

Curso de atresia de esófago para profesionales

Tema 2. Tratamiento toracoscópico de la atresia del esófago

Desarrollo de la CMI en Pediatría

1990

2020

Patologías recientes o específicas de pediatría

Patología del adulto

Baja complejidad o frecuentes

Complejidad moderada

Alta complejidad

Colecistectomía
Esplenectomía
Nefrectomía
Funduplicatura

Apendicitis
Biopsias
Quiste ovárico
Varicocele
Empiema
Testículo no descendido

Estenosis de piloro
Pieloplastia
Hernia inguinal

**Malformaciones
neonatales**

2000

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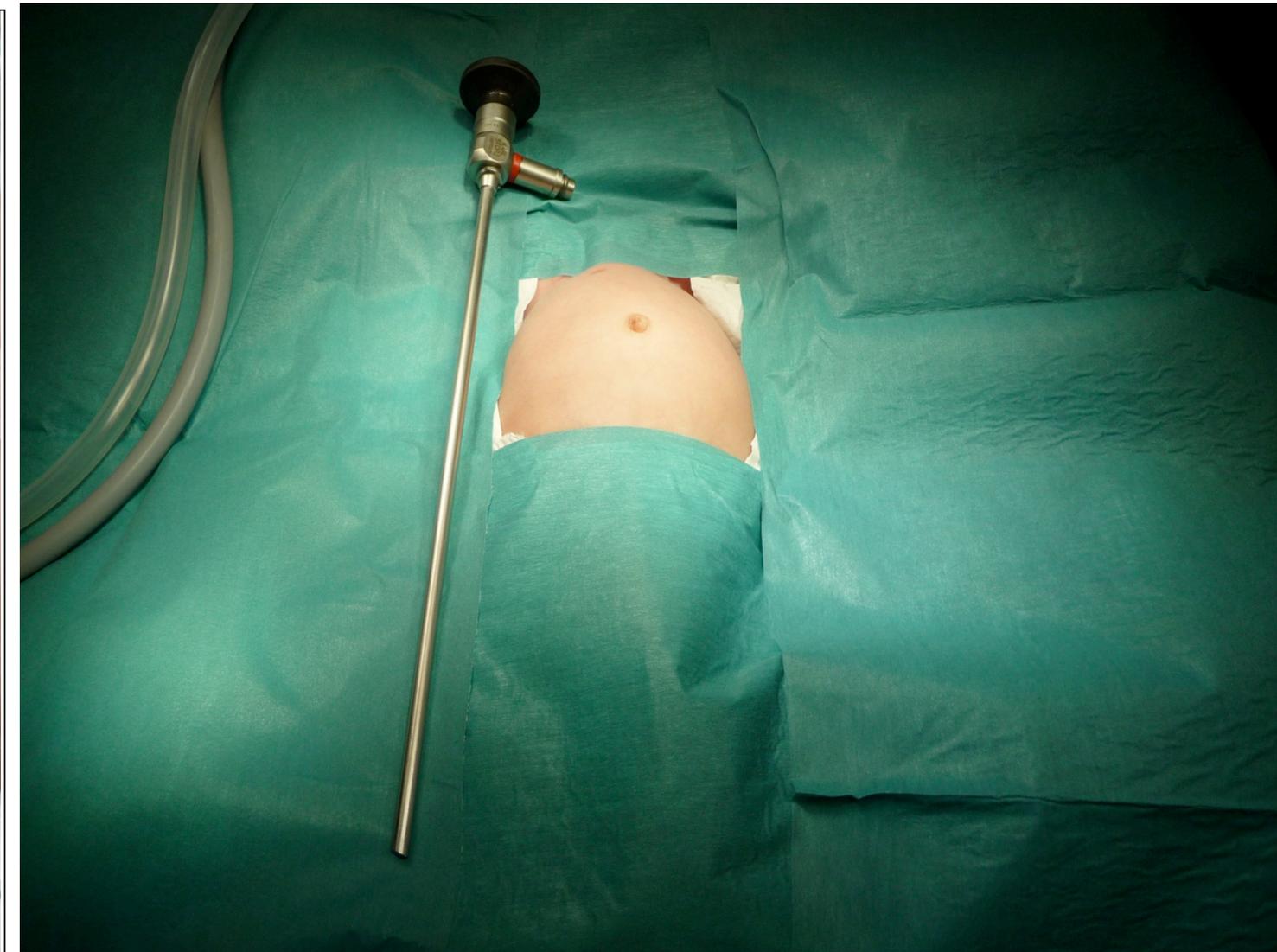
Tema 2. Tratamiento toracoscópico de la atresia del esófago

Two decades of minimally invasive pediatric surgery—taking stock

Journal of Pediatric Surgery (2008) 43, 1653–1659

Vinci S. Jones*, Ralph C. Cohen

Lack of technology to adequately miniaturize the instruments was a serious limitation for pediatric use



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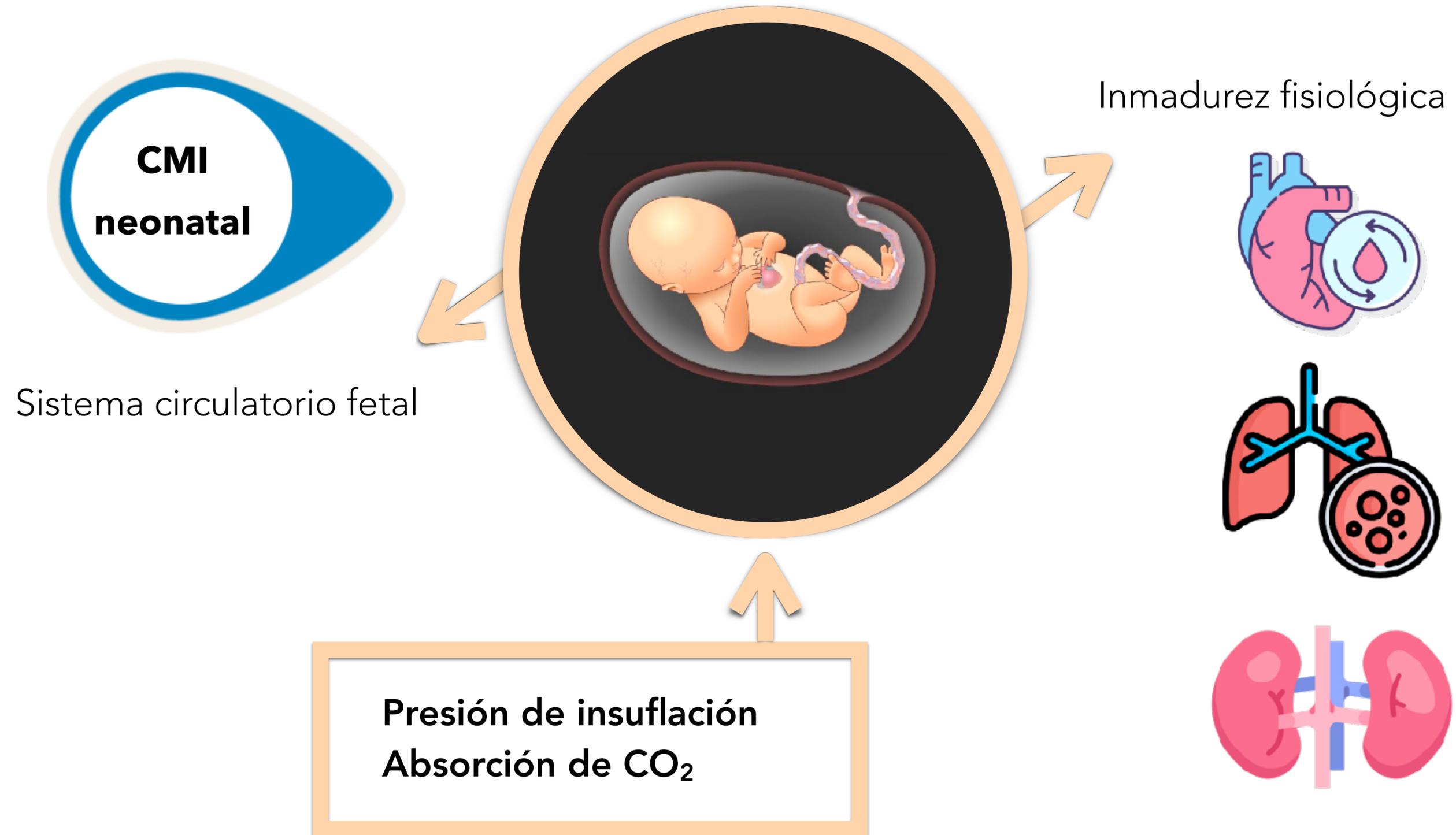
Tecnología: Instrumental adaptado al paciente



Trabajo en espacio reducido

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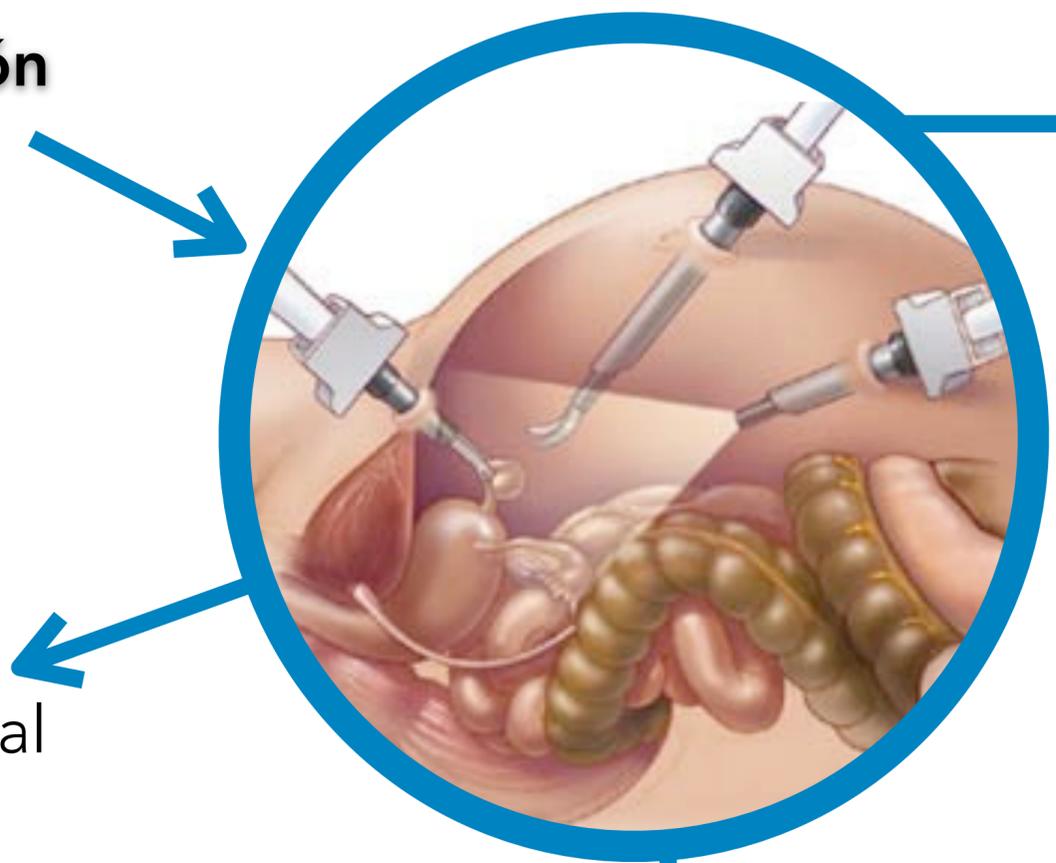
Tema 2. Tratamiento toracoscópico de la atresia del esófago



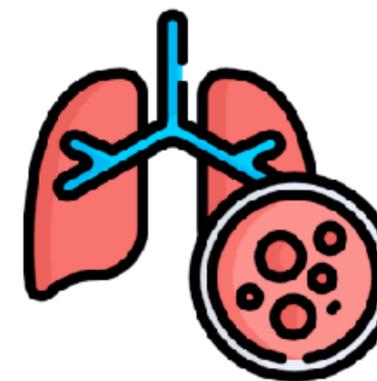
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Presión de insuflación

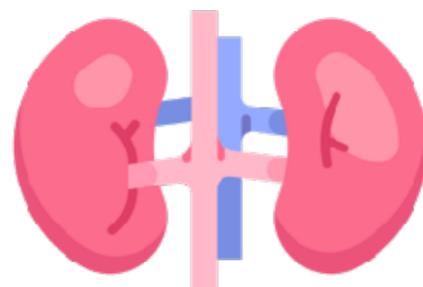


Compresión diafragma



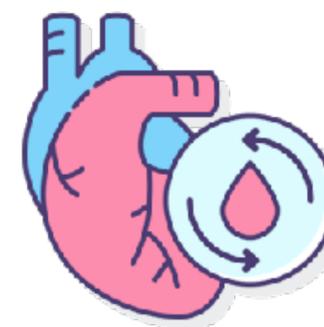
ventilación

Compresión arterial



oliguria

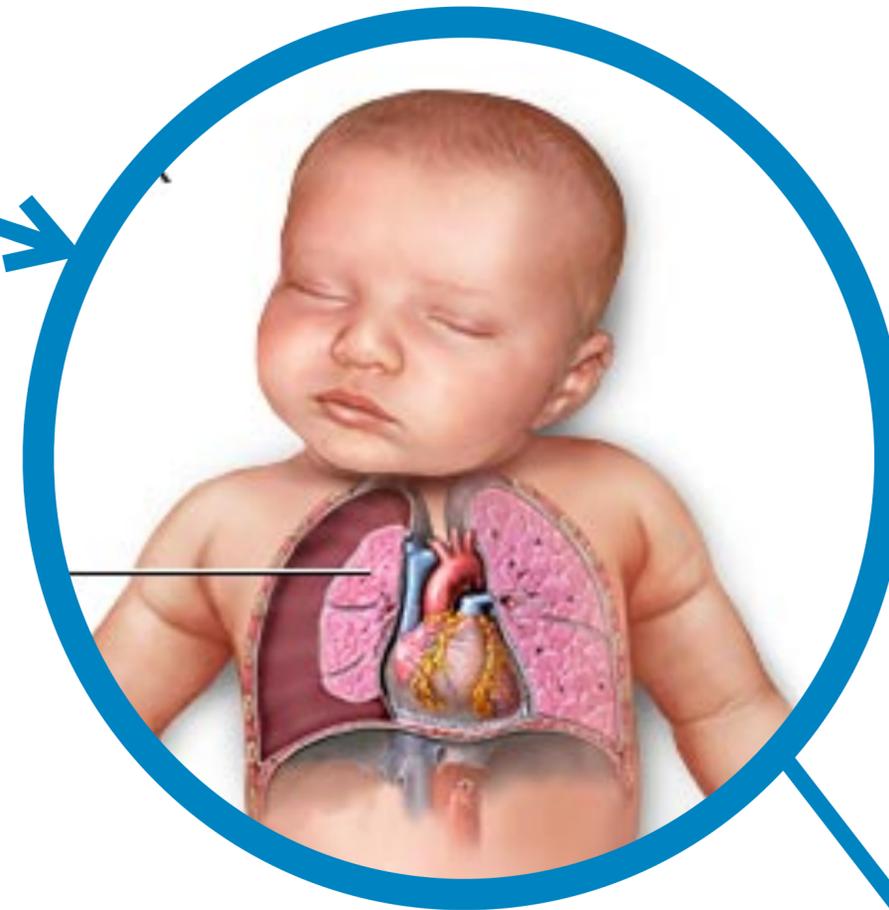
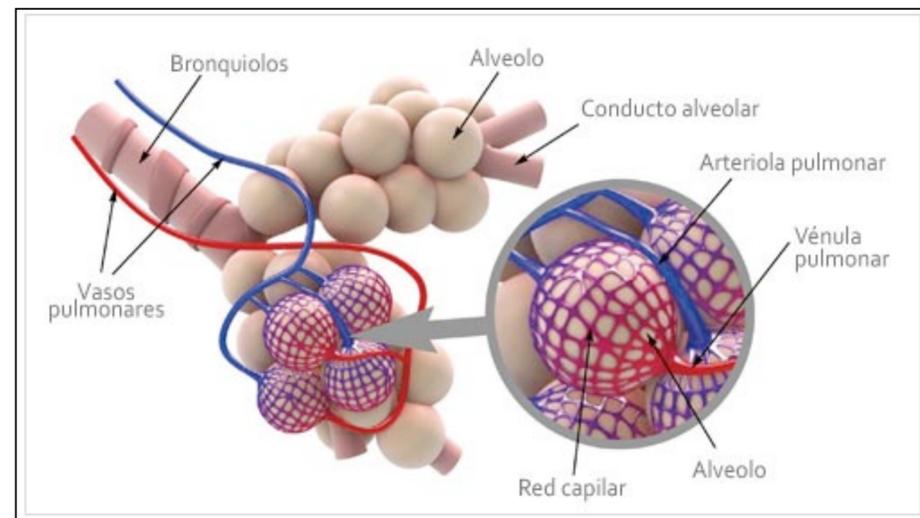
Compresión



precarga
volumen circulante

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Presión de insuflación



Menor superficie alveolar

Aumento frecuencia respiratoria

Mayor consumo de oxígeno



Sistema al límite de reserva funcional

Colapso del pulmón ipsilateral

Dificultad de intercambio gaseoso

Presión directa corazón

Alteración del volumen cardiaco

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Absorción de CO₂ (aumentada)

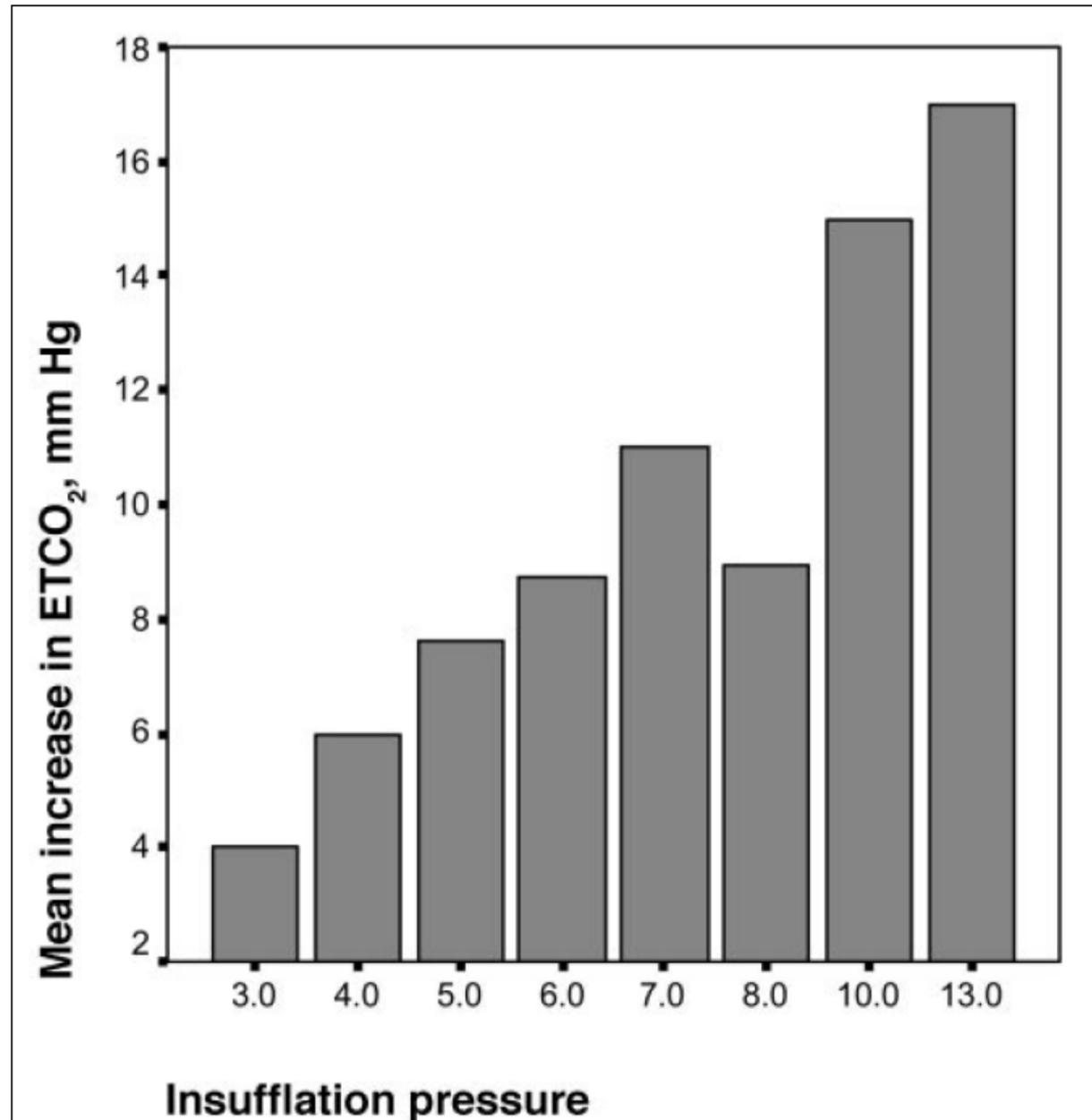


Fig 1. The mean variation in ETCO₂ depends on the insufflation pressure of pneumoperitoneum or pneumothorax ($P = .05$).

