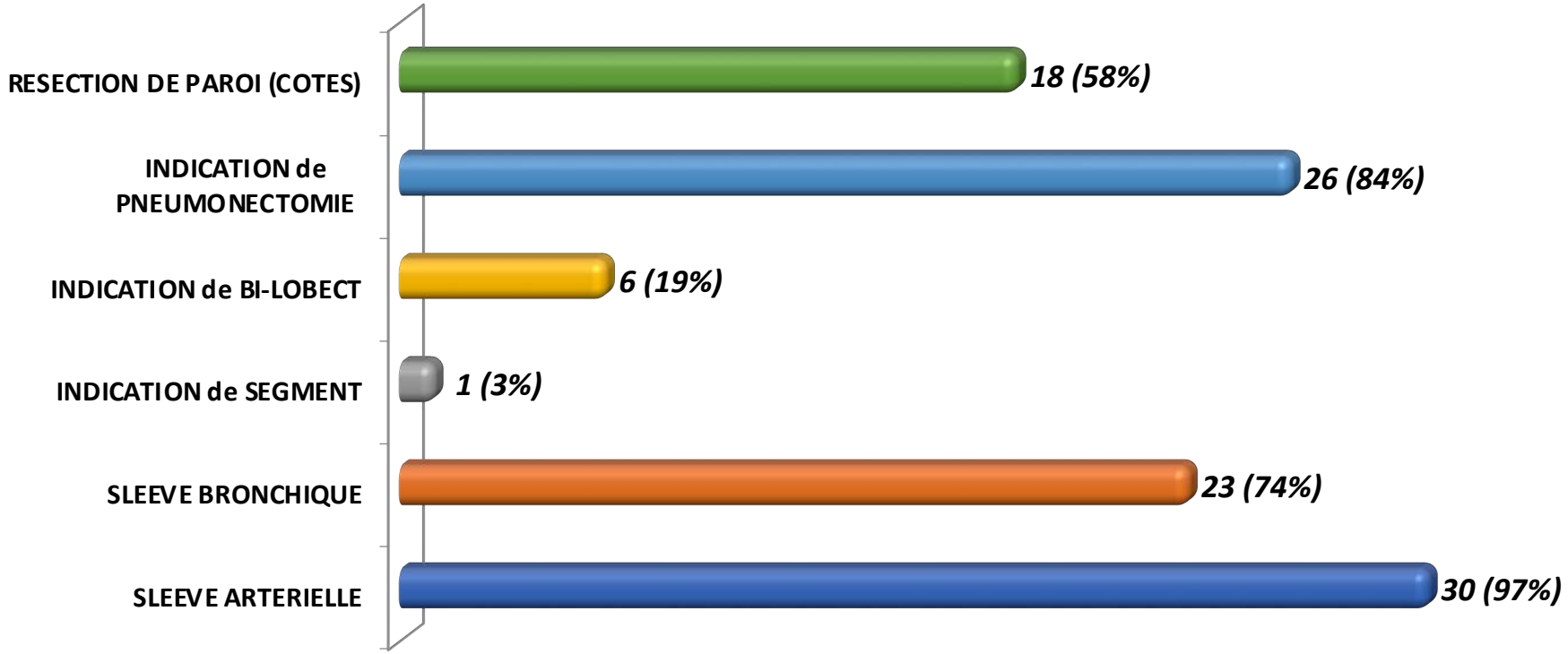
Indications et CI de la VATS?

ATTEINTE N « considérée ou Prouvée » ?



