Difficult Airway in Thoracic Surgery

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Association of Anaesthetists of Great Britain and Ireland (AAGBI).

Safari, Southern of Sinai, Sharm El Sheikh, Egypt

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Disclosure

I received free airway device samples from Ambu USA in 2014 and Airtraq UK in 2015 for use in two studies and I have no direct financial or other interest in Ambu USA or Airtraq UK (in the context of this lecture and other studies).

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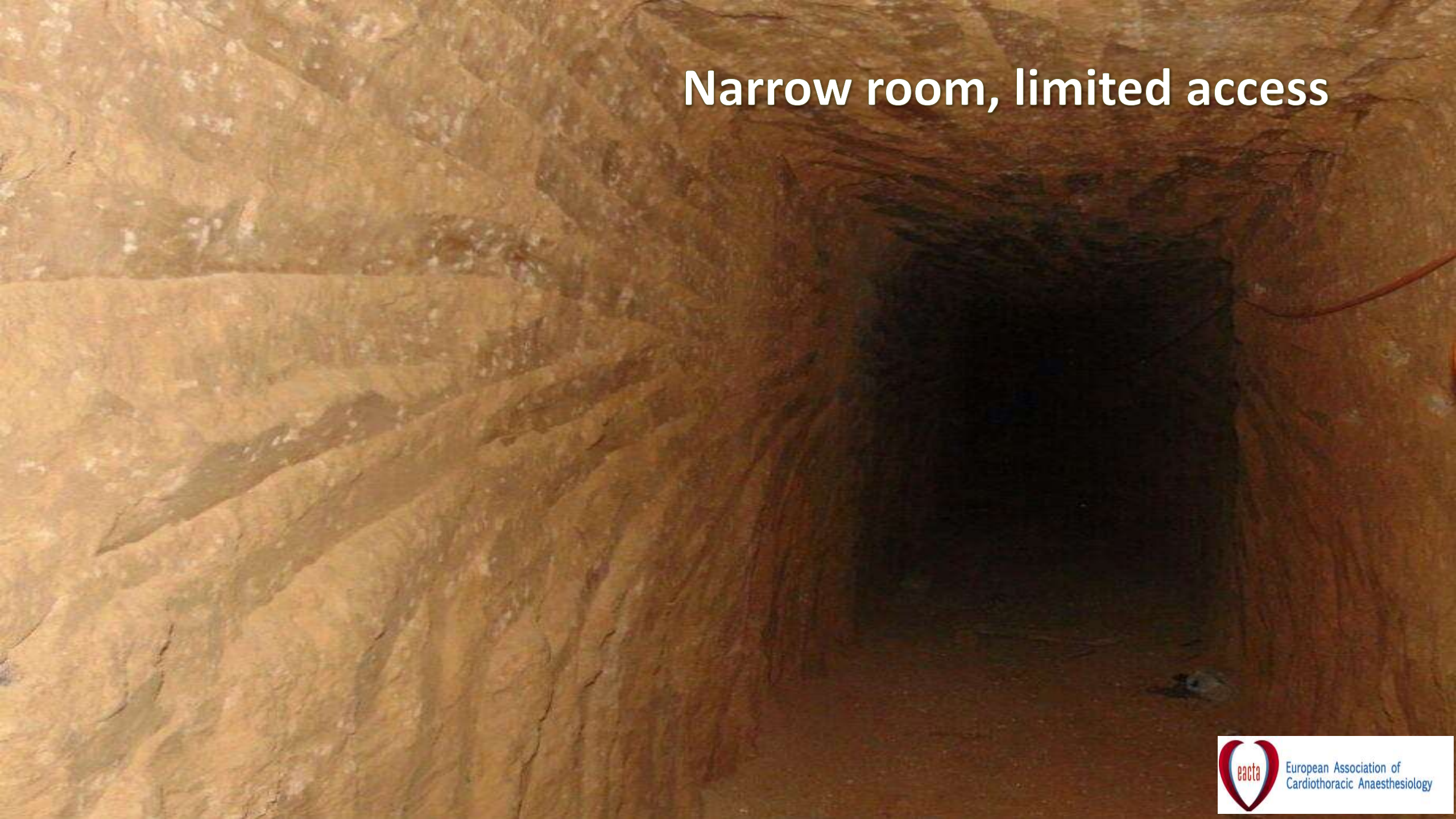
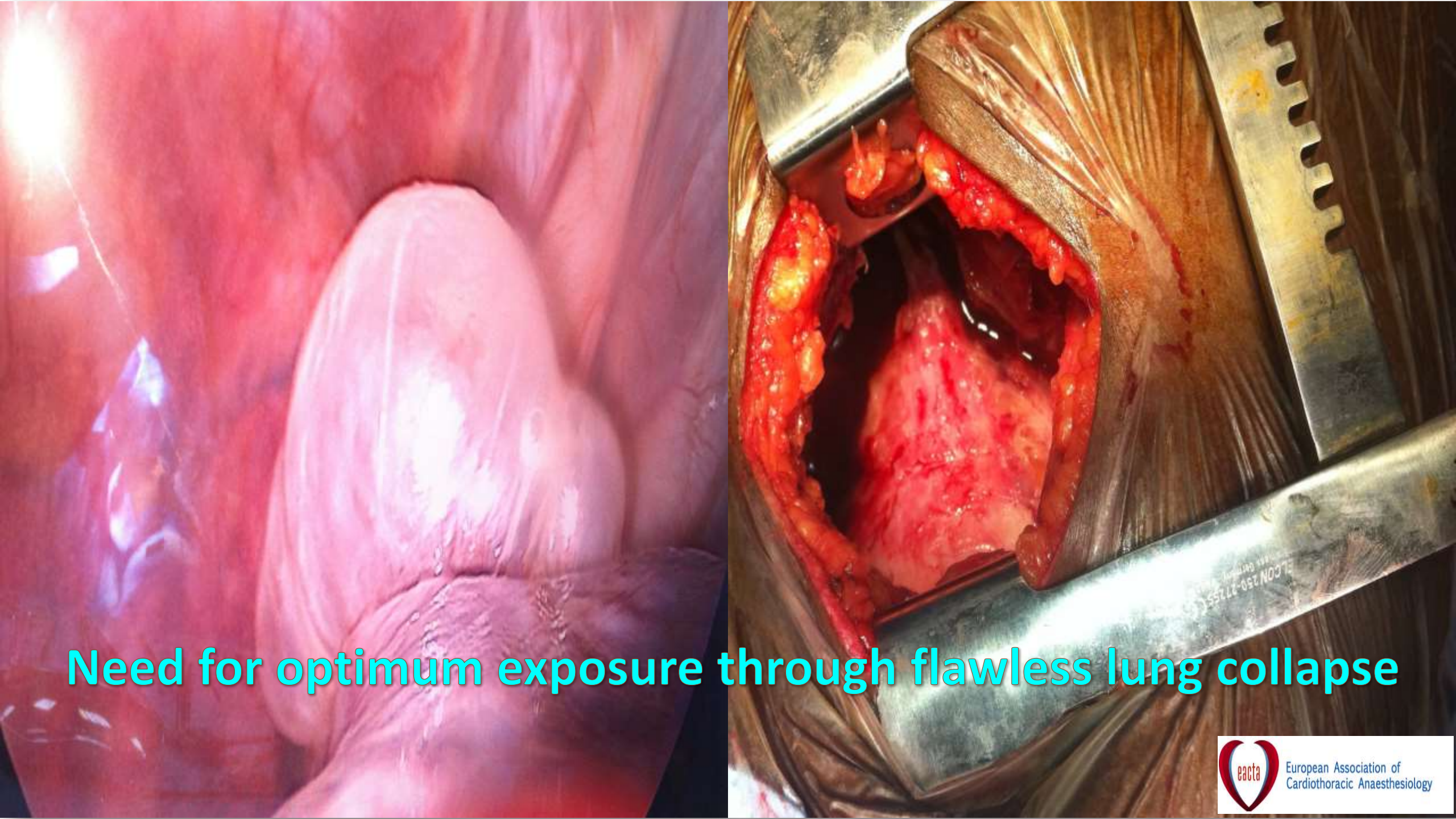
Objectives

- To highlight the extend of the problem of difficult airway during thoracic surgery in terms of difficult lung isolation or inadequate lung deflation.
- To address the importance of the ABC approach to identify patients with difficult lung separation.
- To summarise the implemented algorithms and different approaches for management of patients with difficult lung isolation or inadequate collapse.




Need for optimum exposure through flawless lung collapse
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Two of the likely horrible vivid nightmares for a thoracic anaesthetist

- **Difficult lung separation.**
- **Inadequate lung collapse.**

Nasser Lake, Sunrise, Aswan, 2013


The DLT has classically been considered the
'gold standard' for achieving OLV
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Frequency of using DLT

Anaesthesist. 2016 Jun;65(6):449-57. doi: 10.1007/s00101-016-0175-2. Epub 2016 May 31.

[A Germany-wide survey on anaesthesia in thoracic surgery].

[Article in German]

Defosse J[1], Schieren M[2], Böhmer A[2], von Dossow V[3], Loop T[4], Wappler F[2], Gerbershagen MU[2].

J Cardiothorac Vasc Anesth. 2013 Dec;27(6):1321-9. doi: 10.1053/j.jvca.2013.03.026. Epub 2013 Sep 12.

Survey of thoracic anesthetic practice in Italy.

Della Rocca G[1], Langiano N, Baroselli A, Granzotti S, Pravisani C.

Saudi J Anaesth. 2012 Jul;6(3):192-6. doi: 10.4103/1658-354X.101196.

Anesthesia for thoracic surgery: a survey of middle eastern practice.

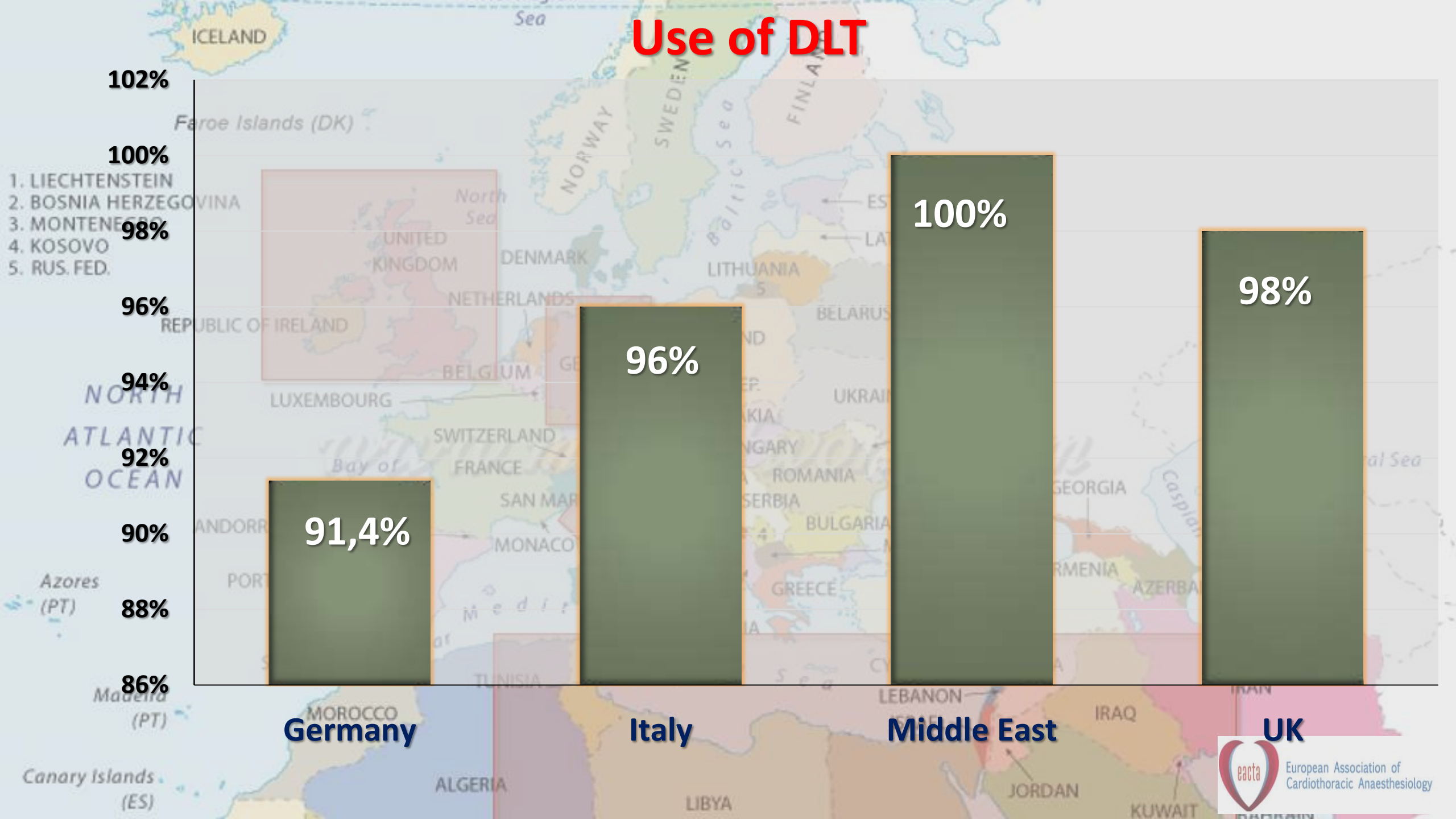
Eldawlatly A[1], Turkistani A, Shelley B, El-Tahan M, Macfie A, Kinsella J; Thoracic-anaesthesia Group Collaborators.

J Cardiothorac Vasc Anesth. 2011 Dec;25(6):1014-7. doi: 10.1053/j.jvca.2011.06.018. Epub 2011 Aug 25.

Anesthesia for thoracic surgery: a survey of UK practice.

Shelley B[1], Macfie A, Kinsella J.

Use of DLT



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Difficult Lung Separation

- Difficult lung separation can be encountered during lung isolation due to:

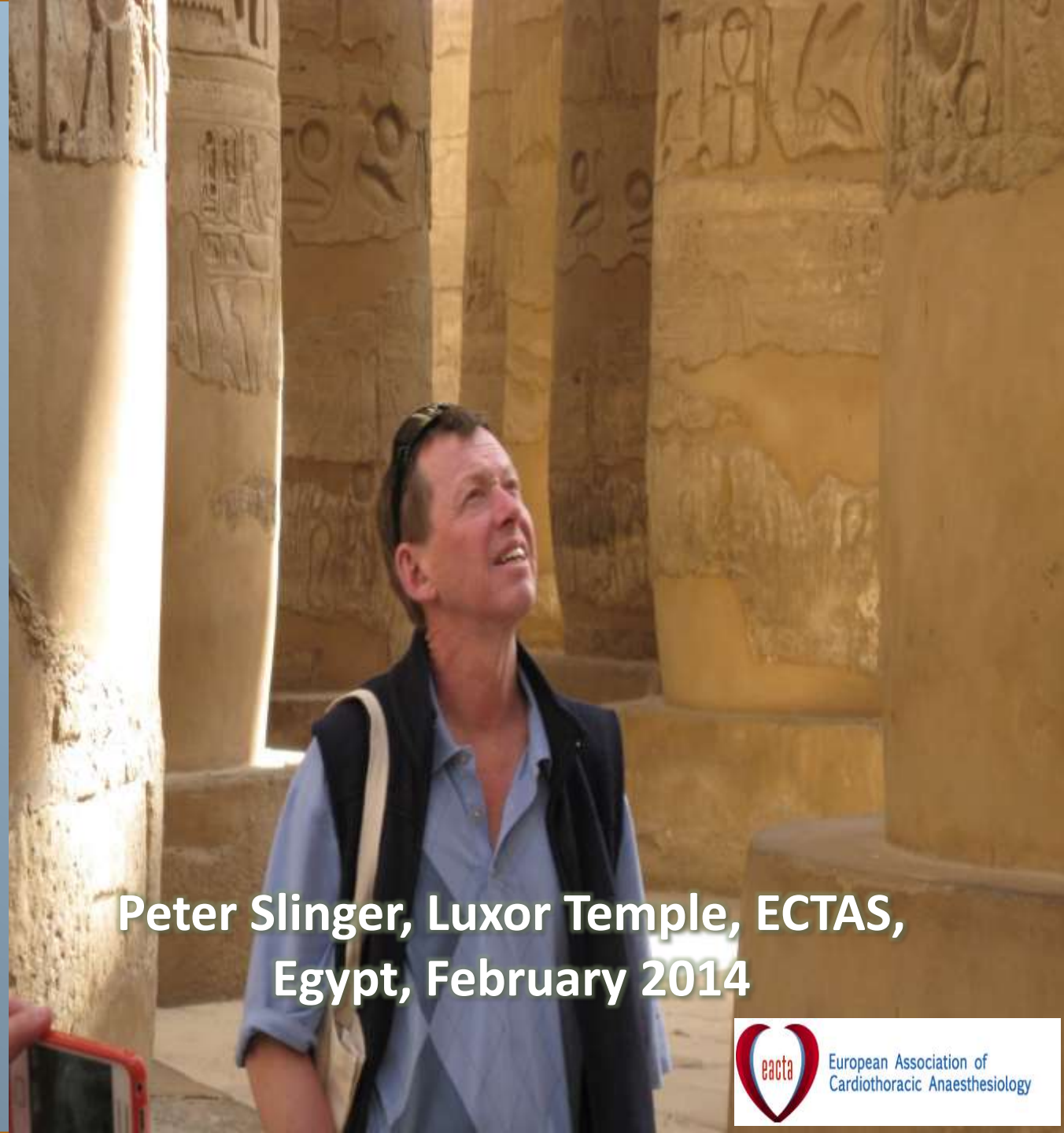
1. Potential difficult upper airway.

- Carcinoma of the pharynx in the epiglottic area (8-10%).
- Previous radiation therapy on the neck.
- Previous airway surgery.
- Distorted upper airway anatomy.

Anatomy

Bronchoscopy

Chest radiology



Peter Slinger, Luxor Temple, ECTAS, Egypt, February 2014

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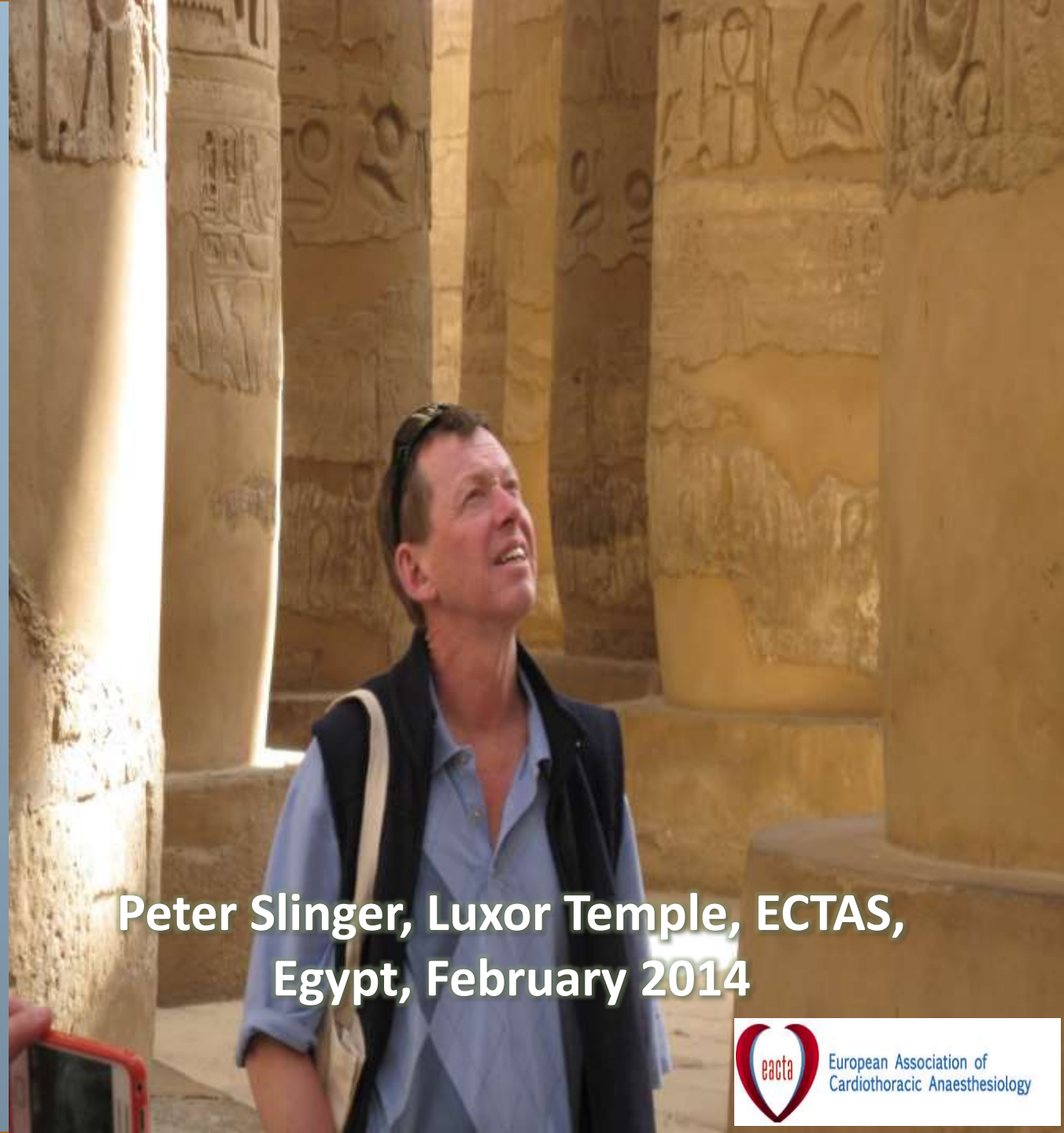
Anatomy