Menos grasa

Vasos mas cercanos a las serosas viscerales

Acidosis respiratoria

Taquicardia

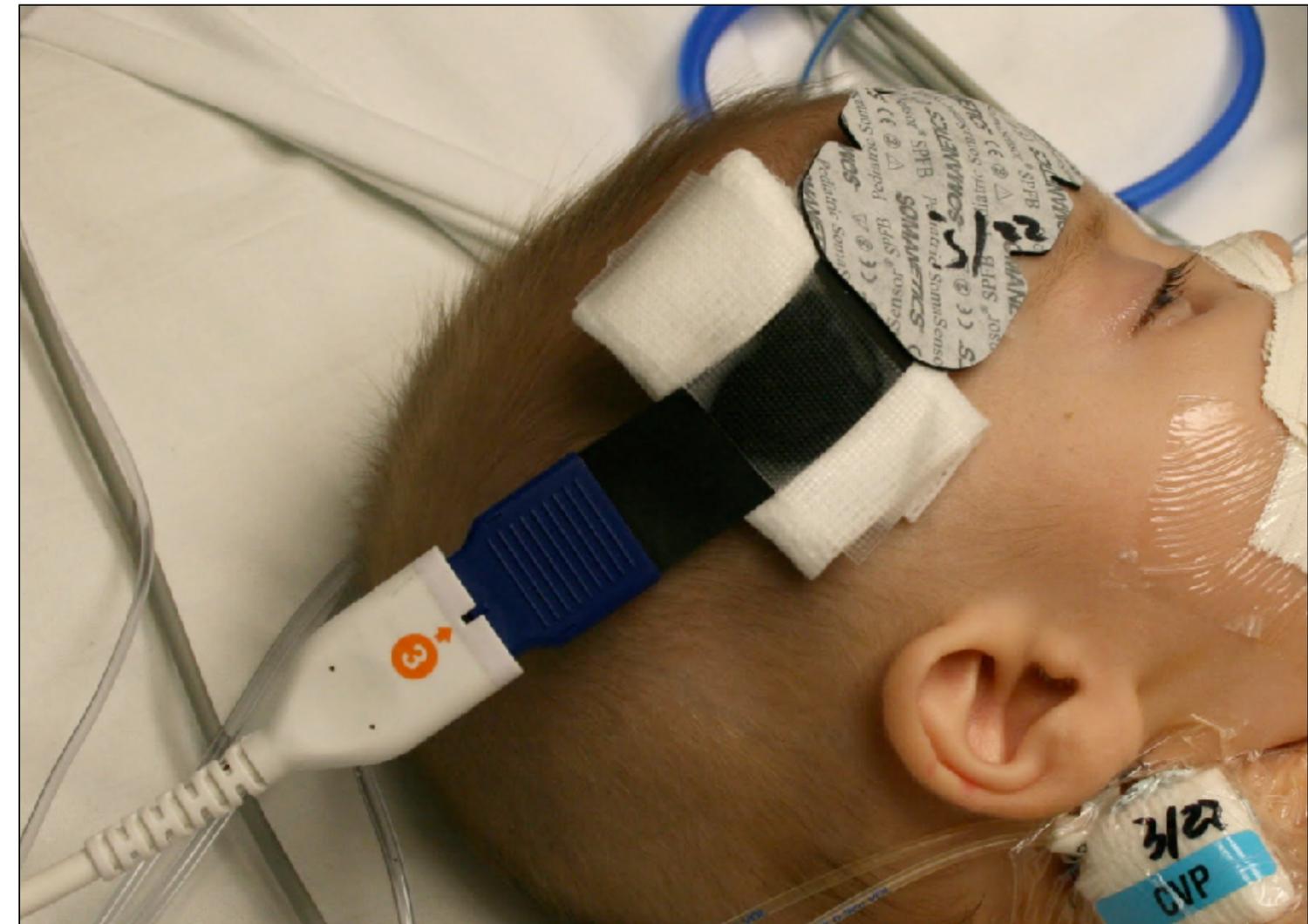
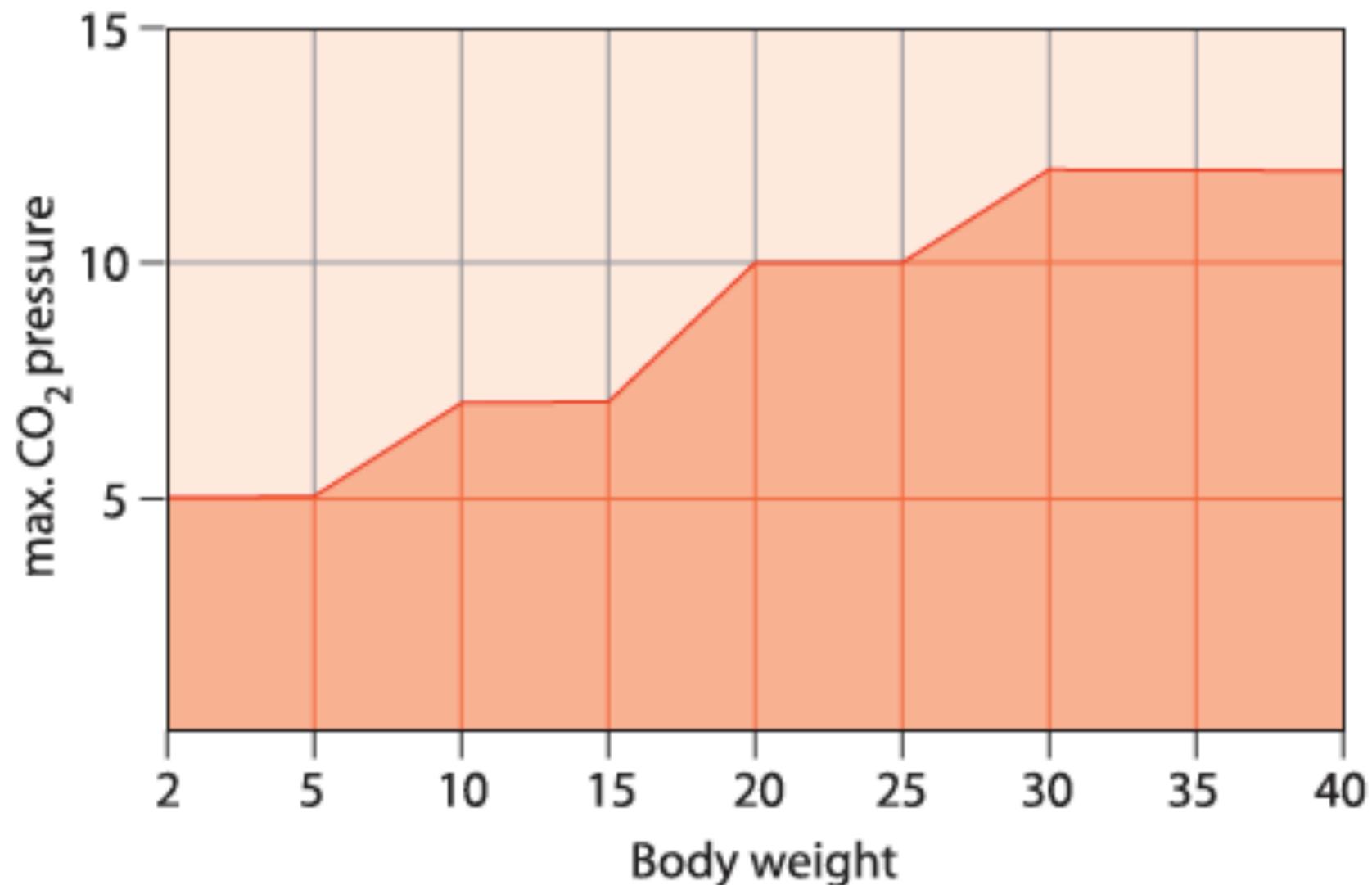
Alteraciones ritmo cardiaco

Alteraciones del flujo cerebral

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Neonatal brain oxygenation during thoracoscopic correction of esophageal atresia

Stefaan H. A. J. Tytgat¹ · Maud Y. A. van Herwaarden¹ · Lisanne J. Stolwijk^{1,2} · Kristin Keunen² · Manon J. N. L. Benders² · Jurgen C. de Graaff³ · Dan M. J. Milstein⁴ · David C. van der Zee¹ · Petra M. A. Lemmers²



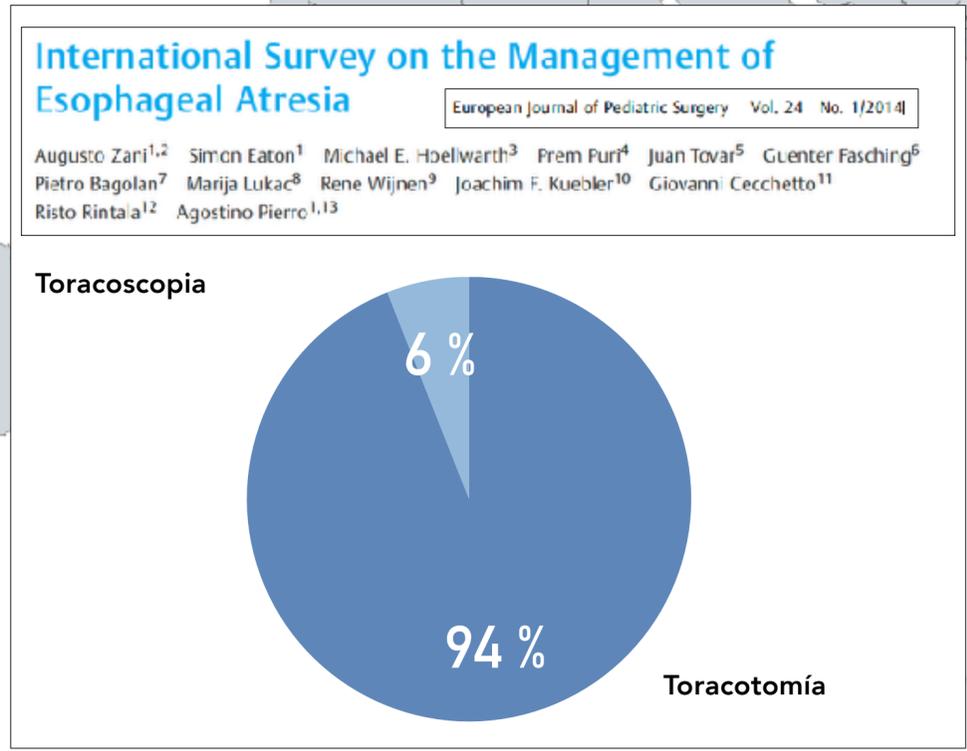
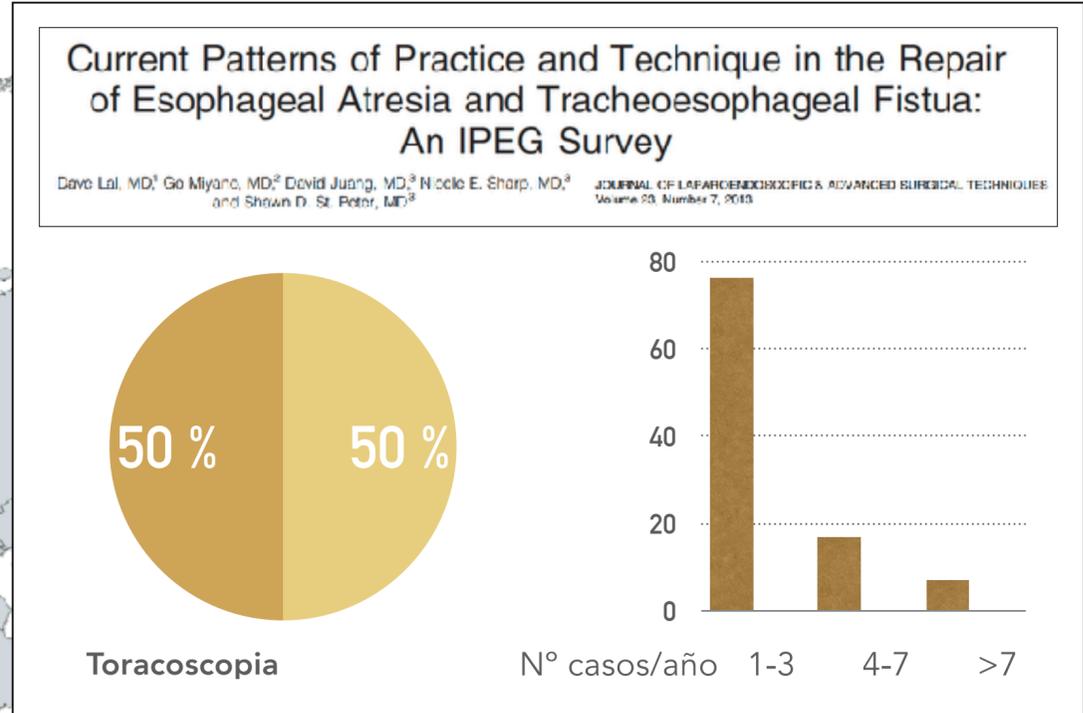
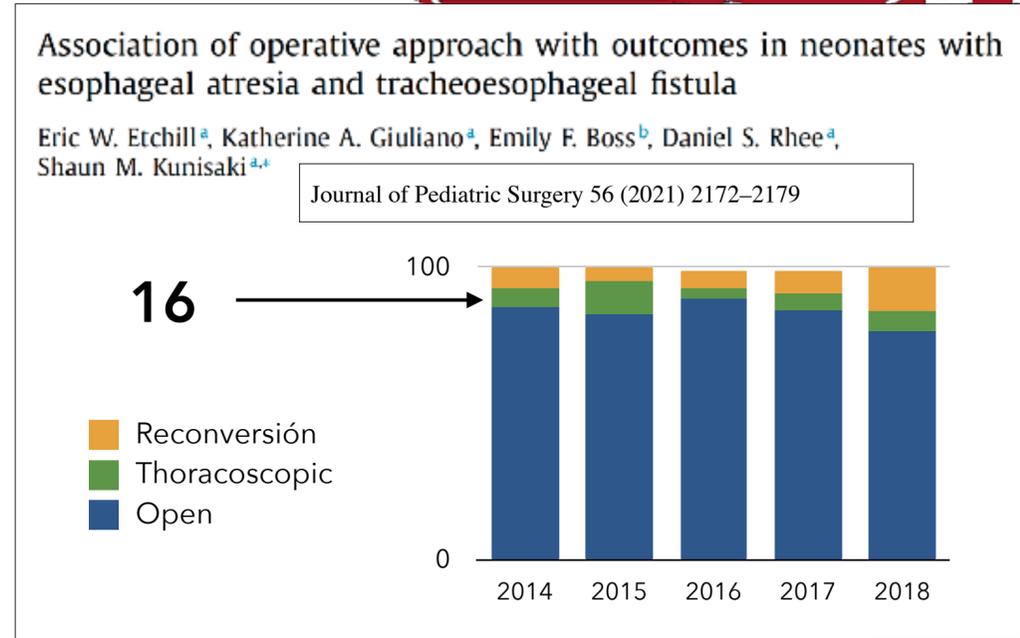
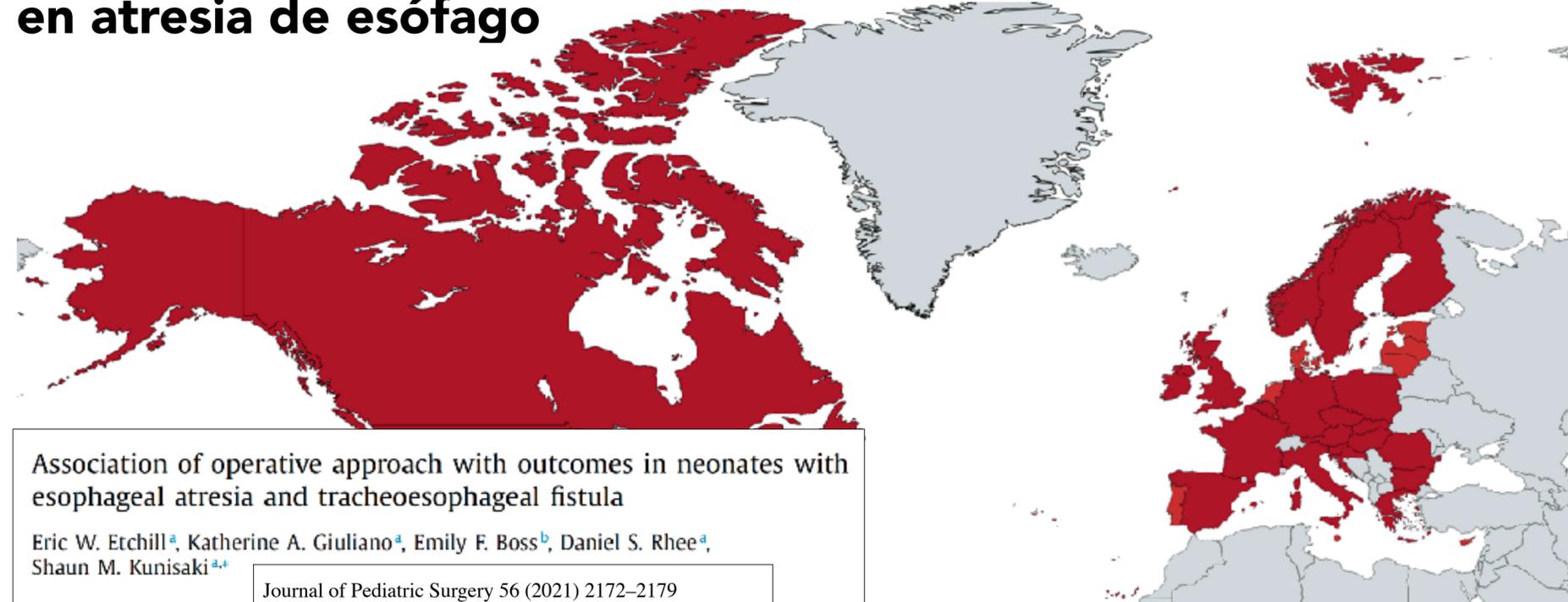
NIRS

Near InfraRed Spectrophotometry

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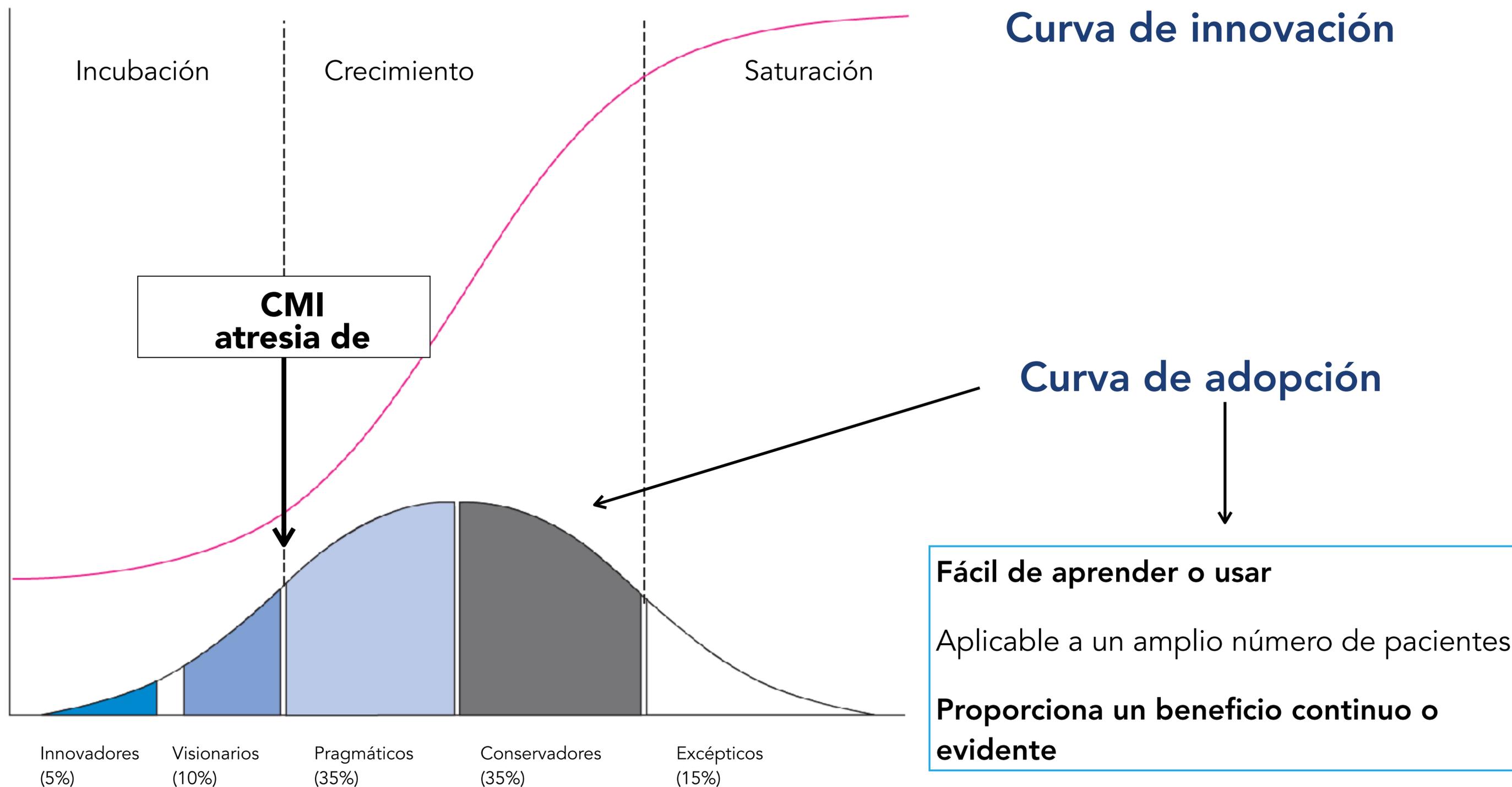
Tema 2. Tratamiento toracoscópico de la atresia del esófago

CMI en atresia de esófago



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Tema 2. Tratamiento toracoscópico de la atresia del esófago

Selección de pacientes

Thoracoscopic Repair of Oesophageal Atresia: Results of a Selective Approach

European Journal of Pediatric Surgery Vol. 23 No. 1/2013

Carmen Dingemann¹ Christoph Zoeller¹ Benno Ure¹

Table 3 Selection criteria for thoracoscopic EA/TEF repair in routine pediatric surgery suggested by our workgroup¹⁰

1	Short-gap esophageal atresia
2	Birthweight \geq 2,000 g
3	Cardiorespiratory stability/no major cardiac or pulmonary malformation (such as double outlet right ventricle, severe bronchopulmonary dysplasia)
4	\leq one major associated malformation (such as duodenal or anal atresia)

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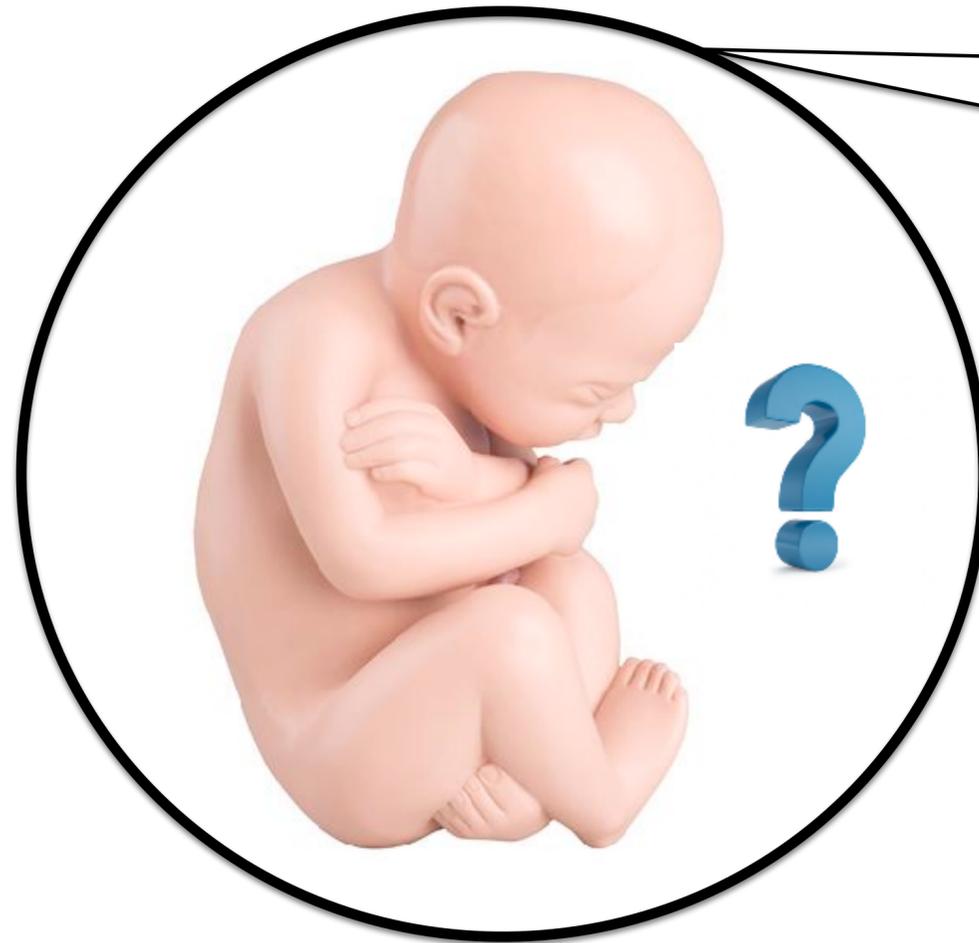
Selección de pacientes

Thoracoscopic esophageal atresia repair: learning curve analysis using Clavien-Dindo surgical complication classification

V. Ibáñez Pradas, M. Couselo Jerez, M.E. Carazo Palacios

Pediatric Surgery Department. La Fe Polytechnic and University Hospital. Valencia (Spain).

