Conflict of Interest - Disclosures

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Confidential agreement *Cook, Mercury Medical , Teleflex Medical, Verathon,* ***Flexicare, AI Endoscopic***

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EAMS past President
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PUMA Task Force
ASA Difficult airways guidelines Task Force
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EU Expamend Expert Panel Medical Devices

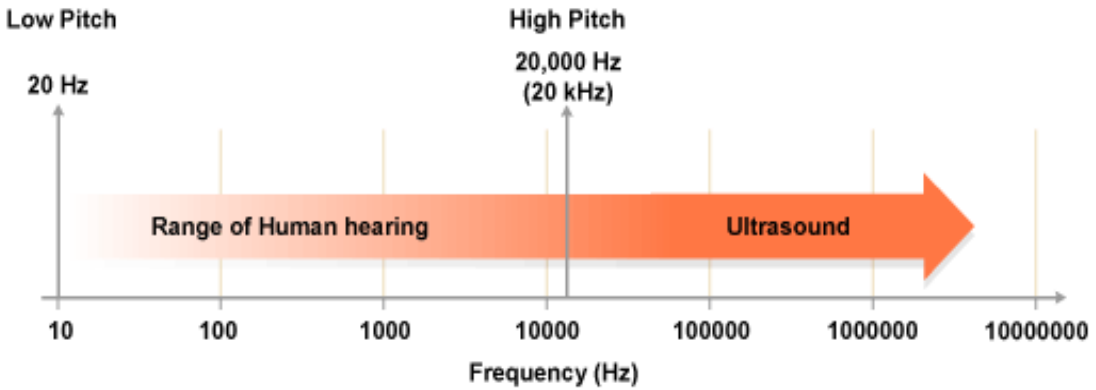
Online version at http://www.minervamedica.it

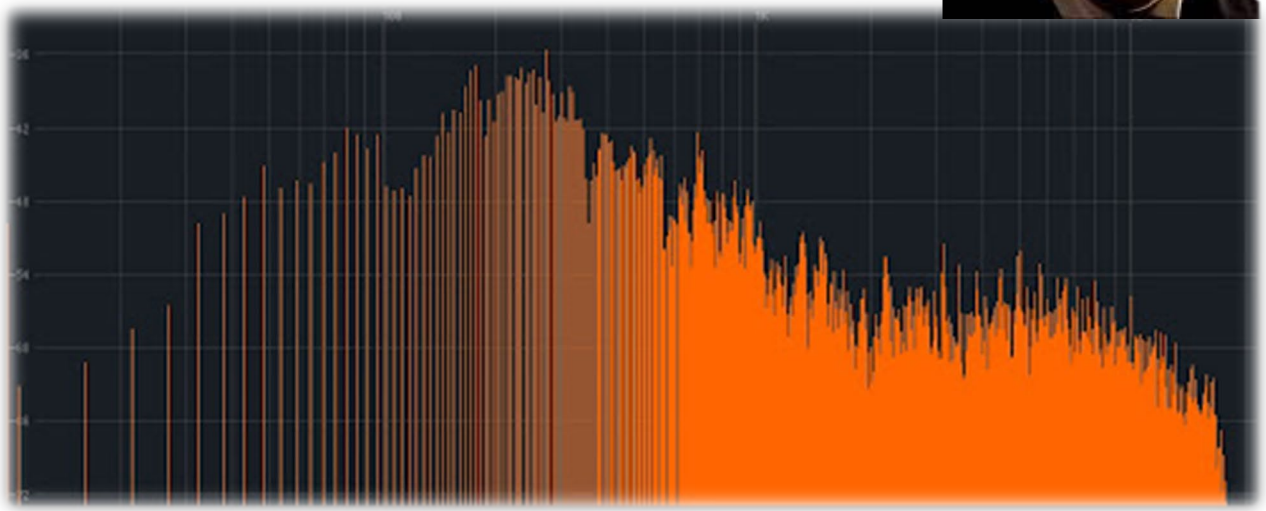
Minerva Anestesiologica 2021 April;87(4):387-90
DOI: 10.23736/S0375-9393.21.15577-4

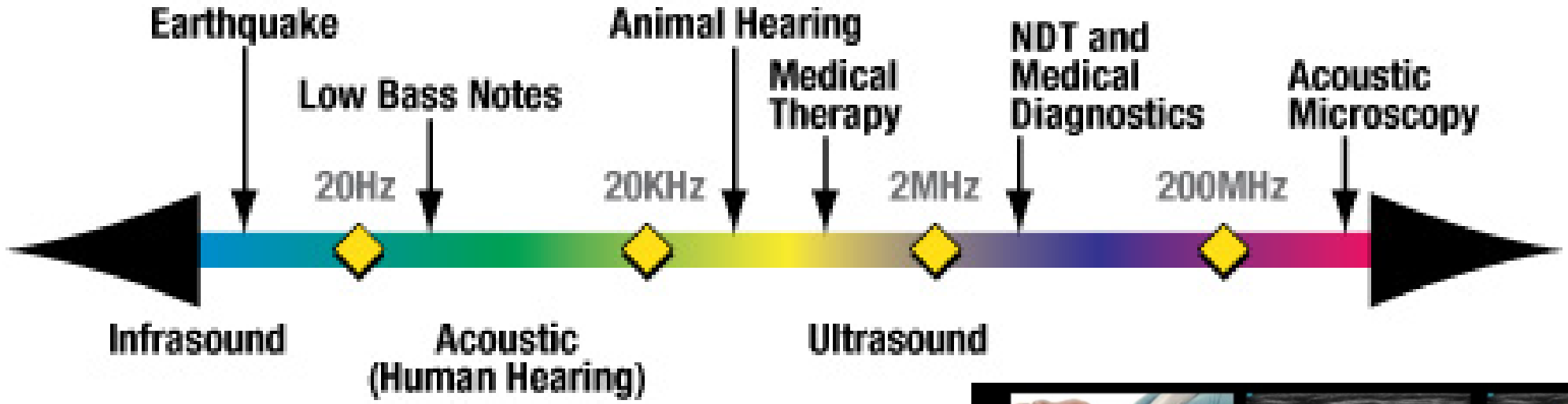
EDITORIAL

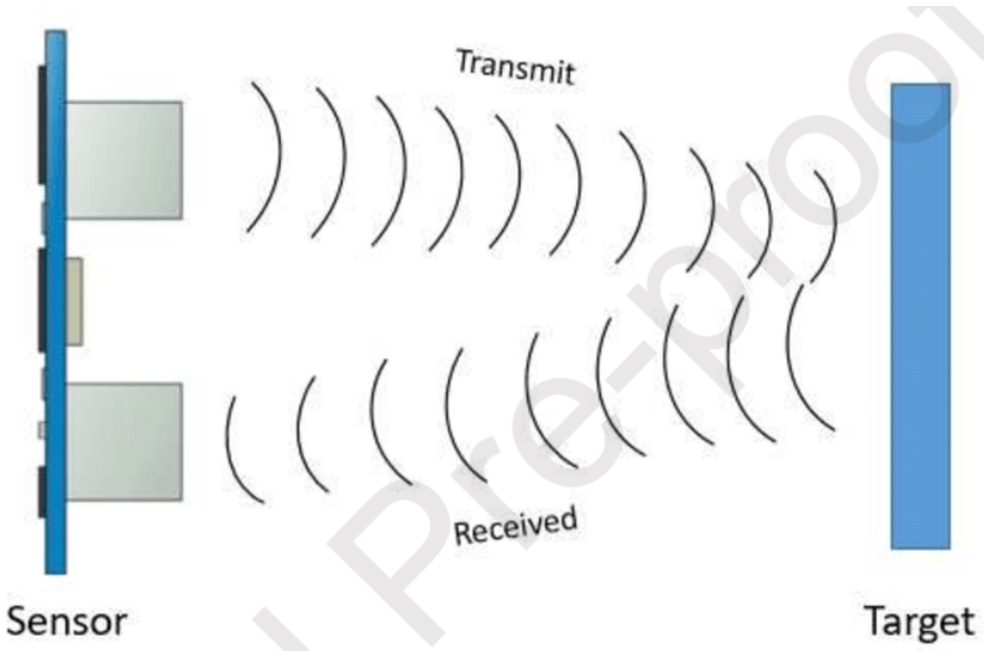
Bats, Dracula and Batman: the sixth sense in airway management