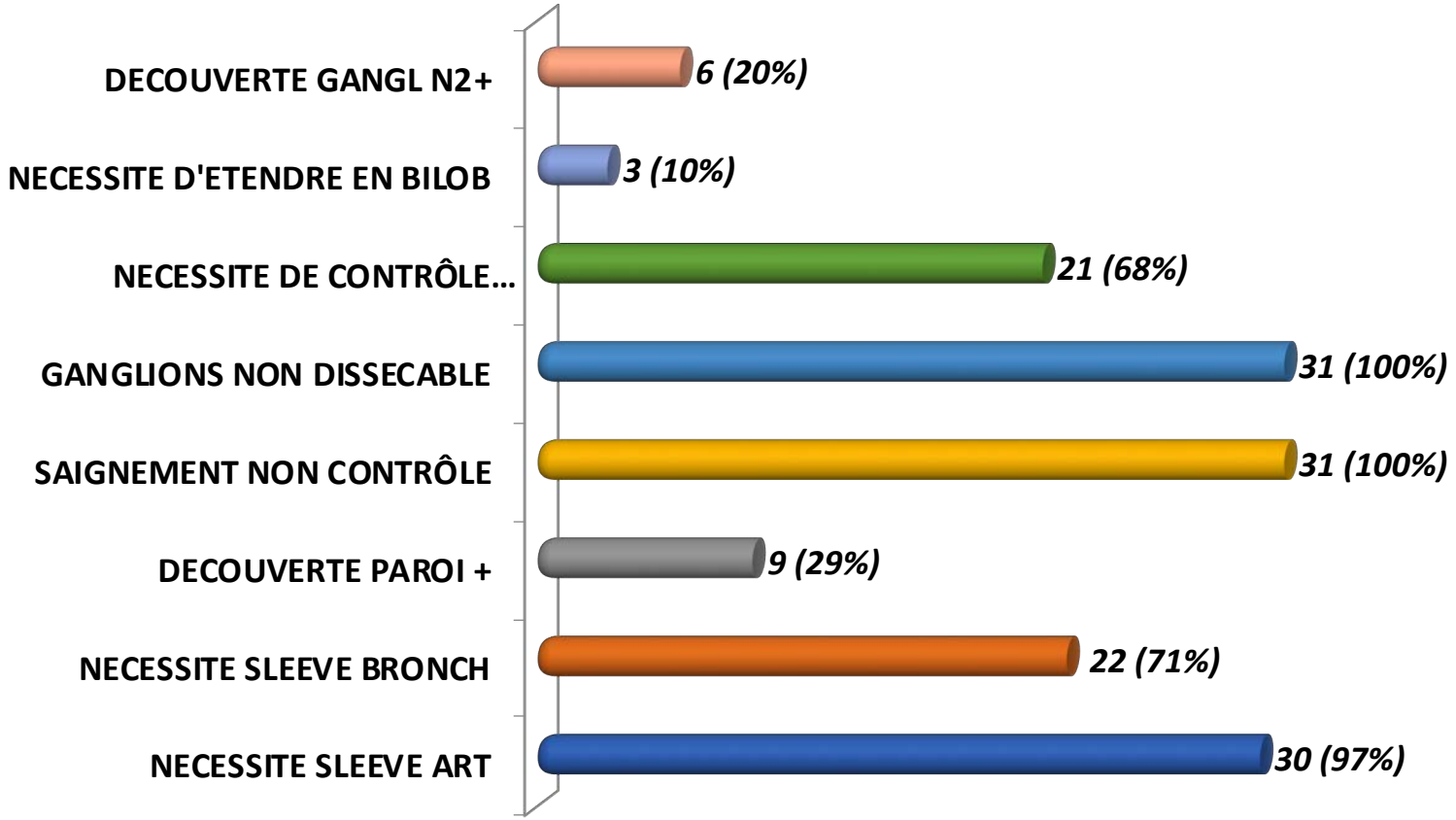
Indications et CI de la VATS?

Eléments qui CI la VATS « en pré-op » ?