Bronchoscopy

Chest radiology




Morbid obesity
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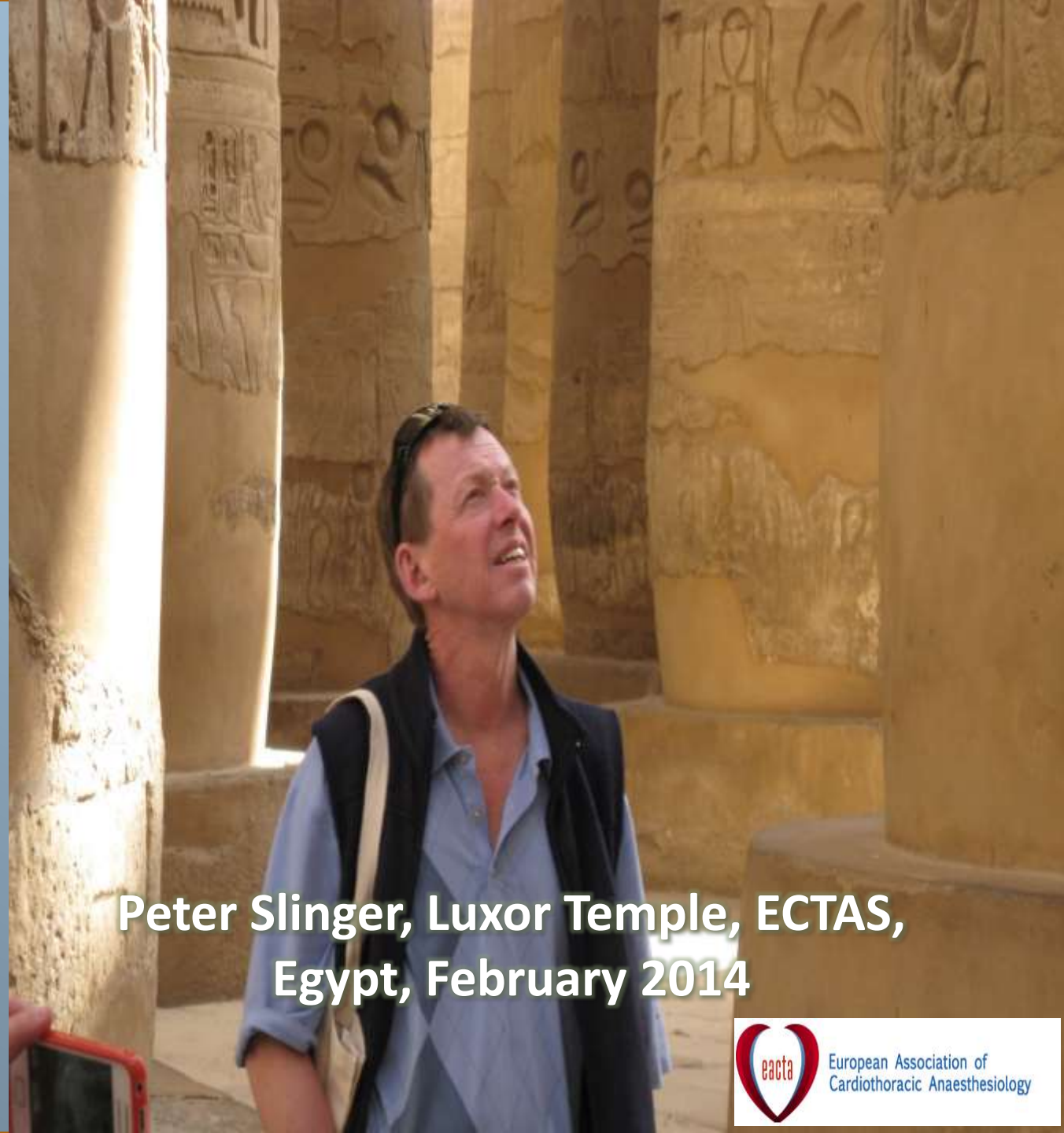
Tracheostomy

Anatomy

Bronchoscopy

Chest radiology



Peter Slinger, Luxor Temple, ECTAS, Egypt, February 2014

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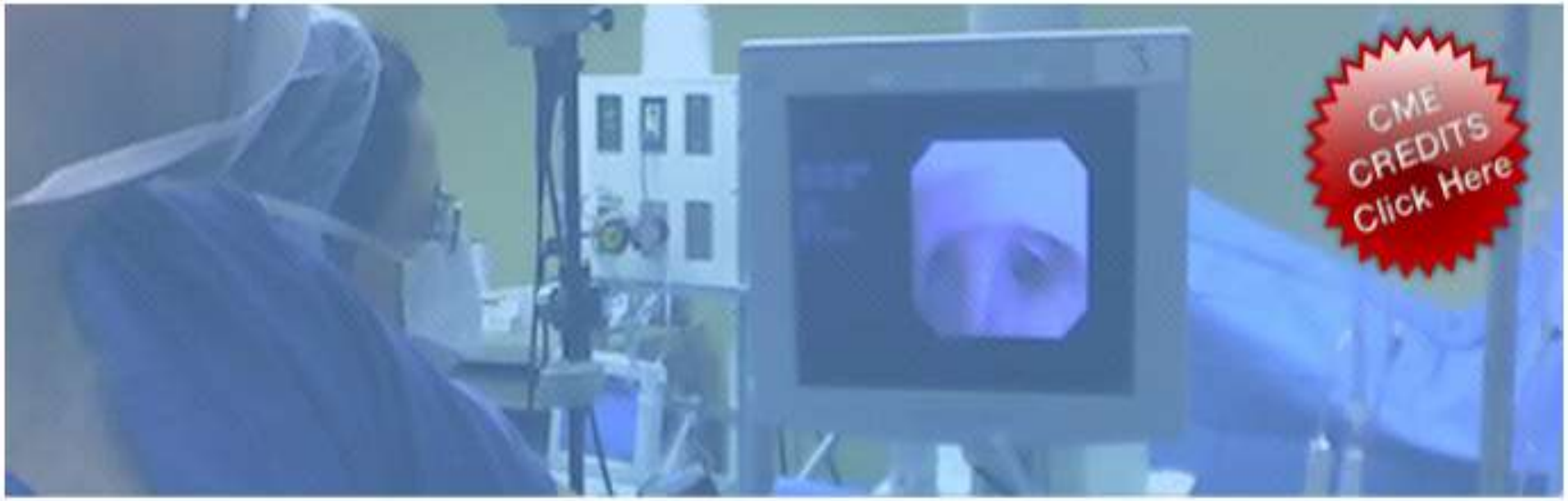
ThoracicAnesthesia.com
Consultation, Information & Reference.
University Health Network

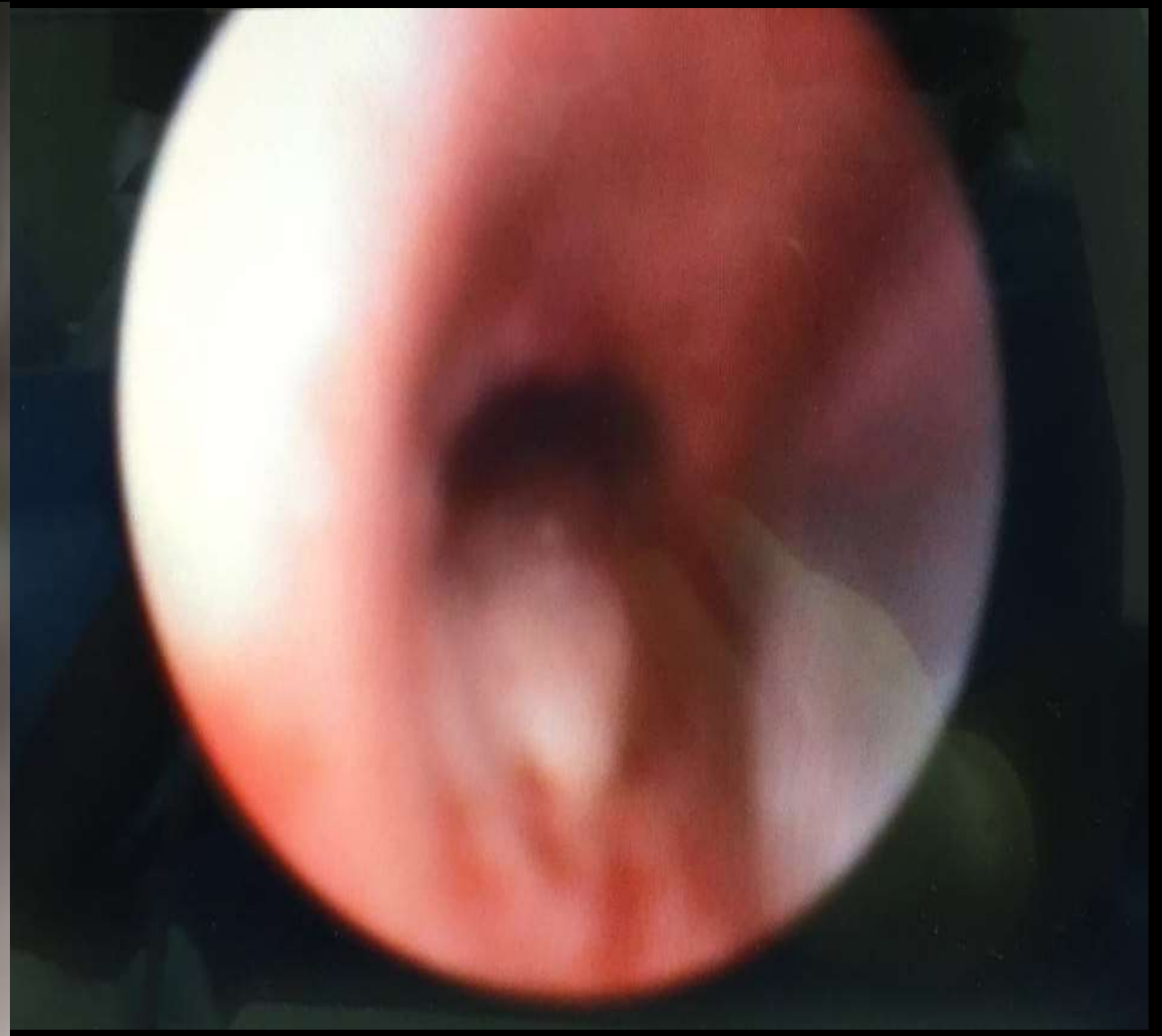


Categories

Bronchoscopy Simulator

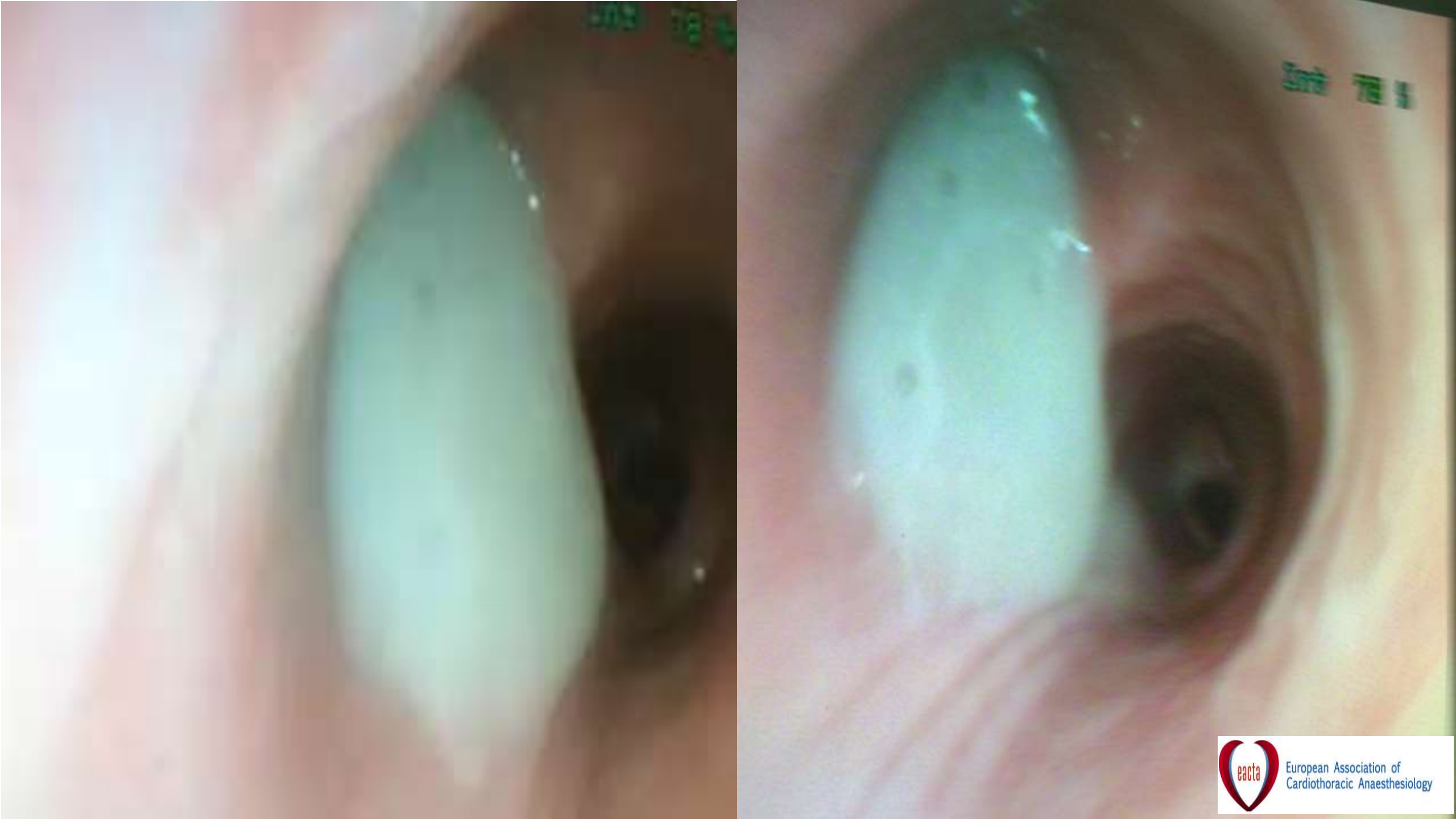
Welcome to the Bronchoscopy Simulation section of www.thoracicanesthesia.com. Using real time video, the simulator has been developed to help teach and review bronchoscopic anatomy. With this knowledge the anesthesiologist can improve upon their lung isolation management skills, leading to improved efficiency and safety. To access the simulator, the user is first asked to complete a brief questionnaire about the airway with multiple choice questions. It should only take a few minutes to answer. The simulator is then accessible indefinitely (see instructions below). After using the simulator, the user will be asked to answer the same

Click on image to launch



Disrupted LMB


Proximal Tracheobronchial Injury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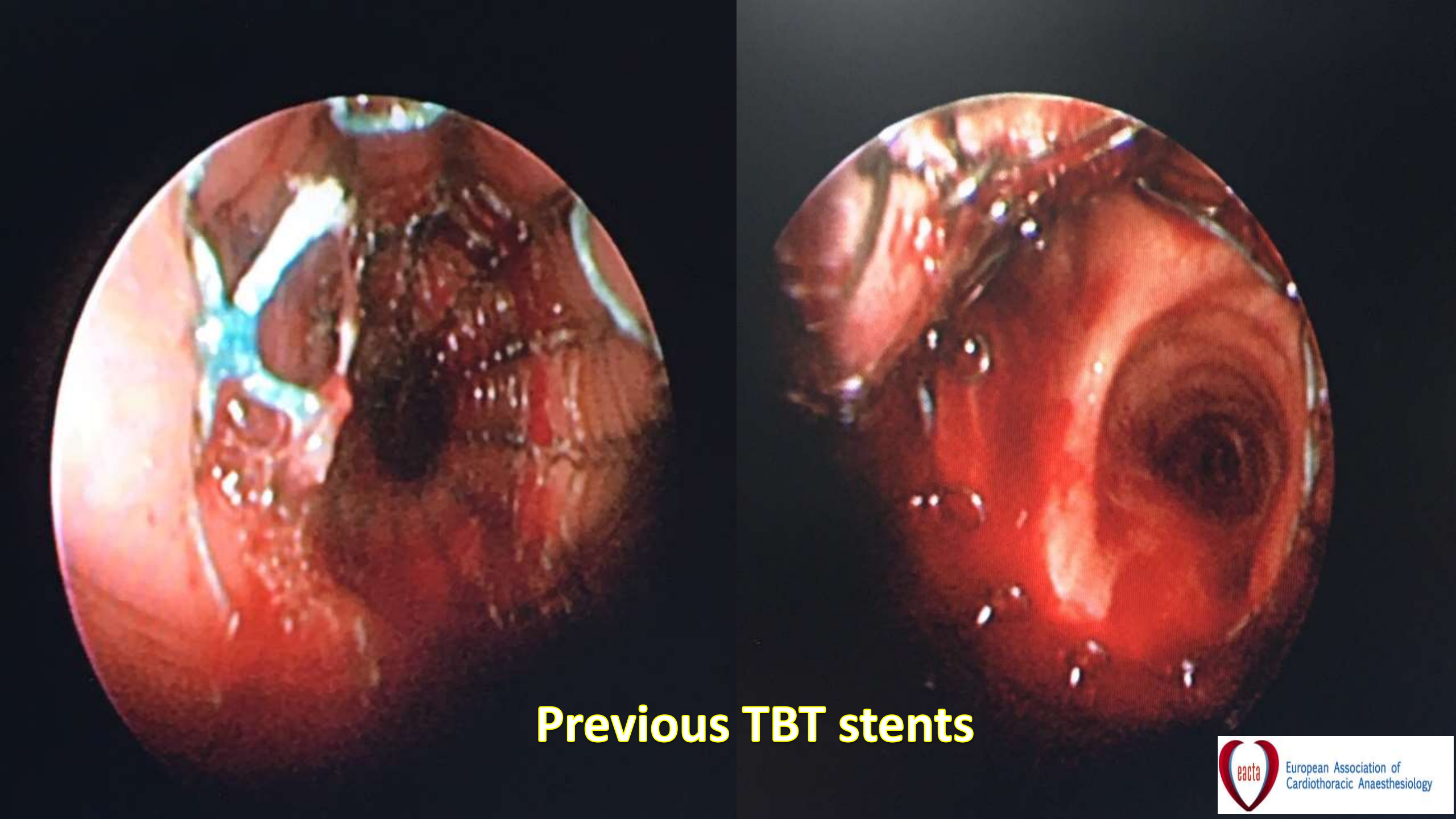
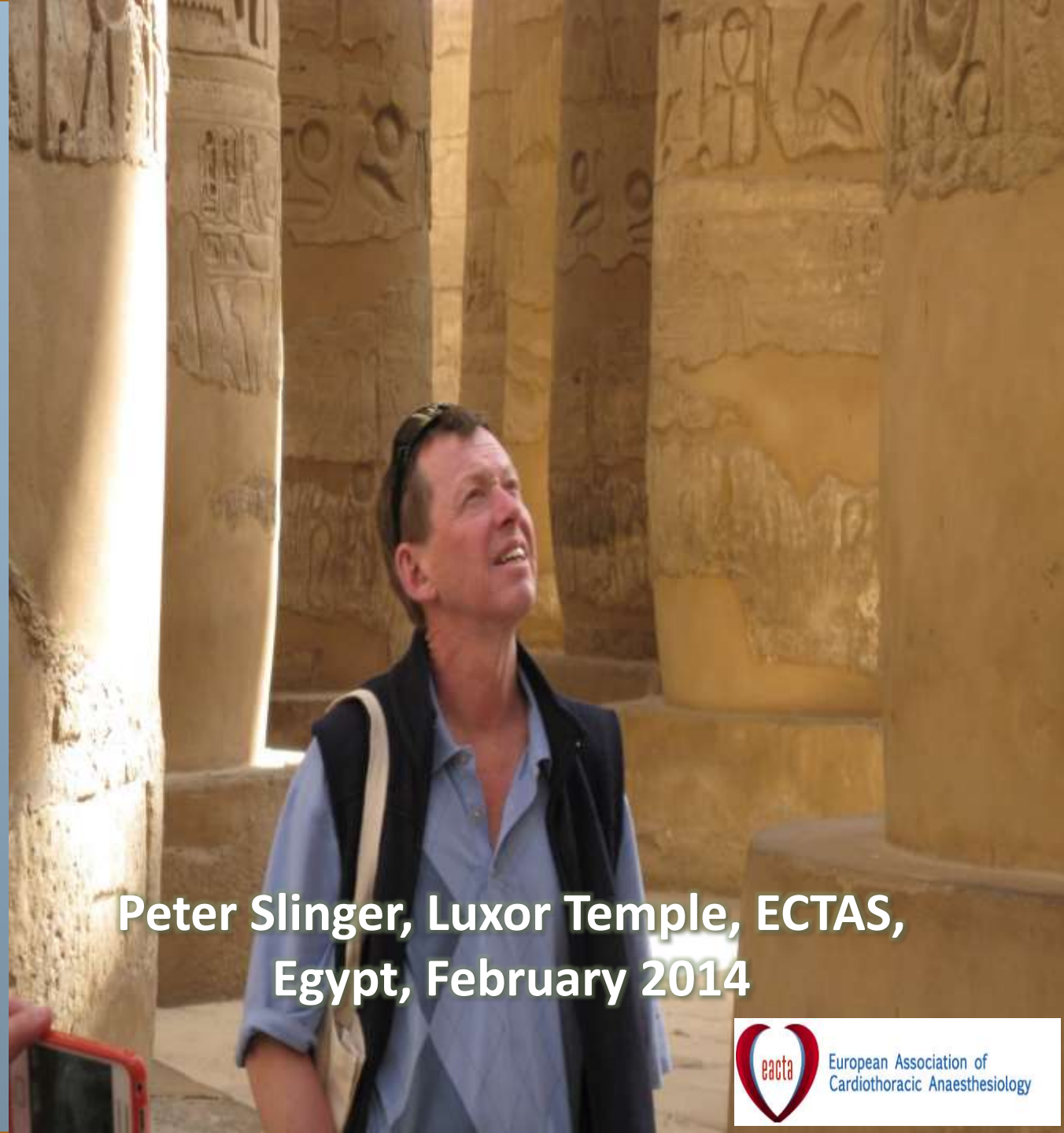
Tracheobronchopathia osteochondroplastica



Anatomy

Bronchoscopy

Chest radiology



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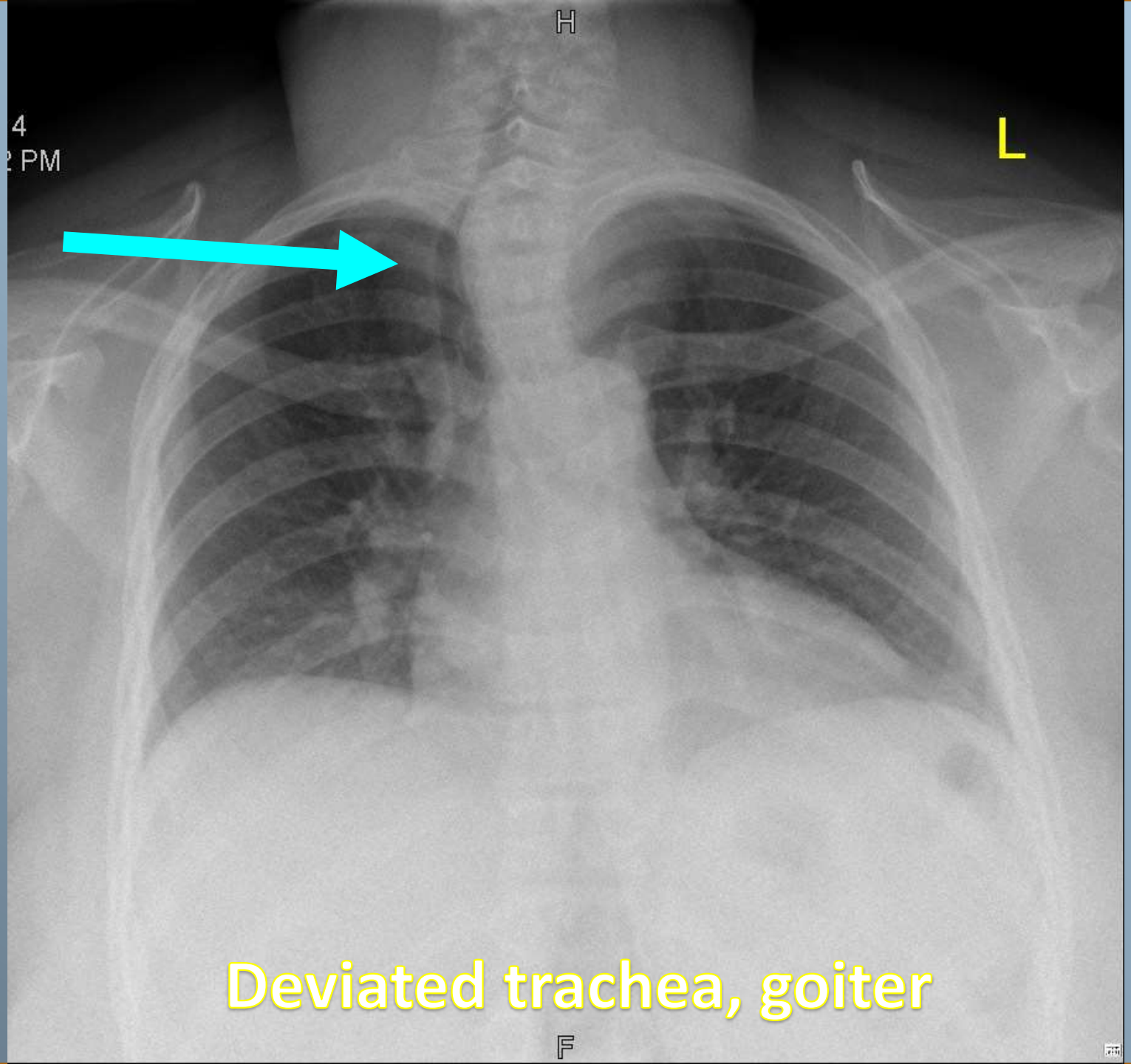