Stefano FALCETTA [1] *, Massimiliano SORBELLO [2]






Earthquake
Low Bass Notes
Animal Hearing
Medical Therapy
NDT and Medical Diagnostics
Acoustic Microscopy
20Hz
20KHz
2MHz
200MHz
Infrasound
Acoustic (Human Hearing)
Ultrasound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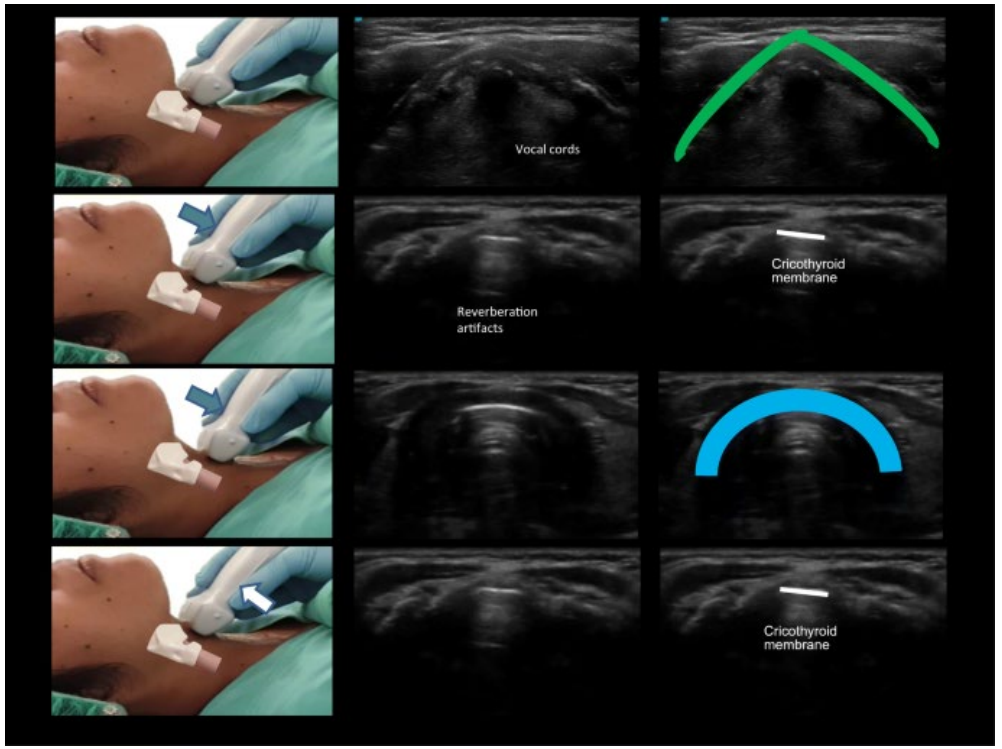
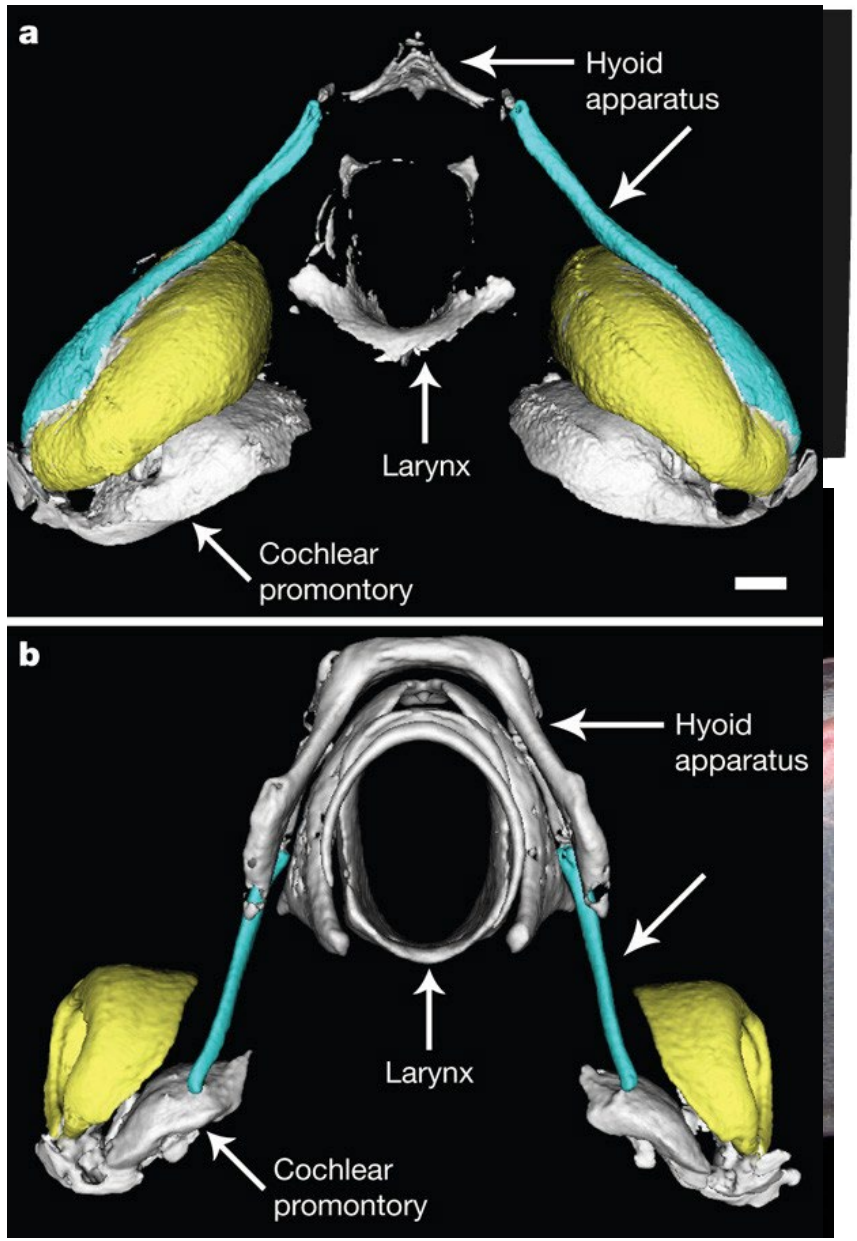

Vocal cords
Cricothyroid membrane
Reverberation artifacts
Cricothyroid membrane

Vampire bat
(*Desmodus rotundus*)