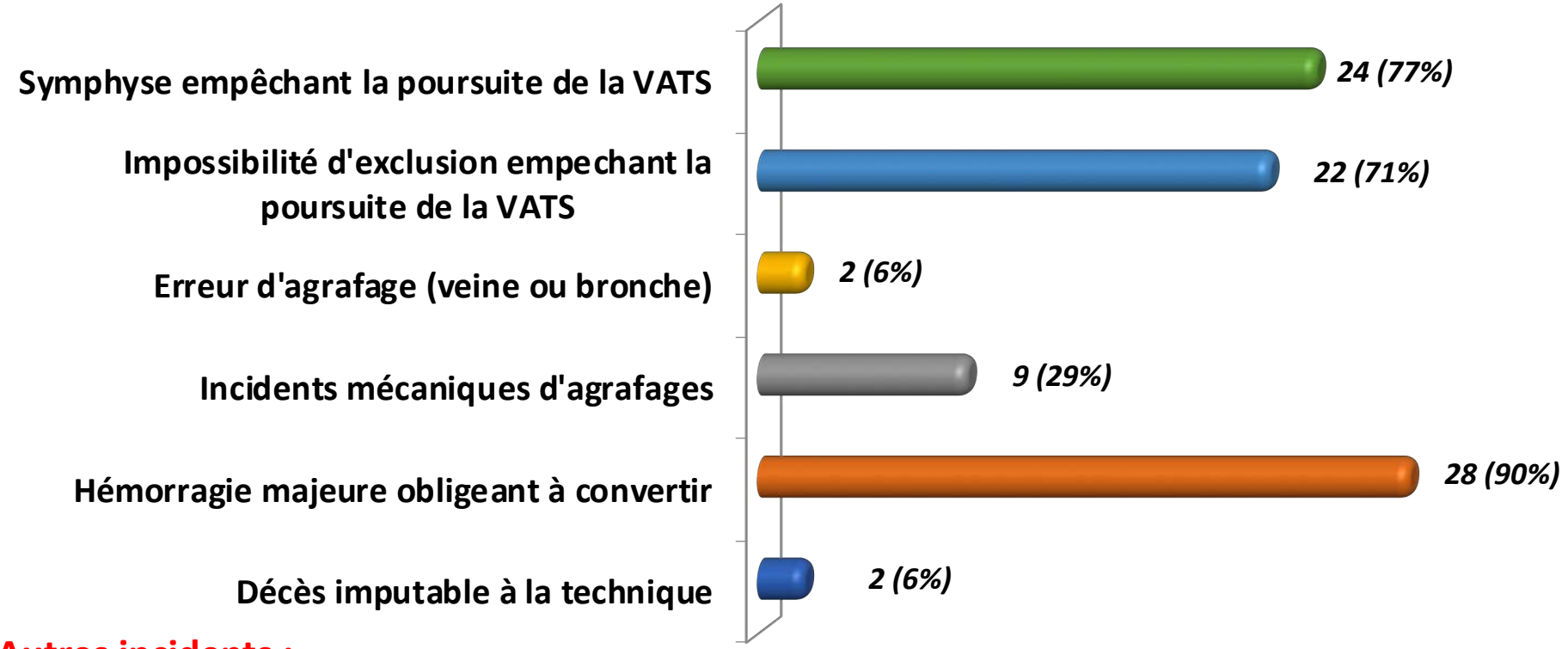


Incidents per-opératoires rencontrés

Eléments qui CI la VATS en « Per-Op »?



Incidents per-opératoires rencontrés

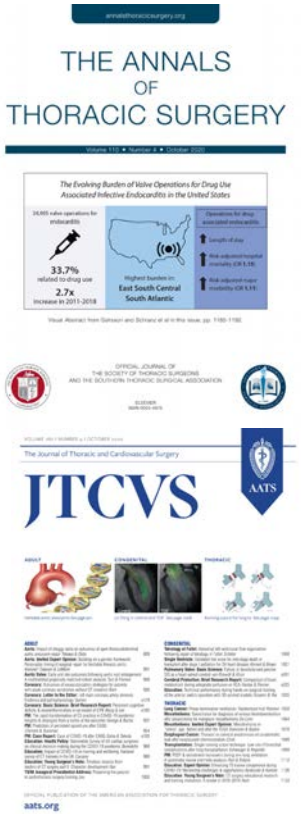


Autres incidents :

- **Scissure indissécable (2)**
- **Nodule non repérable**
- **Saignement non compris**
- **Recoupe bronchique positive**
- **Temps trop important poussant à convertir**

Does failed video-assisted lobectomy for lung cancer prejudice immediate and long-term outcomes?

Jones RO, Casali G, Walker WS Ann Thorac Surg. 2008; 86:235-9.



Predictors of conversion to thoracotomy for video-assisted thoracoscopic lobectomy: a retrospective analysis and the influence of computed tomography-based calcification assessment.

Samson P, Guitron J, Reed MF, Hanseman DJ, Starnes SL. J Thorac Cardiovasc Surg. 2013;145:1512-8.

- Pas de differences en terme de complications post-opératoires entre une chirurgie VATS et une chirurgie convertie.