Deviated trachea, goiter

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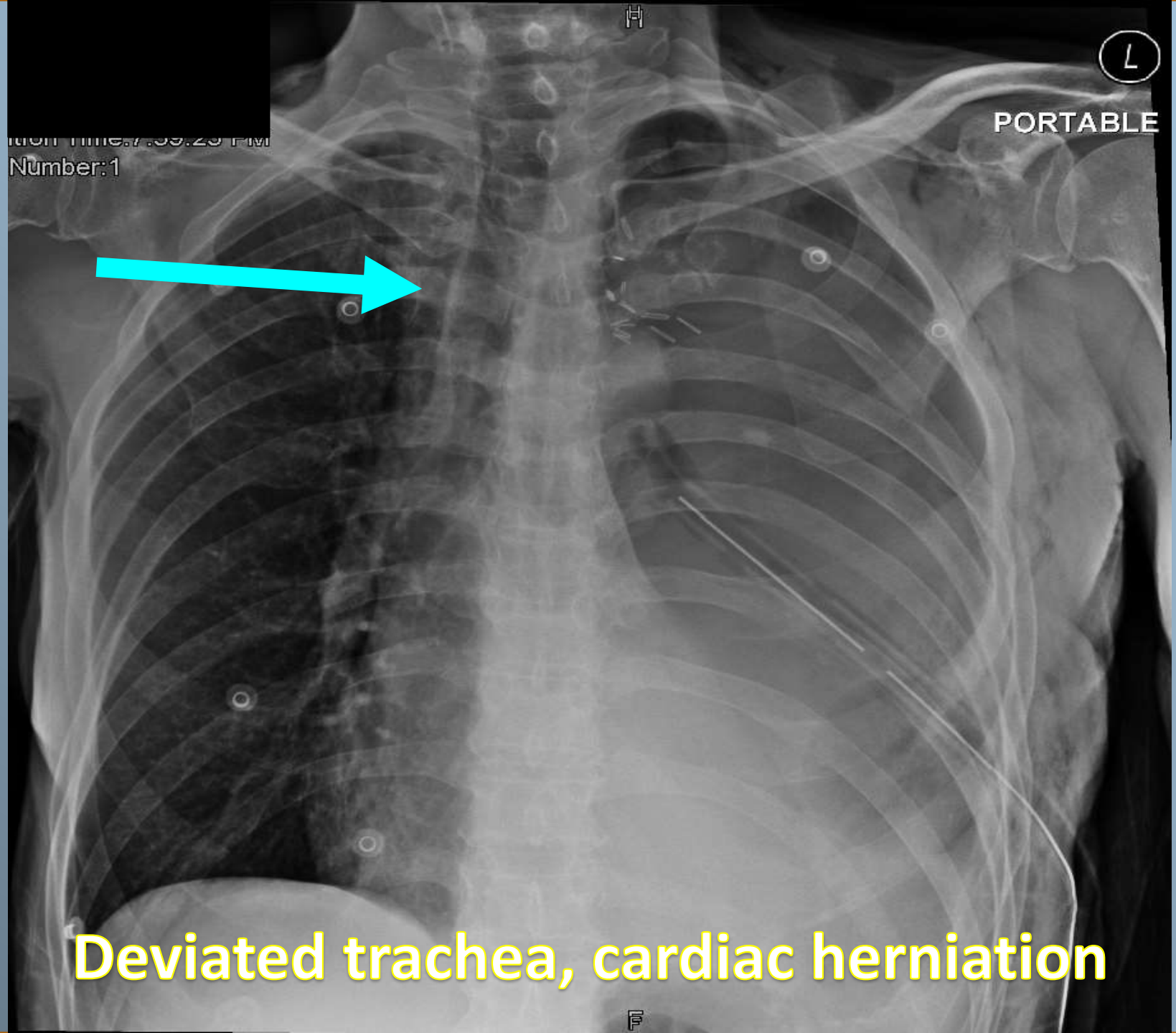

Deviated trachea, cardiac herniation

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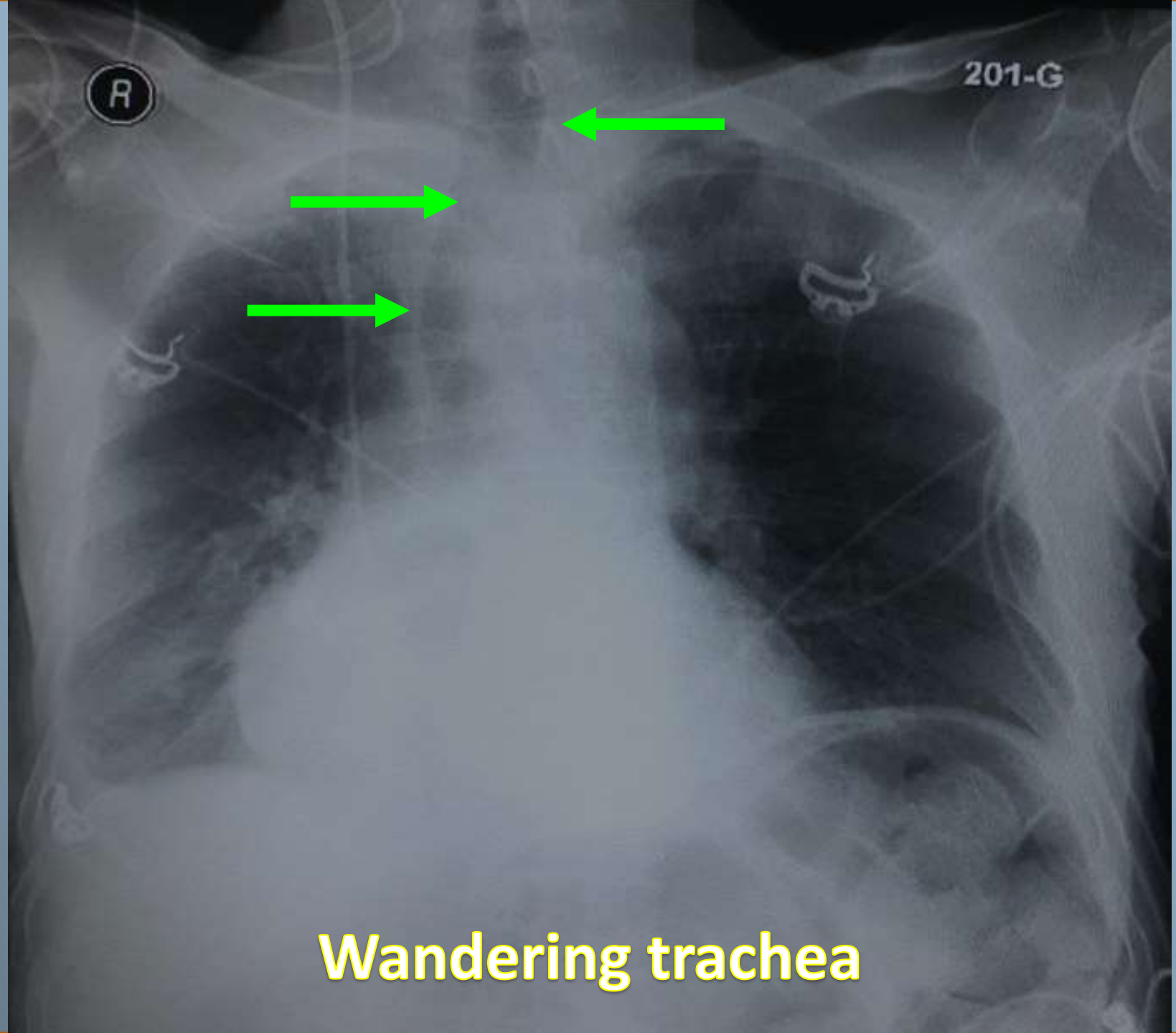
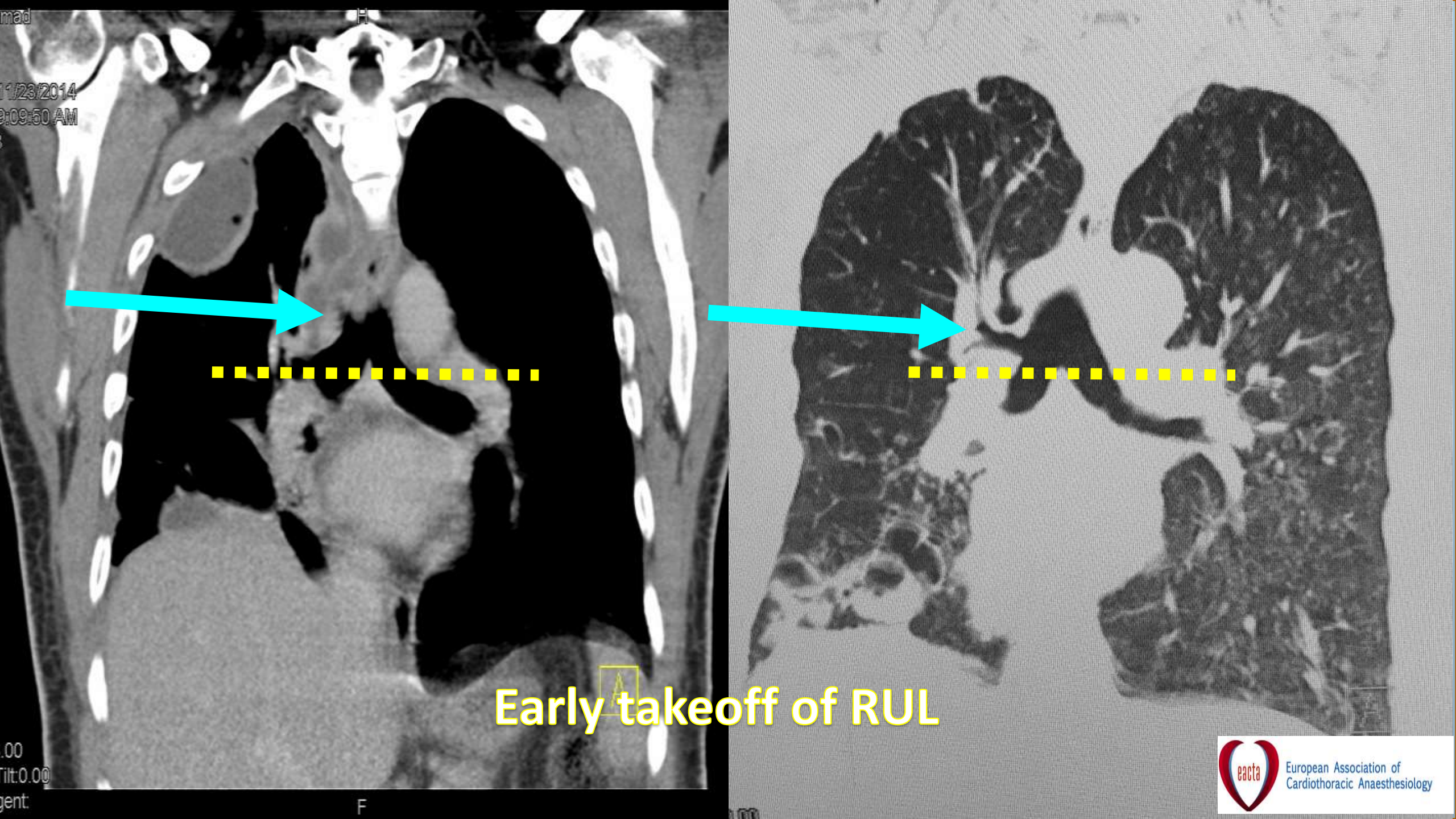


Wandering trachea


Early takeoff of RUL
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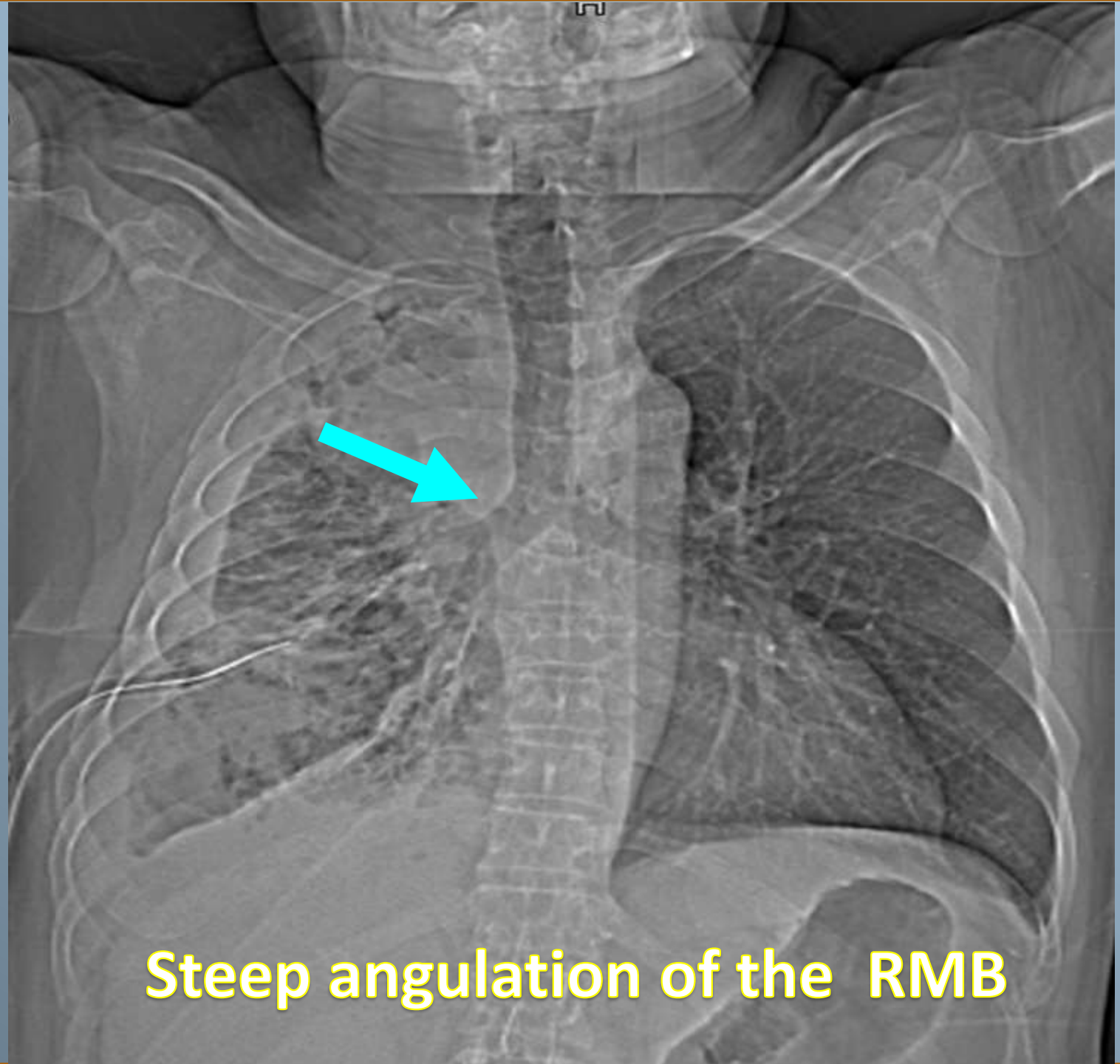
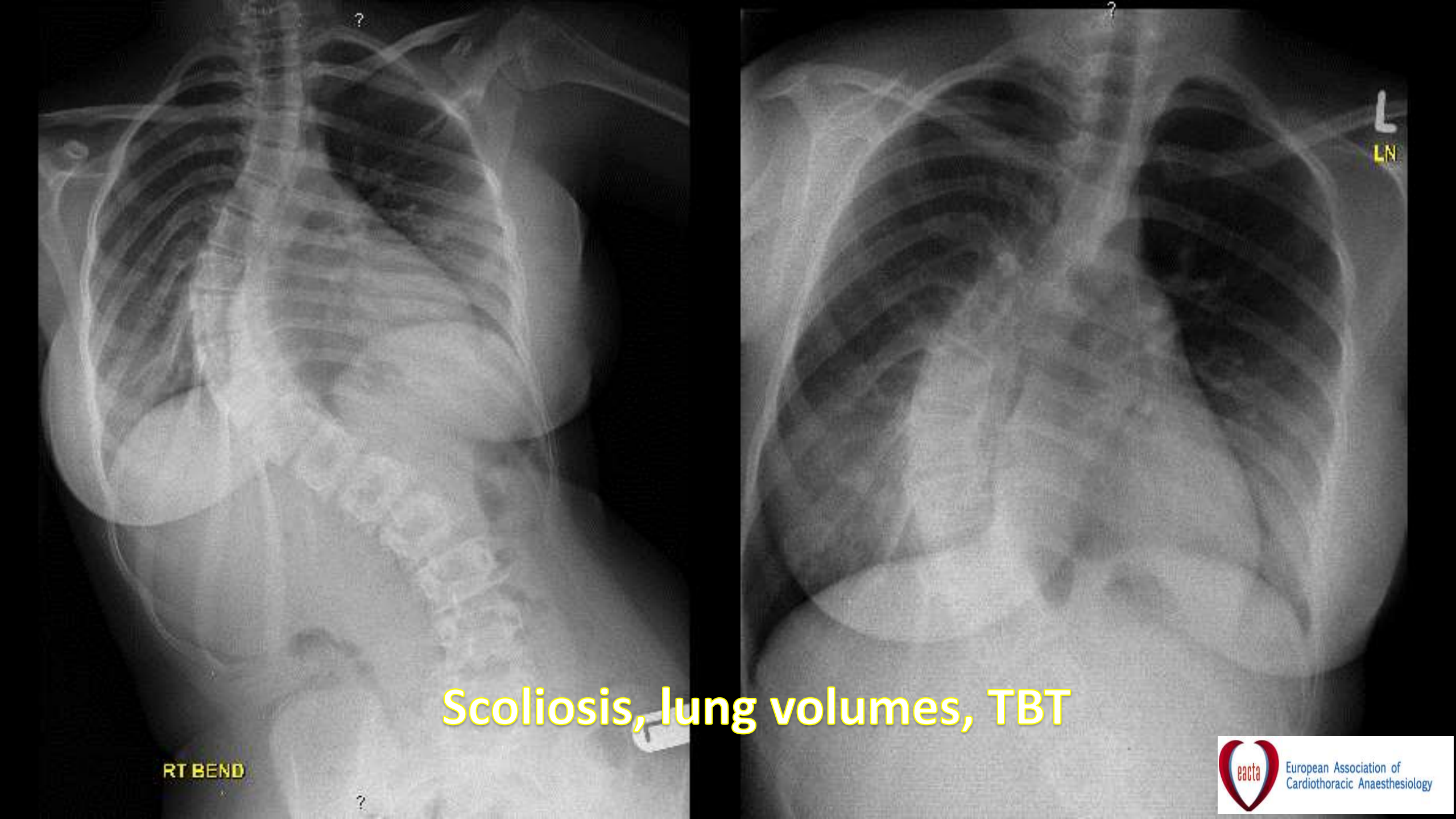