Cir Pediatr. 2020; 33: 166-171



Peso < 1700 g

Necesidad de drogas vasoactivas

Soporte ventilatorio

Malformaciones asociadas (MAR)

Cardiopatía mayor

Exclusió

Tema 2. Tratamiento toracoscópico de la atresia del esófago

Selección de pacientes

Is thoracoscopic esophageal atresia repair safe in the presence of cardiac anomalies?

Journal of Pediatric Surgery 55 (2020) 1511–1515

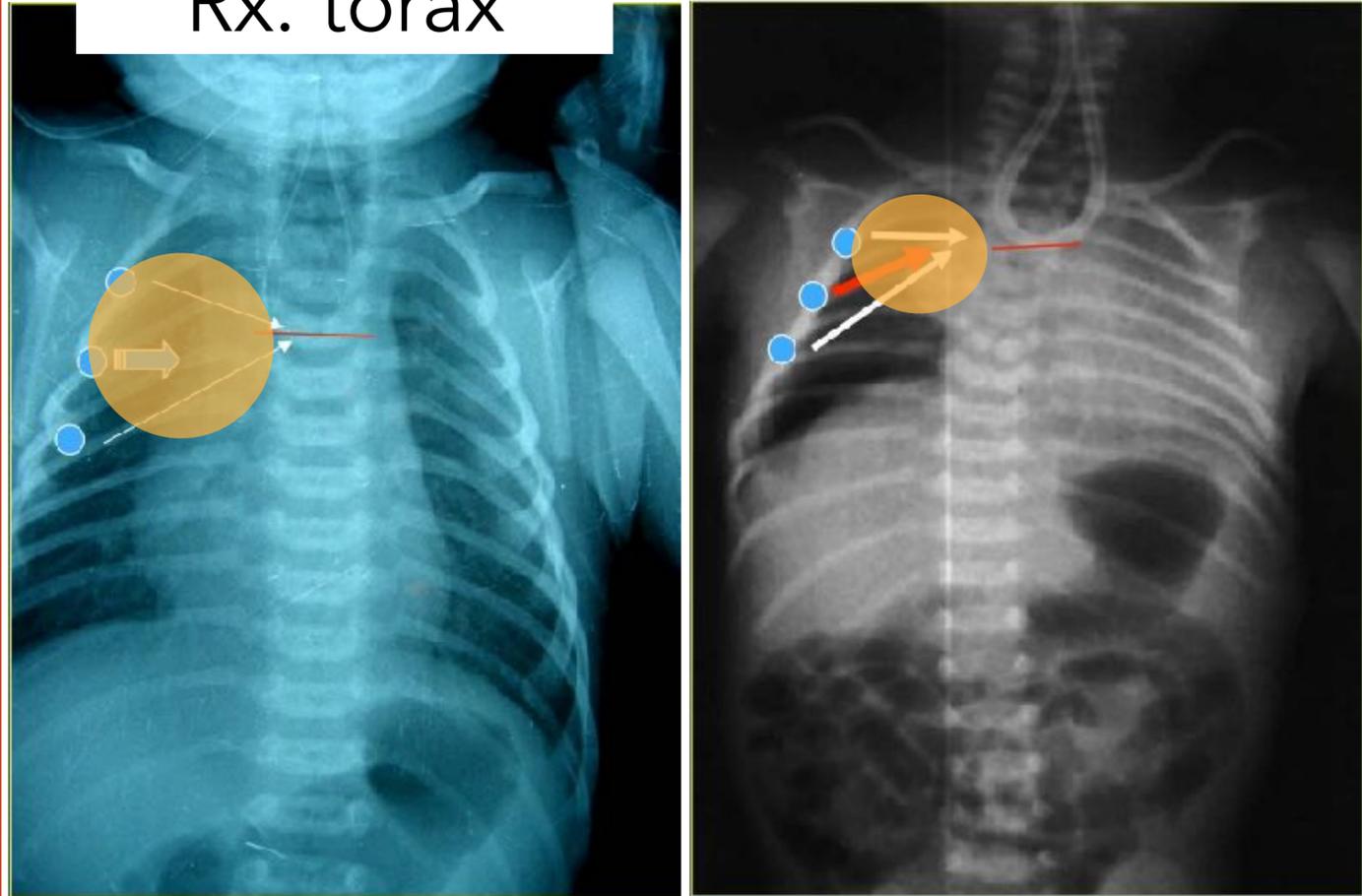
Erika Fernandes ^a, Amanda Kusel ^a, Stephen Evans ^a, James Houghton ^b, James K. Hamill ^{a,*}

	Thoracoscopic <i>n</i> = 25		Open <i>n</i> = 24	
	CHD <i>n</i> = 9	No CHD <i>n</i> = 16	CHD <i>n</i> = 11	No CHD <i>n</i> = 13
Anorectal	3 (33%)	2 (12%)	1 (9%)	0
Duodenal atresia	0	1 (6%)	1 (9%)	1 (8%)
Genetic syndrome ^a	1 (11%)	1 (6%)	2 (18%)	1 (8%)
Limb	1 (11%)	2 (12%)	0	0
Renal	2 (22%)	2 (12%)	0	2 (15%)
Vertebral	5 (55%)	5 (31%)	4 (36%)	3 (23%)
Vascular ^b	9 (100%)	2 (12%)	11 (100%)	1 (8%)
Complete atrioventricular canal	2 (22%)	–	1 (9%)	–
Tetralogy of Fallot	1 (11%)	–	1 (9%)	–
Ventricular septal defect	5 (56%)	–	3 (27%)	–
Atrial septal defect	1 (11%)	–	8 (73%)	–
Coarctation of the aorta	1 (11%)	–	0	–
TGA	0	–	1 (9%)	–
Valvular (other)	3 (33%)	–	1 (9%)	–

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Estudio preoperatorio

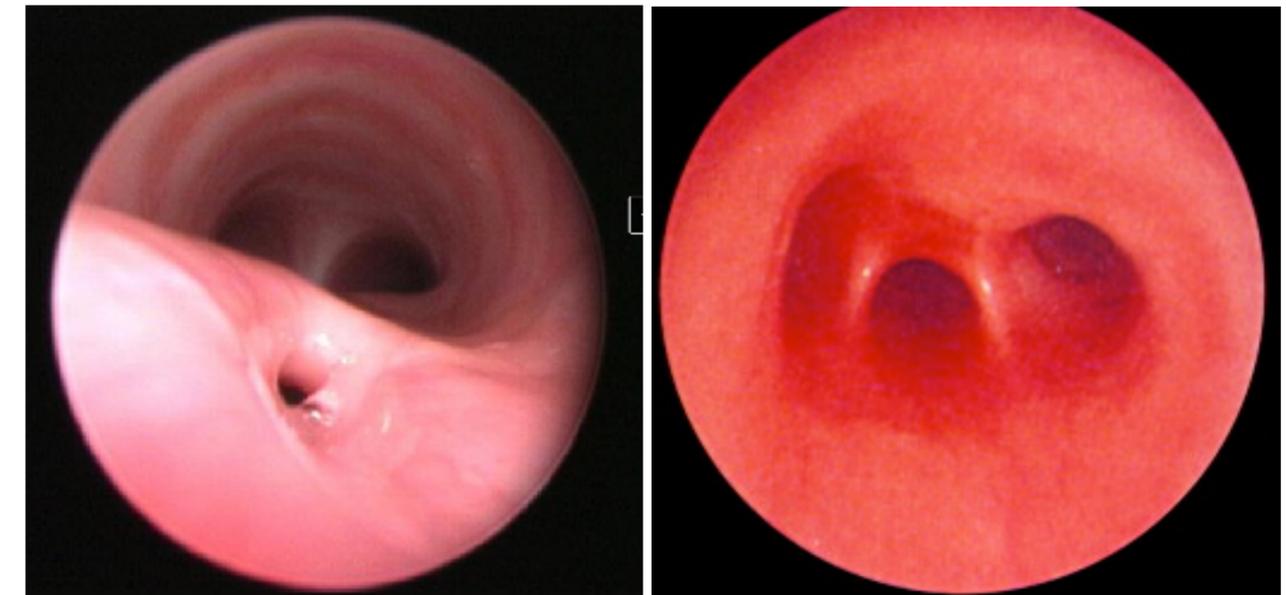
Rx. tórax



esófago superior bajo

esófago superior alto

Broncoscopia



fístula alta

fístula baja



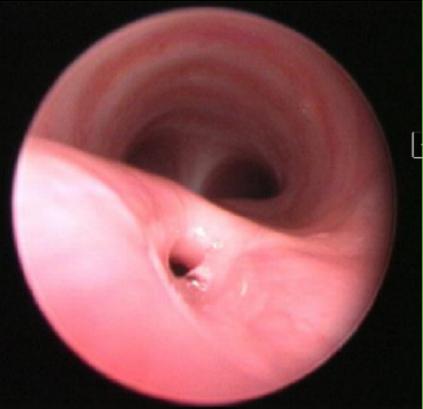
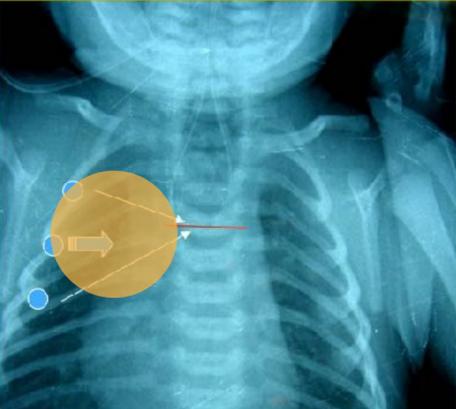
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I

esófago superior bajo fístula alta

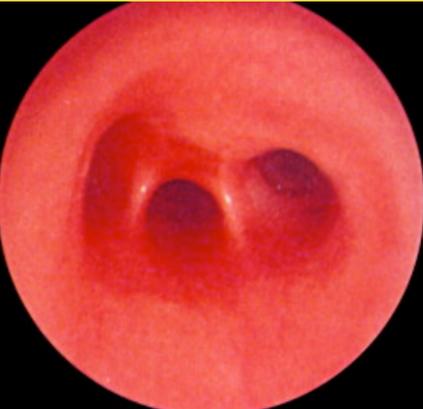
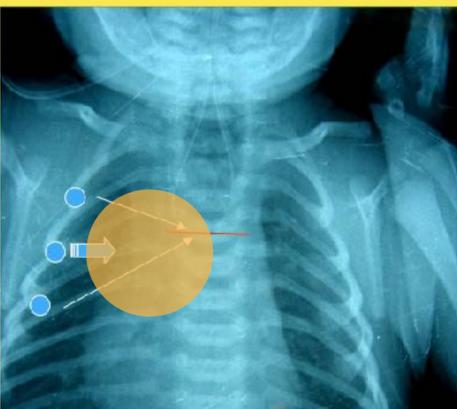
Favorable
Anastomosis sin tensión
Mejores resultados



II

esófago superior bajo fístula baja

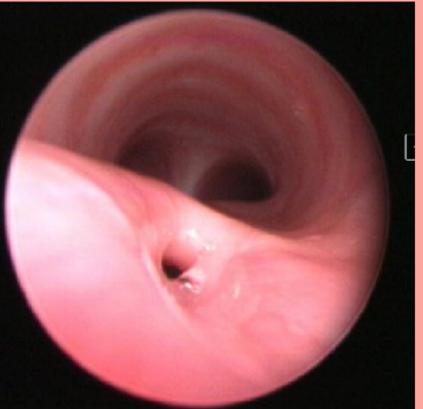
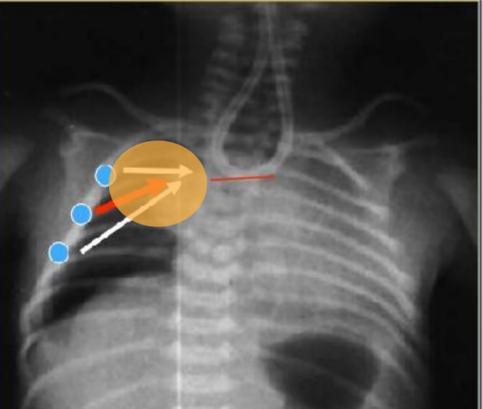
Menos favorable
Anastomosis adecuada movilizándolo inferior
Buenos resultados



III

esófago superior alto fístula alta

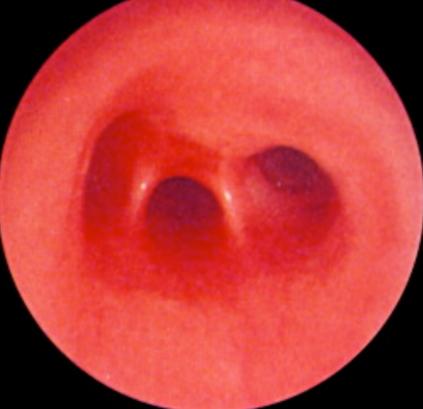
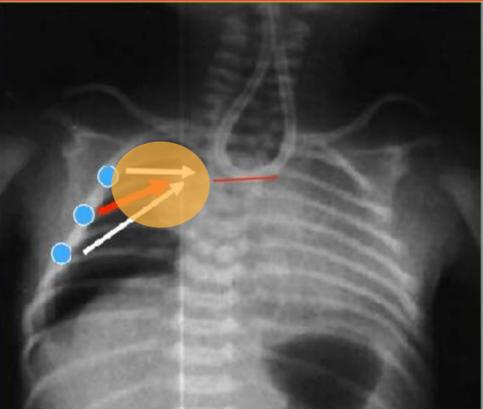
Cirugía complicada
Anastomosis técnicamente difícil con mayor tensión
Mayor posibilidad de complicaciones



IV

esófago superior alto fístula baja

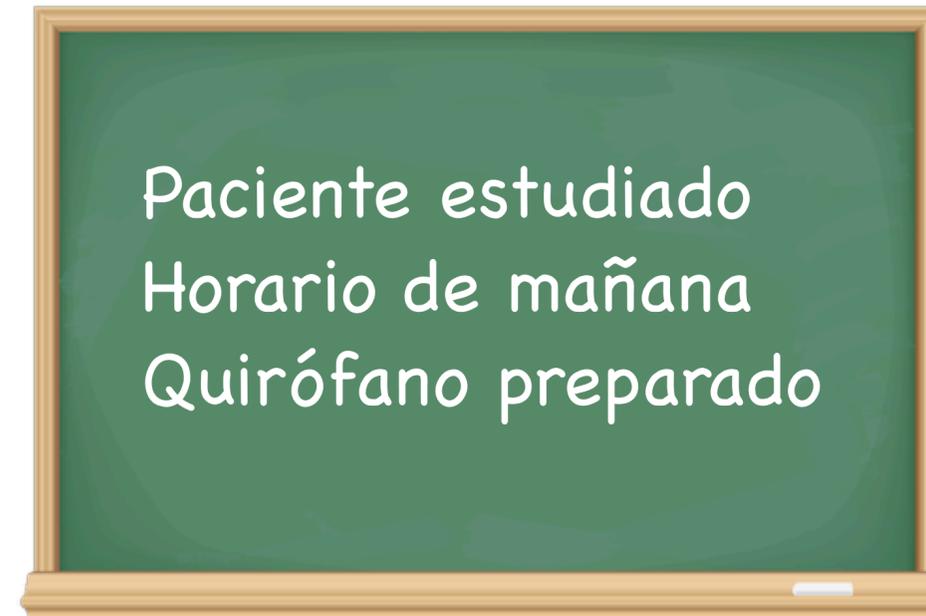
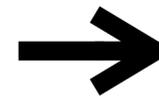
LONG GAP
Extremadamente difícil
Anastomosis con gran tensión
Valorar cirugía diferida



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Urgente



Cirugía programable



Equipo

Thoracoscopic surgery for esophageal atresia

George W. Holcomb III¹

Pediatr Surg Int (2017) 33:475–481

Therefore, for this reason, we rarely perform these operations on the weekend or holidays so that we have a full team available to help manage the baby.

Tema 2. Tratamiento toracoscópico de la atresia del esófago

Management of neonates with oesophageal atresia and tracheoesophageal fistula [Early Human Development 174](#)

Natalie Durkin a, Paolo De Coppi a,b,* a

Stem Cells and Regenerative Medicine Section, Developmental Biology and Cancer, Great Ormond Street Institute of Child Health, University College London, London,

Timing of operation is also important with a recent shift in attitude. Most centres now agree that **a stable neonate with OA should be operated on a semi-elective basis** during working hours in the working week.