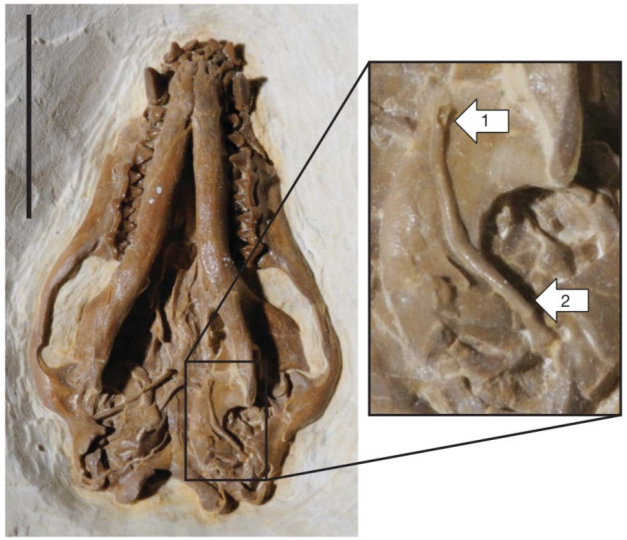


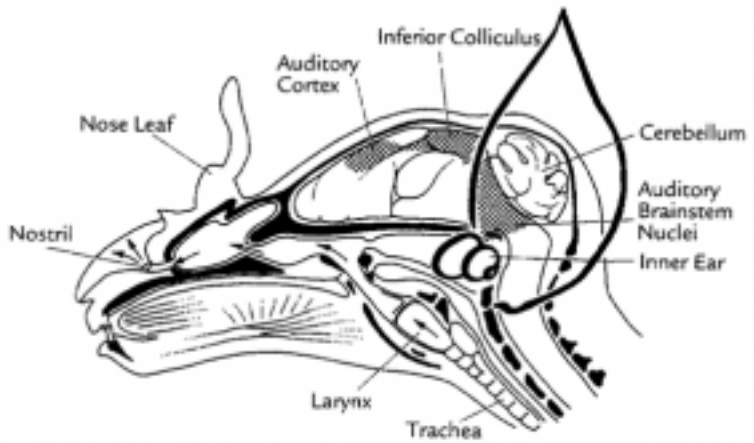
Vol 463|18 February 2010|doi:10.1038/nature08737 nature

LETTERS

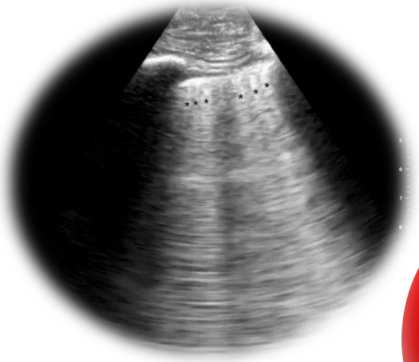
A bony connection signals laryngeal echolocation in bats

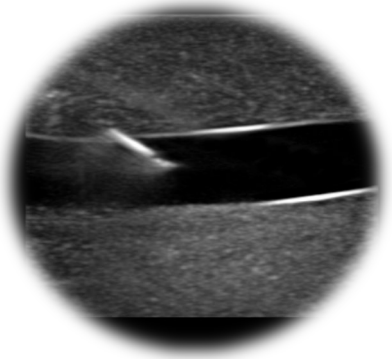
Nina Veselka[1], David D. McErlain[2,3], David W. Holdsworth[2,4], Judith L. Eger[5], Rethy K. Chhem[6,7], Matthew J. Mason[8], Kirsty L. Brain[8], Paul A. Faure[9] & M. Brock Fenton[1]



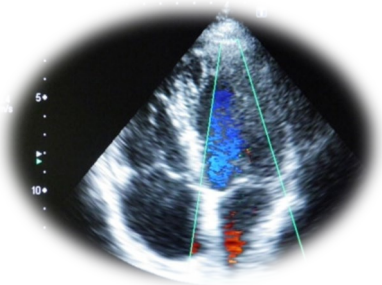


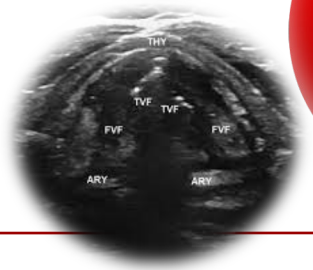

Bob Kane, 1939





- Regional anesthesia
- Lung evaluation
- Central veins placement
- US
- Cardiac evaluation
- Echo-fast
- Airway prediction





Insights Imaging (2014) 5:253–279
DOI 10.1007/s13244-014-0309-5

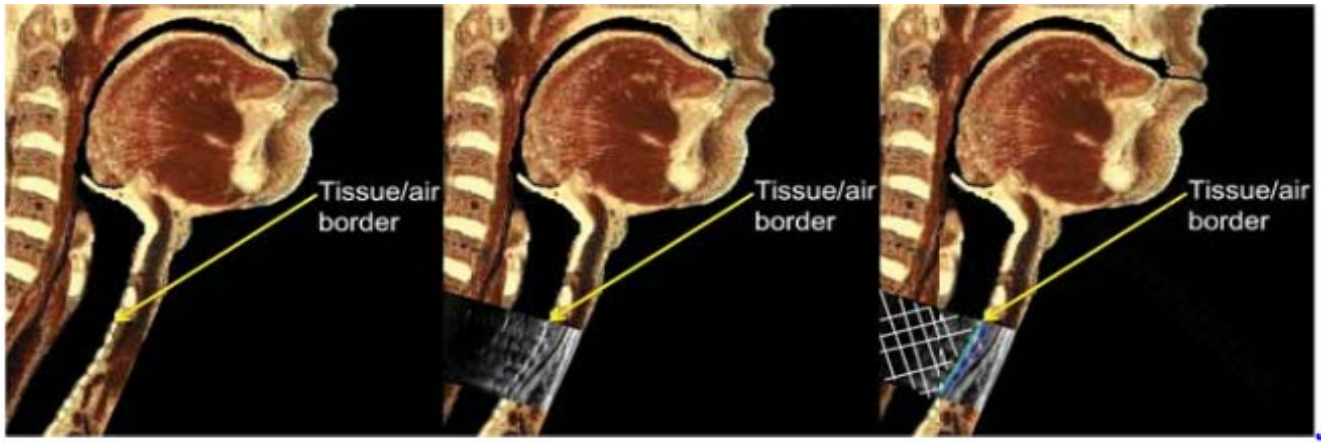
REVIEW

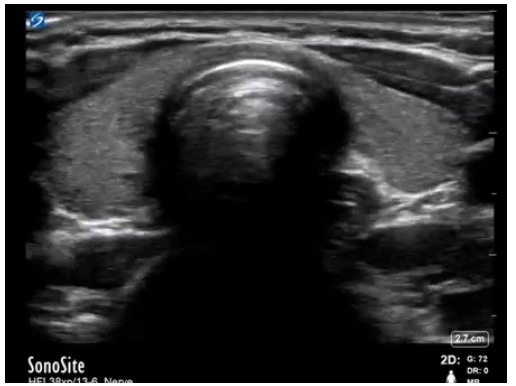
Ultrasonography for clinical decision-making and intervention in airway management: from the mouth to the lungs and pleurae

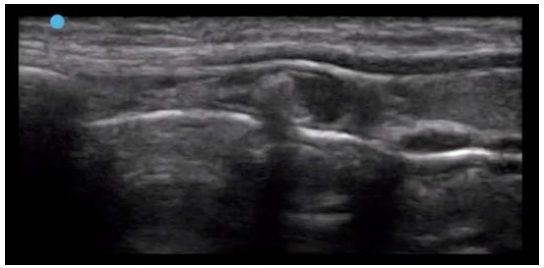
Michael S. Kristensen · Wendy H. Teoh · Ole Graumann · Christian B. Laursen

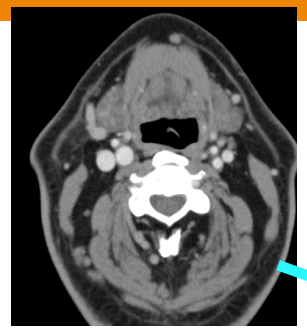
Table 1. Important Airway Structures Visible on Ultrasound[3-10]