Steep angulation of the RMB



Scoliosis, lung volumes, TBT

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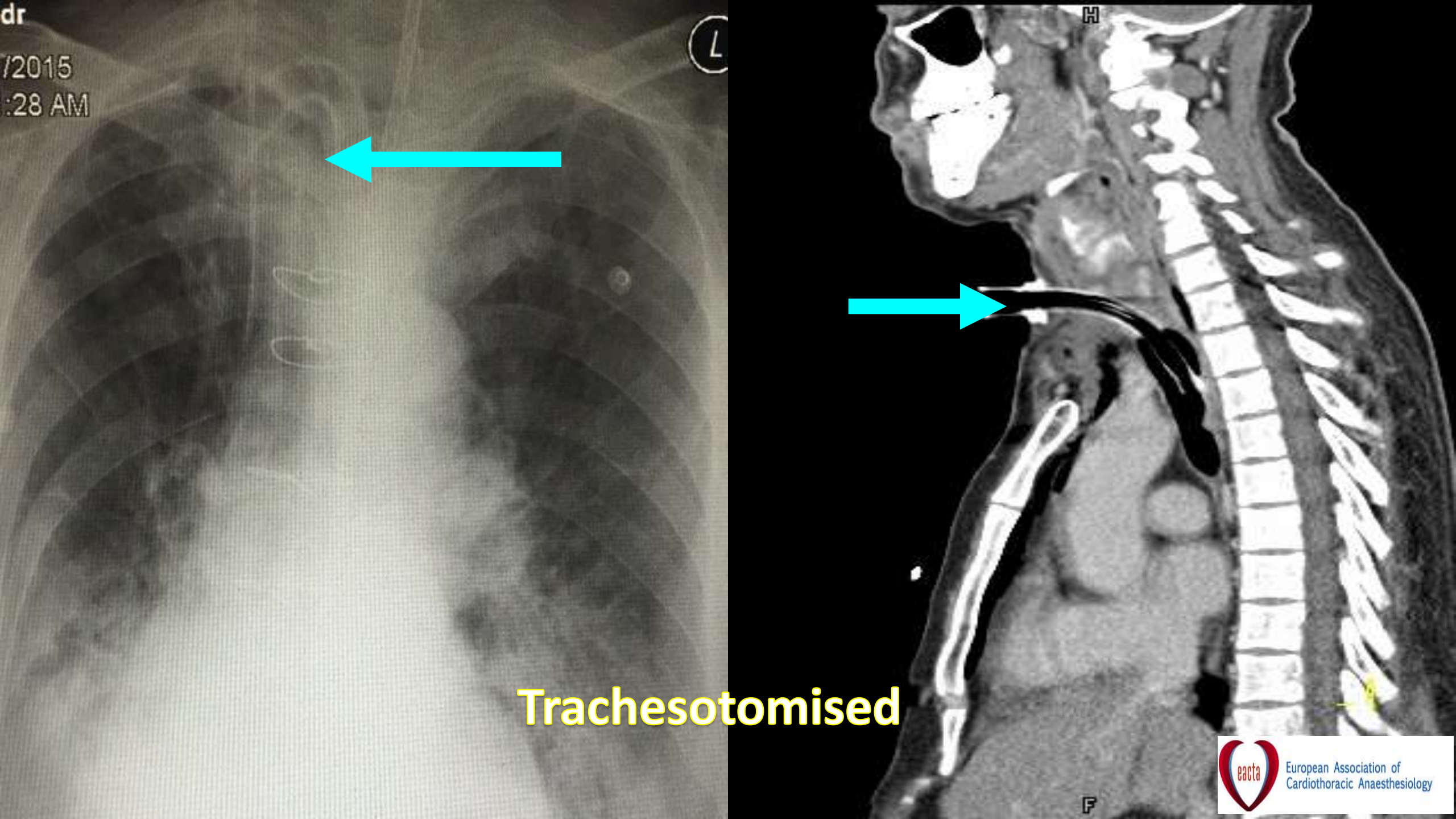
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Trachesotomised
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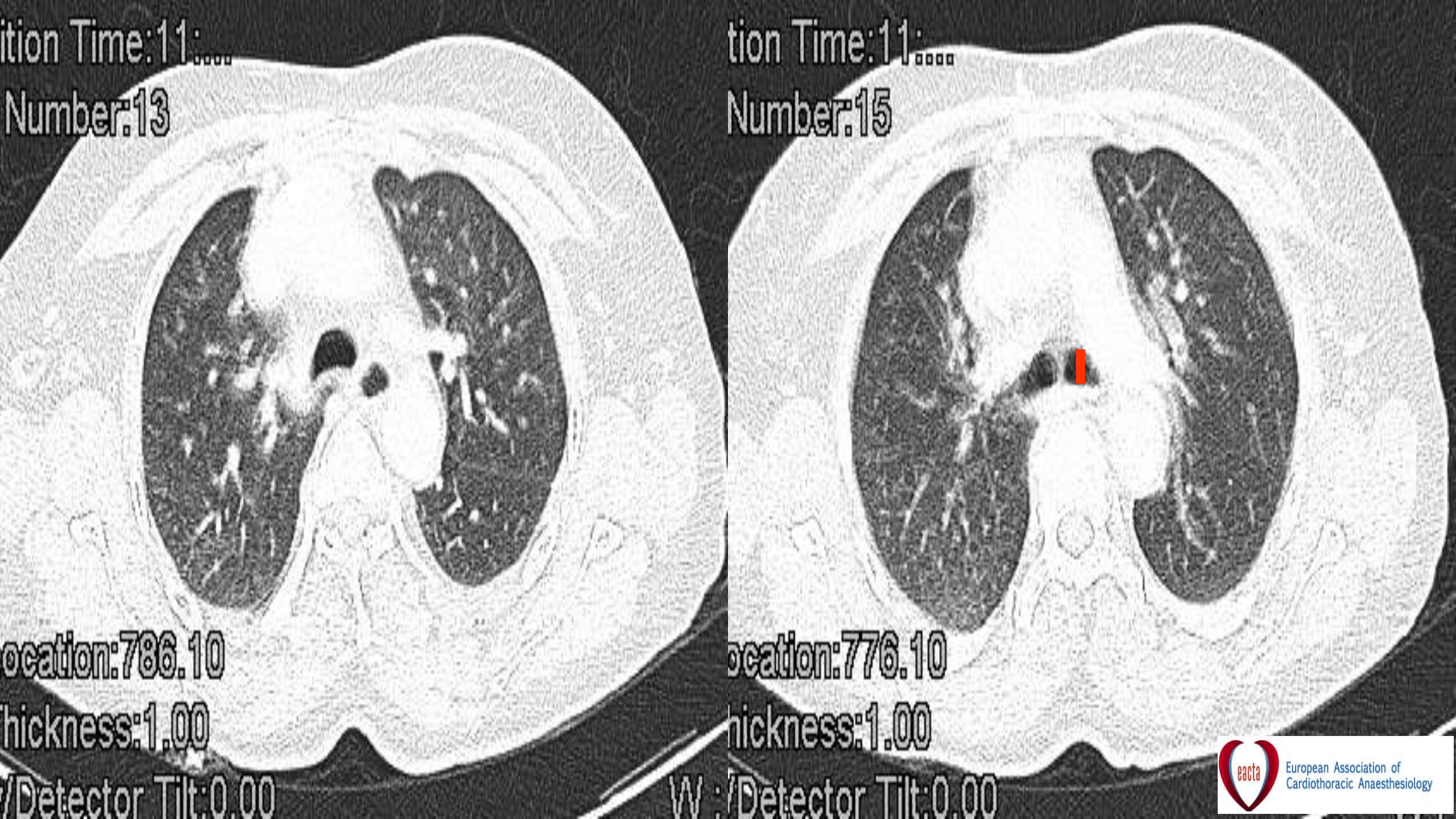
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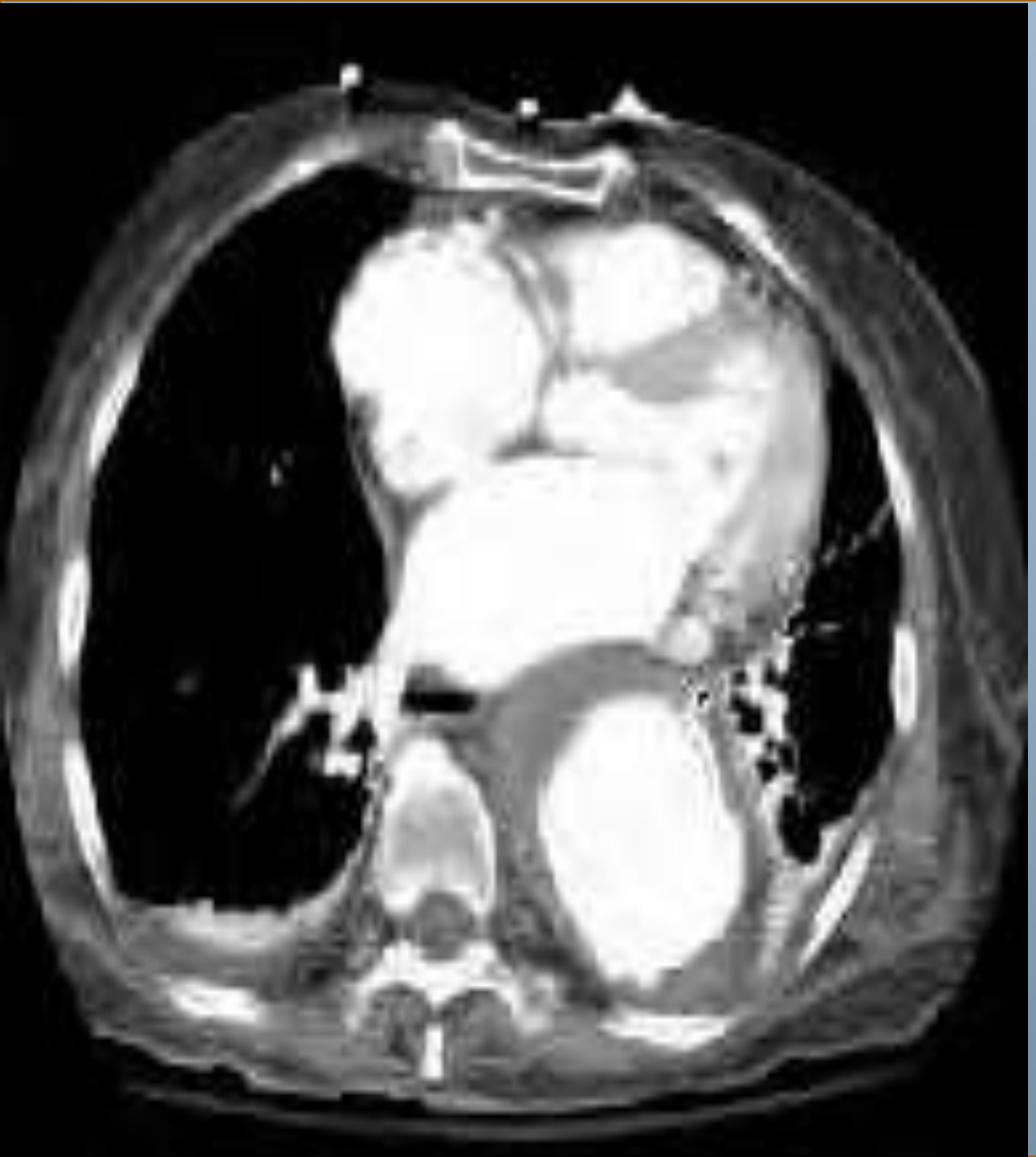

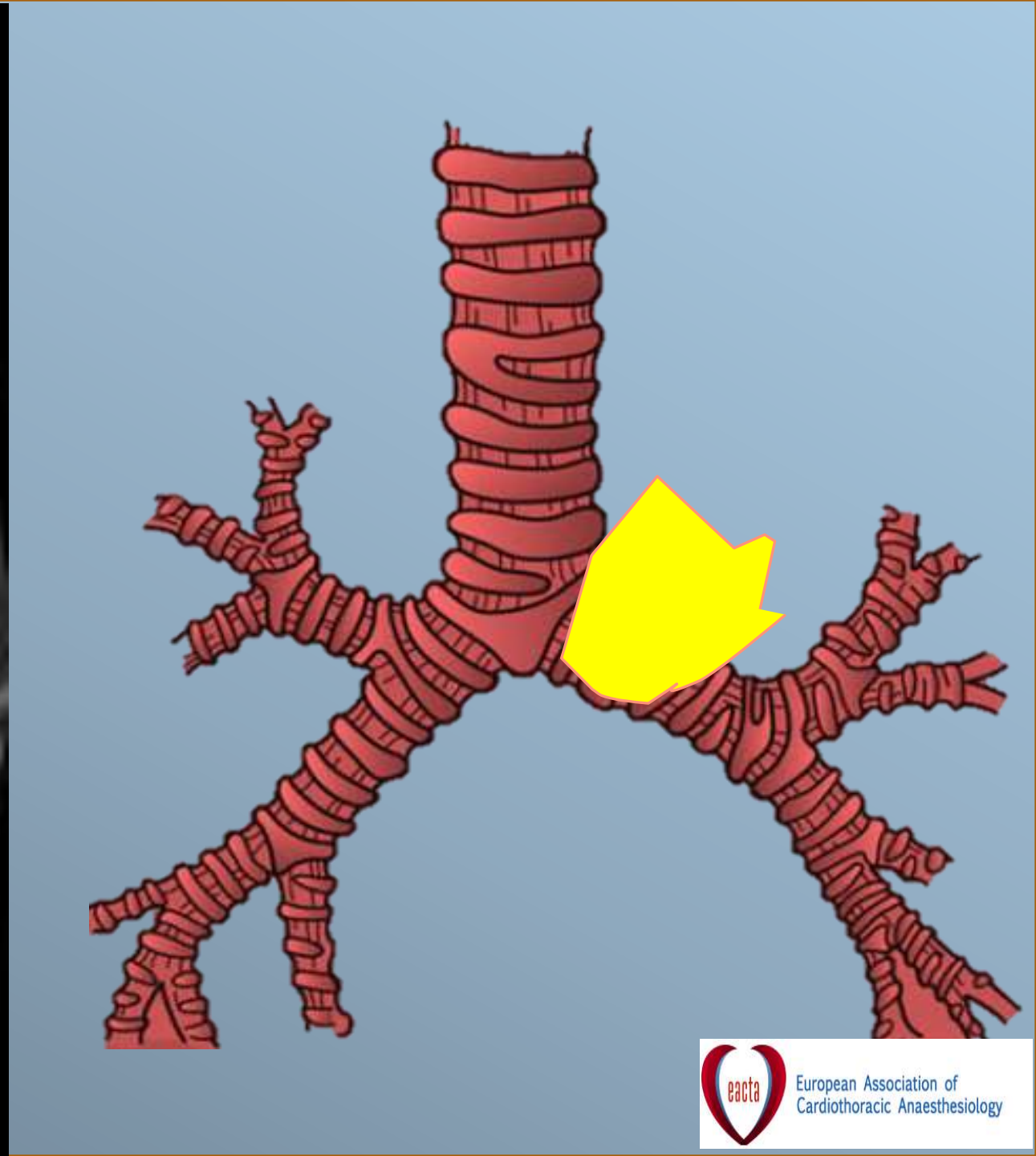

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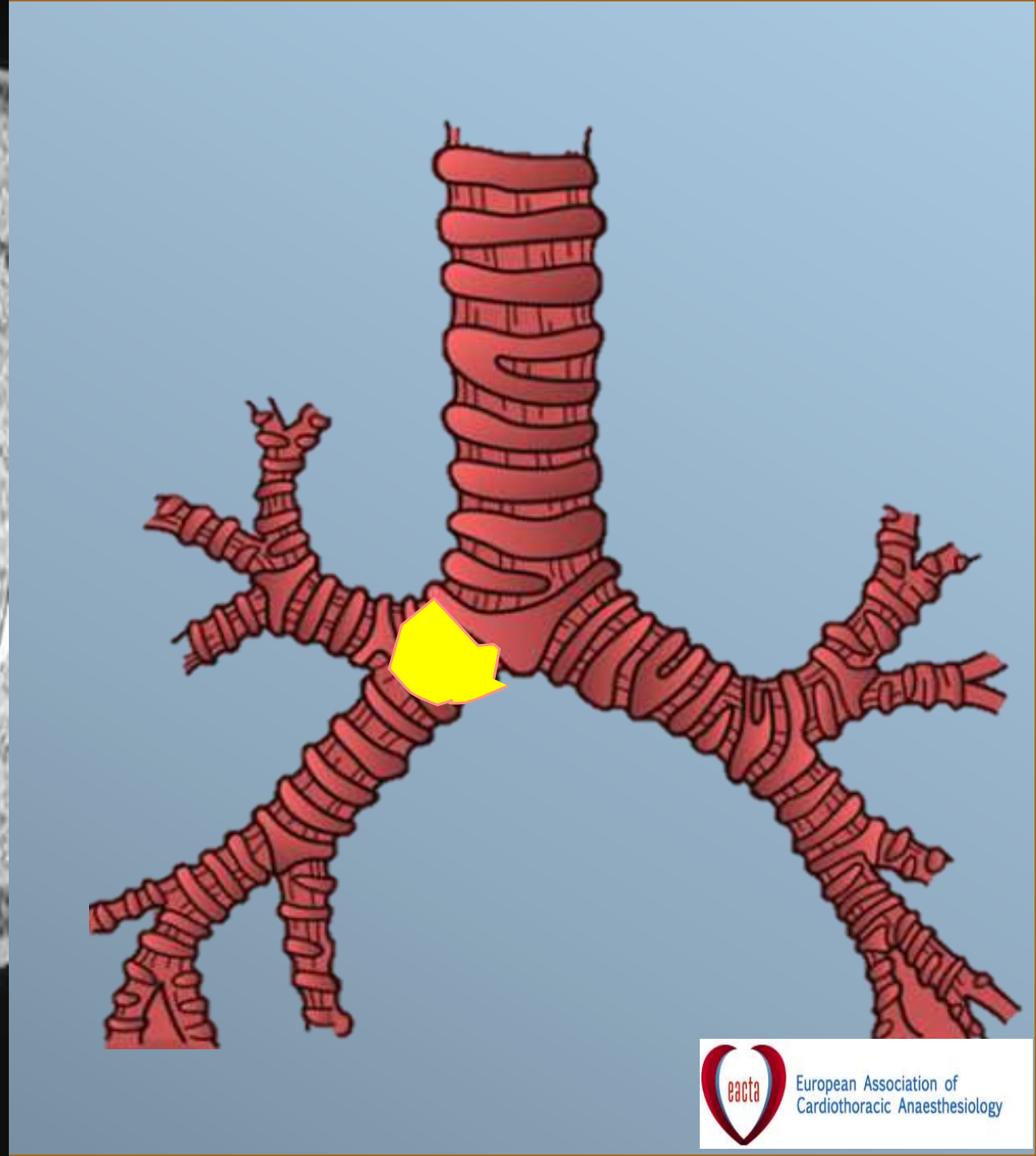
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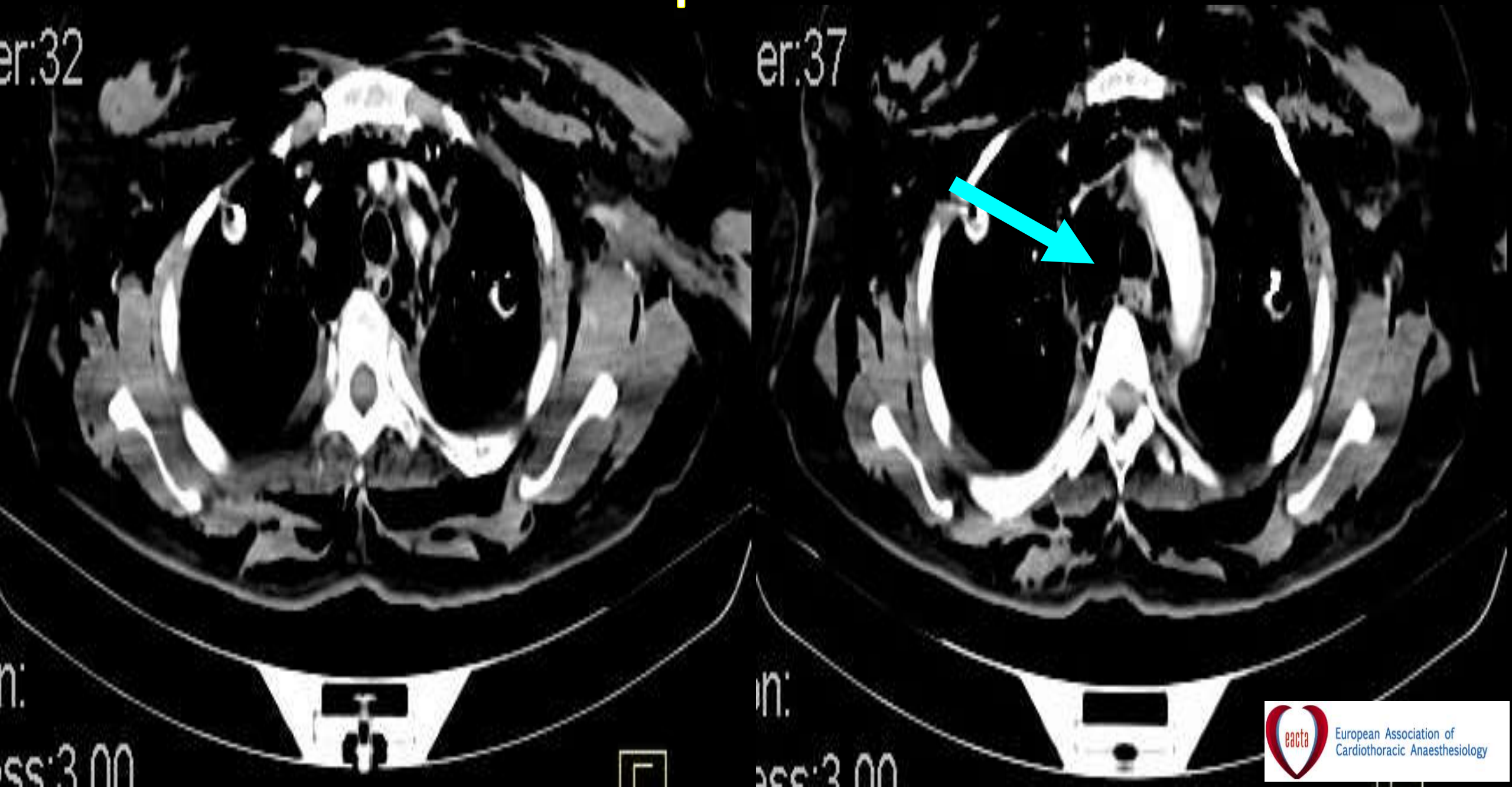
Disrupted RMB



Post-intubation stenosis

Call FOR HELP

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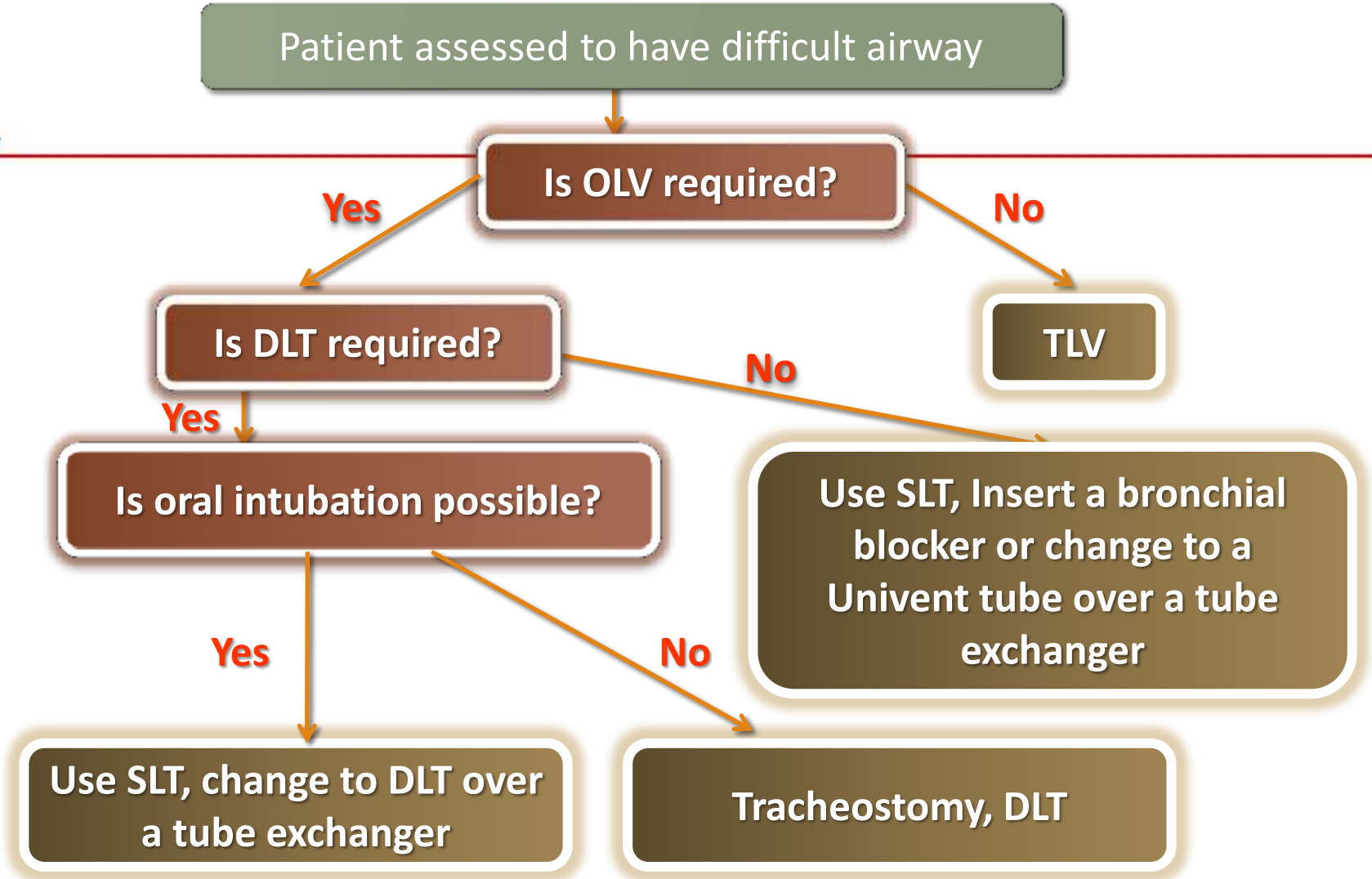
What Should We Do?