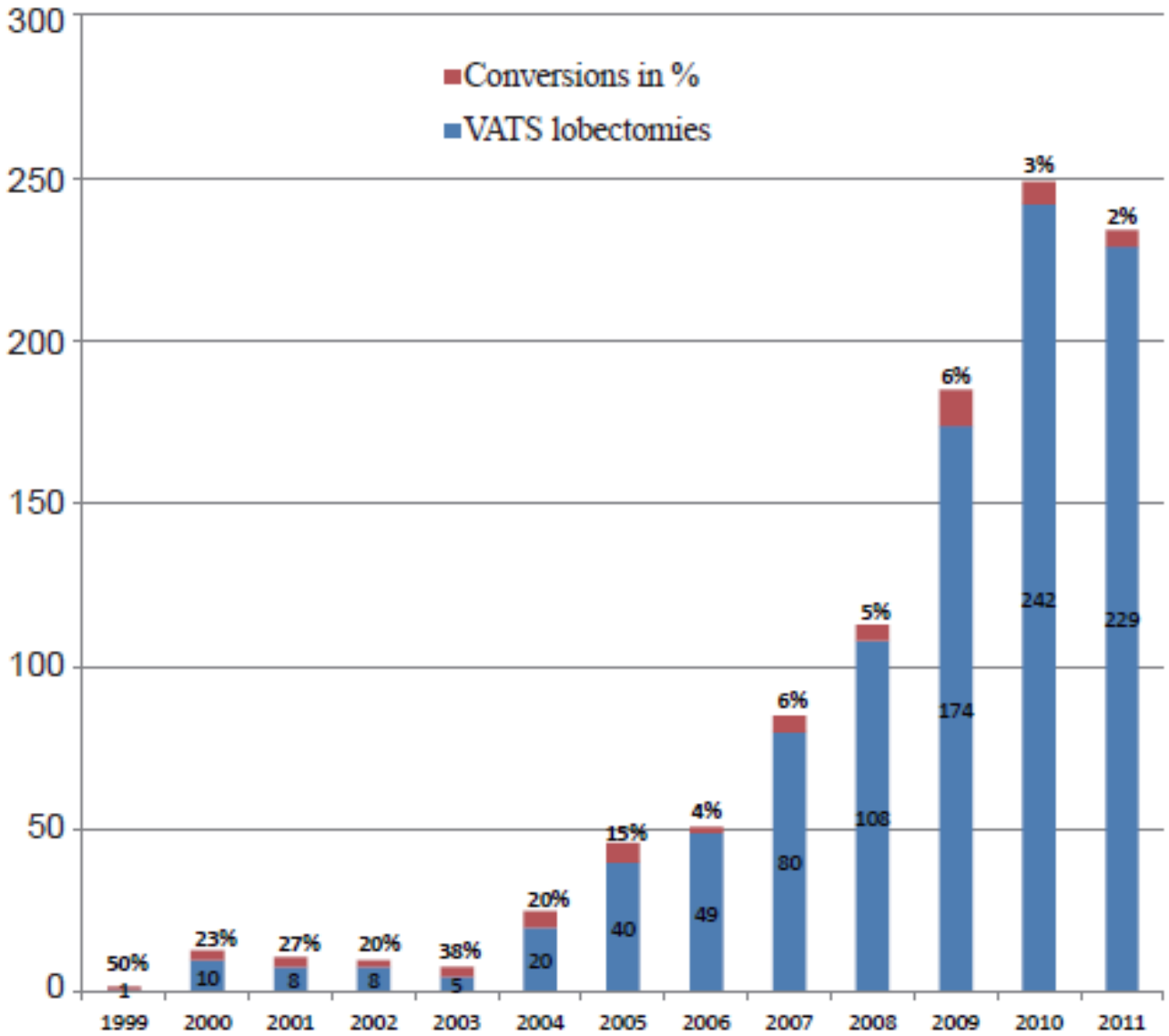


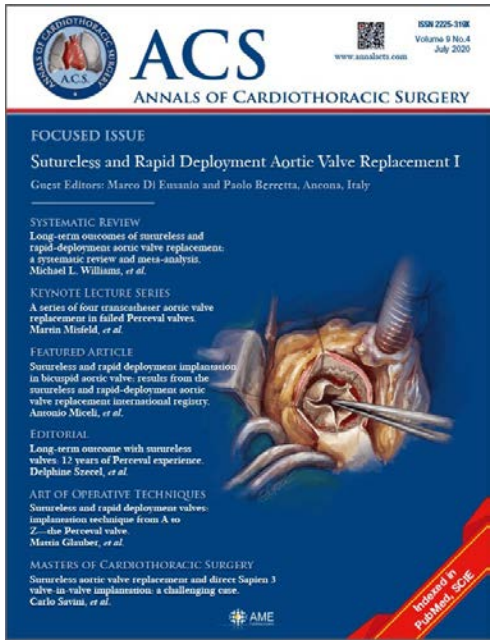
Figure 1 Number of VATS lobectomies performed in Copenhagen 1999 to 2011 and conversions in %

Perspective

Learning curve associated with VATS lobectomy

René H. Petersen, Henrik J. Hansen

Ann Cardiothorac Surg 2012;1(1):47-50



Robotic lobectomies: when and why?

Sara Ricciardi[1], Giuseppe Cardillo[2], Carmelina Cristina Zirafa[1], Federico Davini[1], Franca Melfi[3]

• Vol 3, No 8 (August 2017)

Les contreverses sur l'utilisation de la robotique demeurent…
Pour la plupart des chirurgiens le temps pour réaliser unes RATS reste plus longue que la voie ouverte ou l'approche VATS.
CO_2 est insufflé (pression entre 5–8 mmHg) repoussant le diaphragme et élargissement de l'espace de travail, permettant une bonne exposition des structures hilaires et facilite la dissection du médiastin.
Certains auteurs affirment que la « learning curve » est plus courte…
Peu de data disponibles sur le caractère oncologique radical et la survie à long terme – séries rétrospectives…
Pour les utilisateurs aguerris l'approche robotique semble permettre une dissection plus efficace dans les espaces confinés et une résection plus efficace des ganglions N1 et N2.
Prise en compte des coûts…
Dépend du système utilisé … Robot Xi…

BENEFICES DE L'ABORD MINI-INVASIF ?

PEU D'ESSAIS CONTROLLES RANDOMISES

SERIES RETROSPECTIVES

META-ANALYSE

ANALYSE DES BASES DE DONNEES NATIONALES

Thoracoscopic Surgery Versus Thoracotomy for Lung Cancer: Short-Term Outcomes of a Randomized Trial

Hao Long [1], Qunyou Tan [2], Qingquan Luo [3], Zheng Wang [4], Gening Jiang [5], Dongrong Situ [6], Yongbin Lin [6], Xiaodong Su [6], Qing Liu [7], Tiehua Rong

Ann Thorac Surg. 2018 Feb;105(2):386-392.

Table 1. Clinical Characteristics of Patients

Characteristic	VATS (n = 215)	Open Operation (n = 210)	*p* Value
Sex			0.663
Male	105 (48.8)	107 (51.0)	
Female	110 (51.2)	103 (49.0)	
Age, years	57.11 ± 9.069	58.1 ± 9.22	0.264
Body surface area, m^2	1.71 ± 0.59	1.67 ± 0.17	0.334
Smoking history	69 (32.1)	73 (34.8)	0.536
Pulmonary comorbidities	20 (9.30)	19 (9.04)	0.928
Other comorbidities	117 (54.4)	106 (50.5)	0.416
Presentation			0.08
Incidental finding	124 (57.7)	103 (49.0)	
Cough	59 (27.4)	80 (38.1)	
Chest pain	12 (5.58)	12 (5.71)	
Hemoptysis	5 (2.33)	7 (3.33)	
Chest tightness	3 (1.40)	3 (1.43)	
Dyspnea	4 (1.86)	0 (0.0)	
Pyrexia	3 (1.40)	0 (0.0)	
Others	5 (2.32)	5 (2.40)	

Values are n (%) or mean ± SD.