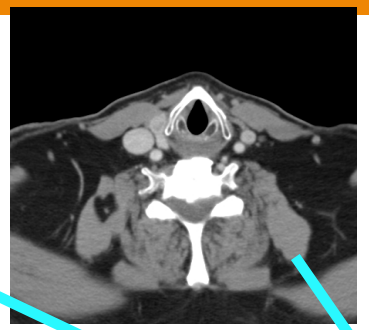
Mouth	Epiglottis	Trachea
Tongue	Larynx	Esophagus
Oropharynx	Vocal cords	Stomach
Hypopharynx	Cricothyroid membrane	Lungs
Hyoid bone	Cricoid cartilage	Pleurae

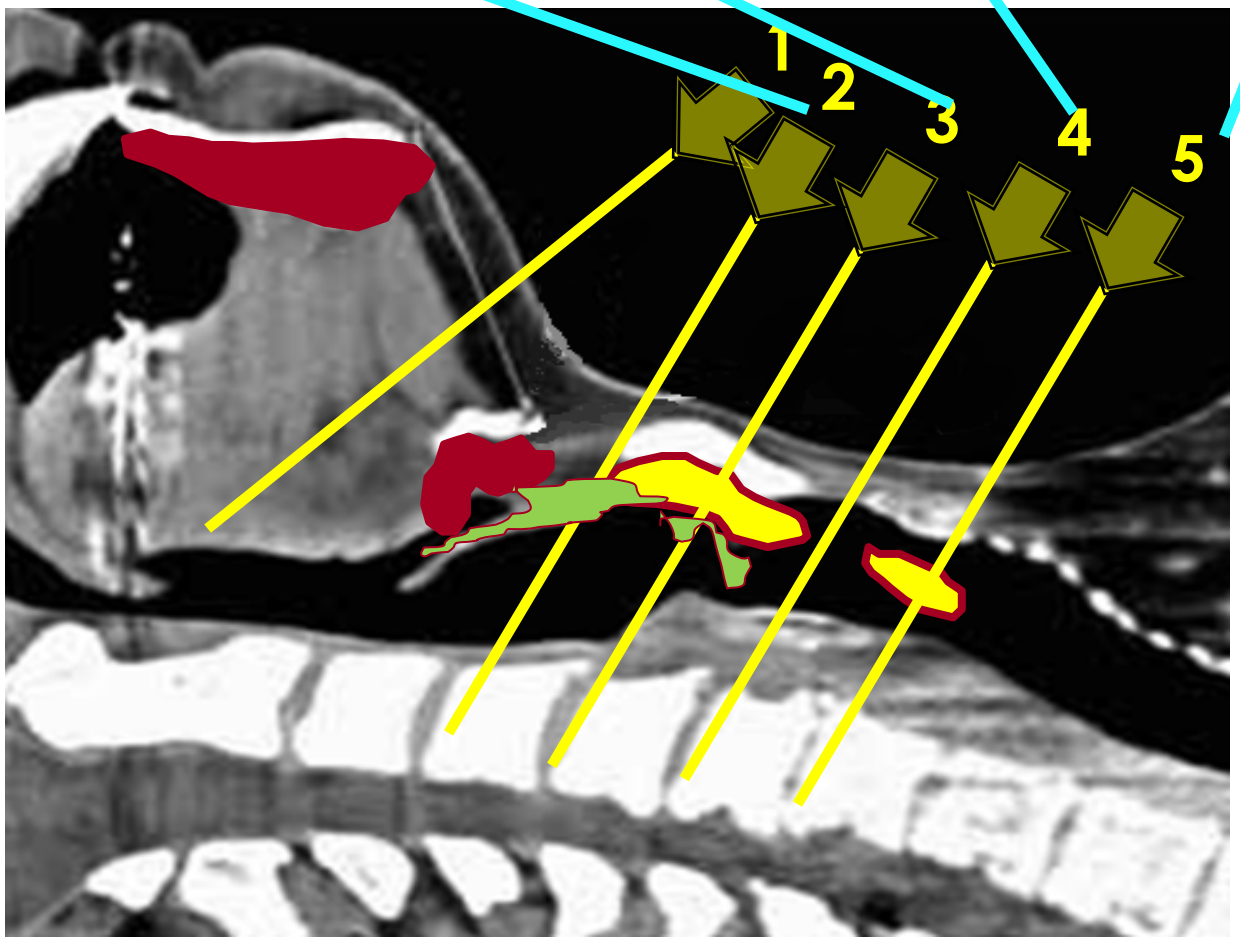












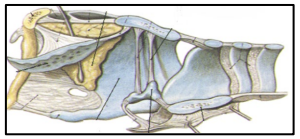
JUM Journal of Ultrasound in Medicine
aium

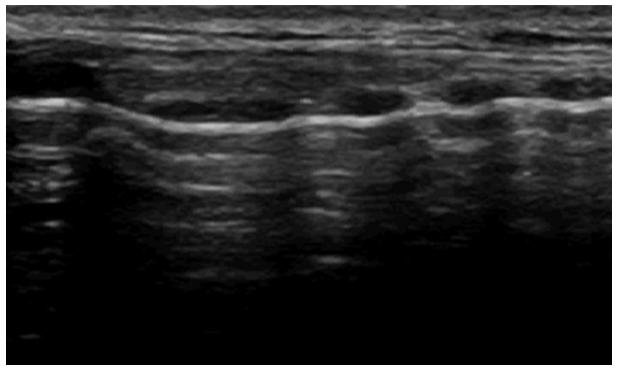
Original Research

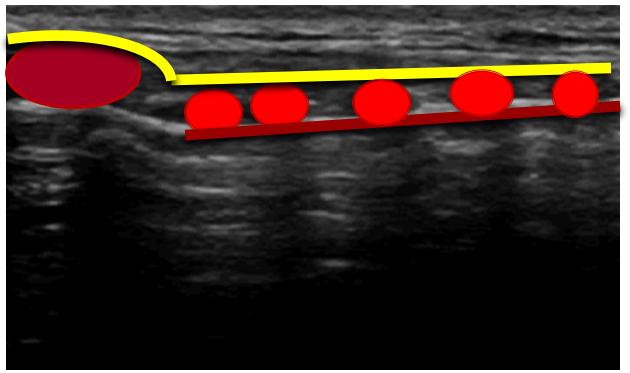
Comparison of Sonography and Computed Tomography as Imaging Tools for Assessment of Airway Structures

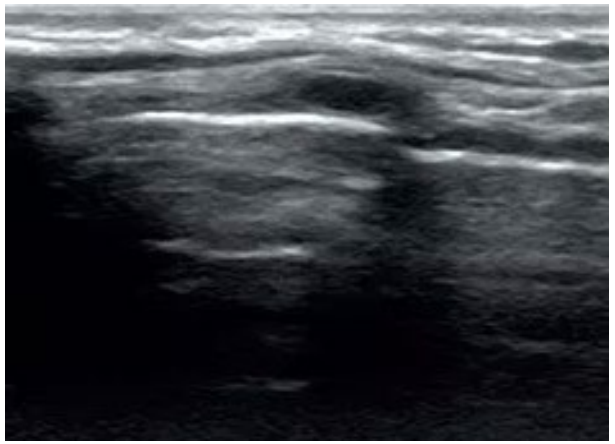
Arun Prasad MBBS, DA, FRCA, FRCPC, Eugene Yu MD, FRCPC, David T. Wong MD, Reena Karkhanis MBBS, Patrick Gullane MD, FRCSC, Vincent W. S. Chan MD, FRCPC,