1. Ensure adequate ventilation.
2. Secure airway first.
3. Separate the lungs.

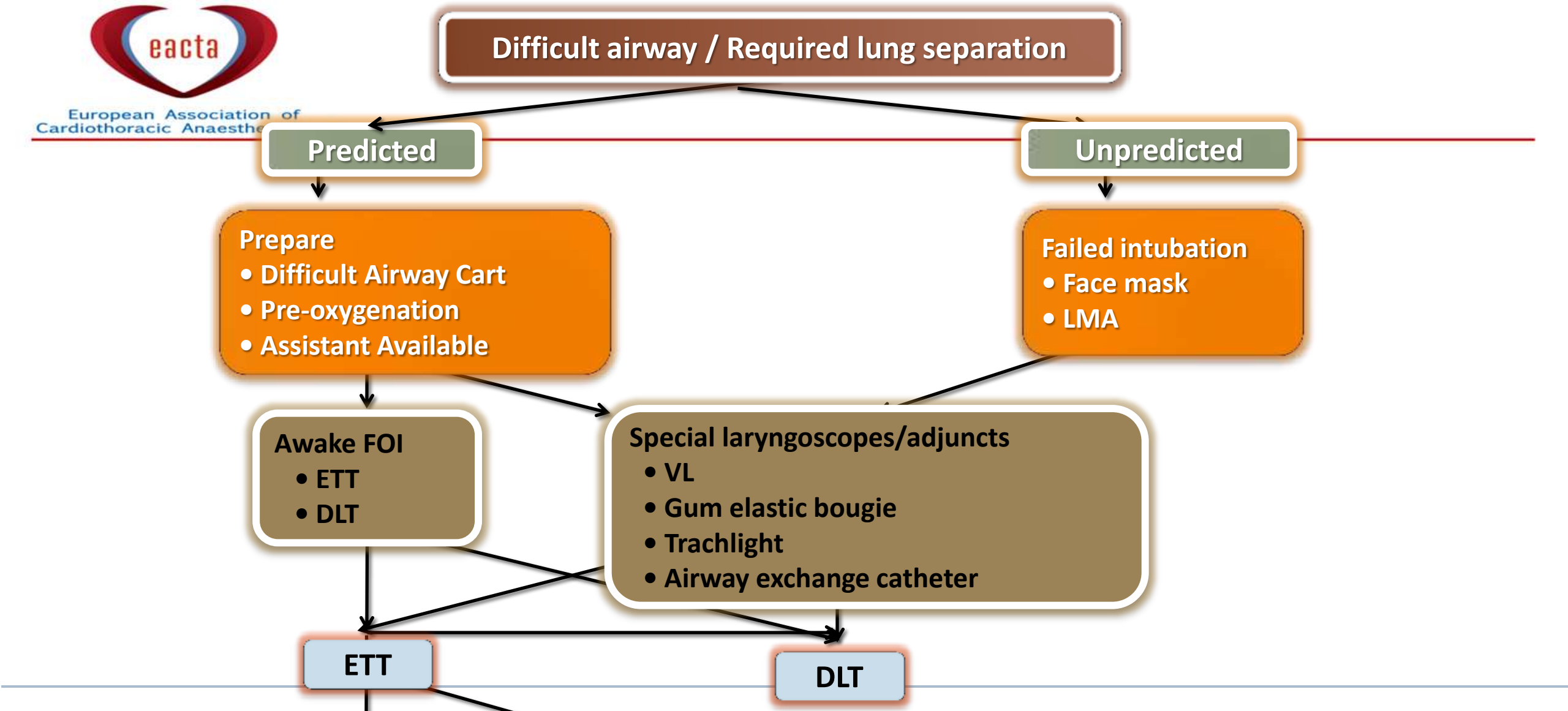


J Cardiothorac Vasc Anesth. 1998 Apr;12(2):186-8.

One-lung ventilation in patients with difficult airways.

Hagihira S, Takashina M, Mori T, Yoshiya I.

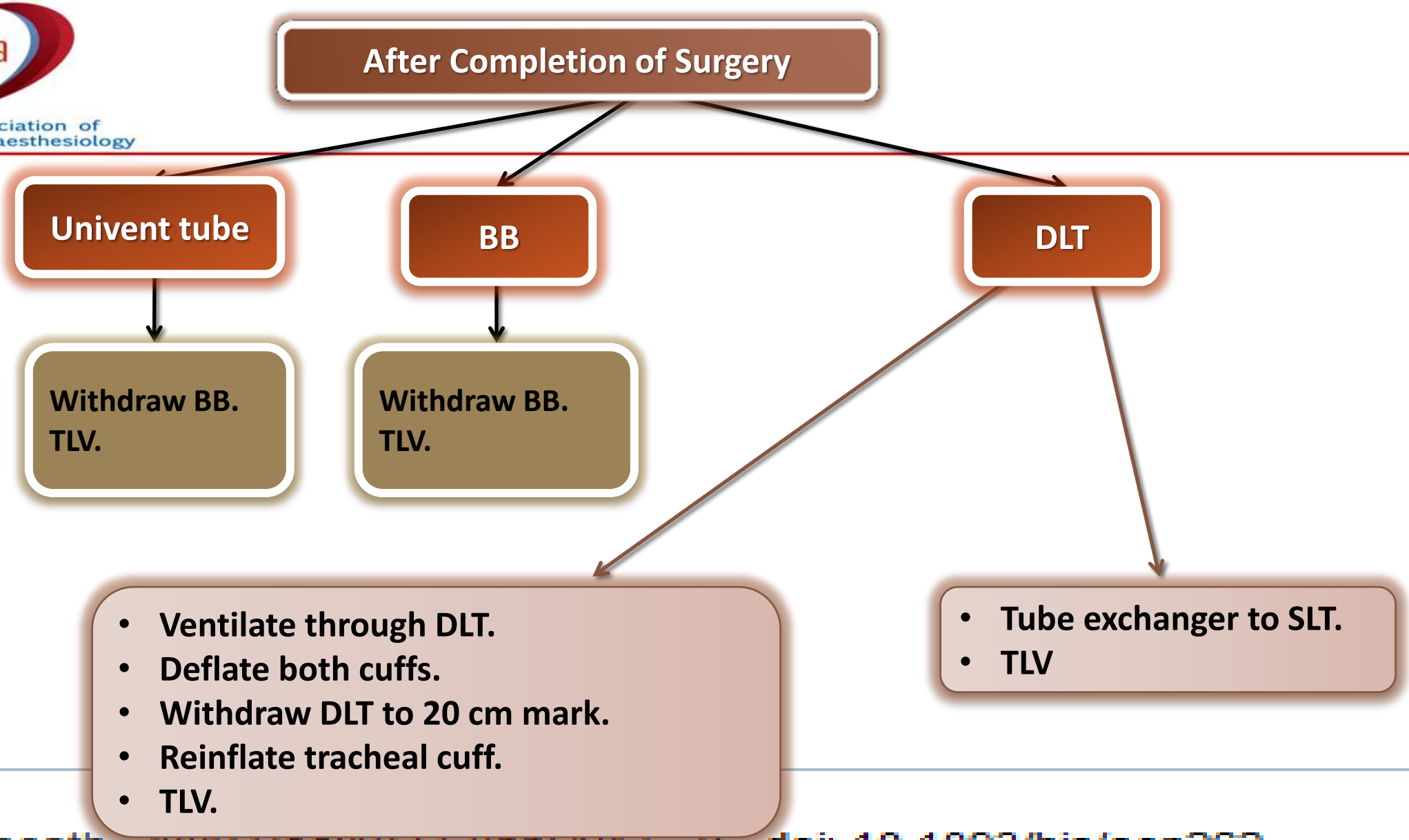

(b)



Br J Anaesth Dec;10 5. doi: 10.1093/bja/aep262.

Lung separation ifficult airway.

Brodsky JB.



Br J Anaesth. 2009 Dec;103 Suppl 1:i66-r5. doi: 10.1093/bja/aep262.

Lung separation and the difficult airway.

Brodsky JB.

Minerva Anestesiol. 2009 Jan-Feb;75(1-2):59-78; 79-96. Epub 2008 Nov 6.

Recommendations for airway control and difficult airway management in thoracic anesthesia and lung separation procedures.

[Article in English, Italian]

Merli G, Guarino A, Della Rocca G, Frova G, Petrini F, Sorbello M, Coccia C; SIAARTI Studying Group on Difficult Airv

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Difficult Airway Management

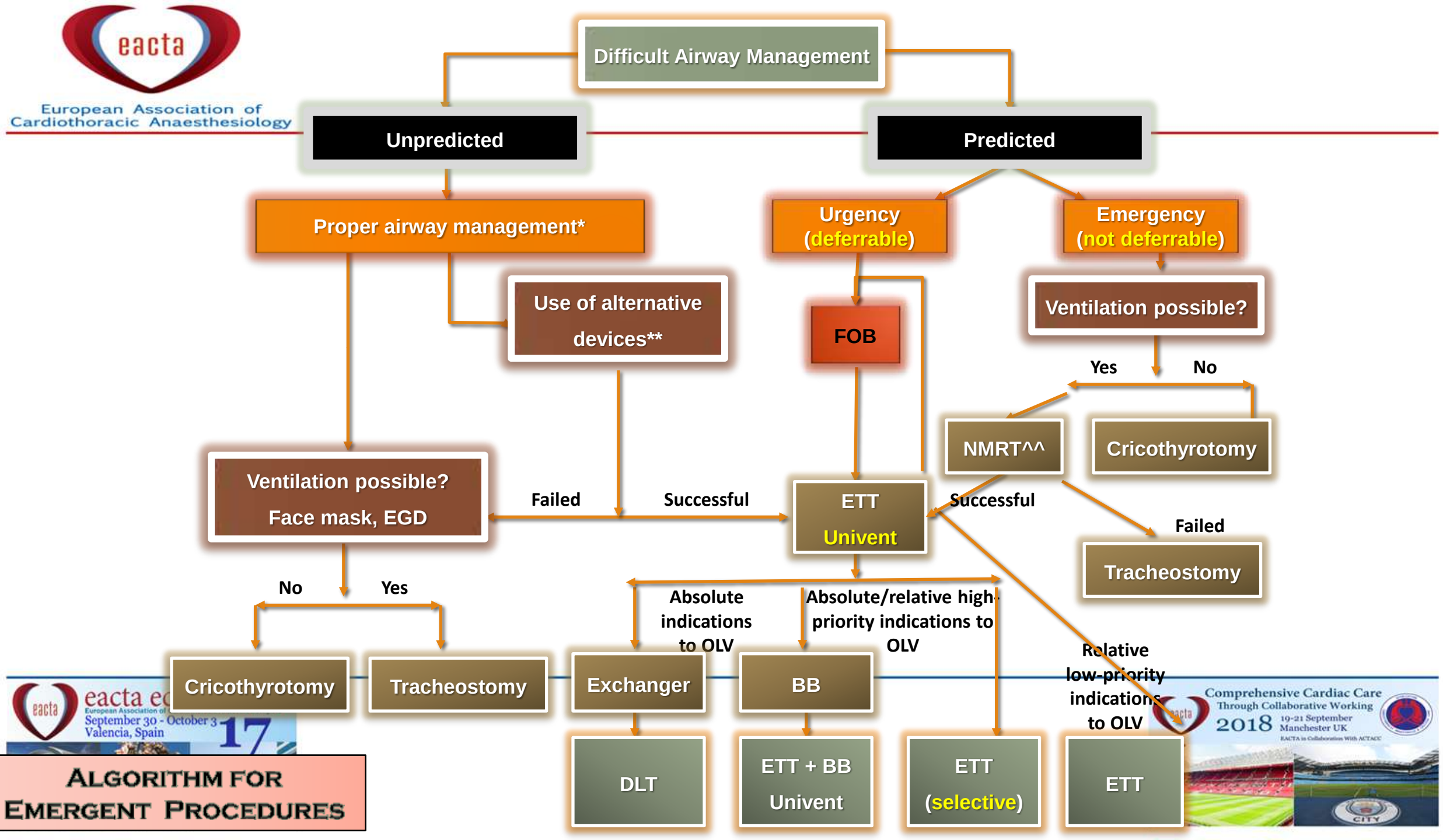
Unpredicted

- Proper airway management*
  - Use of alternative devices**
  - Ventilation possible?
    - Failed → Use of alternative devices**
    - Successful → ETT Univent
    - No → Cricothyrotomy
    - Yes → Wake Up
      - Wake Up → FOB
      - Wake Up → Tracheostomy (LA)

Predicted

- Proper airway management*
  - FOB → ETT Univent
  - ETT Univent → Relative low-priority indications to OLV → ETT
  - ETT Univent → Absolute indications to OLV → Exchanger → DLT
  - ETT Univent → Absolute/relative high-priority indications to OLV → BB → ETT + BB Univent
  - ETT Univent → ETT (selective)

ALGORITHM FOR NON-EMERGENT PROCEDURES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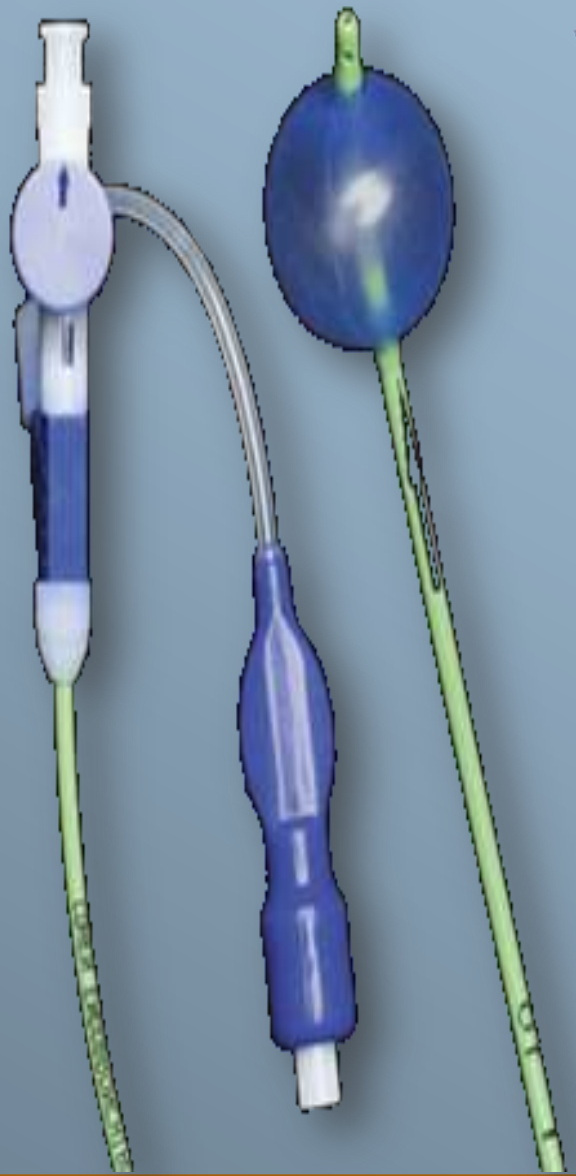
Difficult Airway Management
Unpredicted
Predicted
Proper airway management*
Use of alternative devices**
Urgency (deferrable)
Emergency (not deferrable)
FOB
Ventilation possible?
Yes
No
NMRT^^
Cricothyrotomy
Ventilation possible? Face mask, EGD
Failed
Successful
ETT Univent
Successful
Failed
Tracheostomy
No
Yes
Absolute indications to OLV
Absolute/relative high-priority indications to OLV
Relative low-priority indications to OLV
Cricothyrotomy
Tracheostomy
Exchanger
BB
DLT
ETT + BB Univent
ETT (selective)
ETT
ALGORITHM FOR EMERGENT PROCEDURES

Arndt

Cohen



Fuji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Bronchial Blockers

Anesth Analg. 2003 Nov;97(5):1266-74.

An update on bronchial blockers during lung separation techniques in adults.

Campos JH.

Paediatr Anaesth. 2007 Mar;17(3):289-94.

Effectiveness of Arndt endobronchial blockers in pediatric scoliosis surgery: a case series.

Bird GT, Hall M, Nel L, Davies E, Ross O.

Masui. 2007 Feb;56(2):167-8.

[Management of one lung ventilation with bronchial blocker catheter for a patient with tracheobronchopathia osteochondroplastica].

[Article in Japanese]

Myojo Y, Kamiutsuri K, Taki Y, Tohyama K, Usukura A.

The New Era of Videolaryngoscopy

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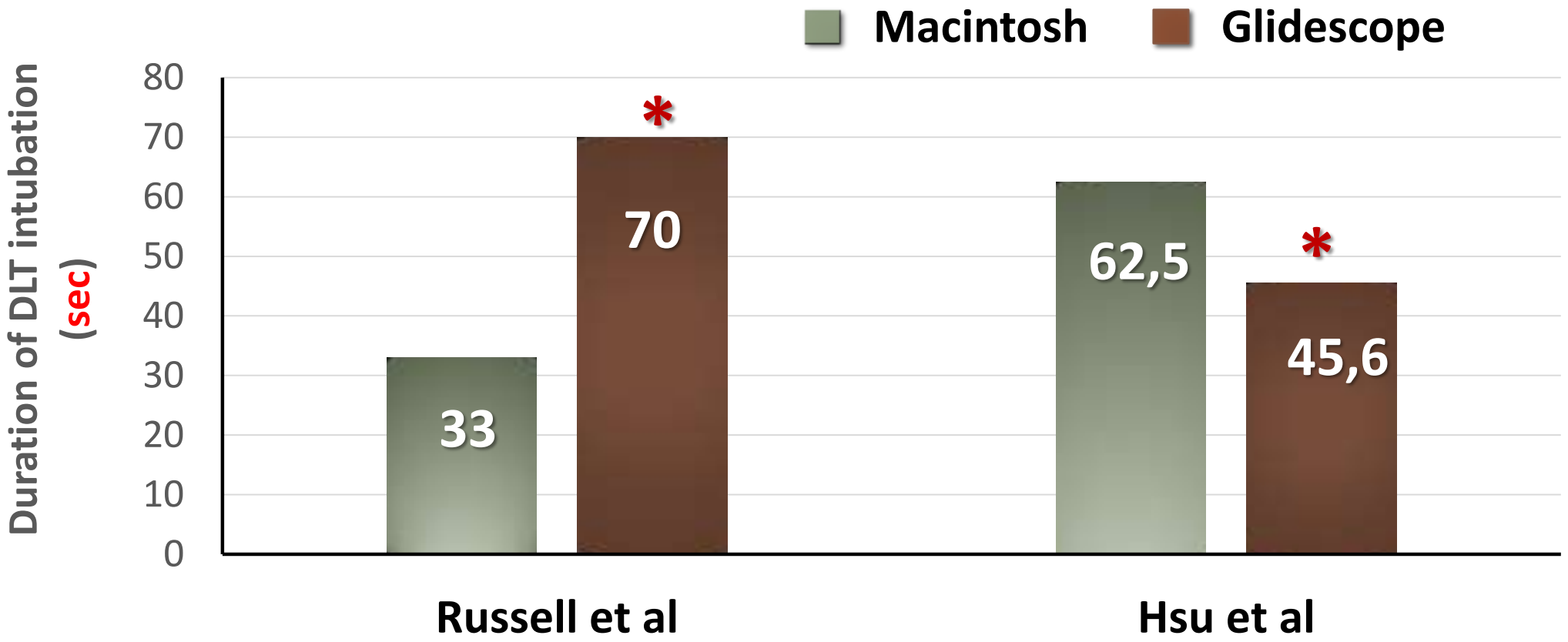
GlideScope

MacGrath



Anaesthesia. 2013 Dec;68(12):1253-8. doi: 10.1111/anae.12322.

A randomised controlled trial comparing the GlideScope(®) and the Macintosh laryngoscope for double-lumen endobronchial intubation.

Russell T, Slinger P, Roscoe A, McRae K, Van Rensburg A.

3-6 times

Anaesthesia. 2012 Apr;67(4):411-5. doi: 10.1111/j.1365-2044.2011.07049.x. Epub 2012 Feb 11.

Comparison of the GlideScope® videolaryngoscope and the Macintosh laryngoscope for double-lumen tube intubation.

Hsu HT, Chou SH, Wu PJ, Tseng KY, Kuo YW, Chou CY, Cheng KI.

300 times

Anesth Analg. 2014 Aug;119(2):449-53. doi: 10.1213/ANE.0000000000000250.

A simulator study of tube exchange with three different designs of double-lumen tubes

Gamez R[1], Slinger P.

Saudi J Anaesth. 2016 Apr-Jun;10(2):218-27. doi: 10.4103/1658-354X.168804.

Videolaryngoscopes for placement of double lumen tubes: Is it time to say goodbye to direct view?

El-Tahan MR[1].

Author information

[1]Department of Anesthesiology, University of Dammam, Dammam, Al Khubar 31952, Saudi Arabia.

Abstract

The advances in thoracic procedures require optimum lung separation to provide adequate room for surgical access. This can be achieved using either a double-lumen tube (DLT) or a bronchial blocker (BB). Most thoracic anesthesiologists prefer the use of DLT. However, lung separation in patients with potential difficult airway can be achieved using either BB through a single lumen tube or placement of a DLT over a tube exchanger or a fiberoptic bronchoscope. Numerous videolaryngoscopes (VL) have been introduced offering both optical and video options to visualize the glottis. Many studies reported improved glottis visualization and easier DLT intubation in patients with normal and potential difficult airway. However, these studies have a wide diversity of outcomes, which may be attributed to the differences in their designs and the prior experience of the operators in using the different devices. In the present review, we present the main outcomes of the available publications, which have addressed the use of VL-guided DLT intubation. Currently, there is enough evidence supporting using VL for DLT intubation in patients with predicted and unanticipated difficult airway. In conclusion, the use of VL could offer an effective method of DLT placement for lung separation in patients with the potential difficult

Reference	Study	Arms	Operators experience	End points	Outcomes
Yao *et al.* (2015)[16]	Randomized Prospective Controlled Powered	Macintosh ($n = 48$) McGrath® ($n = 48$) Patients with normal airway	Experts	Time to intubation Other outcomes Cormack and Lehane grade DLT malposition Success rate at the first attempt Difficult intubation score Hoarseness Oropharyngeal trauma. Sore throat	The use of the McGrath® was associated with a longer time to intubation by 15 sec, $p < 0.05$ more Cormack and Lehane grade-1 views by 37%, and a higher incidence of DLT malposition by + 12.5% Comparable rate of success at the first attempt, difficult intubation score, and complications
Yao *et al.* (2014)[17]	Prospective Observational	McGrath® ($n = 43$) Patients with airway	N/A	Cormack and Lehane grade Other outcomes Time to intubation Overall success rate Difficult intubation score Complications	The McGrath® provided a high rate of grade-1 laryngeal views (88%), acceptable intubation time (54 sec), a high rate of successful intubation at the 1st attempt (95%), and was easy to intubate in 79%
Purugganan *et al.* (2012)[18]	Retrospective Controlled	Macintosh ($n = 40$) Miller ($n = 44$) McGrath® ($n = 15$) STRORZ C-MAC® ($n = 31$) Patients with normal and abnormal airway	> 25 times	Difficult intubation score Other outcomes Cormack and Lehane grade Number of intubation attempts. Airway trauma	The use of the McGrath® and C-MAC® was associated with lower Cormack and Lehane grades; $p < 0.006$ and easier intubation than the other two groups Comparable Number of intubation attempts