VATS = video-assisted thoracoscopic surgery.

Variable	VATS (n = 215)	Open Operation (n = 210)	*p* Value
Histologic subtype			0.218
Adenocarcinoma	178 (82.79)	161 (76.67)	
Squamous carcinoma	17 (7.91)	28 (13.33)	
Large cell carcinoma	0 (0.0)	2 (0.95)	
Others	20 (9.30)	19 (9.04)	
Tumor size, mm	25 (17–32)	30 (20–40)	0.0068
Pathologic stage			0.235
IA	94 (43.72)	74 (35.24)	
IB	61 (28.37)	58 (27.62)	
IIA	19 (8.8)	27 (12.86)	
IIB	7 (3.26)	12 (5.71)	
IIIA	31 (14.41)	38 (18.09)	
IIIB	3 (1.40)	1 (0.48)	
Surgical margin			0.128
Negative margin	213 (99.07)	205 (97.62)	
Positive margin	1 (0.47)	5 (2.38)	
Missing data	1 (0.47)	0 (0.0)	
Number of harvested lymph nodes	10 (6–18)	12 (7–18)	0.389

Values are n (%) or median (25th–75th percentile).

VATS = video-assisted thoracoscopic surgery.

	VATS Including Conversions (n = 223)	VATS Excluding Conversions (n = 215)	Open Operation (n = 210)	*p* Value
Quality of operation				0.549
Complete resection	222 (99.55)	214 (99.53)	208 (99.05)	
Incomplete resection	1 (0.45)	1 (0.47)	2 (0.95)	
Modality of lymphadenectomy				0.53
Mediastinal lymph node dissection	219 (98.21)	211 (98.14)	201 (95.71)	
Mediastinal lymph node sampling	4 (1.79)	4 (1.86)	7 (3.33)	
Missing data	0	0	2 (0.95)	
Duration of operation, minutes	150 (117–200)	150 (115–195)	166 (130–205)	0.009
Blood loss, mL	100 (50–150)	100 (50–150)	100 (100–200)	0.001
Duration of chest drainage, days	4 (3–6)	4 (3–6)	4 (3–6.25)	0.126
Total volume of chest drainage, mL	950 (600–1,645)	950 (600–1,625)	1148 (685–1,740)	0.074
Length of hospitalization, days	14 (12–19)	14 (12–19)	15 (13–19)	0.304
Postoperative complication	23 (10.31)	22 (10.23)	23 (10.95)	0.825
Hemorrhage	3 (1.34)	2 (0.93)	0	0.499
Grade 1	3 (1.34)	2 (0.93)	0	
Grade 2	0	0	0	
Grade 3–4	0	0	0	
Pneumonia	3 (1.35)	3 (1.40)	5 (2.38)	0.966
Mild	2 (0.90)	2 (0.93)	3 (1.43)	
Moderate	1 (0.45)	1 (0.47)	2 (0.95)	
Severe	0	0	0	
Air leak	9 (4.04)	9 (4.19)	5 (2.38)	0.301
Mild	7 (3.14)	7 (3.26)	4 (1.90)	
Moderate	2 (0.90)	2 (0.93)	1 (0.48)	
Severe	0	0	0	
Arrhythmia	3 (1.35)	3 (1.40)	7 (3.33)	0.474
Atelectasis	0	0	2 (0.95)	0.151
Respiratory failure	1 (0.45)	1 (0.47)	1 (0.48)	0.987
Chylothorax	0	0	2 (0.95)	0.151
Recurrent nerve injury	0	0	1 (0.48)	0.493
Others	4 (1.79)	4 (1.86)	0	…

Thoracoscopic Surgery Versus Thoracotomy for Lung Cancer: Short-Term Outcomes of a Randomized Trial

Hao Long [1], Qunyou Tan [2], Qingquan Luo [3], Zheng Wang [4], Gening Jiang [5], Dongrong Situ [6], Yongbin Lin [6], Xiaodong Su [6], Qing Liu [7], Tiehua Rong

Ann Thorac Surg. 2018 Feb;105(2):386-392.