[ERNICA Consensus Conference on the Management of Patients with Esophageal Atresia and Tracheoesophageal Fistula: Diagnostics, Preoperative, Operative, and Postoperative Management](#)

Carmen Dingemann¹ Simon Eaton² Gunnar Aksnes³ Pietro Bagolan⁴ Kate M. Cross⁵ Paolo De Coppi^{5,6} JoAnne Fruithof⁷ Piergiorgio Gamba⁸ Steffen Husby⁹ Antti Koivusalo¹⁰ Lars Rasmussen¹¹ Rony Sfeir¹² Graham Slater¹³ Jan F. Svensson¹⁴ David C. Van der Zee¹⁵ Lucas M. [European Journal of Pediatric Surgery Vol. 30 No.](#)

	Operative management	Consensus	%	Votes	Median (range)
15	A stable neonate with EA should preferably be operated during working hours during the week	+	94.4	17/18	9 (3–9)

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Colocación del equipo



Decúbito prono con elevación de 30°

Protección térmica

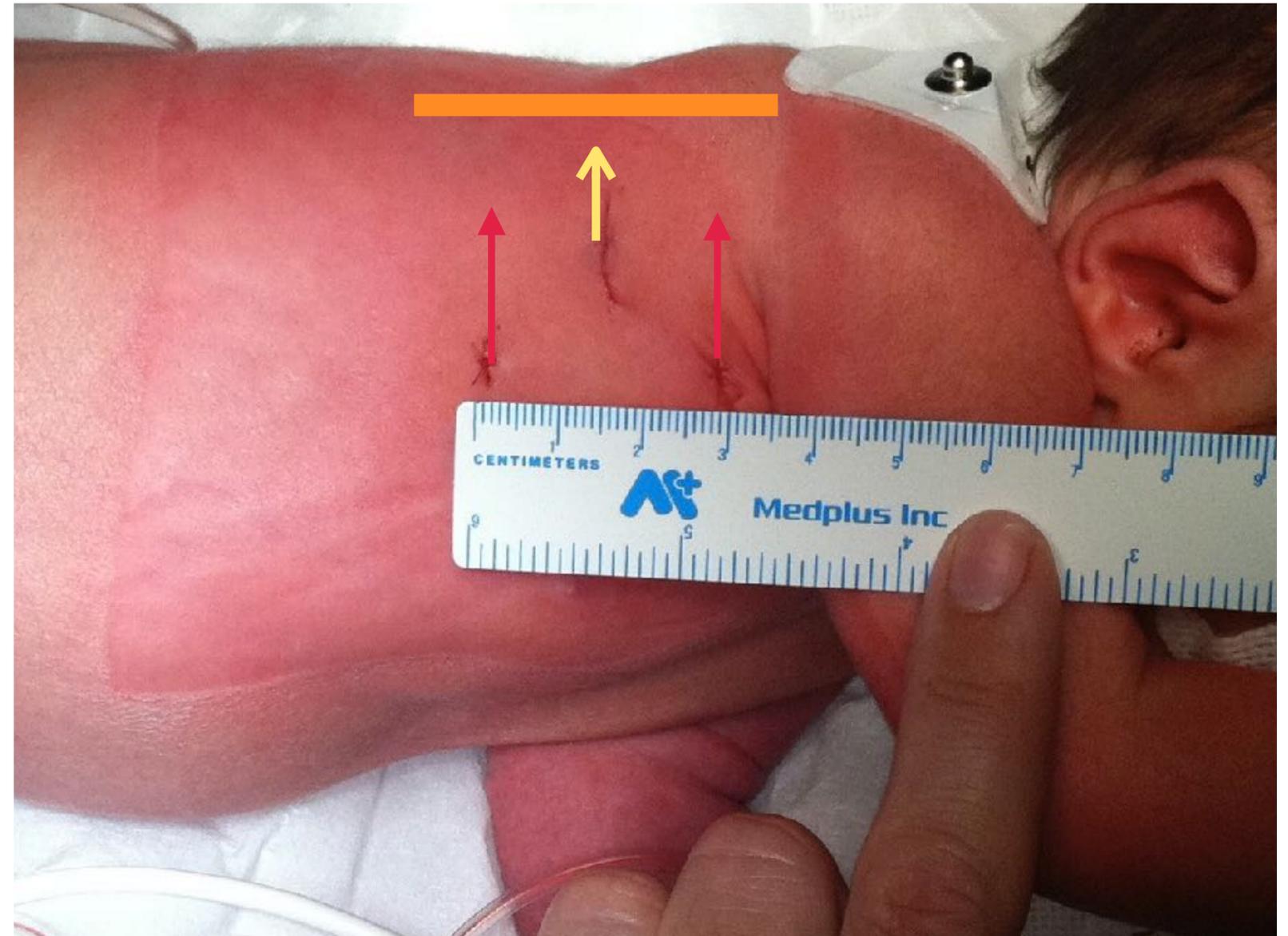
Protección de plexo braquial



Ergonomía
Orden

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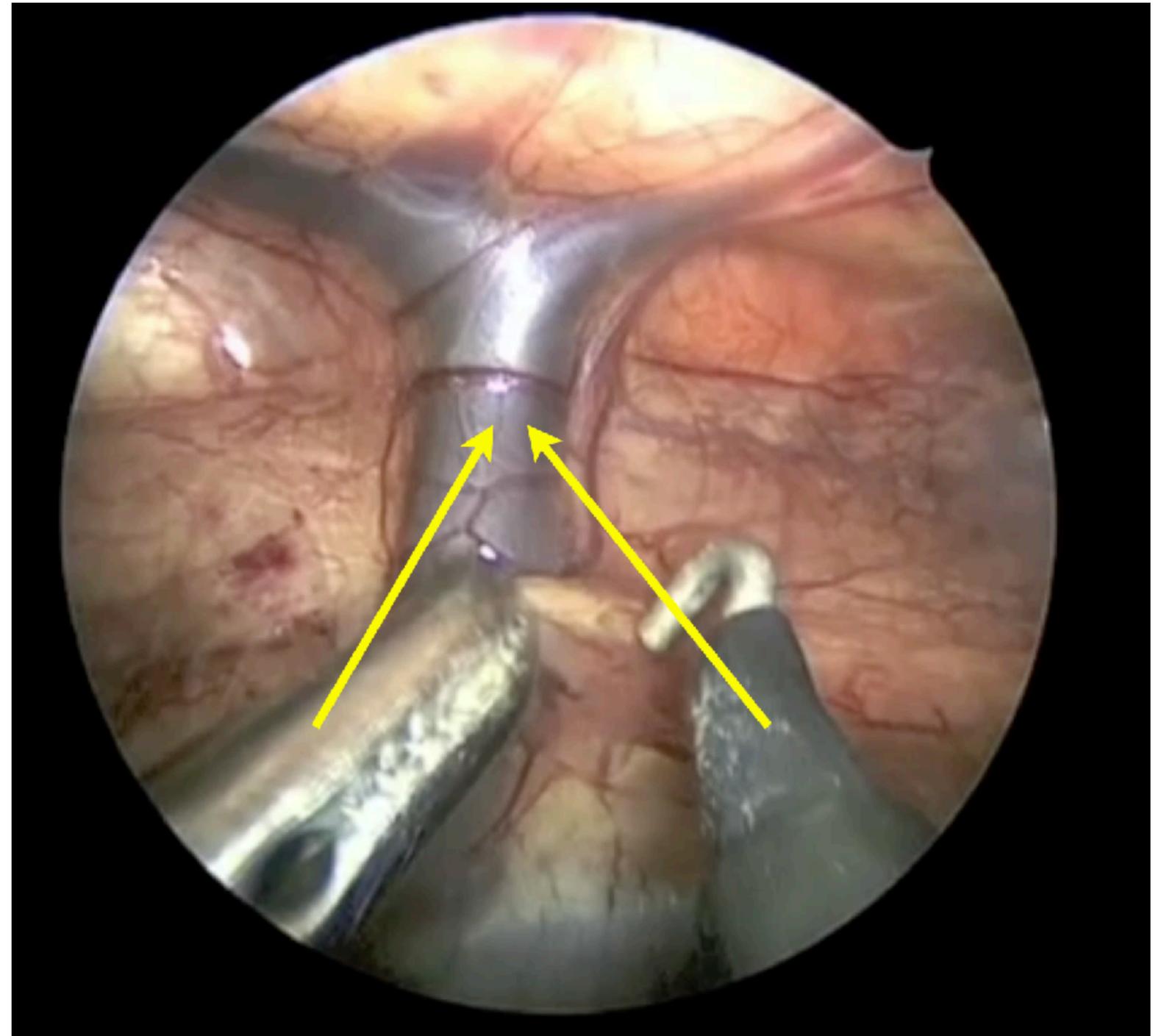
Colocación de los trocares



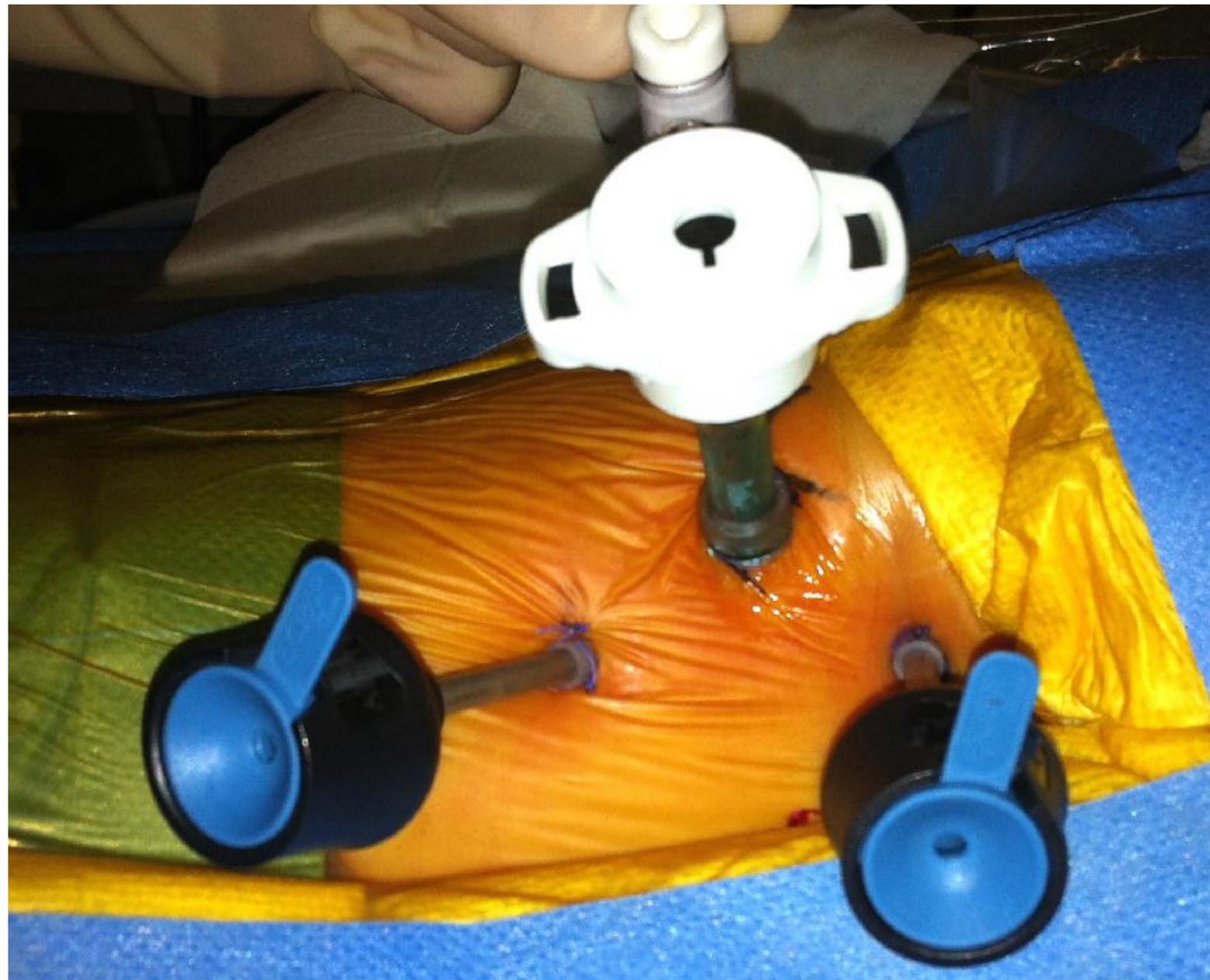
Bax

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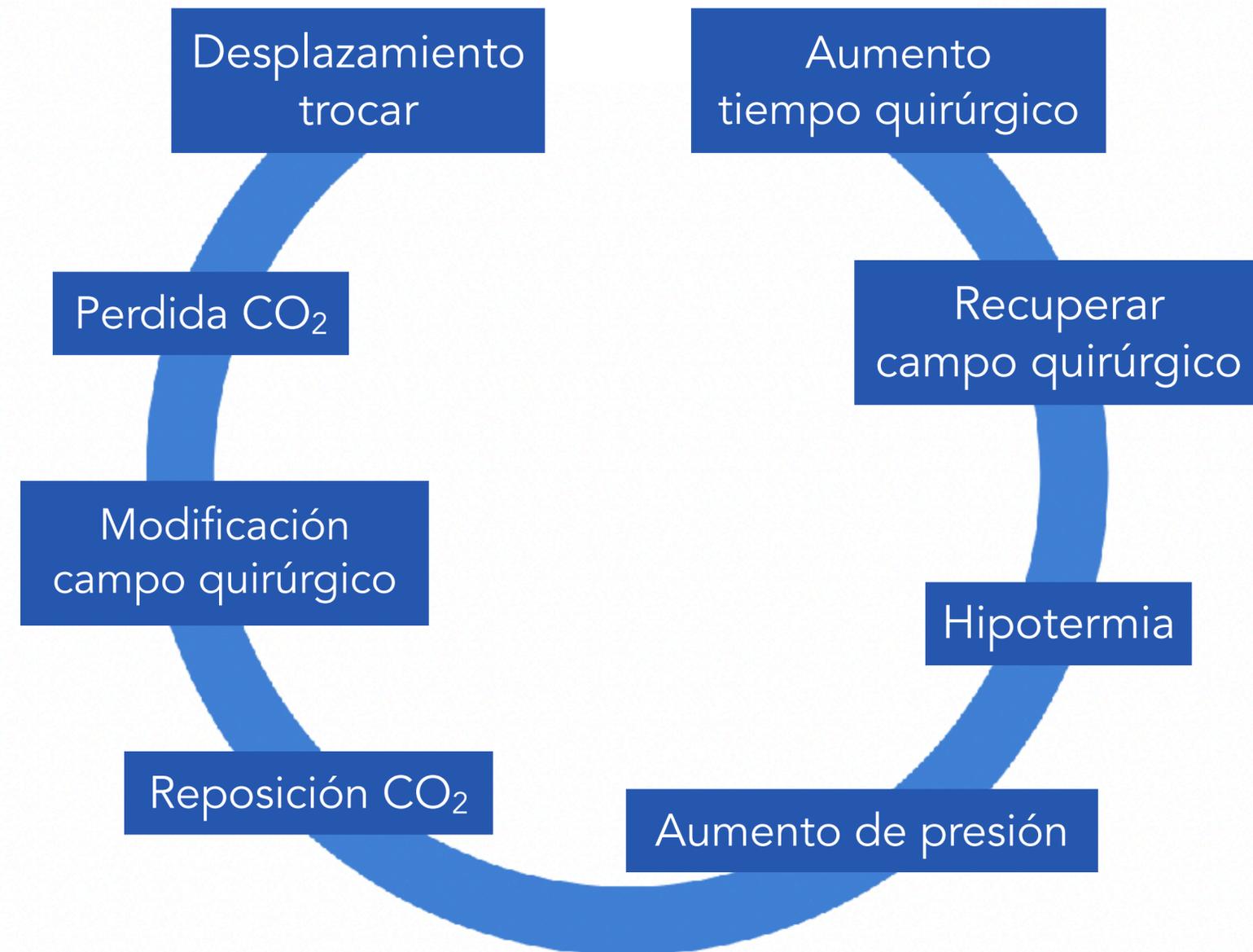
Colocación de los trocares



Tema 2. Tratamiento toracoscópico de la atresia del esófago



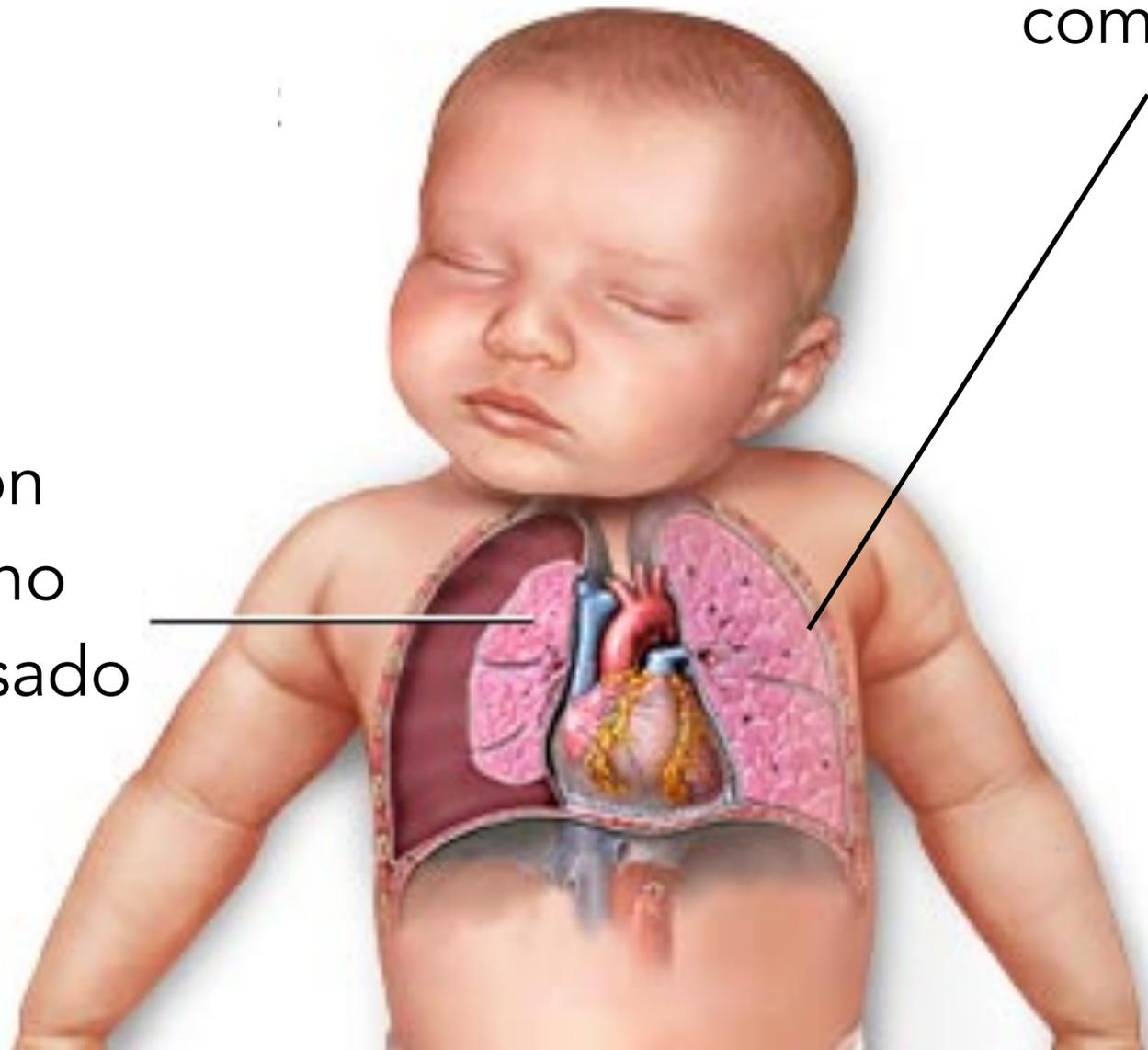
Fijación del campo quirúrgico
Sutura de trócares



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Ventilación bipulmonar

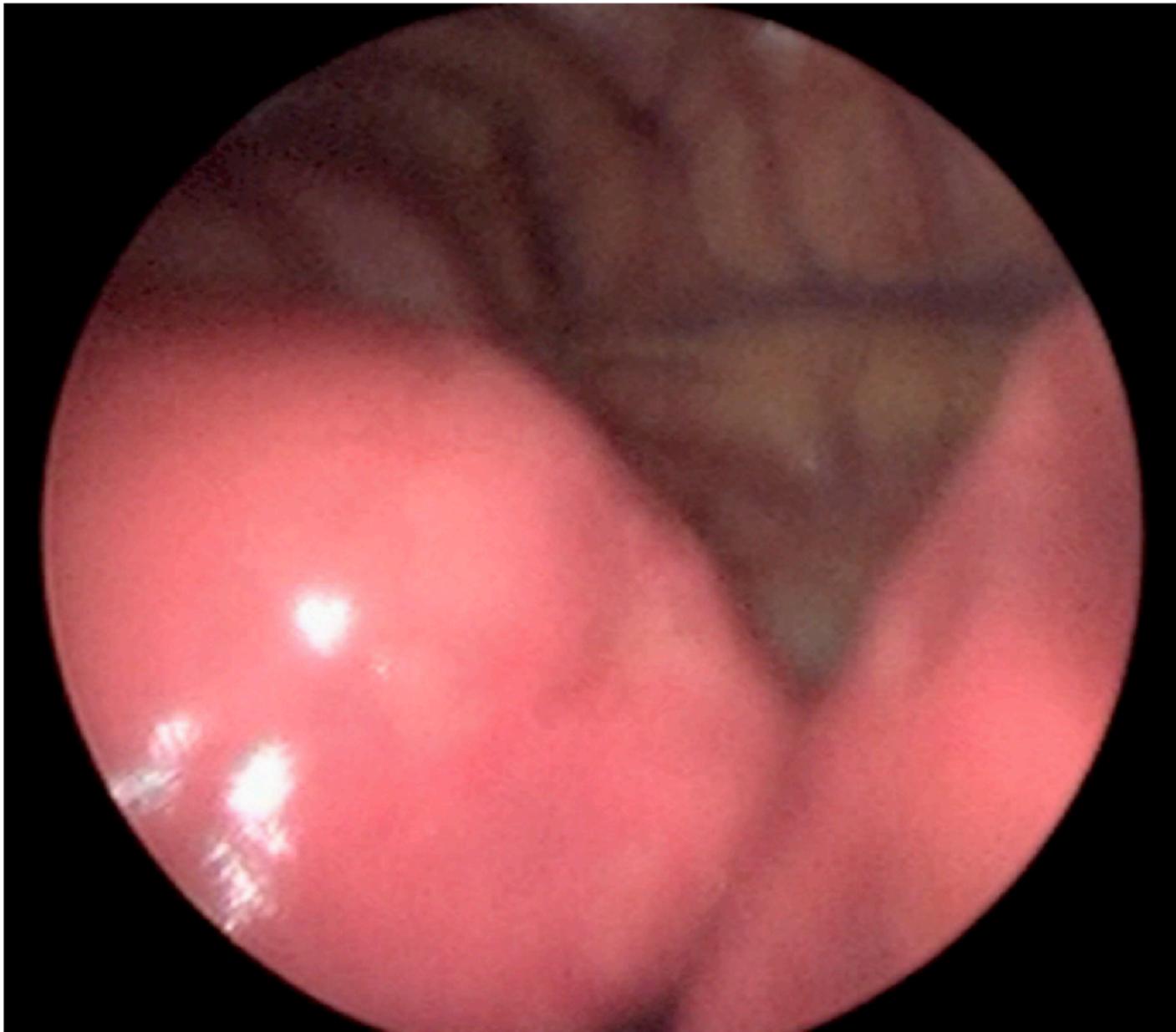
Pulmón
derecho
colapsado



Pulmón
derecho
comprimido



Tema 2. Tratamiento toracoscópico de la atresia del esófago



Presión: 4 - 5 mm mmHg
Flujo: 0.5-2 l/min

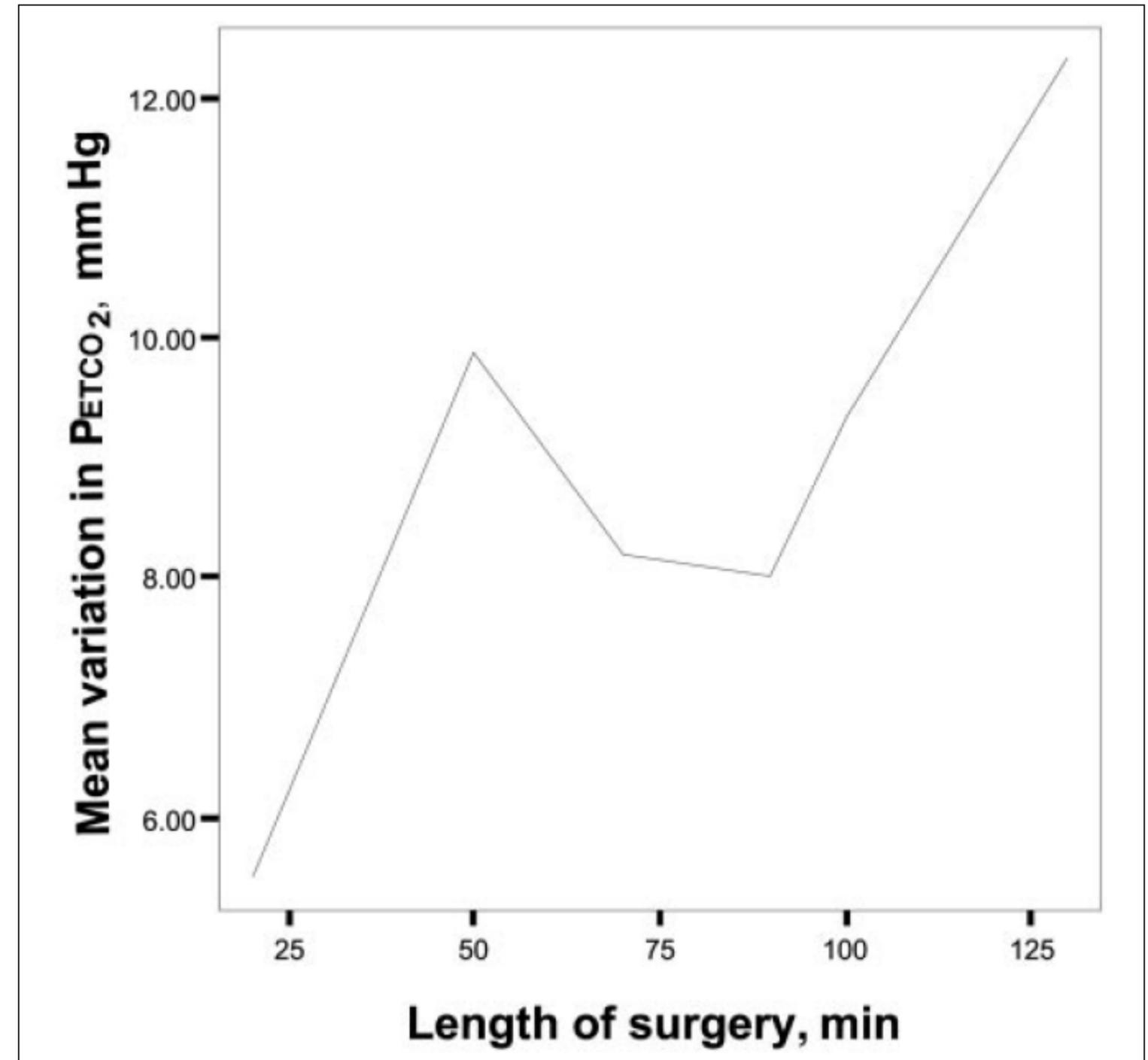


Fig 1. The mean variation in ETCO₂ depends on the insufflation pressure of pneumoperitoneum or pneumothorax ($P = .05$).