N/A; Not available

Airtraq

Airway Scope

King Vision

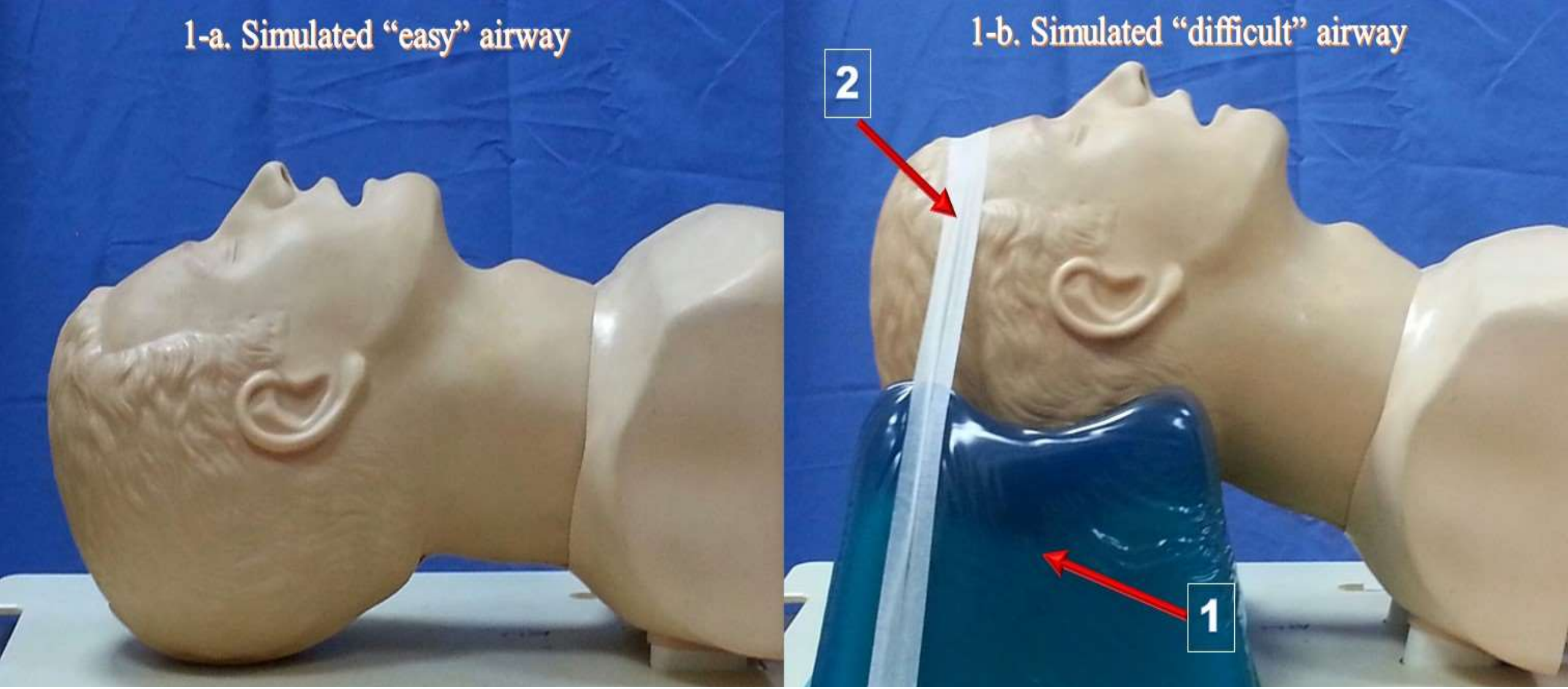
Reference	Study	Arms	Operators experience	End points	Outcomes
Yi *et al.* (2015)[28]	Randomized Prospective Controlled Powered	Airtraq® ($n = 35$) GlideScope® ($n = 35$) Patients with normal airway	>30 times	Time to intubation Other outcomes Cormack-Lehane grades Success rate Difficult intubation score Hemodynamic variables Sore throat	Shorter time to intubation by 18 sec, $p = 0.002$, and less hemodynamic changes with using the Airtraq® Comparable rate of success at the first attempt, difficult intubation score, and Sore throat
Hamp *et al.* (2015)[27]	Randomized Prospective Controlled Powered	Macintosh ($n = 20$) Airtraq® ($n = 20$) Patients with normal airway	N/A	Hemodynamic variables Other outcomes Catecholamine levels Bispectral index Time to intubation	Higher epinephrine level and non-statistically shorter time to intubation by 18 sec, $p = 0.26$ with using the Airtraq® Comparable hemodynamic changes
Chastel *et al.* (2015)[26]	Prospective Observational	Airtraq® ($n = 37$) Patients with normal and abnormal airway	>20 times	Success rate for intubation Other outcomes Glottis exposure Complications	only 33 (89%) were successfully intubated within 120s (mean time: 44 ± 27s) using the Airtraq®
Wasem *et al.* (2013)[24]	Randomized Prospective Controlled Powered	Macintosh ($n = 30$) Airtraq® ($n = 30$) Patients with normal and abnormal airway	N/A	Time to intubation Other outcomes Difficult intubation score Cormack and Lehane grade Hemodynamic variables Hoarseness Oropharyngeal trauma Sore throat	Comparable time to intubation , difficult intubation score, and Cormack and Lehane grade The use of the Airtraq® was associated with higher incidence of hoarseness Comparable rate of success at the first attempt
Hirabayashi and Seo (2007)[25]	Prospective Observational	Airtraq® ($n = 10$) Patients with normal and abnormal airway	N/A	Time to intubation	Time to intubation was 49 ± 22 s Improved glottis view in 90% Correct placement of left DLT in 70%

Abbreviation: N/A; not available

Minerva Anestesiol. 2016 Oct;82(10):1050-1058. Epub 2016 May 12.

Comparison of three videolaryngoscopes for double-lumen tubes intubation in simulated easy and difficult airways: a randomized trial.

El-Tahan MR[1], Al'ghamdi AA, Khidr AM, Gaarour IS.



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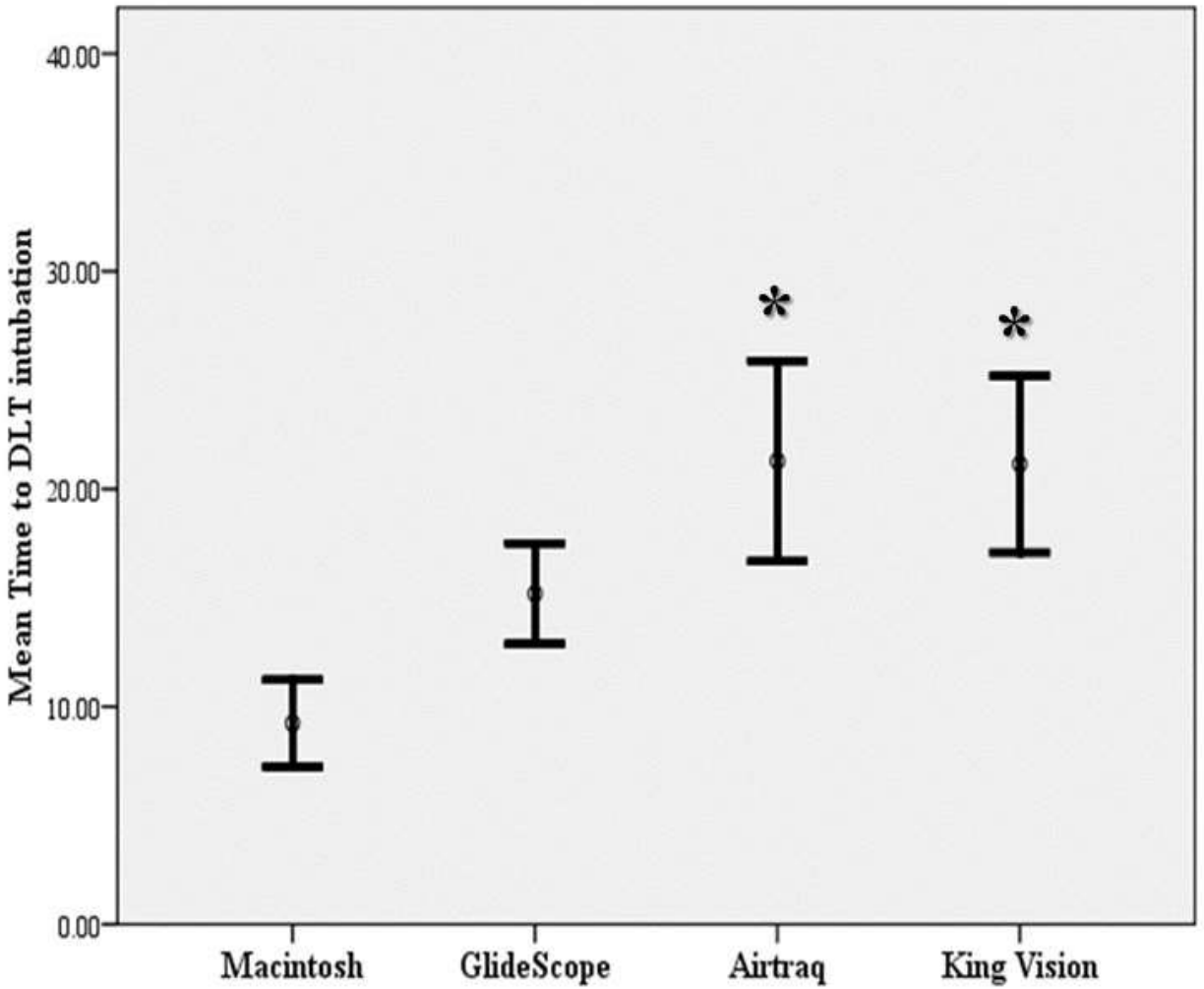
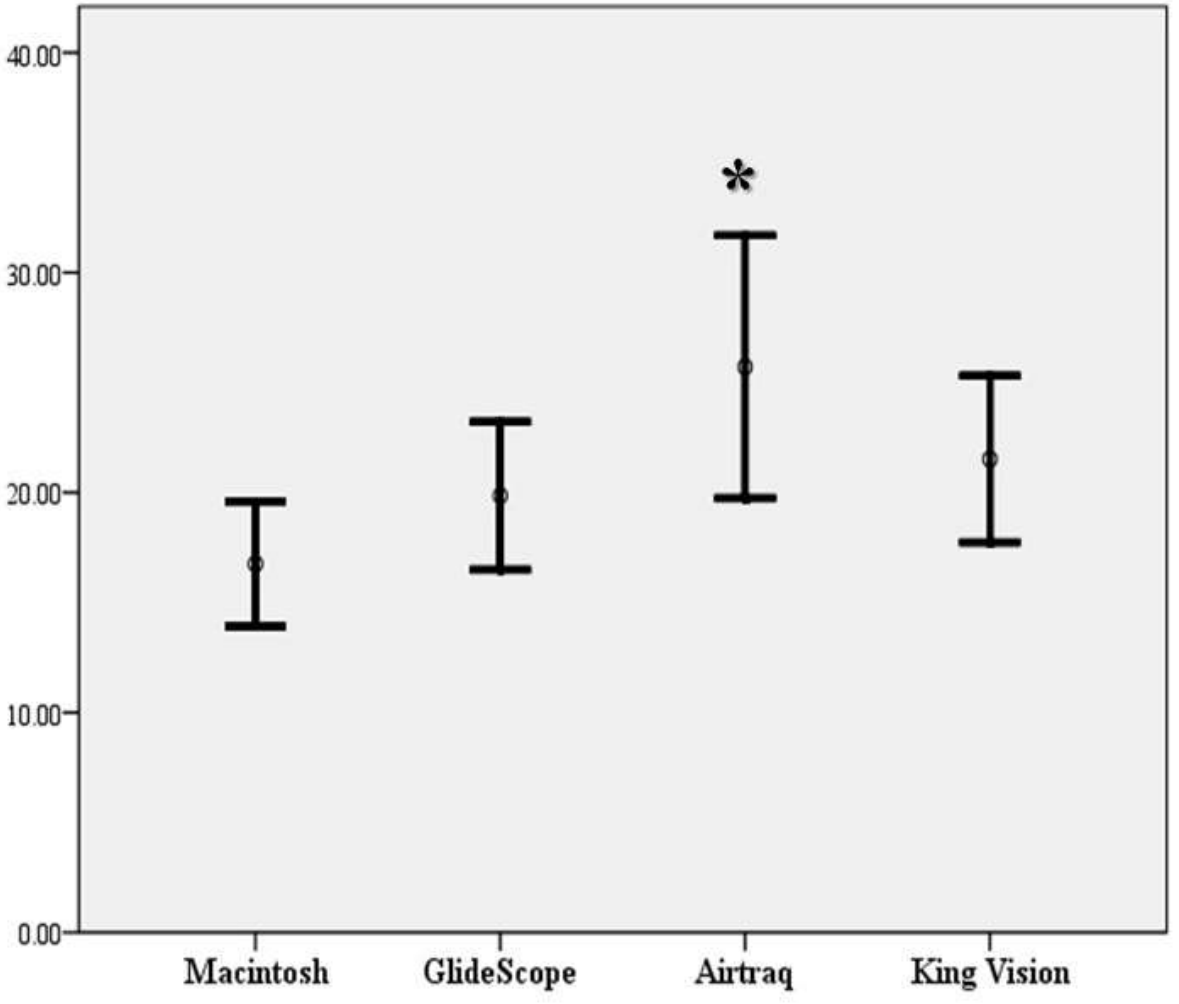
1-a. Simulated "easy" airway



1-b. Simulated "difficult" airway



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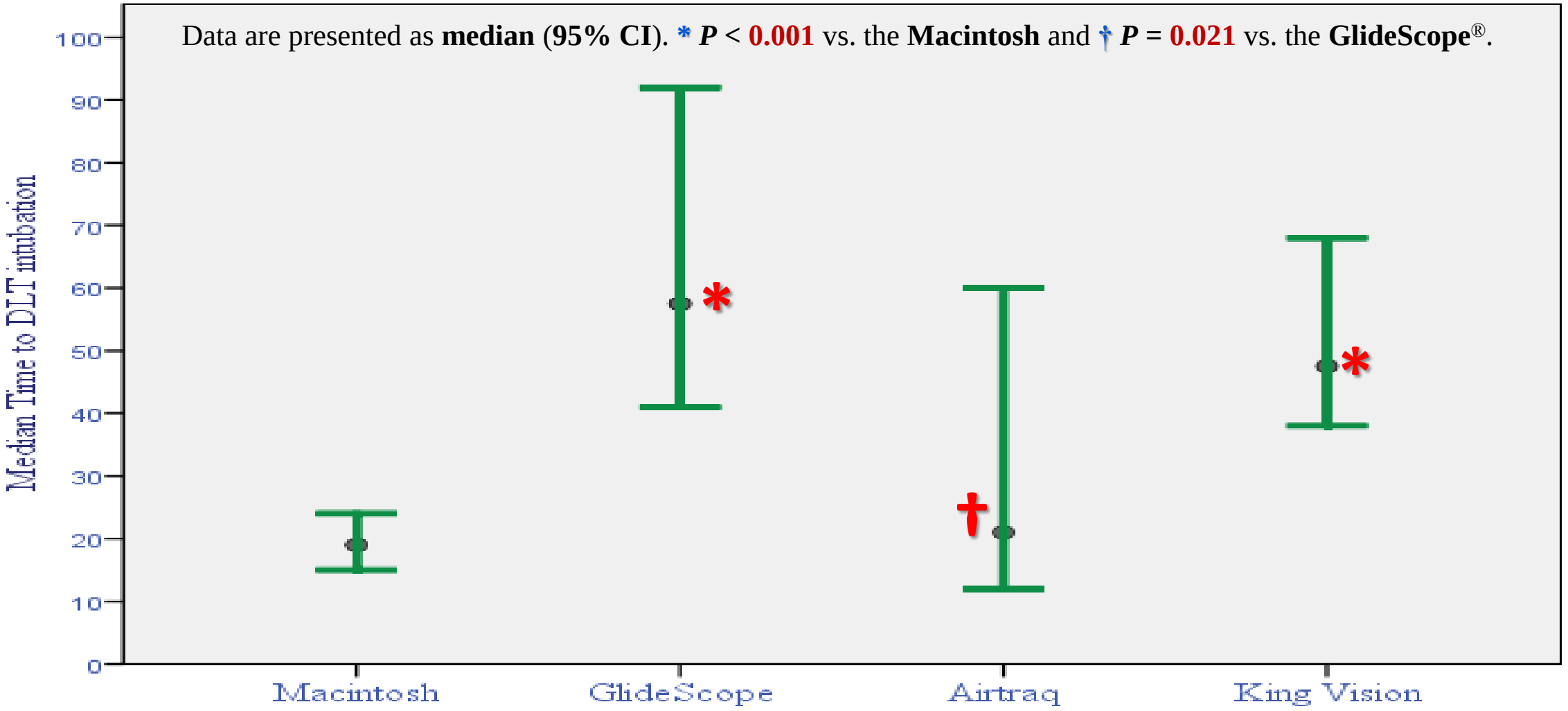
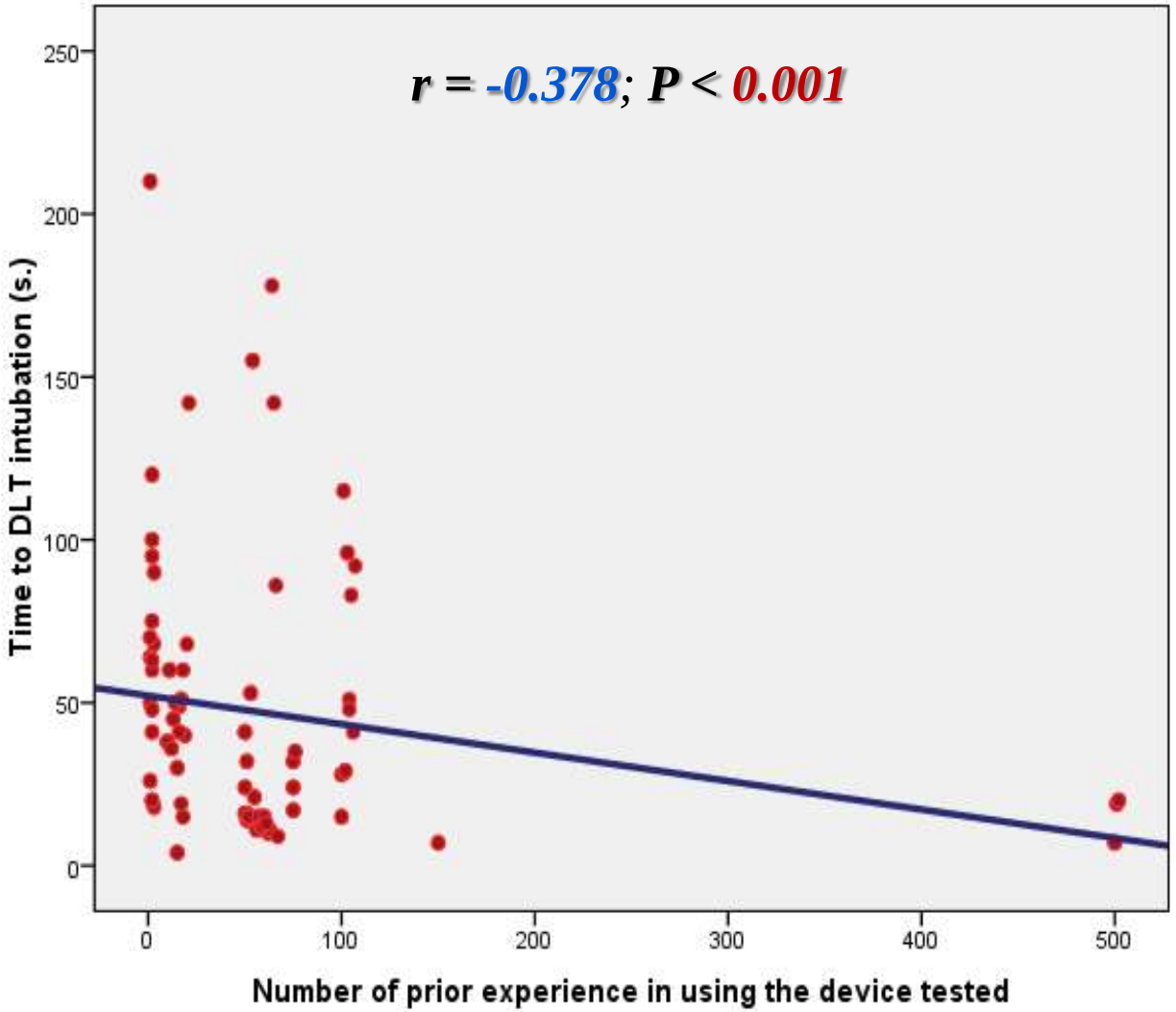
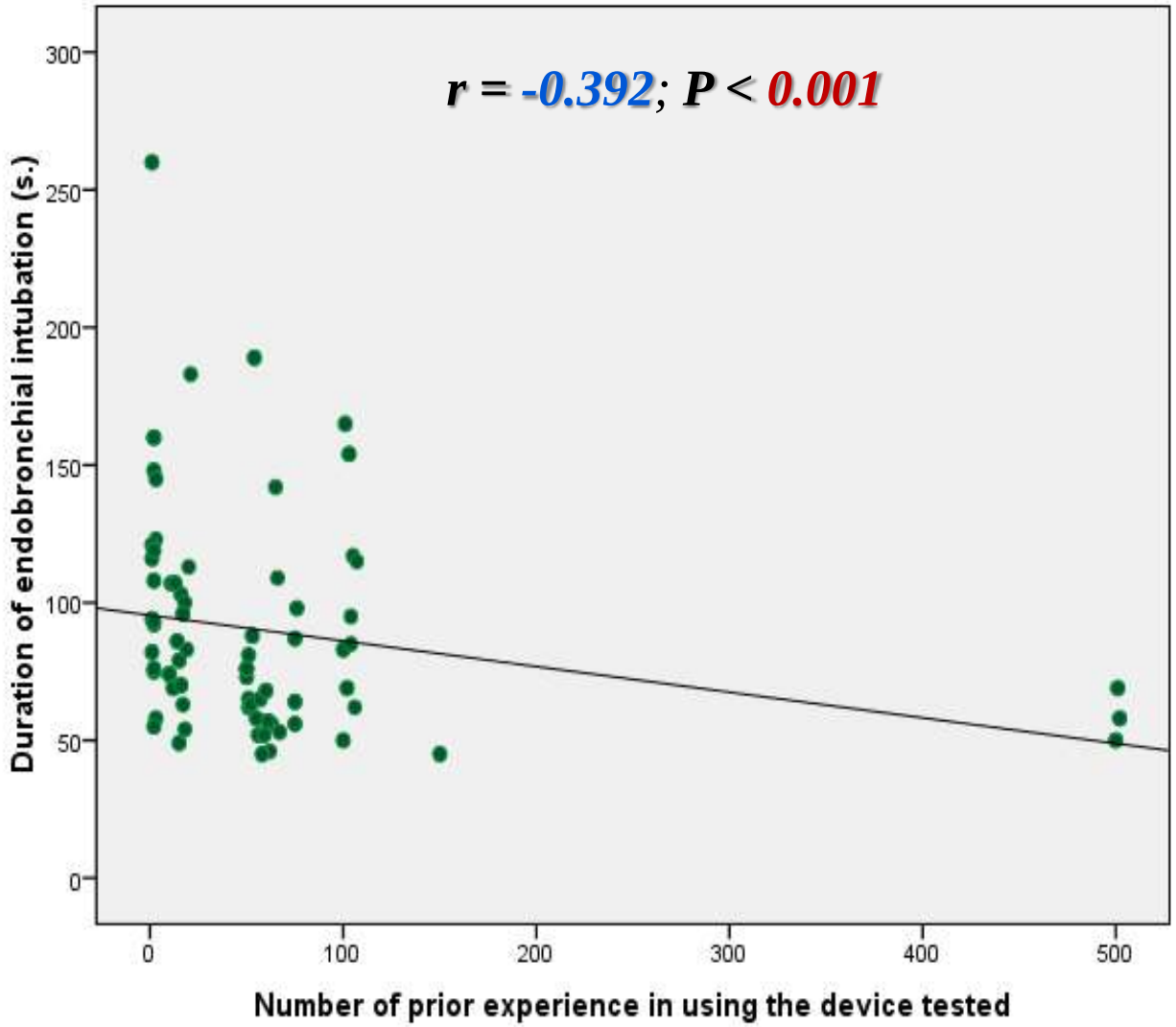


A comparison of three videolaryngoscopes for double-lumen tubes intubation in humans by users with mixed experience. A randomized controlled study

Mohamed El Tahan, A Khidr, I Gaarour, S Alshadwi, T Alghamdi, A Al'ghamd
King Fahd Hospital of the University of Dammam, Department of Anaesthesiology, Al Khobar, Dammam, Saudi Arabia