VATS lobectomy is a safe and reliable procedure for the treatment of clinically early-stage NSCLC,
and it may be superior to axillary thoracotomy approach in terms of operation time and intraoperative blood loss.
However, long-term follow-up is warranted to verify the superior or equivalent oncologic outcome of VATS lobectomy. The report could be expected by the end of 2019
(toujours pas publié en 2020…)
Pas de données sur les douleurs…

Postoperative pain and quality of life after lobectomy via video-assisted thoracoscopic surgery or anterolateral thoracotomy for early stage lung cancer: a randomised controlled trial

Morten Bendixen, PhD Ole Dan Jørgensen, PhD Christian Kronborg, PhD Claus Andersen, PhD Prof Peter Bjørn Licht, PhD

2016 VOLUME 17, ISSUE 6, P836-844

CNPC de stade I: 103 pts Thoracotomies – 103 VATS
Objectifs : évaluer la douleur post-opératoirte et la Qualité de vie

During 52 weeks of follow-up, episodes of moderate-to-severe pain were significantly less frequent after VATS than after anterolateral thoracotomy ($p<0{\cdot}0001$)

Complications post-op : différences non significatives

VATS is associated with less postoperative pain and better quality of life than is anterolateral thoracotomy for the first year after surgery, suggesting that VATS should be the preferred surgical approach for lobectomy in stage I non-small-cell lung cancer.

Long term survival with thoracoscopic versus open lobectomy: propensity matched comparative analysis using SEER-Medicare database

Subroto Paul associate professor 1 2, Abby J Isaacs senior analyst 1, Tom Treasure professor 3, Nasser K Altorki professor 2, Art Sedrakyan associate professor and director

BMJ Journals
BMJ Open

BMJ 2014;349:g5575

Propensity matched cohort		
Thoracoscopy (n=1195)	Thoracotomy (n=1195)	P value
19.9 (27.5)	17.6 (26)	0.0327
10 (5-18)	9 (5-15)	0.0004
398/1072 (37.1)	317/1090 (29.1)	<0.0001
6.6 (6)	8.7 (6.6)	<0.0001
5 (3-8)	7 (5-10)	<0.0001
25 (2.1)	43 (3.6)	0.0290
229 (19.2)	265 (22.2)	0.0690
74 (6.2)	100 (8.4)	0.0423
125 (10.5)	176 (14.7)	0.0013
32 (2.7)	48 (4.0)	0.07
16 (1.3)	32 (2.7)	0.0209

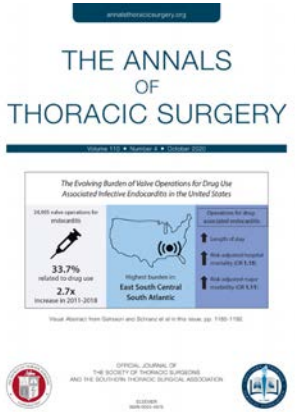
Patients undergoing thoracoscopic lobectomy had a shorter length of stay compared with those undergoing thoracotomy lobectomy (5 v 7 days, P<0.001) and lower in-hospital mortality rates

Patients undergoing thoracoscopic lobectomy have similar long term survival outcomes compared with patients undergoing thoracotomy lobectomy

Propensity Score Analysis Comparing Videothoracoscopic Lobectomy With Thoracotomy: A French Nationwide Study

Pierre-Benoit Pages, MD, PhD, Jean-Philippe Delpy, MD, Bastien Orsini, MD, Dominique Gossot, MD, Jean-Marc Baste, MD, PhD, Pascal Thomas, MD, PhD, Marcel Dahan, MD, PhD, and Alain Bernard, MD, PhD, for the Epithor project (French Society of Thoracic and Cardiovascular Surgery)

Ann Thorac Surg 2016;101:1370–8



Variable[a]	Thoracotomy (n = 24,811)	VATS (n = 1,278)	p Value
72–101	5,438 (22)	189 (15)	
103–129	4,536 (18)	256 (20)	
>129	4,748 (19)	431 (34)	
Year of treatment			
2005–2006	4,585 (18)	61 (5)	<0.0001
2007–2008	5,932 (24)	99 (8)	
2009–2010	7,318 (29)	284 (22)	
2011–2012	6,976 (28)	834 (65)	

Variables	No Replacement Descending	p Value
Postoperative complications[a]		
Atelectasis	0.44 (0.23–0.84)	0.01
Pneumonia	0.62 (0.38–1)	0.055
Severe pulmonary complications	0.7 (0.43–1.19)	0.198
Air leak >7 days	0.9 (0.6–1.45)	0.725
Arrhythmia	0.72 (0.47–1.12)	0.147
Bronchopleural fistula	0.12 (0.02–0.64)	0.013
Empyema	0.25 (0.03–2)	0.198
Hemorrhage	1.6 (0.7–3.8)	0.243
Postoperative death[a]	0.89 (0.45–1.8)	0.763
Hospital length of stay[b], d	–2.4 (–1.7 to 3)	0.0001
Overall survival[c]	0.81 (0.45–1.42)	0.5
Disease-free survival[c]	1 (0.7–1.4)	0.9

DMS santé Atlantique

Démarrage de la technique mini-invasive en 2012… taux mini-invasif > 80-90% (environ 170-180 exérèses/an)

DMS 2010 (154) : NI 9,51 / NII 12,15

DMS 2013 (136) : NI 5,38 / NII 7,57
DMS 2014 (138) : NI 5,54 / NII 8,32
DMS 2015 (146) : NI 5,32 / NII 6,85
DMS 2016 (141) : NI 3,98 / NII 6,88
DMS 2017 (120) : NI 4,07 / NII 6,25
DMS 2018 (152) : NI 3,60 / NII 6,24
DMS 2019 (159) : NI 3,97 / NII 6,89

IMPACT MAJEUR du MINI INVASIF SUR LA DMS

GAIN au **moins 3 à 4 jours**

CONCLUSIONS

DOIT-ON RECOMMANDER LES VOIES MINI-INVASIVES ?