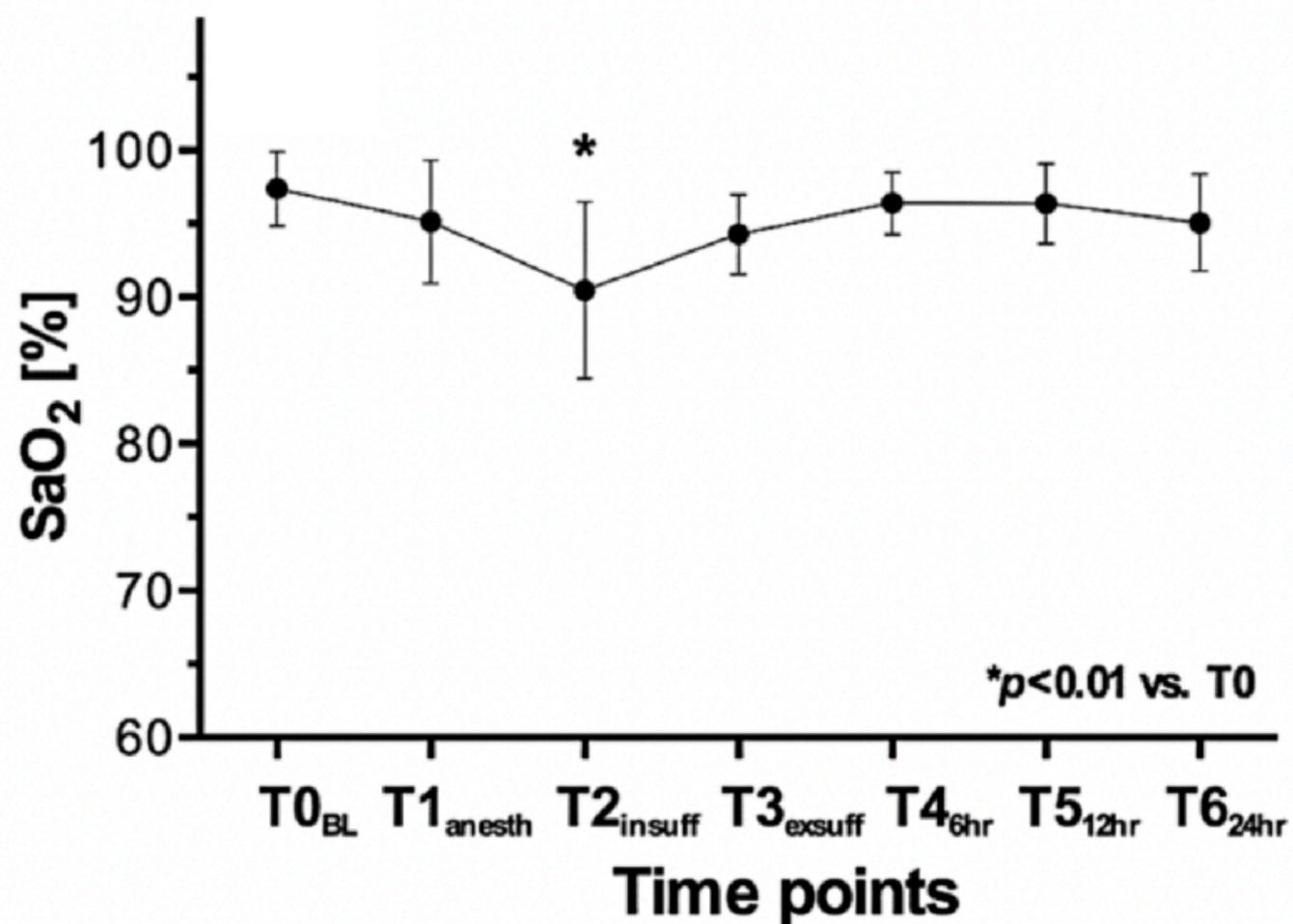
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Neonatal brain oxygenation during thoracoscopic correction of esophageal atresia

Surg Endosc (2016) 30:2811–2817

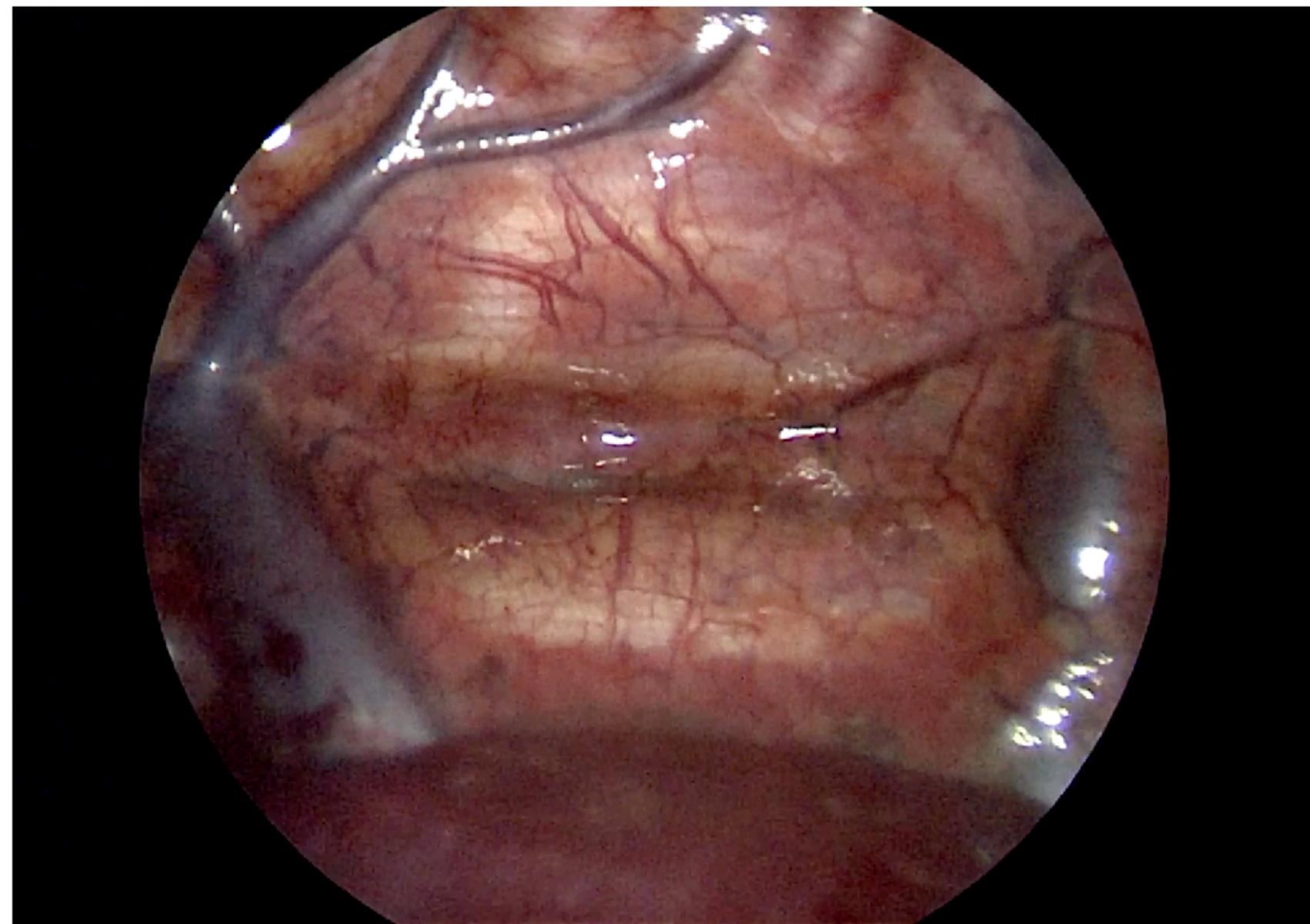
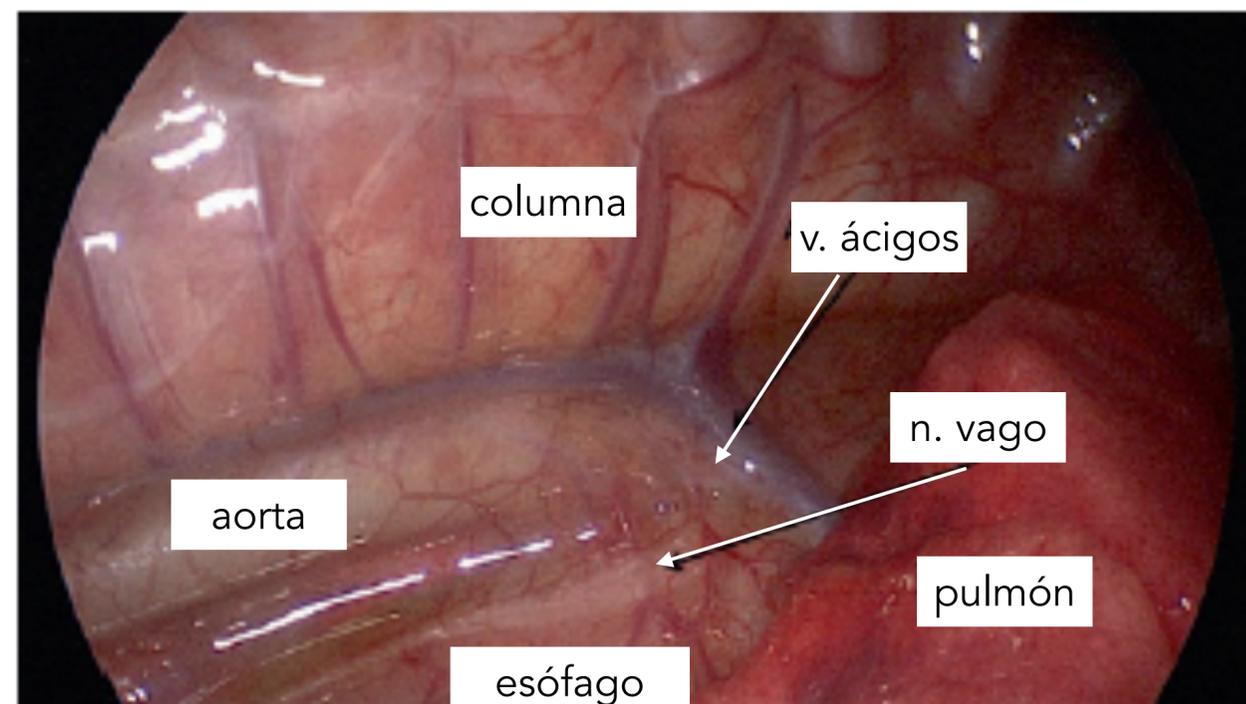
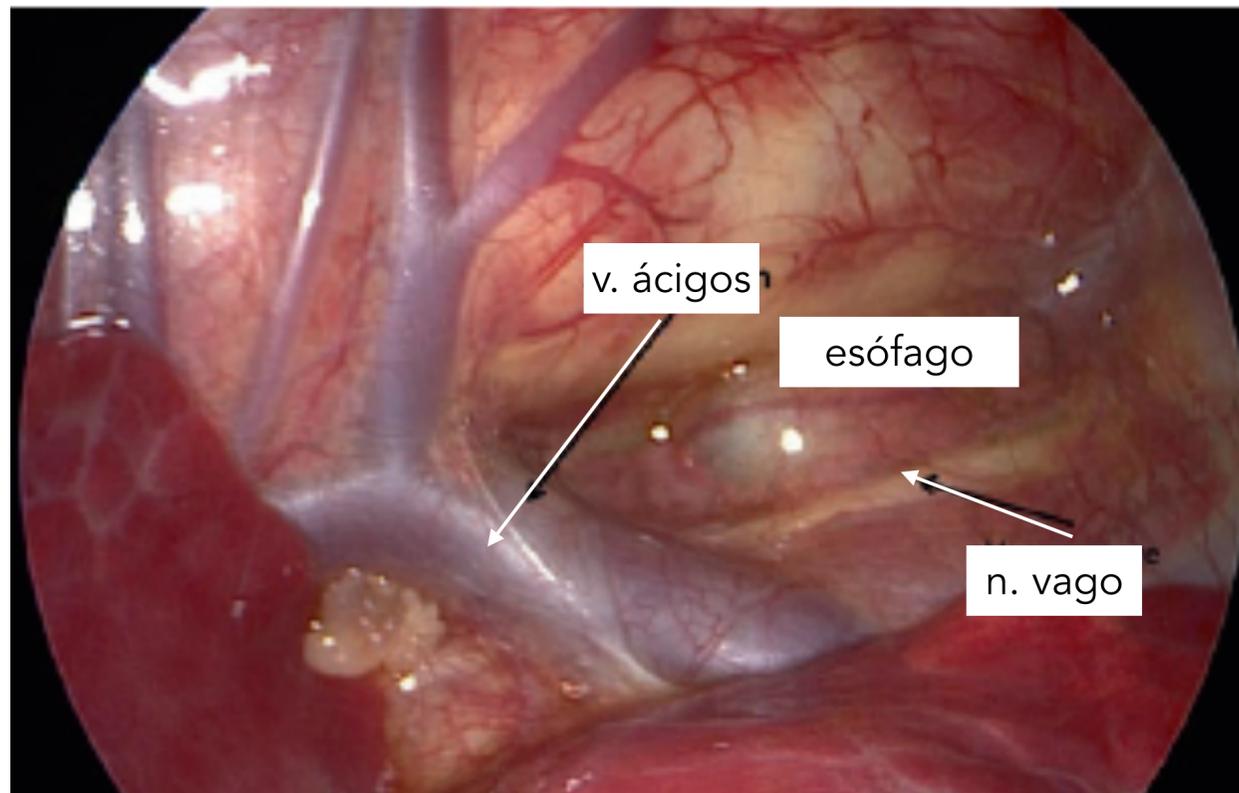
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NIRS en todo paciente



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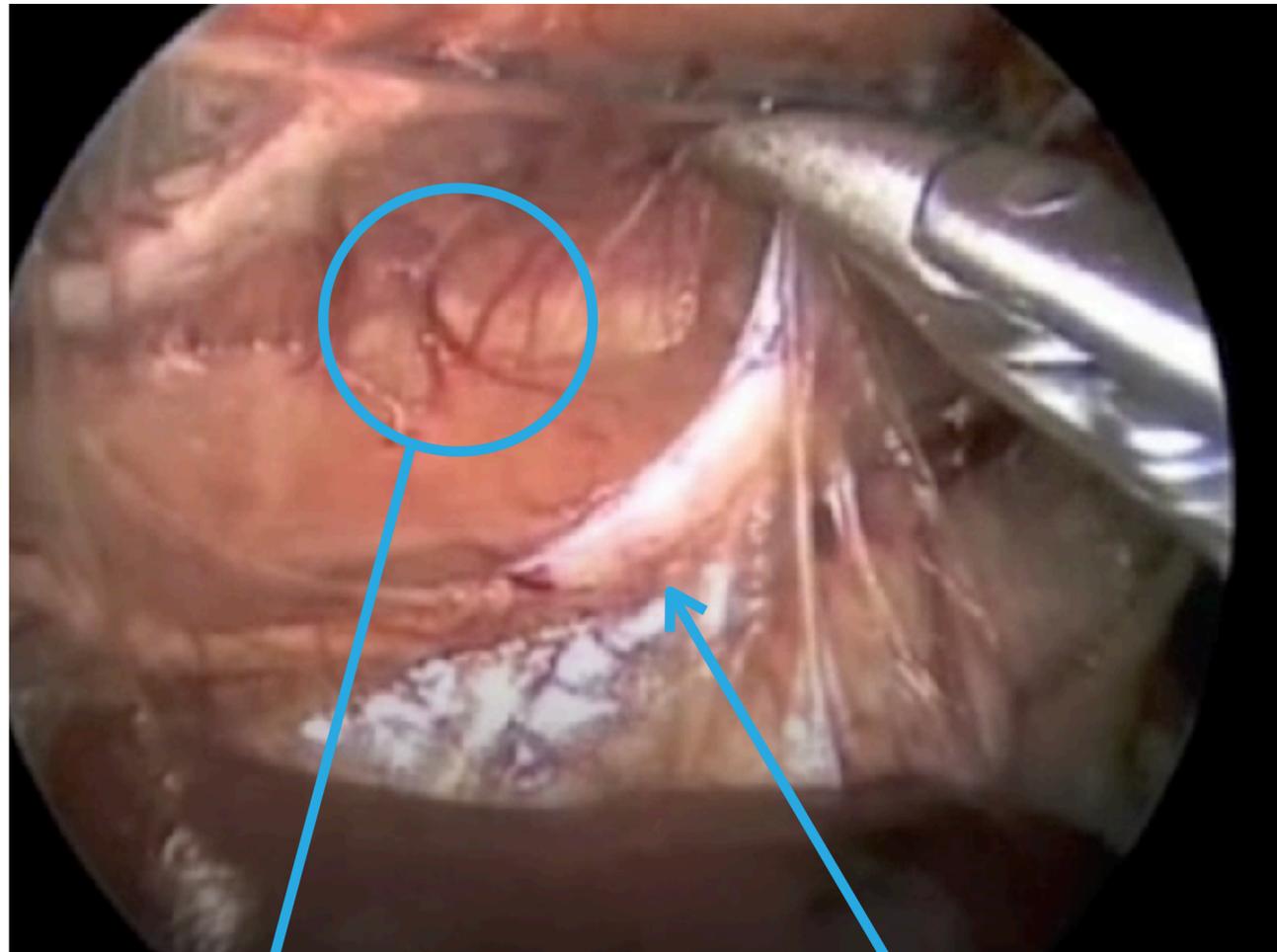
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Extrapleural / Transpleural