Journal of Cardiothoracic and Vascular Anesthesia





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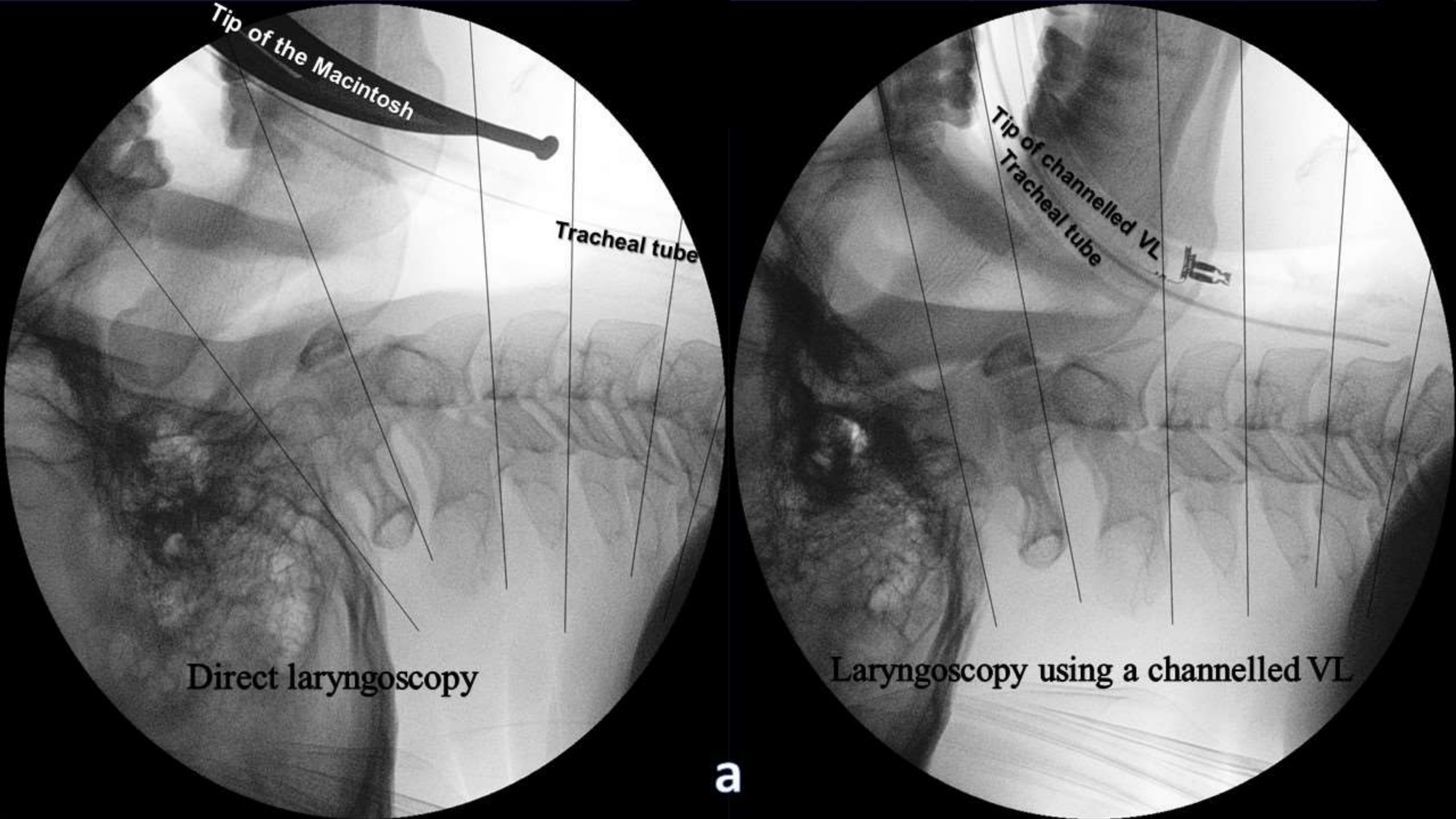
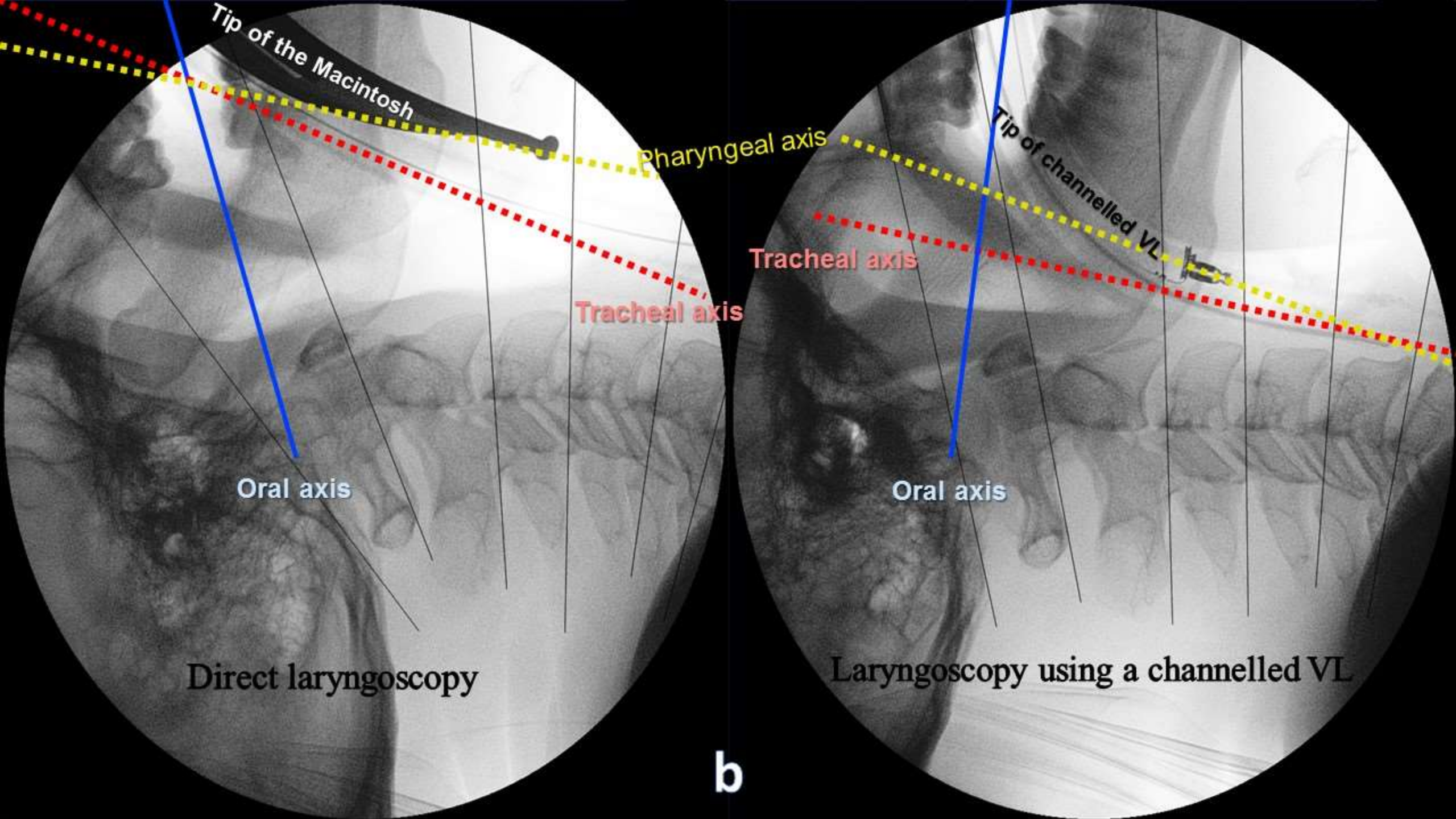
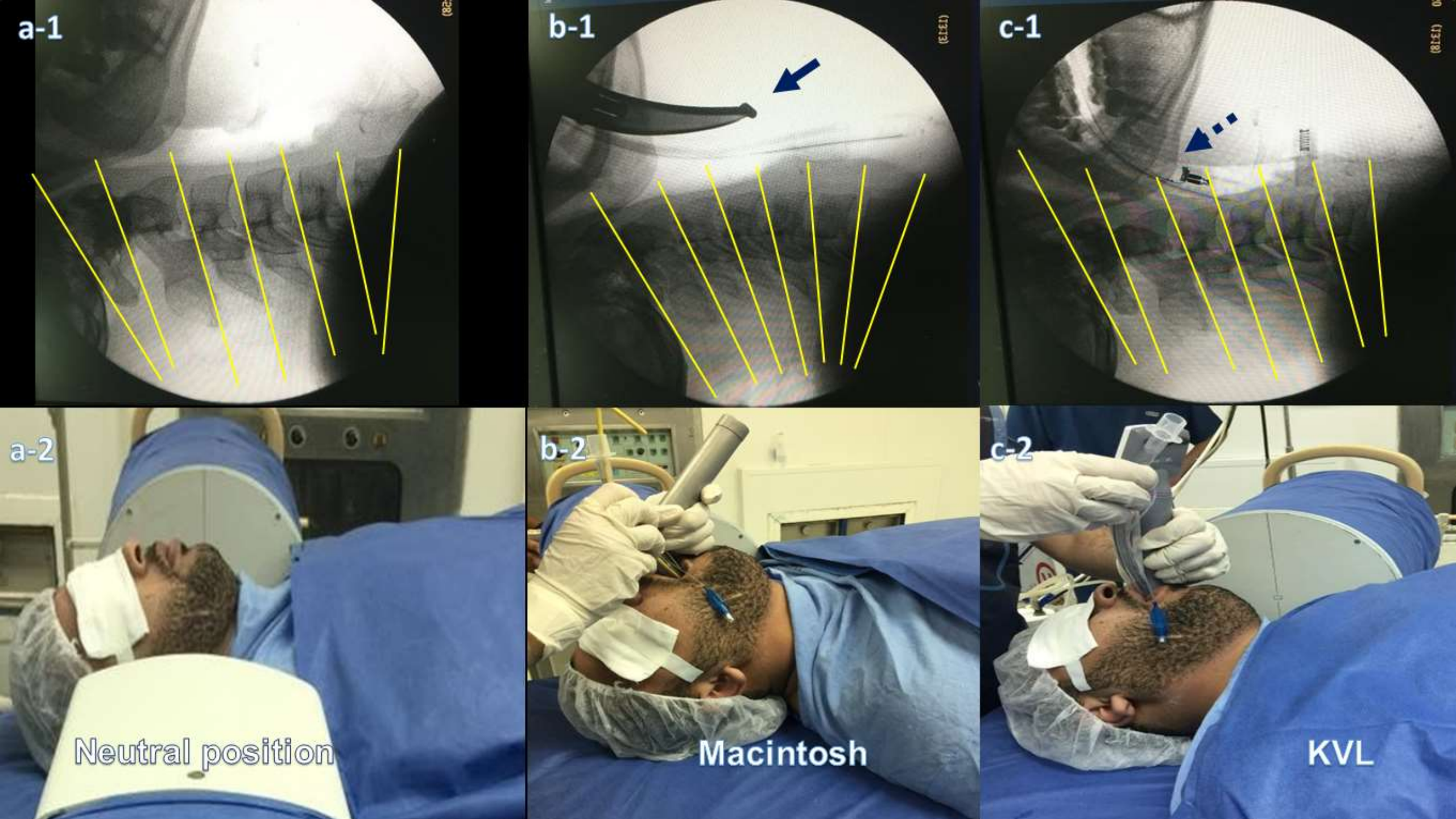
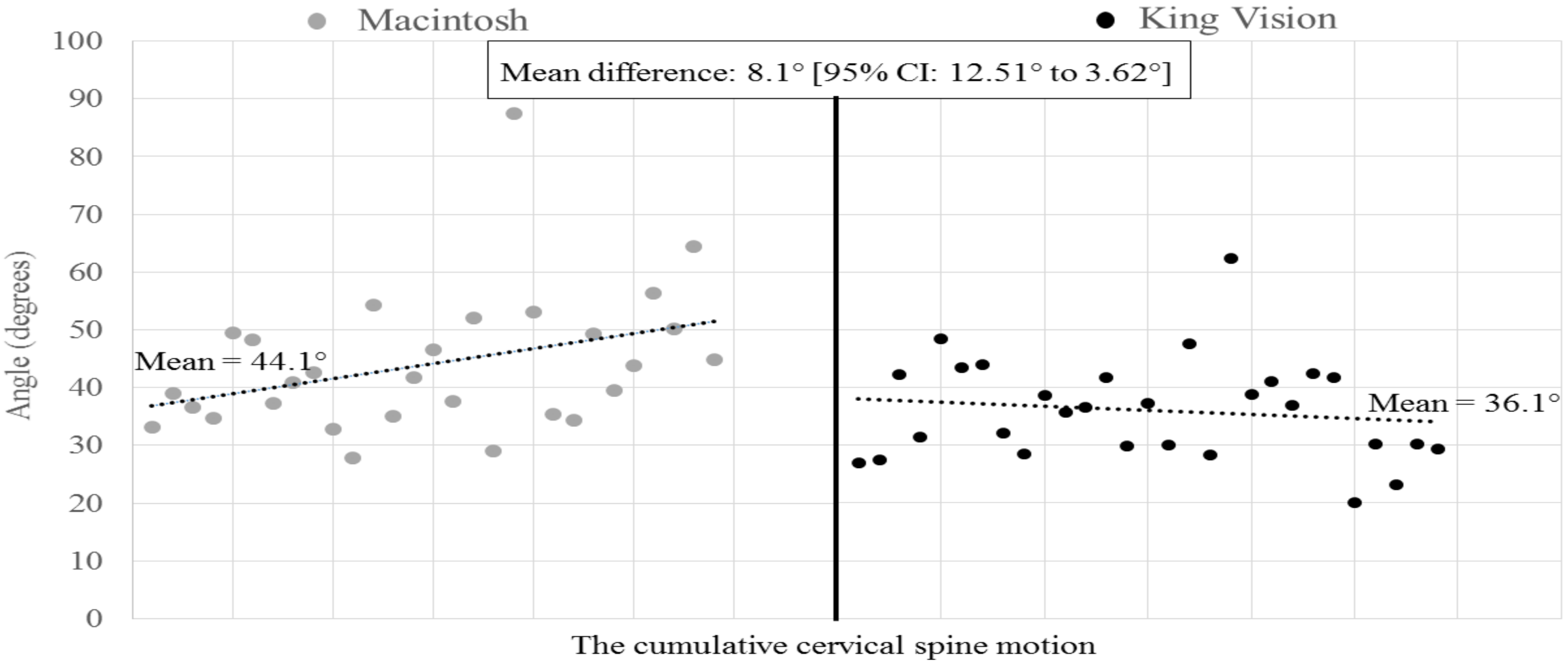

Tip of the Macintosh
Tracheal tube
Direct laryngoscopy
Tip of channelled VL
Tracheal tube
Laryngoscopy using a channelled VL
a


Tip of the Macintosh
Pharyngeal axis
Tracheal axis
Oral axis
Direct laryngoscopy
Tip of channelled VL
Tracheal axis
Oral axis
Laryngoscopy using a channelled VL
b

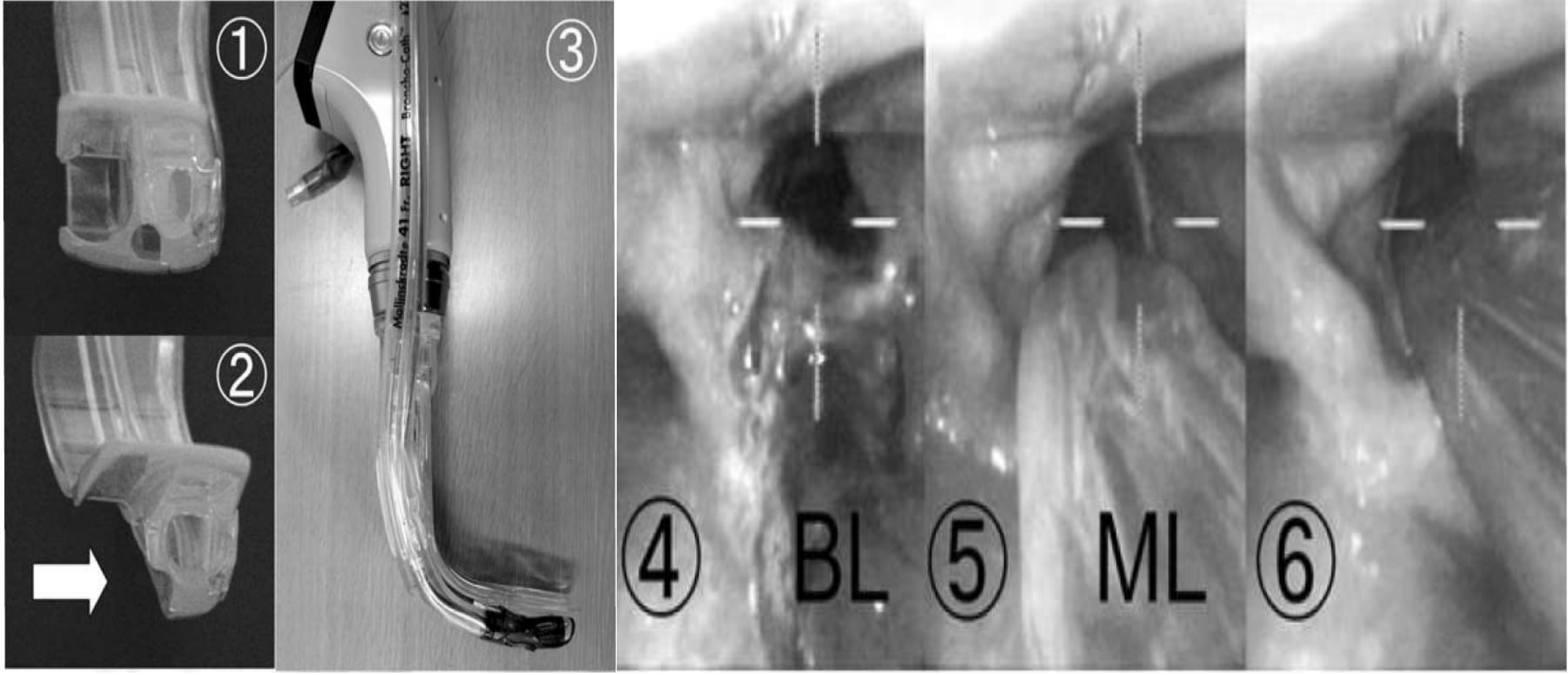

a-1
b-1
c-1
a-2
Neutral position
b-2
Macintosh
c-2
KVL



Abstract PR537: Does King Vision™ Videolaryngoscope Reduce Cervical Spine Motion During Endotracheal Intubation? A Crossover Study

El Tahan, M. R.; Al Kenany, S.; Khidr, A. M.; More

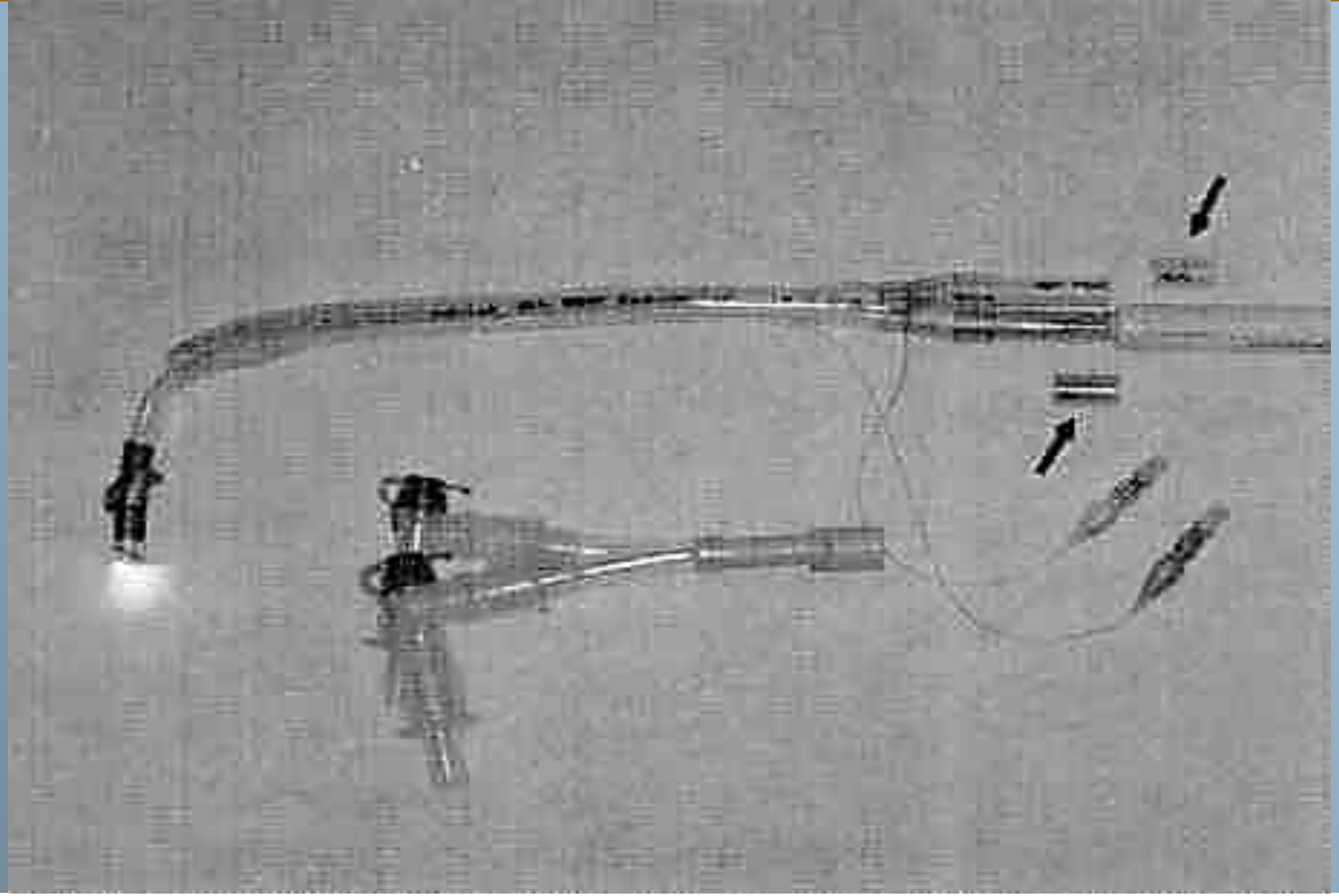
Anesthesia & Analgesia . 123(3S_Suppl):682-683, September 2016.



Can J Anaesth. 2007 Oct;54(10):853-4.

Double lumen tube placement with the Pentax-Airway Scope.