OUI, mais niveau de preuve qui reste faible +++, nécessite plus d'études prospectives, néanmoins :

- **↘ des douleurs post-opératoires, ↑ Qualité vie.**
- **↘ des complications post-opératoires, (pneumopathies, atélectasies, …)**
- **↘ de la DMS**

Technique couteuse / expertise chirurgicale +++

Pas de recommandations sur le type de techniques mini-invasives

NIH U.S. National Library of Medicine
ClinicalTrials.gov

VATS VS. Open Thoracic Surgery for Stage II - III Lung Cancer (VOLCANO)
(Shangaï - December 30, 2025)

Robotic Lobectomy vs. Thoracoscopic Lobectomy for Early Stage Lung Cancer (Toronto - January 2022)

Medicoeconomic Evaluation of Two Surgical Techniques for Lobectomy in the Lung Cancer (LungSco01) – VATS vs OPEN
(CH Dijon - October 2021)

Robot-assisted vs VATS Lobectomy for NSCLC
(Ruijin, August 31, 2022)

VATS vs. Robotic Approach for Lobectomy or Anatomical Segmentectomy (ROMAN)
(Verone, March 6, 2023)

Impact of Robotic Approach Compared to VATS and Open Approach on Quality of Life in Patients With Lung Cancer (Istituto Clinico Humanitas, Italy, December 1, 2020)

VIdeo Assisted Thoracoscopic Lobectomy Versus Conventional Open Lobectomy for Lung Cancer (VIOLET)
(University of Bristol, March 2020, devrait paraître…)

NOUVELLES PRISES EN CHARGE RRAC

Il est très probable que cela influence les résultats (DMS, CPO, etc):

Bonne stratégie doit être:

Pré-op:

- Meilleure préparation, réhabilitation, sevrage tabac, programme sportif, aspect nutritionnel, Kiné, VNI, …

Per-op :

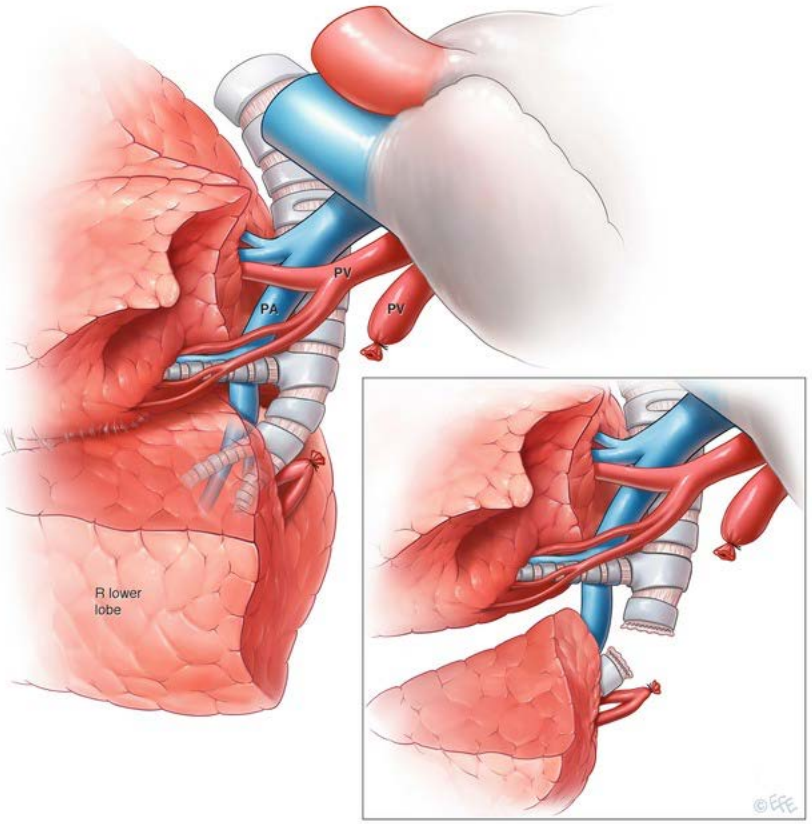
- Privilégier le mini-invasif, gestion anesthésique, …

Post –op :