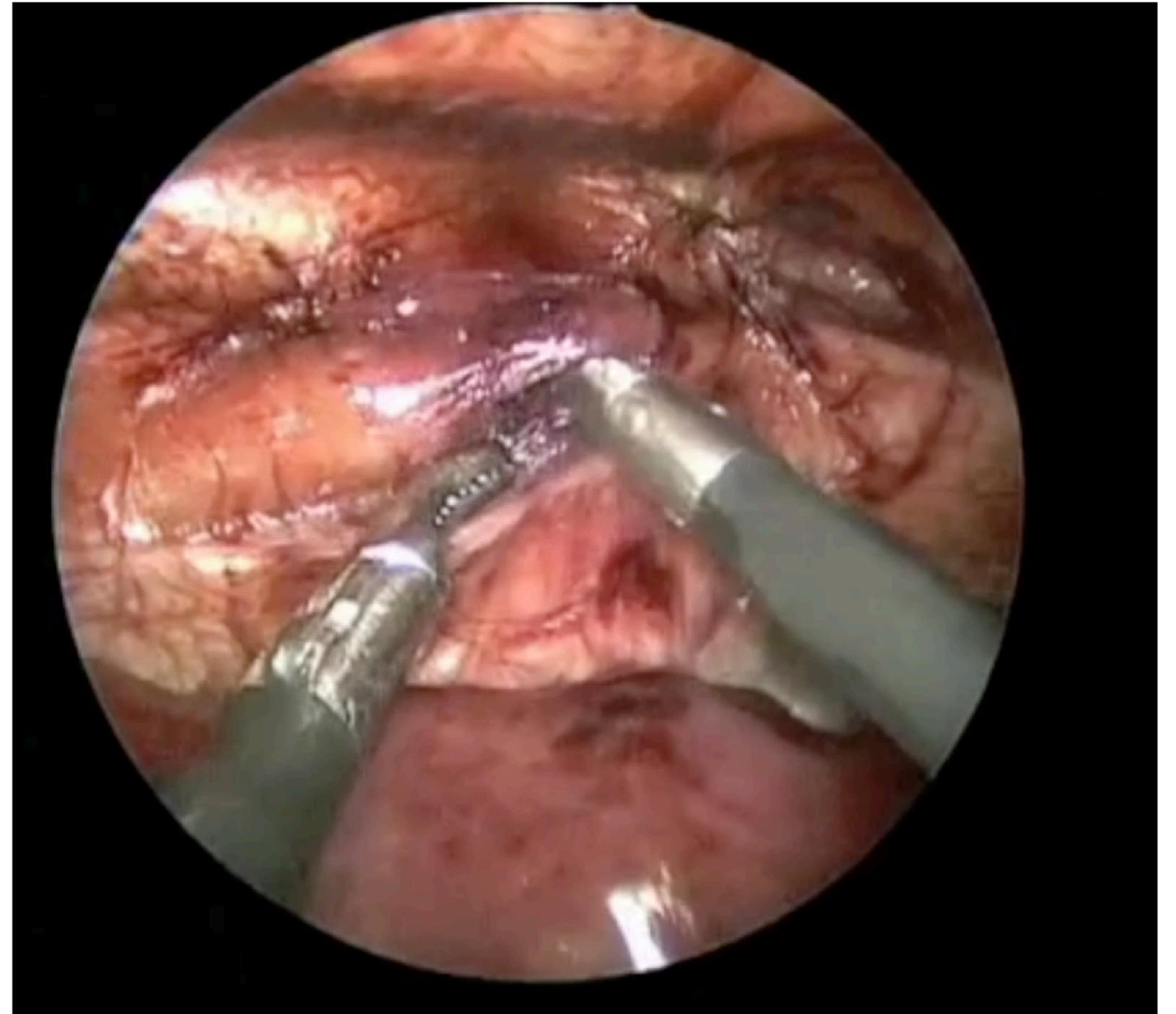
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Mínima disección

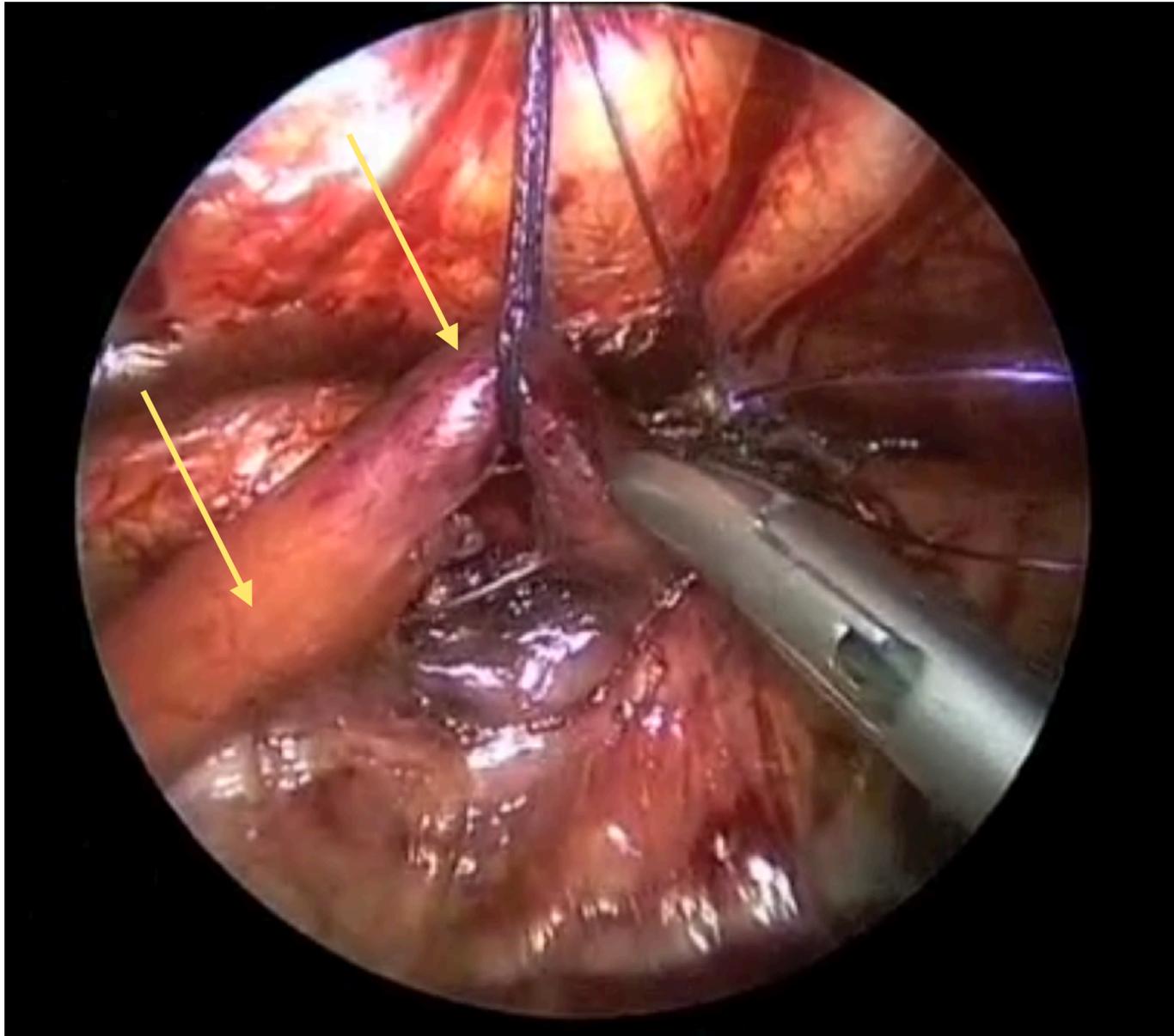


vascularización

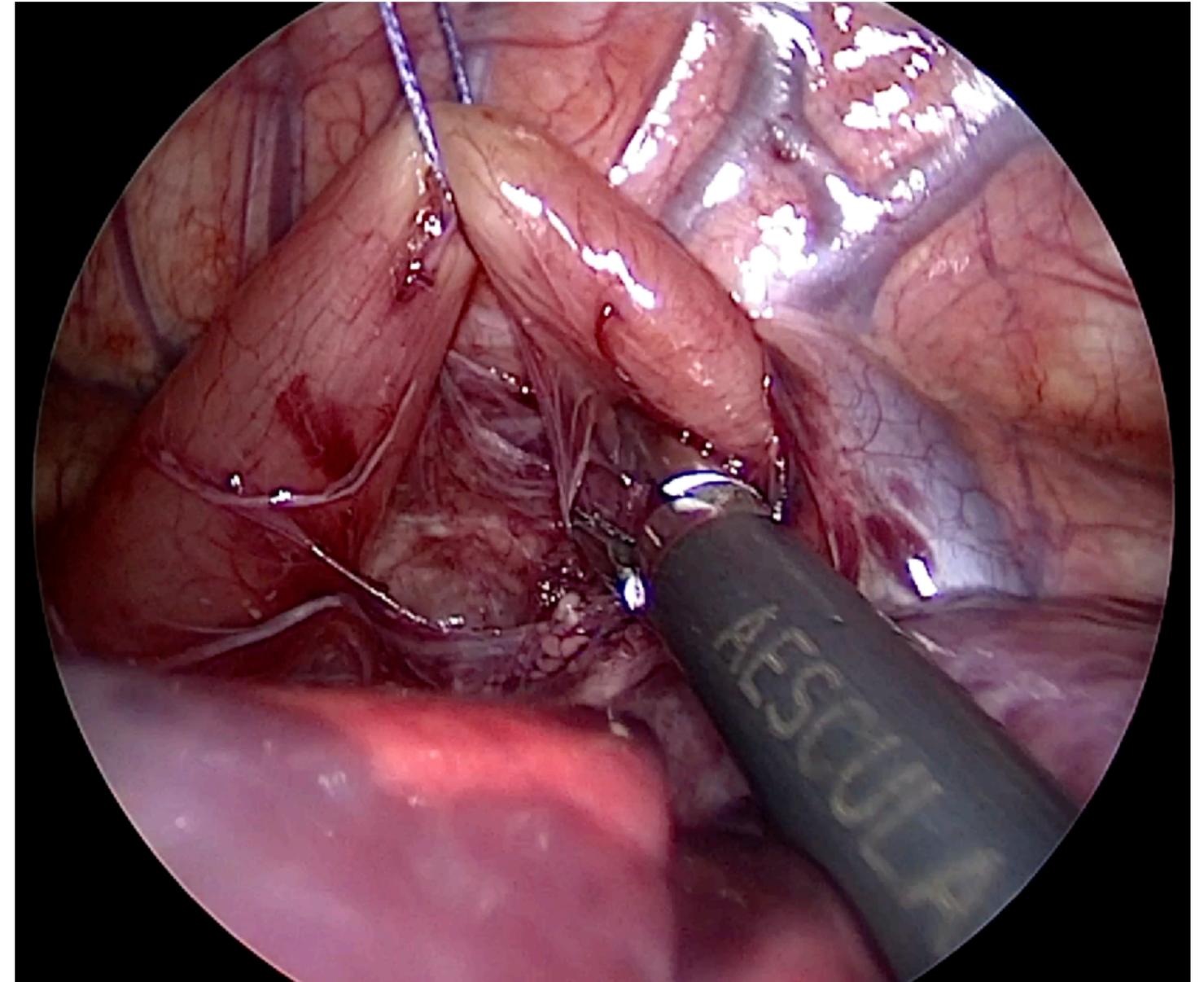
n. vago



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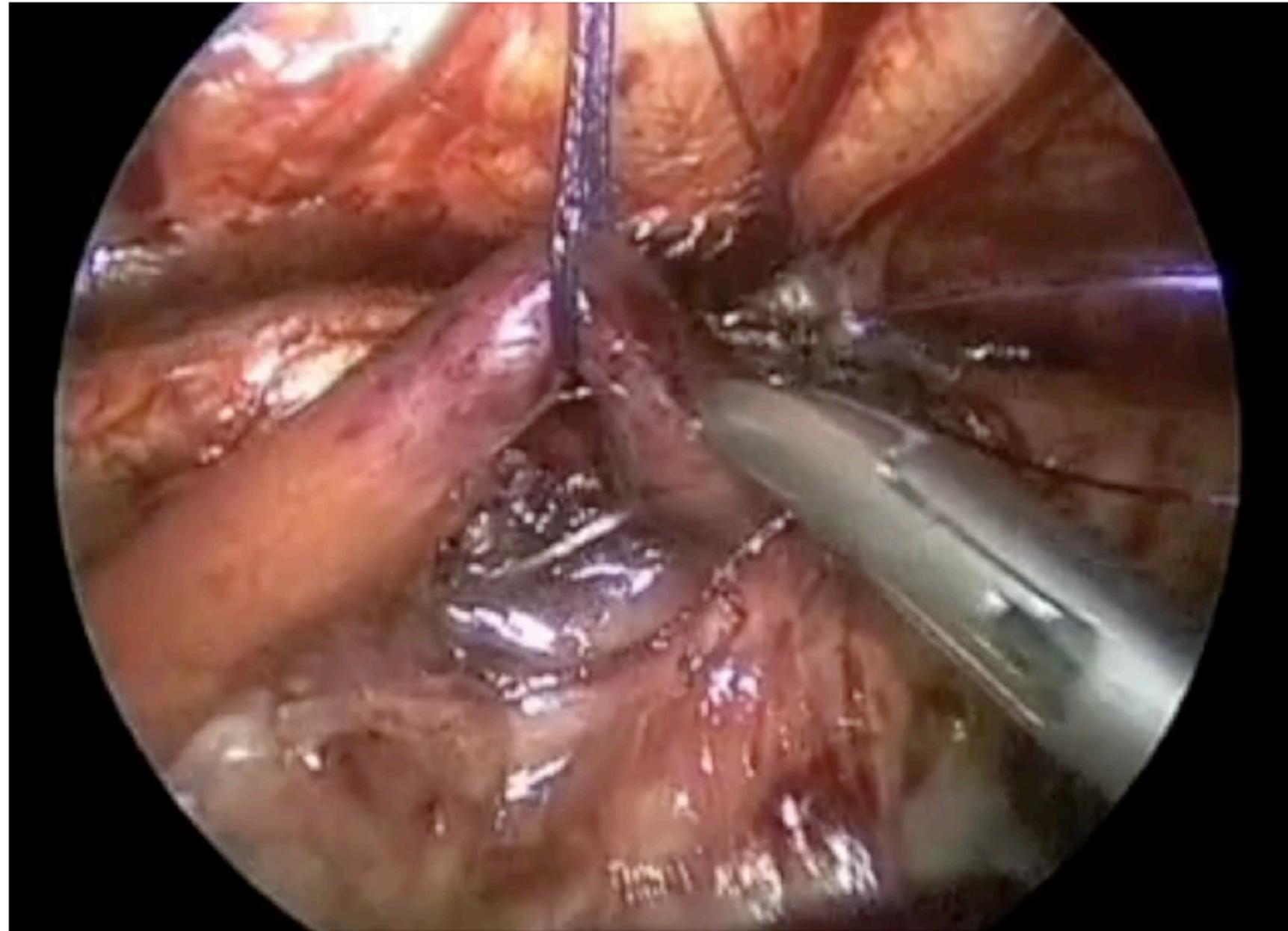


Sección ácigos
Dissección distal



Preservación ácigos
Dissección distal

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Cierre de la fístula

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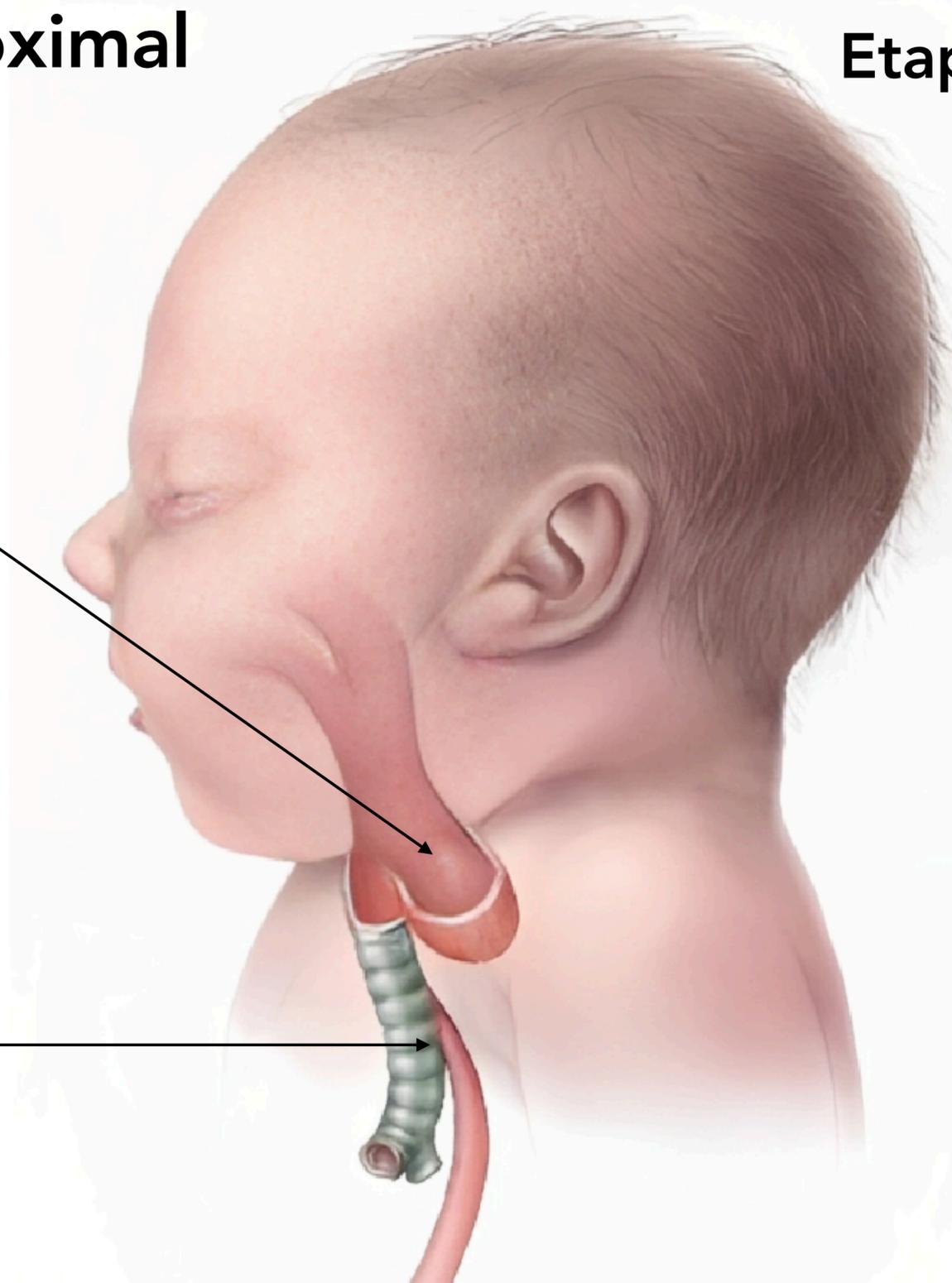
Disección esófago proximal

Etapa mas importante de la cirugia

Lesión traquea

¿Diatermia?

Lesión esófago

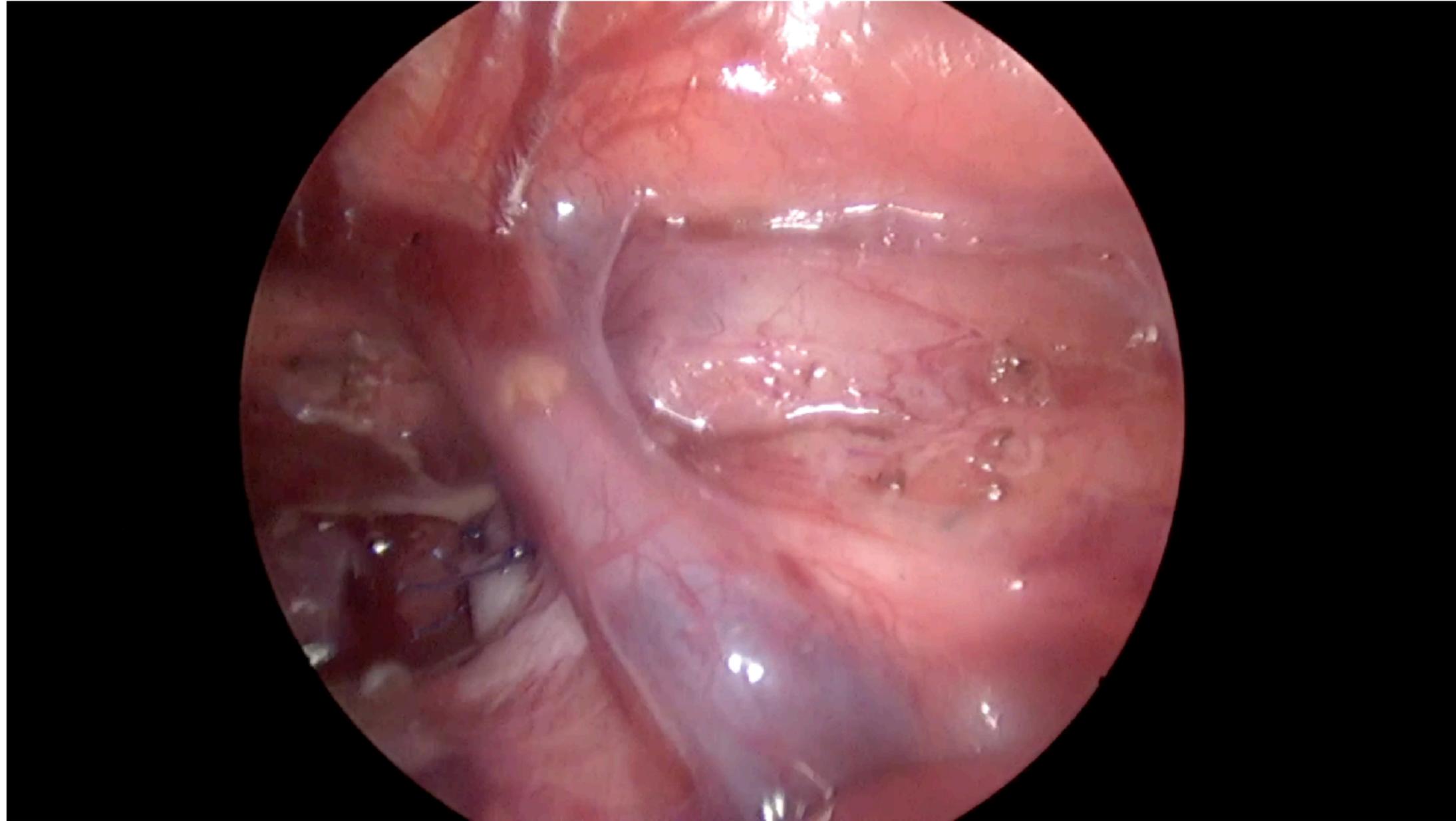


¿Hasta donde llevar la disección

Lesión s. parasimpático

¿Anastomosis primaria o tracción ?