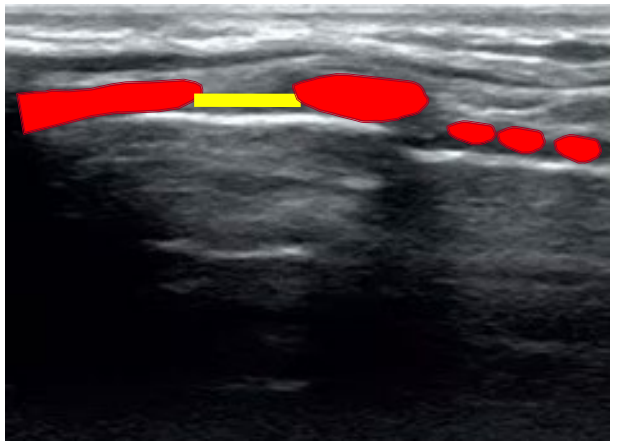
First published: 01 July 2011 | https://doi.org/10.7863/jum.2011.30.7.965 | Citations: 53



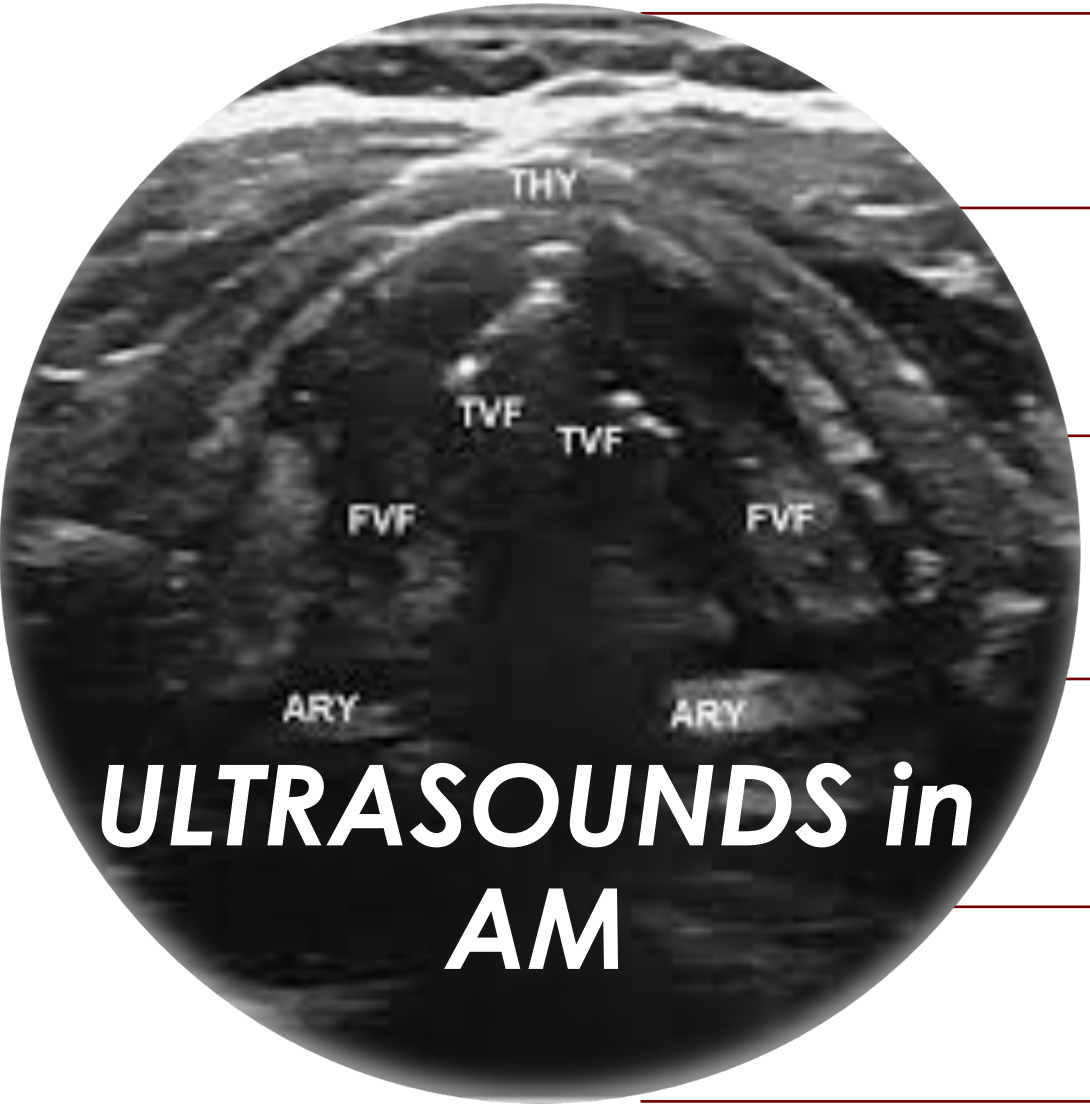






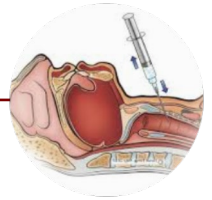


PROF. MASSIMILIANO SORBELLO, MD, FEAMS - maxsorbello@gmail.com



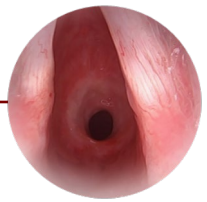
ULTRASOUNDS in AM

- ET TUBE POSITION CHK
- PEDIATRIC ET SIZE CHOICE
- DLT SIZE CHOICE
- LMA POSITION CHK

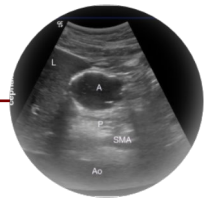


- PRE-EMPTIVE CTM LOCALIZATION
- PERCUTANEOUS TRACHEOSTOMY GUIDANCE

- LARYNGEAL BLOCKS FOR ATI
- POST-OP VOCAL CORDS EVALUATION



- UPPER AIRWAY OBSTRUCTION
- POST-EXTUBATION STRIDOR



- GASTRIC REPLETION STATUS

AIRWAY MANAGEMENT PREDICTION

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Neonatology

Original Paper

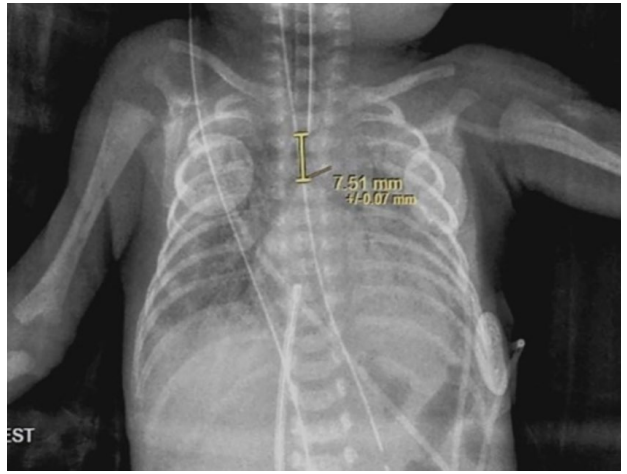
Neonatology
DOI: 10.1159/000518278

Received: January 9, 2021
Accepted: June 26, 2021
Published online: September 8, 2021

Ultrasound for Endotracheal Tube Tip Position in Term and Preterm Infants

Sabrina Salvadori[a] Daniel Nardo[a] Anna Chiara Frigo[b] Martina Oss[a] Irene Mercante[a] Laura Moschino[a] Elena Priante[a] Luca Bonadies[a] Eugenio Baraldi[a]

[a]Neonatal Intensive Care Unit, Department of Women's and Children's Health, Padova University Hospital, Padua, Italy; [b]Biostatistics, Epidemiology and Public Health Unit, Department of Cardiac, Thoracic and Vascular Sciences, Padova University Hospital, Padua, Italy



In conclusion, this study shows that using US to check the ETT tip position is rapid, well-tolerated, and reliable. We suggest that ETT-echo is a promising approach for use in neonatology to confirm the correct position of the tip of an ETT and can be considered a good way to reduce radiation exposure in newborn patients.