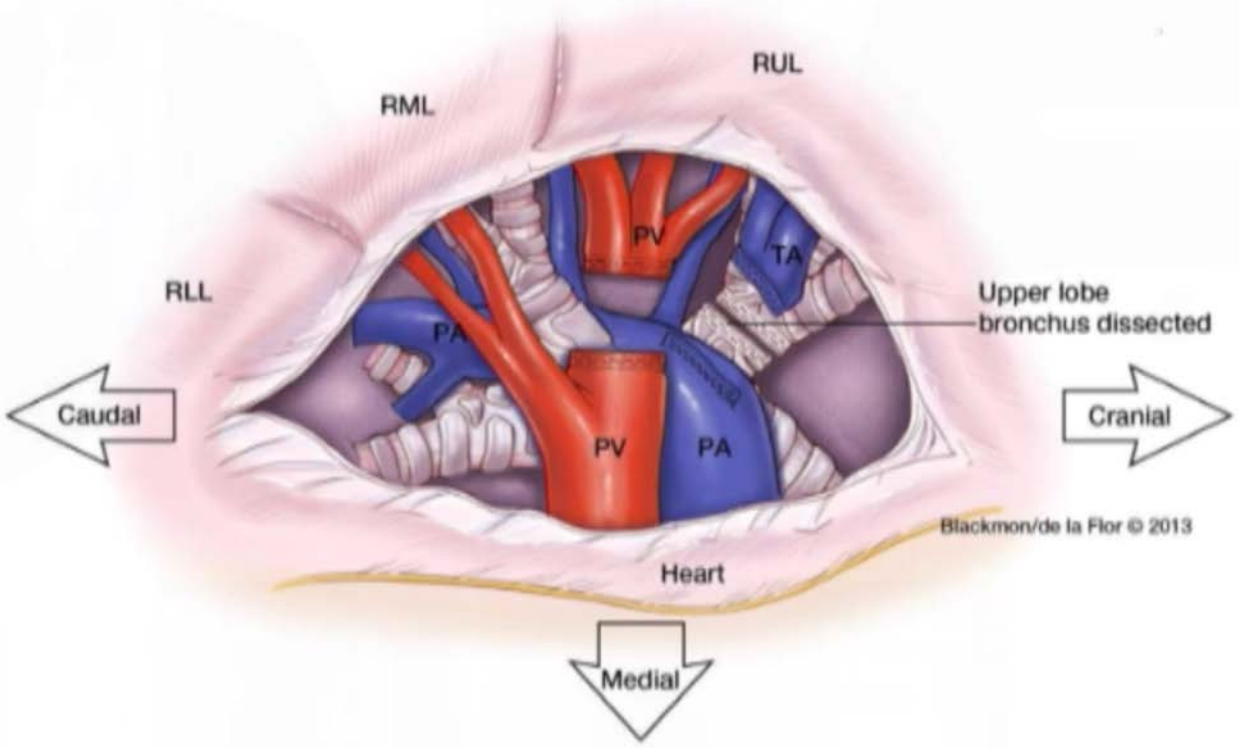
- Levé précoce, nutrition, kiné, VNI, …

MERCI DE VOTRE ATTENTION

LID

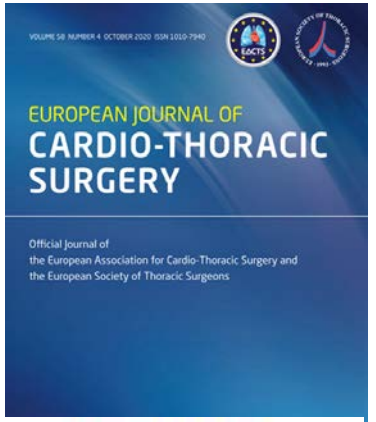

PV
PA
PV
R lower lobe

LSD


RML
RUL
RLL
PV
TA
PA
Upper lobe bronchus dissected
Caudal
Cranial
PV
PA
Heart
Medial
Blackmon/de la Flor © 2013

Video-assisted thoracoscopic surgery lobectomy at 20 years: a consensus statement

European Journal of Cardio-Thoracic Surgery, Volume 45, Issue 4, April 2014, Pages 633–639



VATS lobectomy training	Number of respondents (%)
How many cases are required to overcome the learning curve?	
25	10 (20)
50	39 (78)
75	0
>100	1 (2)
What is the minimum resident case volume that defines a training centre?	
>30 cases per year	24 (48)
>50 cases per year	26 (52)
How many cases should a surgeon perform to maintain his/her VATS lobectomy operative skills?	
20 cases per year	31 (62)
40 cases per year	19 (38)
≥60 cases per year	0

Feasibility and safety of robot-assisted thoracic surgery for lung lobectomy in patients with non-small cell lung cancer: a systematic review and meta-analysis

Shiyou Wei[1,3†], Minghao Chen[2†], Nan Chen[1,3] and Lunxu Liu[1,3*]

World Journal of Surgical Oncology (2017) 15:98

The aim of this study is to **evaluate the feasibility and safety of robot-assisted thoracic surgery (RATS) lobectomy versus video-assisted thoracic surgery (VATS) for lobectomy** in patients with non-small cell lung cancer (NSCLC).

Méta-analyse de la littérature

the current systematic and meta-analysis demonstrates that RATS lobectomy is a feasible and safe technique for selected patients and can achieve an equivalent short-term surgical efficacy when compared with VATS procedure. However, longer operative time and cost effectiveness of RATS should be taken into consideration, and long-term oncological efficacy of the RATS approach remains to be seen.