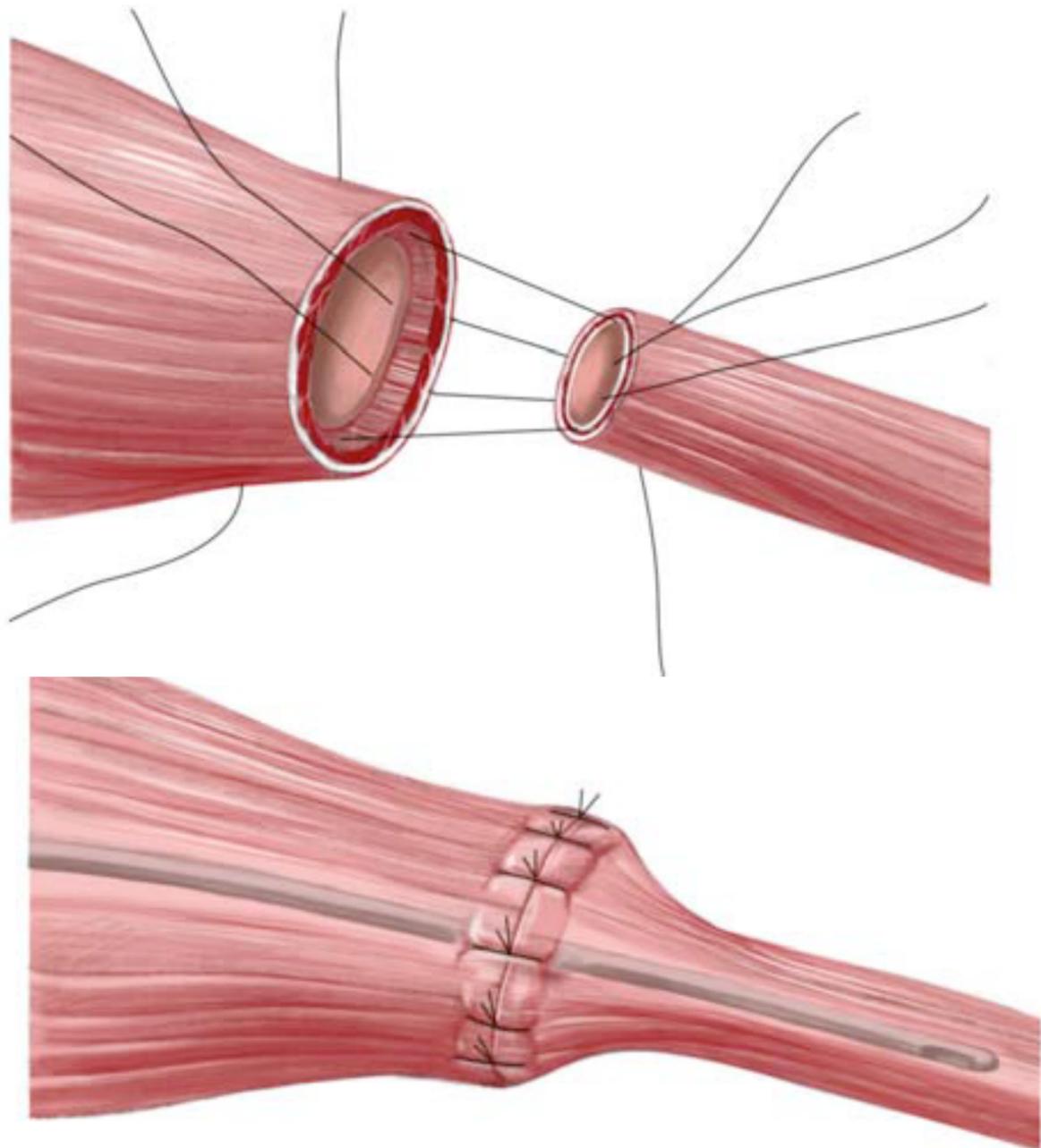
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Vena ácigos

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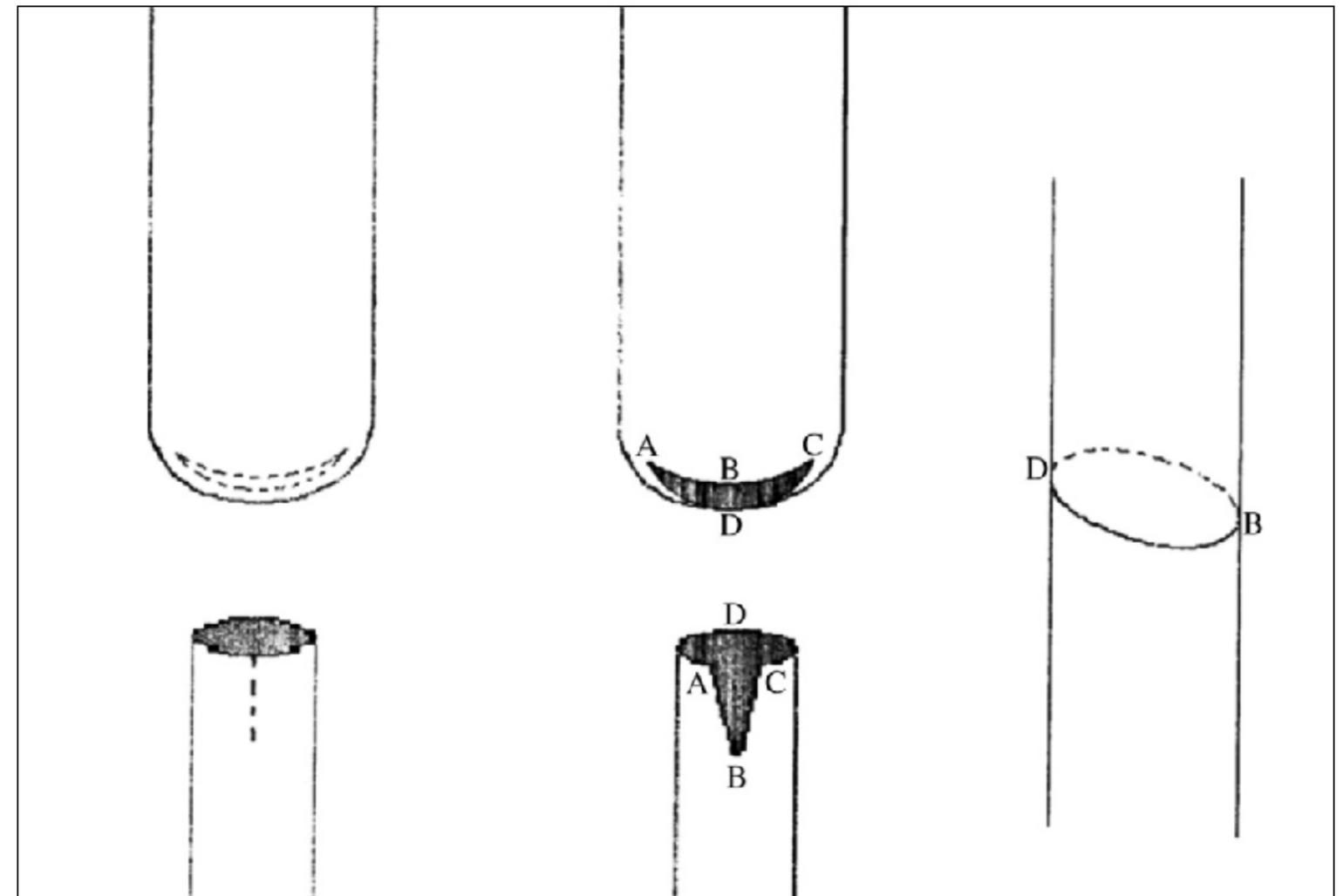
Termino terminal



A simple technique of oblique anastomosis can prevent stricture formation in primary repair of esophageal atresia

Pieralba Catalano*, Maria Rita Di Pace, Anna Maria Caruso, Sergio Salerno, Marcello Cimador, Enrico De Grazia

Pediatric Surgical Unit, Department of Mother and Child Care, University of Palermo, Palermo, Italy

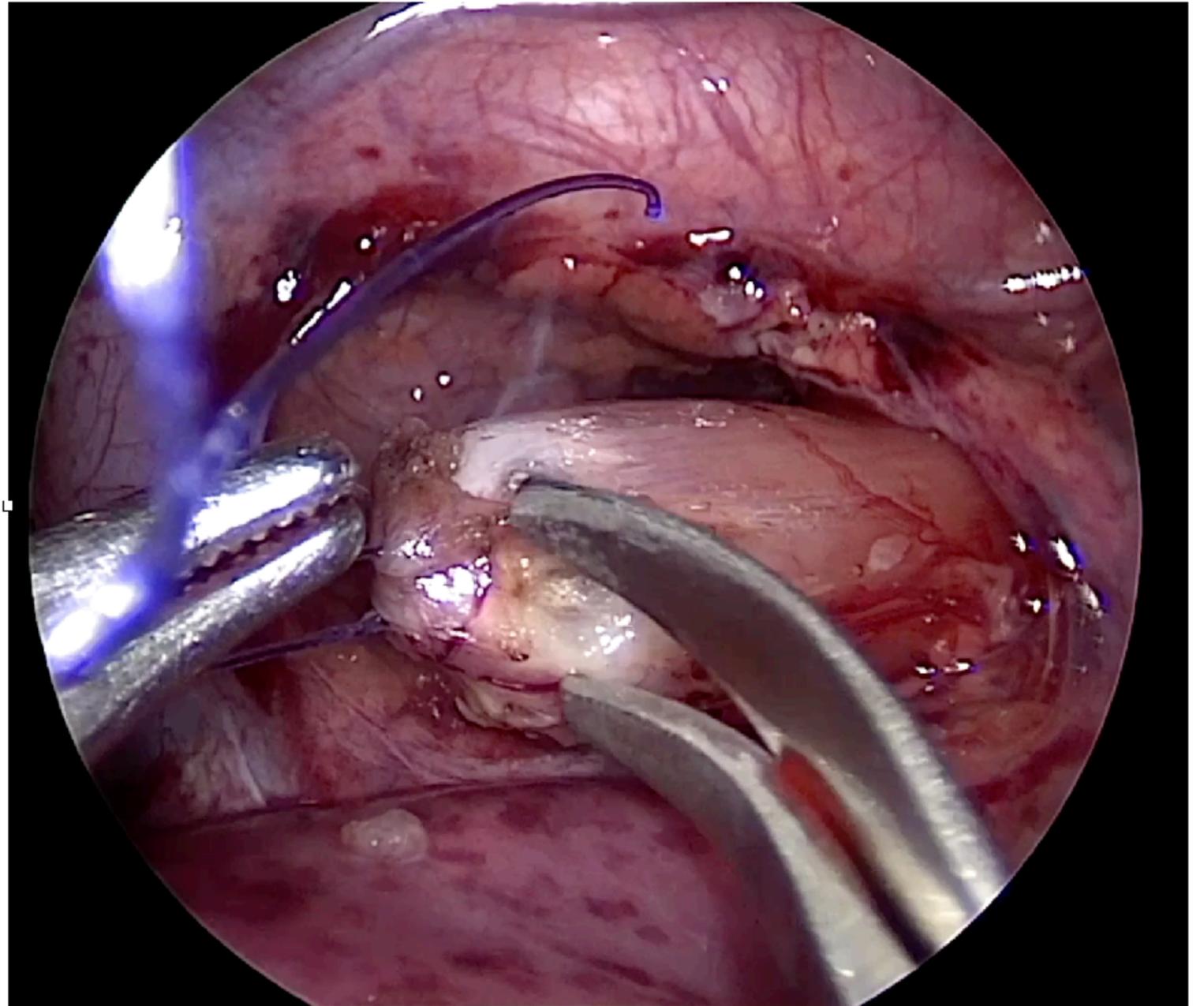
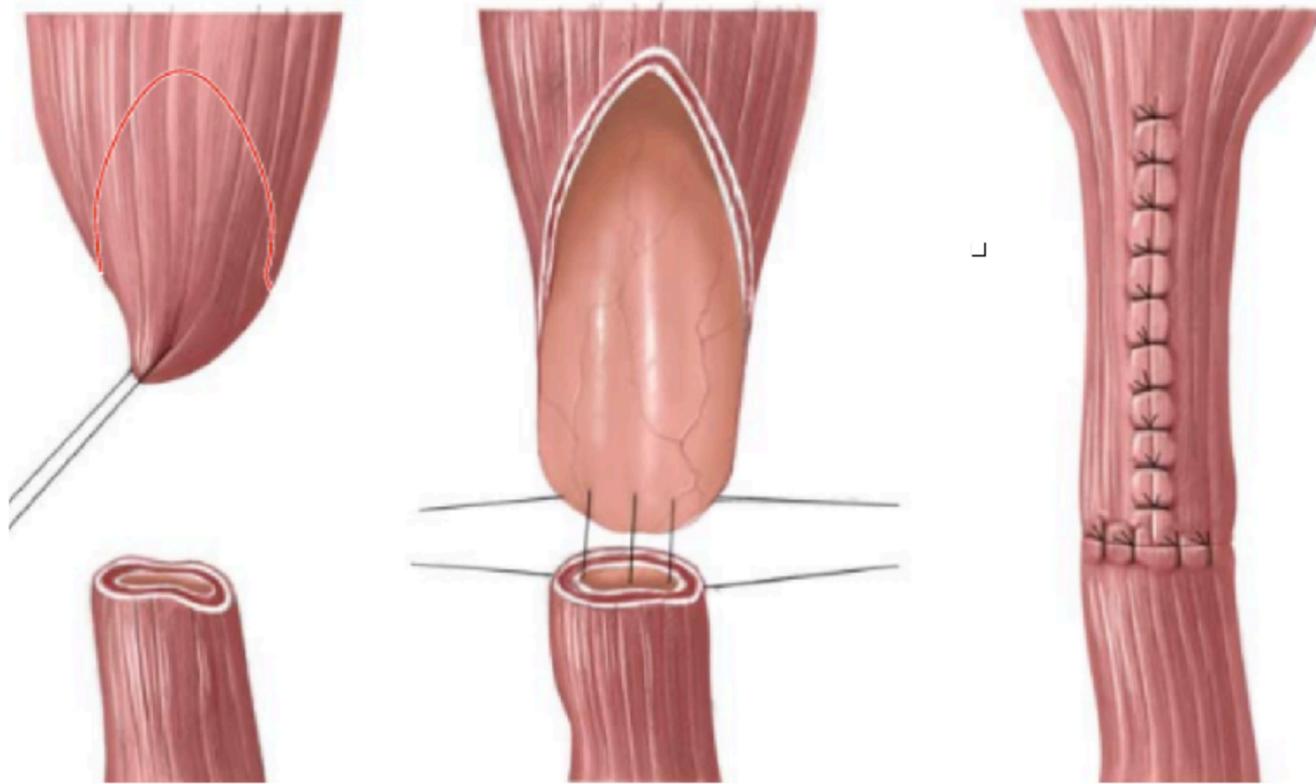


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J Pediatr Surg. 1980 Jun;15(3):310-1.

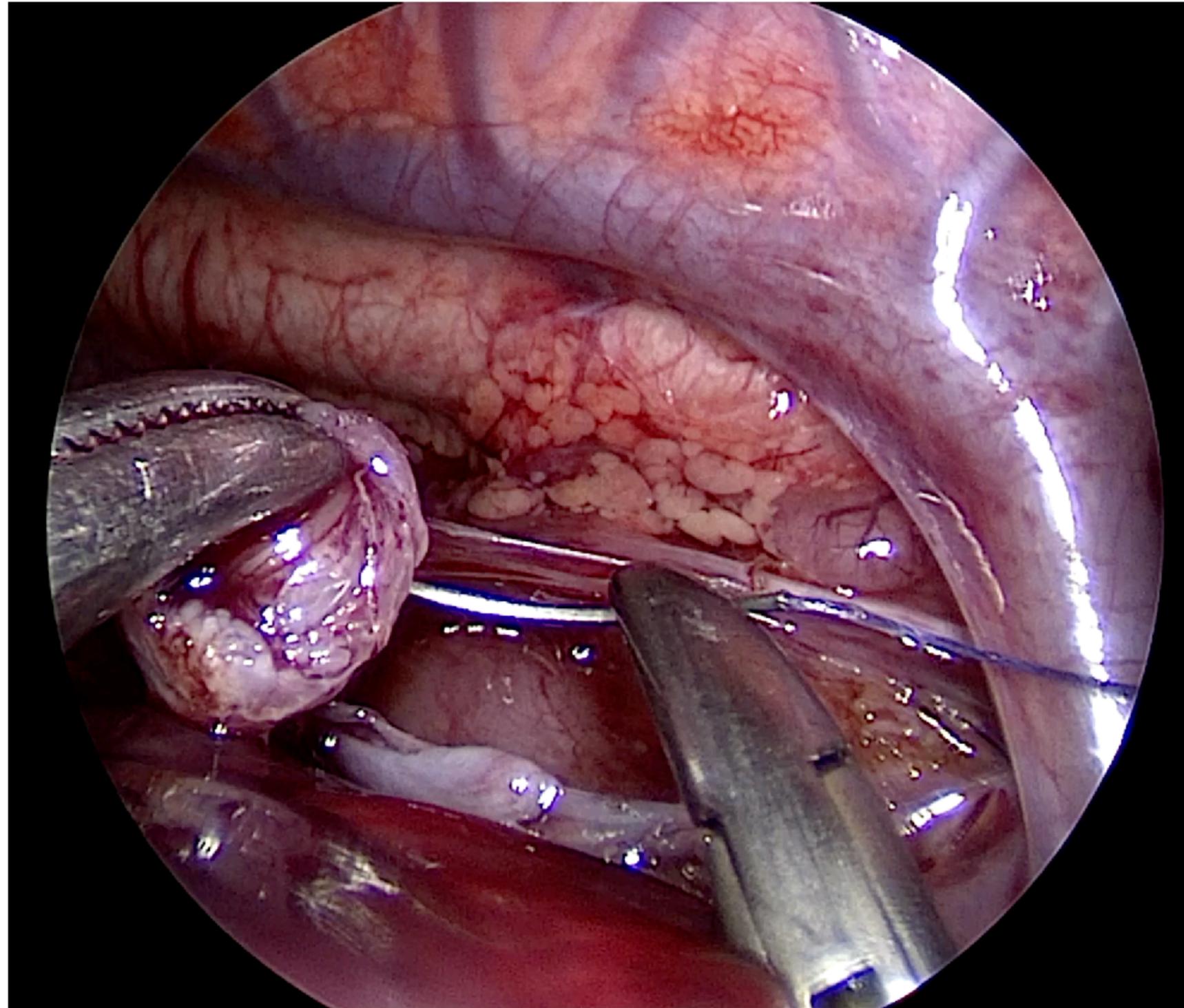
Esophageal atresia--use of an anterior flap in the difficult anastomosis.

Gough MH.



Tema 2. Tratamiento toracoscópico de la atresia del esófago

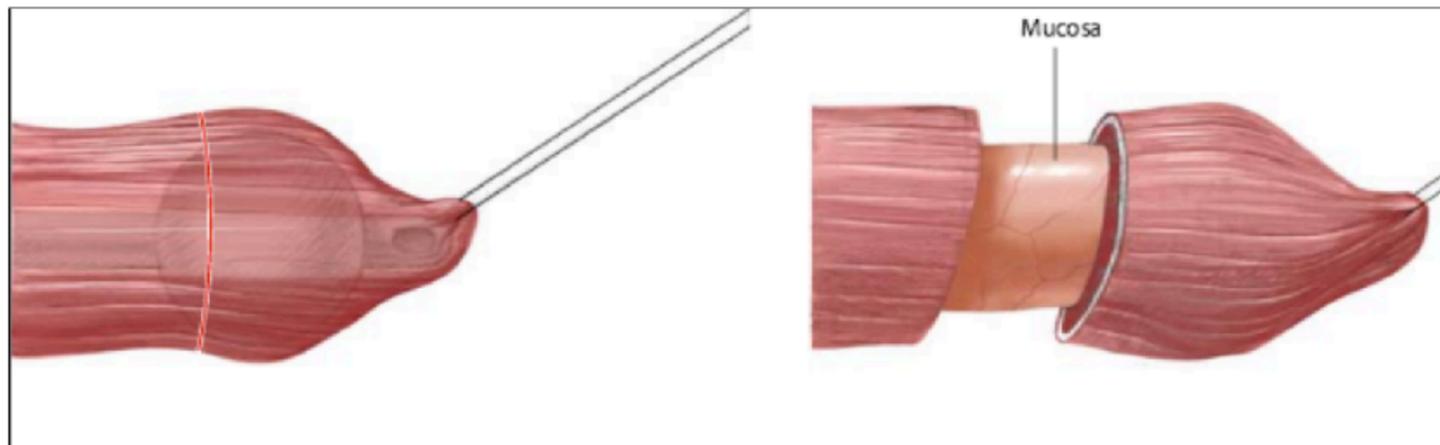
Anastomosis



Tema 2. Tratamiento toracoscópico de la atresia del esófago

Anastomosis con tensión

Livaditis A, Radberg L, Odensjo G. Esophageal end-to-end anastomosis. Reduction of anastomotic tension by circular myotomy. Scand J Thorac Cardiovasc Surg 1972;6:206-14.