PEDIATRICS INTERNATIONAL Official Journal of the Japan Pediatric Society

Original Article

Ultrasonographic confirmation of endotracheal intubation in extremely low birthweigh infants – secondary publication

Syusuke Takeuchi, Junichi Arai, Motomichi Nagafuji, Ayako Hinata, Tae Kamakura, Yusuke Hoshino, Yoshiya Yukitake,

First published: 30 November 2019 | https://doi.org/10.1111/ped.14069

Prospective Clinical Research Report

Journal of INTERNATIONAL MEDICAL RESEARCH

Journal of International Medical Research
48(4) 1–10

DOI: 10.1177/0300060519894771
journals.sagepub.com/home/imr
SAGE

Application of bedside real-time tracheal ultrasonography for confirmation of emergency endotracheal intubation in patients in the intensive care unit

Weiting Chen[1,*], Junbo Chen[2,*], Hehao Wang[1] and Yingzi Chen[1]

Table 3. Identification of esophageal and tracheal intubation using bedside real-time tracheal ultrasonography.

	Fiberoptic bronchoscopy		
Tracheal ultrasonography	Tracheal intubation	Esophageal intubation	Total
Tracheal intubation	106	3	109
Esophageal intubation	0	9	9
Total	106	12	118

> Overall, the results from this study suggest that it is feasible to perform bedside real-time tracheal ultrasonography to identify the ETT position in patients in the ICU. Bedside real-time tracheal

ENDOTRACHEAL TUBE PLACEMENT CONFIRMATION BY ULTRASONOGRAPHY: A SYSTEMATIC REVIEW AND META-ANALYSIS OF MORE THAN 2500 PATIENTS

Ankit Kumar Sahu, MBBS, Sanjeev Bhoi, MD, Praveen Aggarwal, MD, Roshan Mathew, MD, Jamshed Nayer, MD, Amrithanand V. T, MD, Prakash Ranjan Mishra, MD, and Tej Prakash Sinha, MS

Ultrasound in Emergency Medicine

The Journal of Emergency Medicine, Vol. ■, No. ■, pp. 1–11, 2020

0736-4679/$ - see front matter

CONCLUSION

Ultrasonography is a useful adjunct to confirm endotracheal intubation with excellent sensitivity and specificity. It should be considered when capnography is not available or unreliable. The incorporation of USG in resuscitation will not only help in dynamic assessment of airway, but also it will serve as a time-saving step.

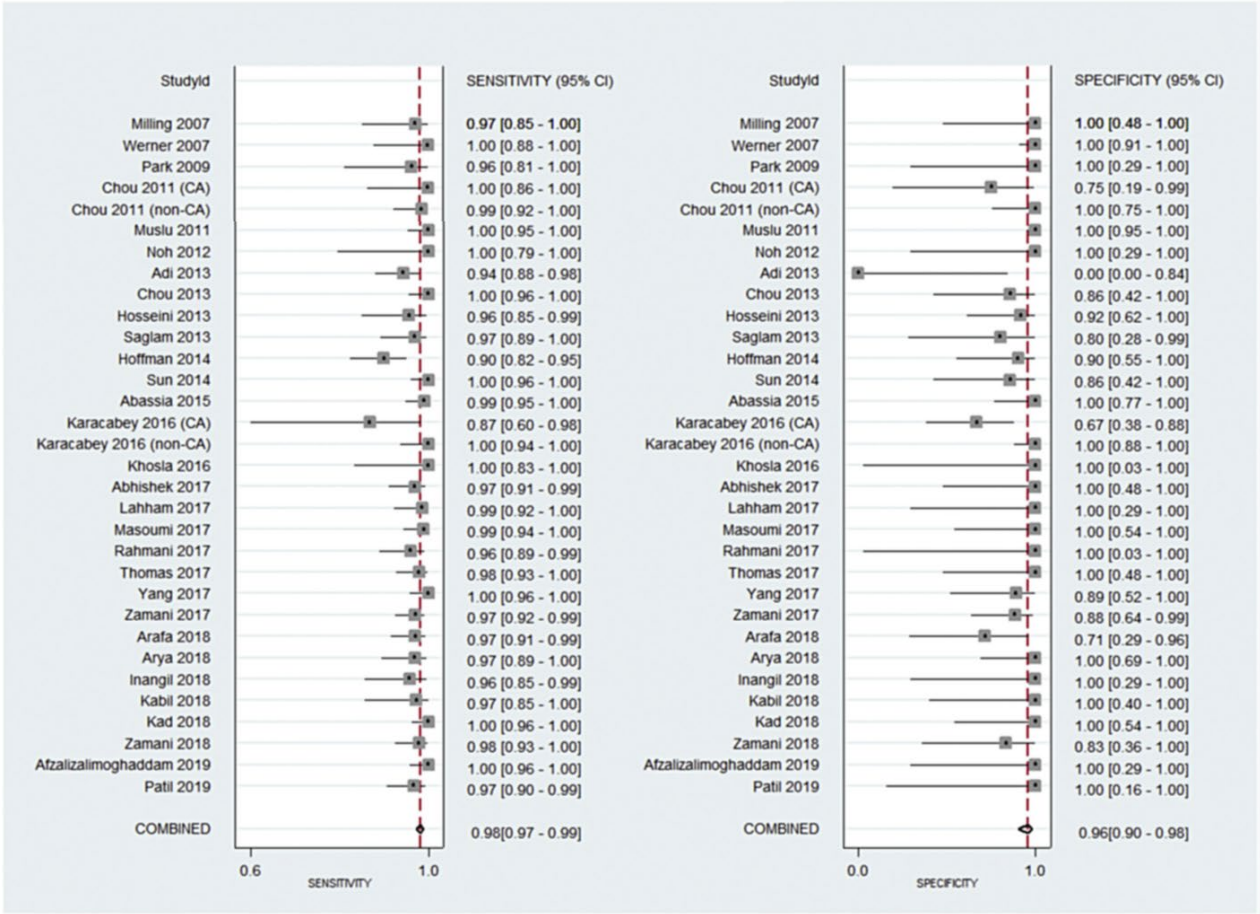


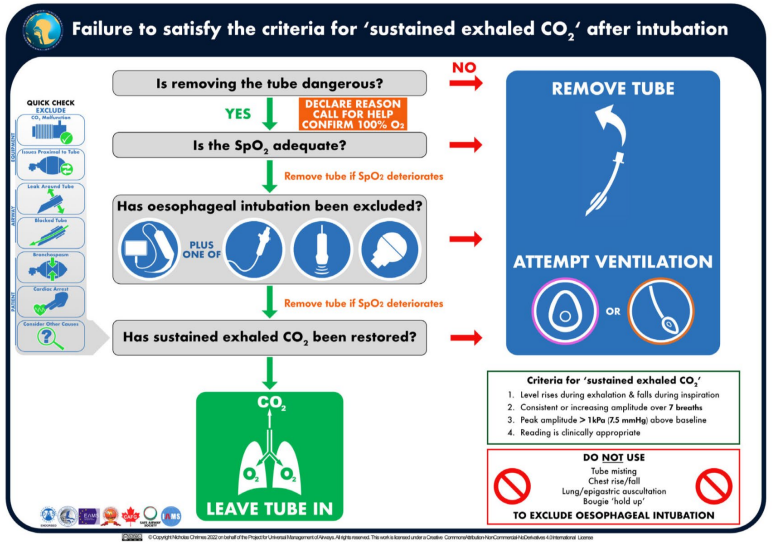
Figure 4. Forest plot of the overall sensitivity and specificity of bedside ultrasonography for identifying endotracheal tube location. COMBINED sensitivity and specificity for USG was 0.982 (95% CI: 0.971–0.988) and 0.957 (95% CI: 0.901–0.982).