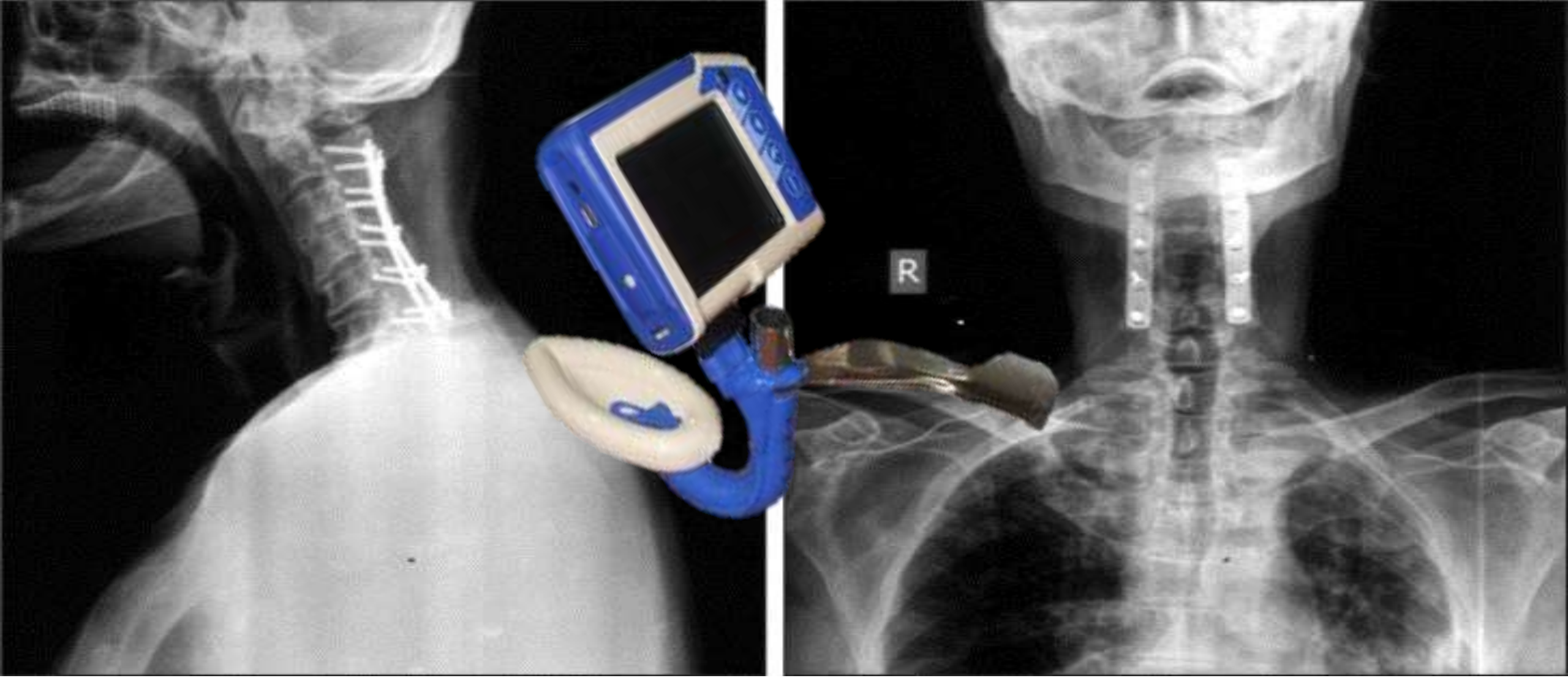
Suzuki A, Kunisawa T, Iwasaki H.



Anesth Analg. 1995 Jul;81(1):205-6.

Lighted stylet for placement of a double-lumen endobronchial tube.

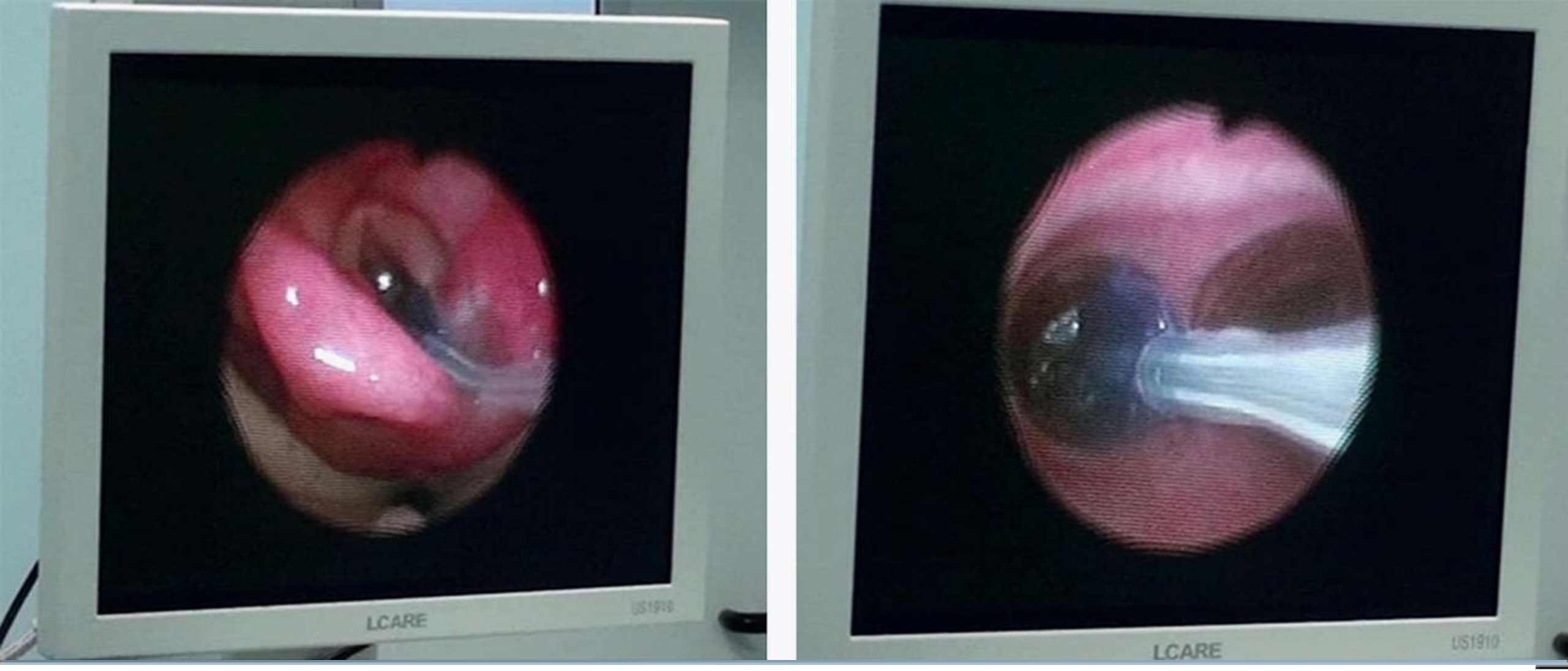
Scanzillo MA, Shulman MS.



Korean J Anesthesiol. 2012 Jun;62(6):565-7. doi: 10.4097/kjae.2012.62.6.565. Epub 2012 Jun 19.

Placement of a double-lumen tube using LMA C Trach and an exchanger catheter in difficult airway intubation -A case report-.

Karabiyik L.



J Cardiothorac Vasc Anesth. 2013 Oct 3. pii: S1053-0770(13)00359-5. doi: 10.1053/j.jvca.2013.06.004. [Epub ahead of print]

A Clinical Evaluation of the ProSeal Laryngeal Mask Airway With a Coopdech Bronchial Blocker for One-lung Ventilation in Adults.

Wang S, Zhang J, Cheng H, Yin J, Liu X.

Masui. 2005 Mar;54(3):291-4.

[Retrograde nasal intubation for a patient with difficult airway by using 28 Fr double lumen tube].

[Article in Japanese]

Katsumata K, Asano S.

How to expedite lung collapse?

Inadequate Lung Collapse

Balloons, Ramses temple, Luxor, Egypt, February 2016

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Deflating Balloon after sunrise trip, Luxor, Egypt, February 2016
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Wide lumens can facilitate differential lung ventilation


1. High FiO_2
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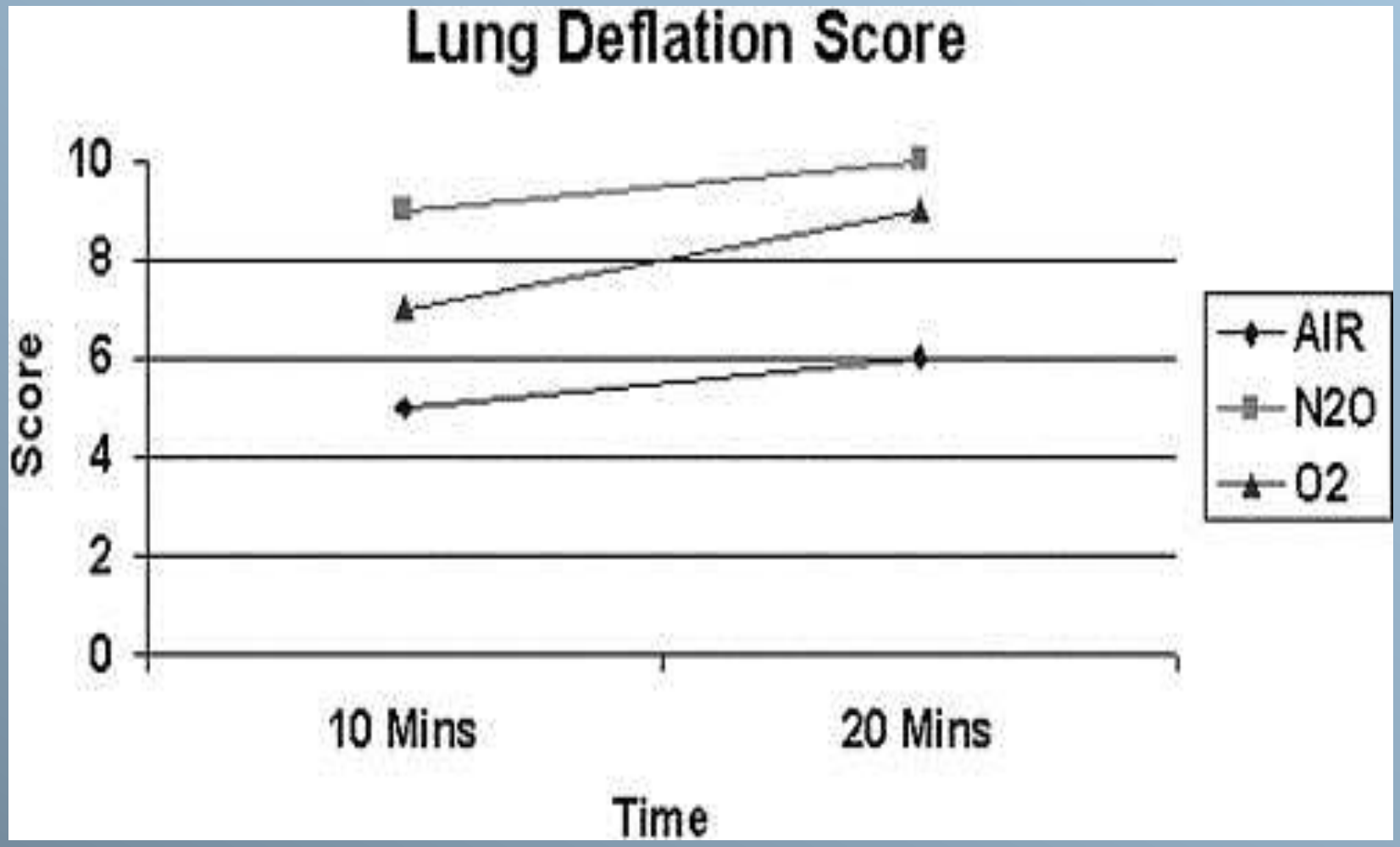

Anesth Analg. 2009 Apr;108(4):1092-6. doi: 10.1213/ane.0b013e318195415f.

The use of air in the inspired gas mixture during two-lung ventilation delays lung collapse during one-lung ventilation.

Ko R[1], McRae K, Darling G, Waddell TK, McGlade D, Cheung K, Katz J, Slinger P.

2. Suction or Disconnection Technique

Mansoura country, Mansoura, Egypt

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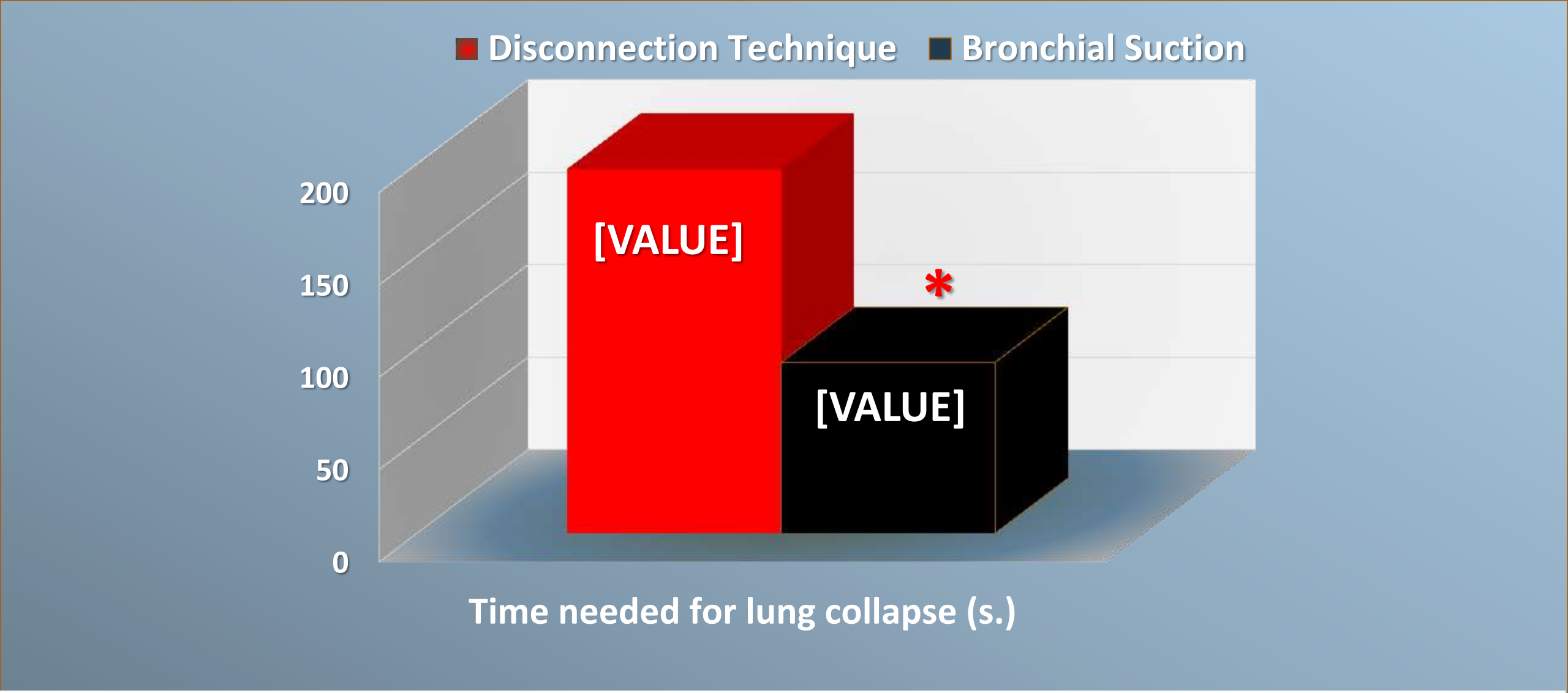
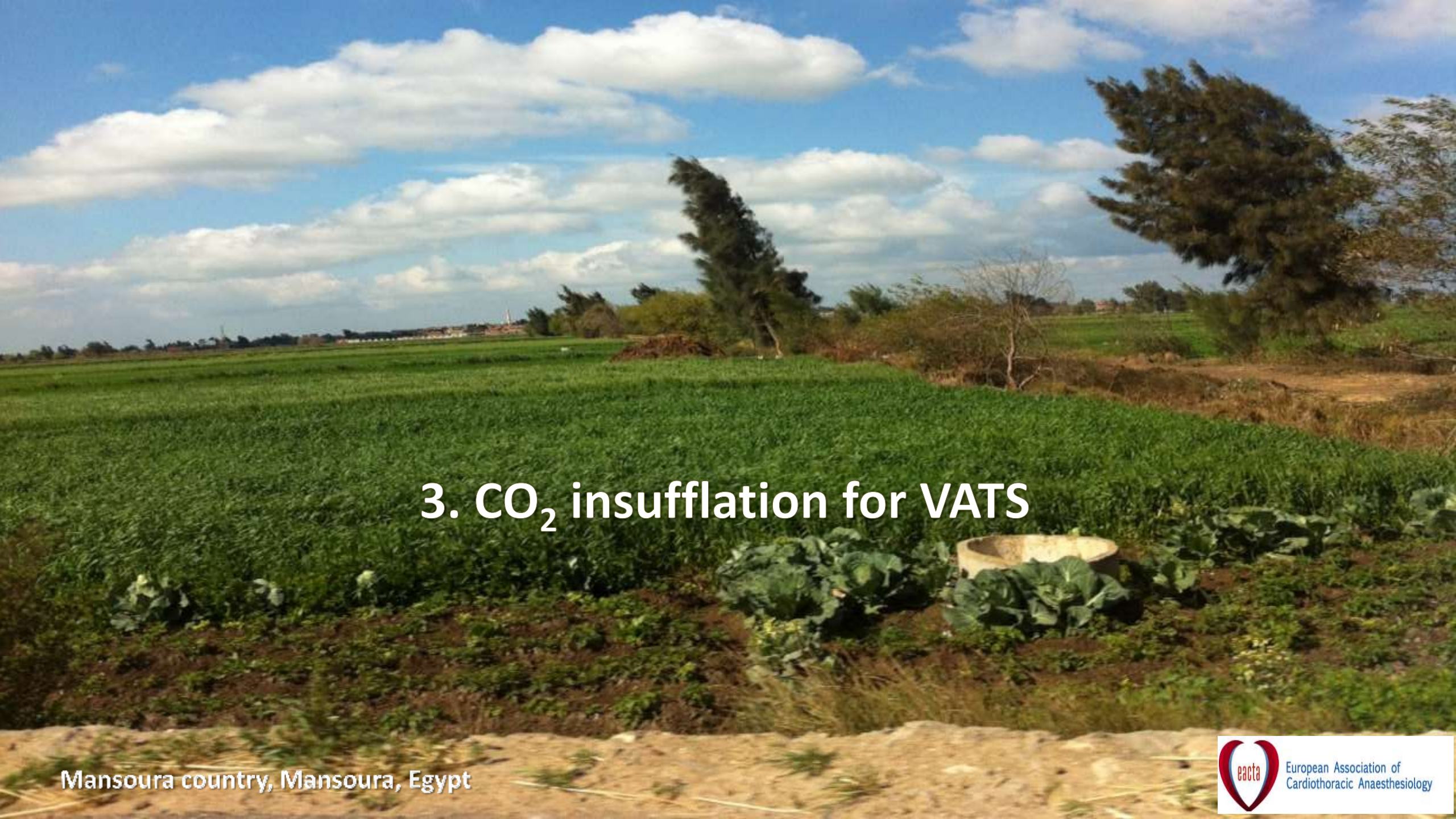
Cardiothoracic Anaesthesiology



Eur J Anaesthesiol. 2015 Jun;32(6):411-7. doi: 10.1097/EJA.0000000000000194.

A comparison of the disconnection technique with continuous bronchial suction for lung deflation when using the Arndt endobronchial blocker during video-assisted thoracoscopy: A randomised trial.

El-Tahan MR[1].



3. CO_2 insufflation for VATS

Mansoura country, Mansoura, Egypt

European Association of Cardiothoracic Anaesthesiology

Operative Times

Times	SLET (n = 65)	DLET (n = 52)	*p* Value
Total OR time	111 ± 4.74 min	127 ± 4.33 min	0.014
Time to incision	49 ± 1.91 min	56 ± 2.48 min	0.029
Surgical time	48 ± 2.89 min	66 ± 7.34 min	0.018

DLET = double lumen endotracheal tube; min = minutes; OR = operation room; SLET = single lumen endotracheal tube.

Ann Thorac Surg. 2013 Aug;96(2):439-44. doi: 10.1016/j.athoracsur.2013.04.060. Epub 2013 Jun 21.

Thoracoscopy without lung isolation utilizing single lumen endotracheal tube intubation and carbon dioxide insufflation.

Sancheti MS[1], Dewan BP, Pickens A, Fernandez FG, Miller DL, Force SD.


4. Insert a blocker through the DLT or a second blocker
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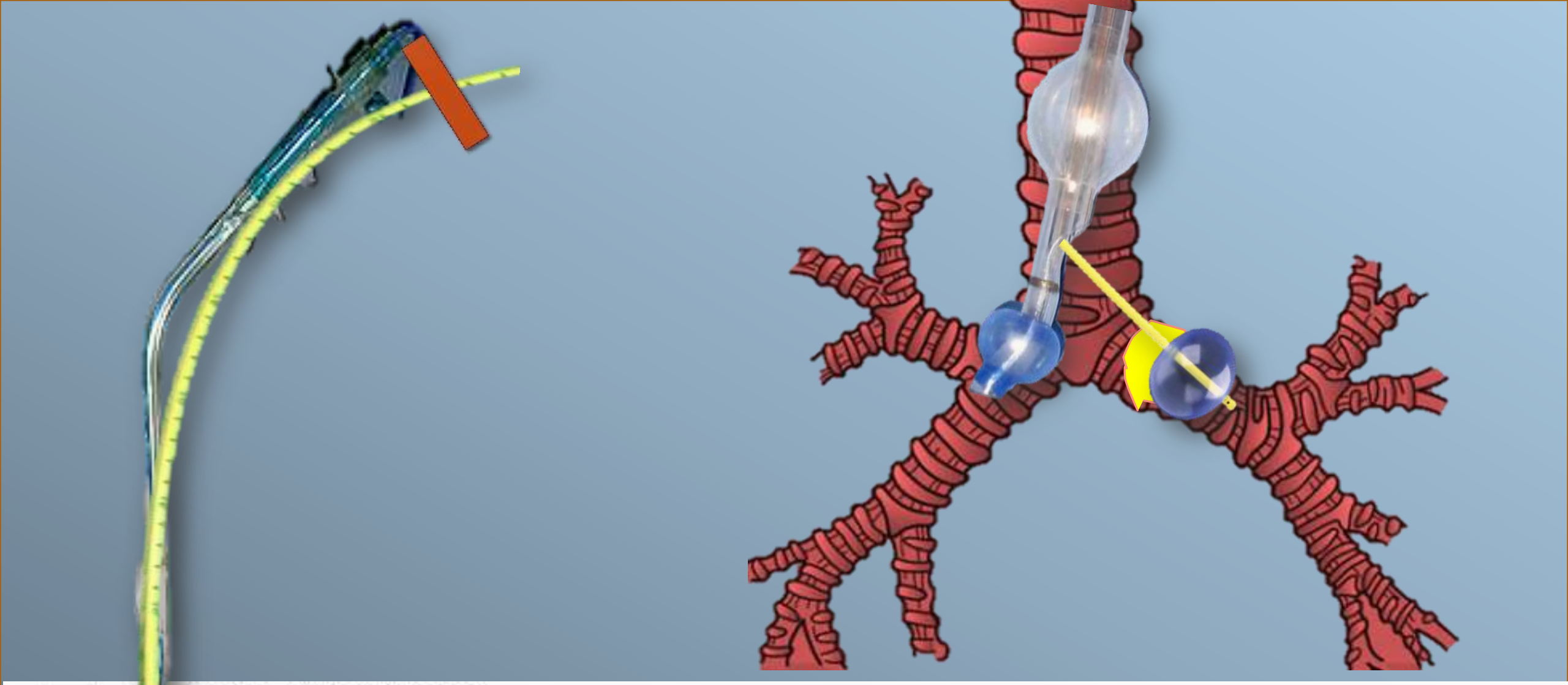

Anesth A[illegible]. 2000 Dec;91(6):1370-1, TOC.

The [illegible] of a bronchial blocker to rescue an ill-fitting double-lumen endotracheal tube.

Nino M, B[illegible]dy SC, Hartigan PM.

Conclusion

- Difficult lung separation is not limited to difficult lung isolation but extending also to inadequate lung deflation.
- The anaesthesiologist should be familial with the ABC approach to identify patients with potential difficult lung separation.
- The different algorithms for management of patients with difficult lung isolation are centred around securing airway with any of the available tools followed with lung separation using either a blocker or DLT.
- Several tricks might be useful to expedite lung collapse.

Ramesses II statute, Karnack temple, Luxor, Egypt

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