Tema 2. Tratamiento toracoscópico de la atresia del esófago

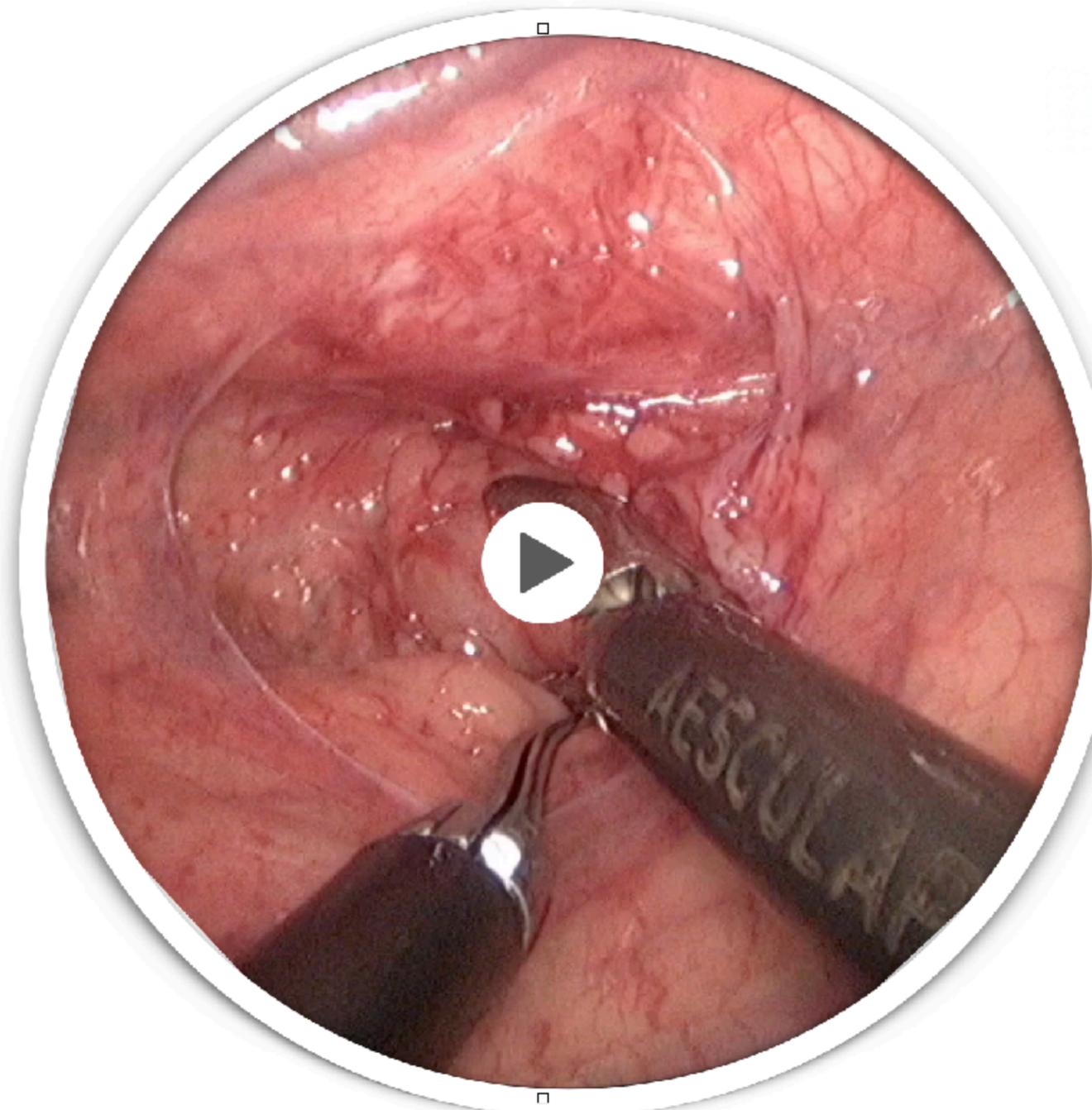
ERNICA Consensus Conference on the Management of Patients with Long-Gap Esophageal Atresia: Perioperative, Surgical, and Long-Term Management

Eur J Pediatr Surg 2021;31:214–225.

b. Principle statements on esophageal reconstruction techniques					
14	Preserving the native esophagus should be preferred as initial management	+	100	22/22	9 (9–9)
15	Delayed primary anastomosis should be preferred	+	100	21/21	9 (6–9)
16	Axial lengthening procedure is a viable option	+	83.3	15/18	7 (3–9)
40 ^a	The thoracoscopic approach is a viable option	+	100	16/16	9 (6–9)
41 ^a	The thoracoscopic approach should be only performed if suitable expertise is available	+	95.2	20/21	9 (1–9)
f. Lengthening techniques					
42	Thoracoscopic pouch mobilization and placement of traction sutures are a novel technique that shows promise, but should only be performed in specialized centers with prospective review and reporting of outcomes	+	100	23/23	9 (6–9)

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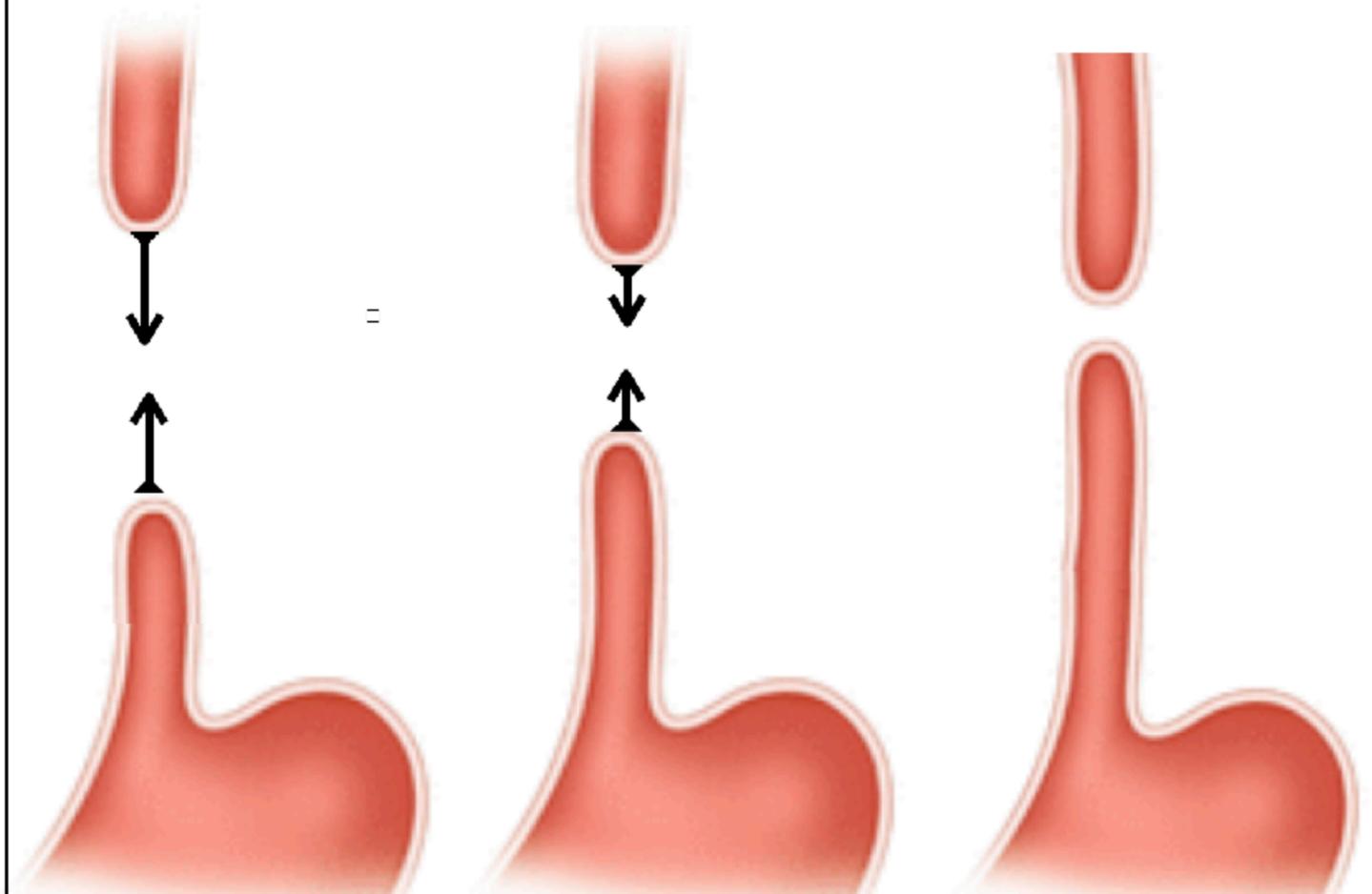
Toracoscopia en atresia long gap



Staged Thoracoscopic Repair of Long-Gap Esophageal Atresia Without Temporary Gastrostomy

Bartosz Bogusz, MD,¹ Dariusz Patkowski, MD, PhD,² Sylwester Gerus, MD,² Marcin Rasiewicz, MD,² and Wojciech Górecki, MD, PhD¹

J. Laparoendosc Adv Surg Tech 2018Dec;28(12):1510-1512



Tema 2. Tratamiento toracoscópico de la atresia del esófago

Thoracoscopy in Children: Is a Chest Tube Necessary?

Todd A. Ponsky, MD,^{1,3} Steven S. Rothenberg, MD,¹ KuoJen Tsao, MD,^{2,4}
Daniel J. Ostlie, MD,² Shawn D. St. Peter, MD,² and G. Whit Holcomb, III, MD²

JOURNAL OF LAPAROENDOSCOPIC & ADVANCED SURGICAL TECHNIQUES
Volume 19, Supplement 1, 2009

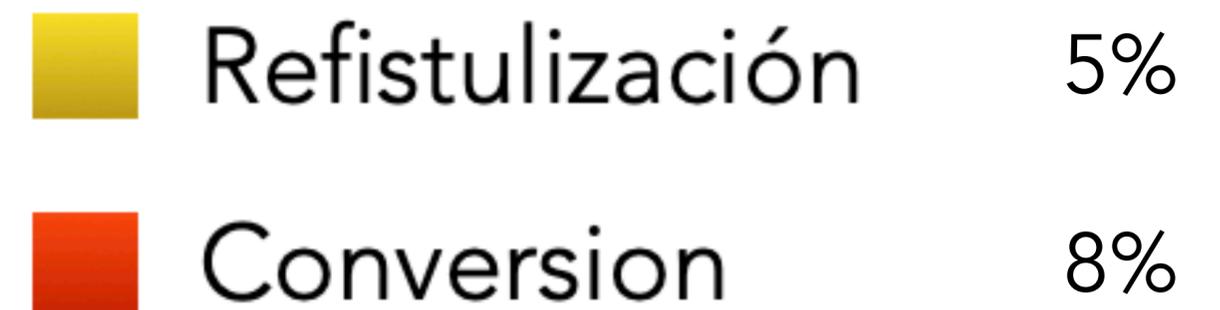
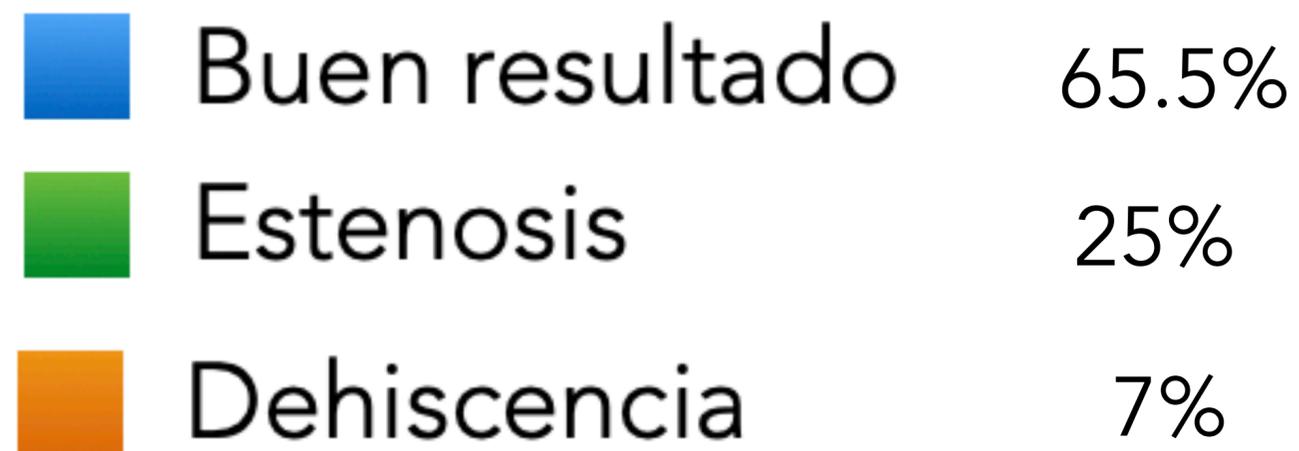
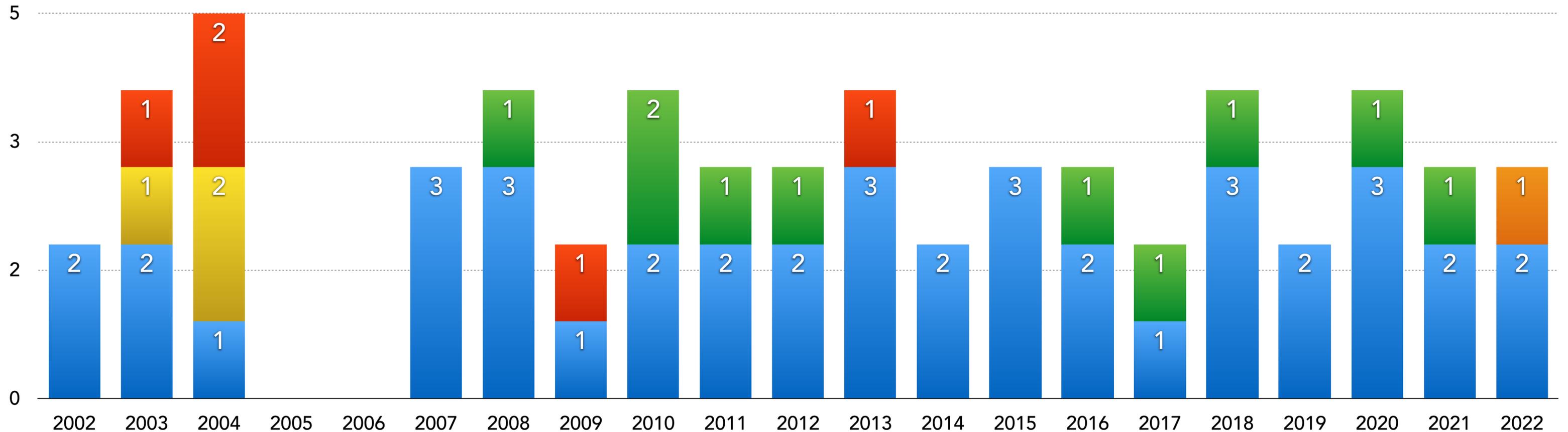


Curso de atresia de esófago para profesionales

Tema 2. Tratamiento toracoscópico de la atresia del esófago



(n: 61)



Tema 2. Tratamiento toracoscópico de la atresia del esófago

Thoracoscopy versus Thoracotomy for Esophageal Atresia and Tracheoesophageal Fistula Repair: Review of the Literature and Meta-analysis

Francesca Astra Borruto¹ Pietro Impellizzeri¹ Angela Simona Montalto¹ Pietro Antonuccio¹
Emanuela Santacaterina¹ Gianfranco Scalfari¹ Francesco Arena¹ Carmelo Romeo¹

Eur J Pediatr Surg 2012;22:415–419.

	Leaks TR	Strictures TR	Leaks COR	Strictures COR
Lugo et al, 2008 ¹¹	1 (14.3%)	1 (14.3%)	5 (19.2%)	13 (50%)
Al Tokhais et al, 2008 ¹²	4 (17.4%)	2 (8.7%)	3 (13.6%)	4 (18%)
Allal et al, 2009 ¹³	0	3 (21.4%)	0	4 (23.5%)
Szavay et al, 2011 ¹⁴	1 (4%)	0	1 (3.1%)	0
Total	6/69 (8.7%)	6/69 (8.7%)	9/97 (9.3%)	21/97 (21.6%)

Abbreviations: COR, conventional open repair; TR, thoracoscopic repair.

Note: The number and percentage of strictures result are higher in the COR group.

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Thoracoscopic esophageal atresia repair: learning curve analysis using Clavien-Dindo surgical complication classification

V. Ibáñez Pradas, M. Couselo Jerez, M.E. Carazo Palacios

Pediatric Surgery Department. La Fe Polytechnic and University Hospital. Valencia (Spain).

Cir Pediatr. 2020; 33: 166-171

Gestational age (weeks)	38.11 (2.86)	37,67 (1.92)	0.32
Weight at birth (grams)	2,734.3 (664.2)	2,674,5 (514.2)	0.93

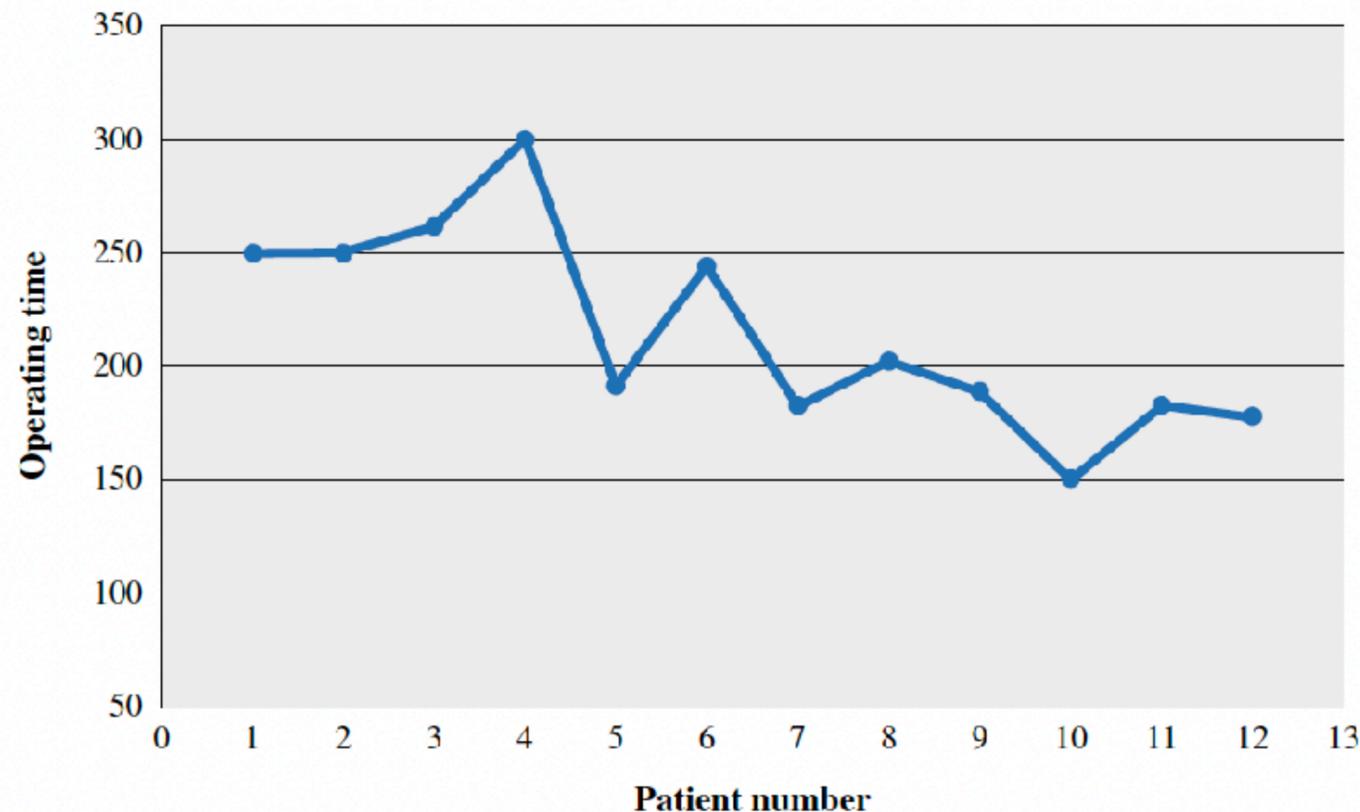


Table 2. Postoperative complications.

	Hospital Universitario 12 de Octubre SaludMadrid		Thoracoscopic (n = 12)
Dehiscence	5 (41.7)	N:12	5 (41.7)
Stenosis	7 (58.3)		7 (58.3)
Re-fistulization	0		0
Chylothorax	0		0
Simple pneumothorax	2 (16.7)	Reconversión 25% Estenosis 33 % Dehiscencia 33 % Refistulización 33 %	2 (16.7)
Sepsis	1 (8.3)		1 (8.3)
Wound infection	0		0
Pulmonary edema	1 (8.3)		1 (8.3)

*95% confidence interval.

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The learning curve for thoracoscopic repair of esophageal atresia with distal tracheoesophageal fistula: A cumulative sum analysis

Wontae Kim ^a, Joonhyuk Son ^b, Sanghoon Lee ^{a,*}, Jeong-Meen Seo ^{a,**}

Journal of Pediatric Surgery 55 (2020) 2527–2530

^a Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

^b Department of Pediatric Surgery, Hanyang University College of Medicine, Seoul, Republic of Korea

Results: Of the 50 consecutive cases evaluated, the mean birth weight was 2634 ± 608 g and the median age at operation was 3 days (range, 1–29 days). The mean operation time was 144 ± 65 min. Anastomosis leakage occurred in 3 cases (6%) and strictures requiring balloon dilatations occurred in 16 cases (32%). The CUSUM analysis evaluated a learning curve of approximately 10 cases of thoracoscopic type C EA/TEF repair. A lower gestational age was associated with longer operation time.

Conclusions: Thoracoscopic repair of type C EA/TEF is a feasible and safe procedure. The number of procedures required to achieve a stable learning curve was 10. The learning phase may be shortened by adequate set-up under the supervision of an expert endoscopic surgeon.

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Learning Curve of Thoracoscopic Repair of Esophageal Atresia

David C. van der Zee · Stefaan H. A. J. Tytgat ·
Sander Zwaveling · Maud Y. A. van Herwaarden ·
Daisy Vieira-Travassos

Table 2 Postoperative outcome in two time periods, 2000–2005 and 2006–2010

Operative results	2000–2005	2006–2010	<i>P</i> value
Median operating time (min)	155	160	
Conversion	2	2 (long gap)	
Median IC admission (days)	4	4	
Median feeding time (days)	4.56	4.25	
Median admission time (days)	16.5	14.3	
Postoperative leakage	9 (22 %)	2 (8 %)	0.082
Recurrent fistula	2 (4 %)	0	
Postoperative stenosis	16 (38 %)	6 (19 %)	0.062
Postoperative death	1	1	

Tema 2. Tratamiento toracoscópico de la atresia del esófago

Thoracoscopic approach for oesophageal atresia: A real game changer?*

Dariusz Patkowski

Journal of Pediatric Surgery 58 (2023) 204–208

Since the first case, all consecutive cases managed in Wroclaw were operated only by **thoracoscopic approach as a procedure of choice**.

There were 172 primary patients with all types of oesophageal atresia with around **12–18 cases a year in recent times**.

Two specialists are involved in their treatment and at least one of them is always present in the operating room.

Results of Wroclaw's OA thoracoscopic repair Type C and D - 2005–2022.

Number of cases 145

Operative Details

Operation Time 1:31 h (range 46 min - 4:05 hr)

Conversion 0 (of 145 cases, 0%)

Complications

Leakage N = 10 cases (6.9%)

Anastomosis dilatation (>1) N = 34 (of 134 cases, 25.4%)

Recurrent TEF N = 1 (of 133 cases, 0.7%)

Results of oesophageal atresia treatment are a kind of a litmus paper and **directly reflect the level of paediatric surgery in the country**

Thus, the question of centralisation for special rare congenital malformations comes back to mind. The benefits of care centralisation seem to be obvious,

mostly patients are treated as an object not as a subject to support the surgeon's ego.