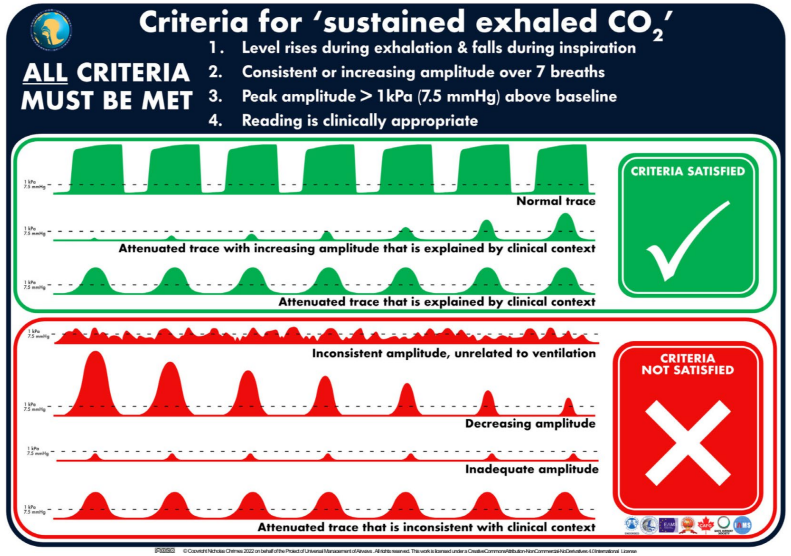
Anaesthesia 2022 doi:10.1111/anae.15817

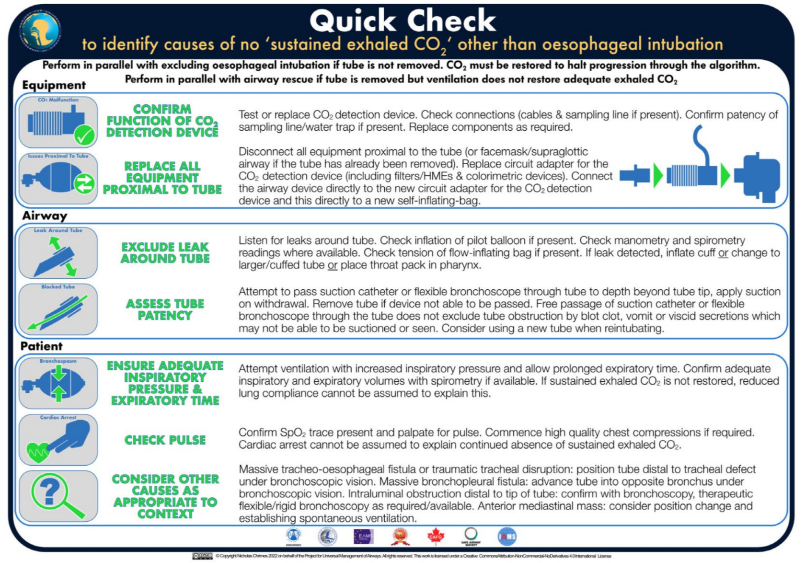
Guidelines

Preventing unrecognised oesophageal intubation: a consensus guideline from the Project for Universal Management of Airways and international airway societies*

N. Chrimes,[1] A. Higgs,[2] C. A. Hagberg,[3] P. A. Baker,[4,5] R. M. Cooper,[6] R. Greif,[7,8] G. Kovacs,[9] J. A. Law,[10] S. D. Marshall,[11,12] S. N. Myatra,[13] E. P. O'Sullivan,[14] W. H. Rosenblatt,[15] C. H. Ross,[16,17] J. C. Sakles,[18] M. Sorbello[19] and T. M. Cook[20,21]







Key recommendations

1 Exhaled carbon dioxide monitoring and pulse oximetry should be available and used for all episodes of airway management.

2 Routine use of a videolaryngoscope is recommended whenever feasible.

3 At each attempt at laryngoscopy, the airway operator is encouraged to verbalise the view obtained.

4 The airway operator and assistant should each verbalise whether `sustained exhaled carbon dioxide´ and adequate oxygen saturation are present.

5 Inability to detect sustained exhaled carbon dioxide requires oesophageal intubation to be actively excluded.

6 The default response to the failure to satisfy the criteria for sustained exhaled carbon dioxide should be to remove the tube and attempt ventilation using a facemask or supraglottic airway.

7 If immediate tube removal is not undertaken, actively exclude oesophageal intubation: repeat laryngoscopy, flexible bronchoscopy, ultrasound and use of an oesophageal detector device are valid techniques.

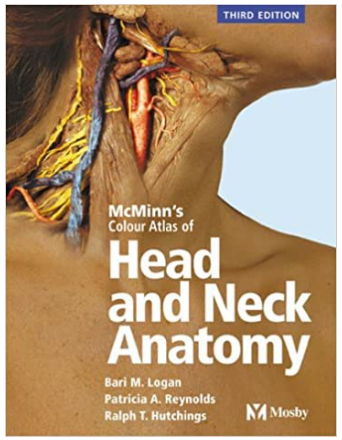
8 Clinical examination should not be used to exclude oesophageal intubation.

9 Tube removal should be undertaken if any of the following are true:

- Oesophageal placement cannot be excluded
- Sustained exhaled carbon dioxide cannot be restored
- Oxygen saturation deteriorates at any point before restoring sustained exhaled carbon dioxide

10 Actions should be taken to standardise and improve the distinctiveness of variables on monitor displays.

11 Interprofessional education programmes addressing the technical and team aspects of task performance should be undertaken to implement these guidelines.



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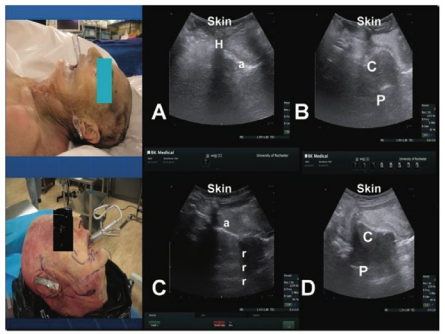


Observational Study > J Clin Anesth. 2016 Nov;34:638-46. doi: 10.1016/j.jclinane.2016.06.019. Epub 2016 Aug 3.

Confirmation of laryngeal mask airway placement by ultrasound examination: a pilot study

Kaicheng Song [1], Jie Yi [2], Wei Liu [3], Shuang Huang [4], Yuguang Huang [5]

Affiliations + expand

PMID: 27687463 DOI: 10.1016/j.jclinane.2016.06.019

Original Article

Comparison of leakage test and ultrasound imaging to validate ProSeal supraglottic airway device placement

DOI: 10.4103/joacp.JOACP_332_19

Sachin E. Ajithan, Archana Puri, Mukul C. Kapoor

Department of Anesthesiology, Max Smart Super Speciality Hospital, Saket, Delhi, India

Laryngo-tracheal ultrasonography to confirm correct endotracheal tube and laryngeal mask airway placement

Jacek A. Wojtczak[1], Davide Cattano[2]

Journal of Ultrasonography 2014; 14: 362–366

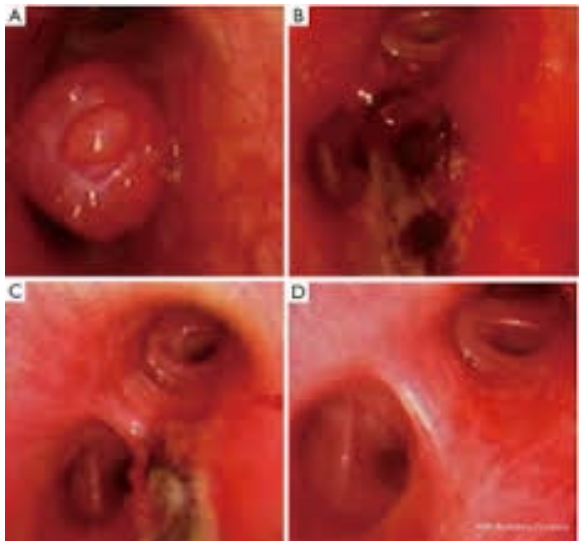
Geriatrics Gerontology INTERNATIONAL

LETTER TO THE EDITOR

Double lumen endotracheal tube, flexible lightwand and ultrasound to safely carry out percutaneous tracheostomy

Maria Vargas ✉, Gennaro Russo, Giuseppe Servillo,

First published: 14 June 2020 | https://doi.org/10.1111/ggi.13912



J Ultrasound (2013) 16:195–199
DOI 10.1007/s40477-013-0050-9

ORIGINAL ARTICLE

Thoracic ultrasound confirmation of correct lung exclusion before one-lung ventilation during thoracic surgery

Andrea Saporito · Antonio Lo Piccolo · Daniele Franceschini · Renato Tomasetti · Luciano Anselmi

Critical Care and Resuscitation
Section Editor: Avery Tung

Practice of Ultrasound-Guided Palpation of Neck Landmarks Improves Accuracy of External Palpation of the Cricothyroid Membrane

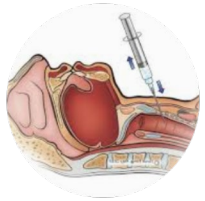
Kong Eric You-Ten, MD, PhD,*† David T. Wong, MD,*‡ Xiang Y. Ye, Msc,§ Cristian Arzola, MD,*† Atoosa Zand, MD,*† and Naveed Siddiqui, MD, MSc*†

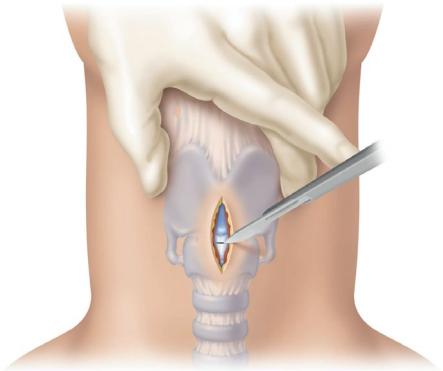
BACKGROUND: Ultrasonography can accurately identify the cricothyroid membrane; however, its impact on the subsequent accuracy of external palpation is not known. In this study, we tested the ability of anesthesia participants to identify the midpoint of the cricothyroid membrane using external palpation with and without ultrasound (US)-guided practice.

METHODS: Following institutional ethics approval and informed consent, anesthesia participants consisting of anesthesia residents, fellows, and practicing anesthesia assistants underwent didactic teaching on neck landmarks. The participants were then randomized to practice palpation of neck landmarks with US guidance (US group) or without ultrasonography (non-US [NUS] group). After the practice session, each participant identified the cricothyroid membrane using external palpation on the neck of 10 volunteers and marked the anticipated entry point for device insertion (palpation point [PT]). The midpoint of the cricothyroid membrane of each volunteer had been premarked with invisible ink using ultrasonography (US point) by a separate member of the research team. The primary outcome was the accuracy rate defined as the percentage of the attempts with the distance ≤5 mm measured from the PT to US point for the participant. The primary outcome was compared between NUS and US groups using Wilcoxon rank sum test. A mixed-effect logistic regression or mixed-effect linear model was also conducted for outcomes accounting for the clustering and adjusting for potential confounders.

RESULTS: Fifteen anesthesia participants were randomized to US (n = 8) and NUS (n = 7) groups. A total of 80 and 61 attempts were performed by the US and NUS groups, respectively. The median accuracy rate in the US group was higher than the NUS group (65% vs 30%; $P = .025$), and the median PT-US distance in the US group was shorter than in the NUS group (4.0 vs 8.0 mm; $P = .04$). The adjusted mean PT-US distance in the US group was shorter compared to the NUS group (adjusted mean [95% CI], 3.6 [2.9–4.6] vs 6.8 [5.2–8.9] mm; $P < .001$).

CONCLUSIONS: Anesthesia participants exposed to practice with US-guided palpation of the cricothyroid membrane location were better able to identify the cricothyroid membrane using only blind palpation than participants without US-guided practice. Practice with US-guided palpation of neck landmarks improves subsequent blind localization of the cricothyroid membrane using palpation alone. (Anesth Analg 2018;127:1377–82)





Ultrasound Improves Cricothyrotomy Success in Cadavers with Poorly Defined Neck Anatomy

A Randomized Control Trial

Naveed Siddiqui, M.D., M.Sc., Cristian Arzola, M.D., M.Sc., Zeev Friedman, M.D., Laarni Guerina, M.D., Kong Eric You-Ten, M.D., F.R.C.P.C.

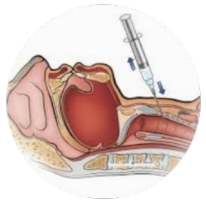
ABSTRACT

Background: Misidentification of the cricothyroid membrane in a "cannot intubate-cannot oxygenate" situation can lead to failures and serious complications. The authors hypothesized that preprocedure ultrasound-guided identification of the cricothyroid membrane would reduce complications associated with cricothyrotomy.

Methods: A group of 47 trainees were randomized to digital palpation (n = 23) and ultrasound (n = 24) groups. Cricothyrotomy was performed on human cadavers by using the Portex® device (Smiths Medical, USA). Anatomical landmarks of cadavers were graded as follows: grade 1—easy = visual landmarks; 2—moderate = requires light palpation of landmarks; 3—difficult = requires deep palpation of landmarks; and 4—impossible = landmarks not palpable. Primary outcome was the complication rate as measured by the severity of injuries. Secondary outcomes were correct device placement, failure to cannulate, and insertion time.

Results: Ultrasound guidance significantly decreased the incidence of injuries to the larynx and trachea (digital palpation: 17 of 23 = 74% *vs.* ultrasound: 6 of 24 = 25%; relative risk, 2.88; 95% CI, 1.39 to 5.94; $P = 0.001$) and increased the probability of correct insertion by 5.6 times ($P = 0.043$) in cadavers with difficult and impossible landmark palpation (digital palpation 8.3% *vs.* ultrasound 46.7%). Injuries were found in 100% of the grades 3 to 4 (difficult–impossible landmark palpation) cadavers by digital palpation compared with only 33% by ultrasound ($P < 0.001$). The mean (SD) insertion time was significantly longer with ultrasound than with digital palpation (196.1 s [60.6 s] *vs.* 110.5 s [46.9 s]; $P < 0.001$).

Conclusion: Preprocedure ultrasound guidance in cadavers with poorly defined neck anatomy significantly reduces complications and improves correct insertion of the airway device in the cricothyroid membrane. (ANESTHESIOLOGY 2015; 123:1033-41)



American Journal of Emergency Medicine 32 (2014) 61–63

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

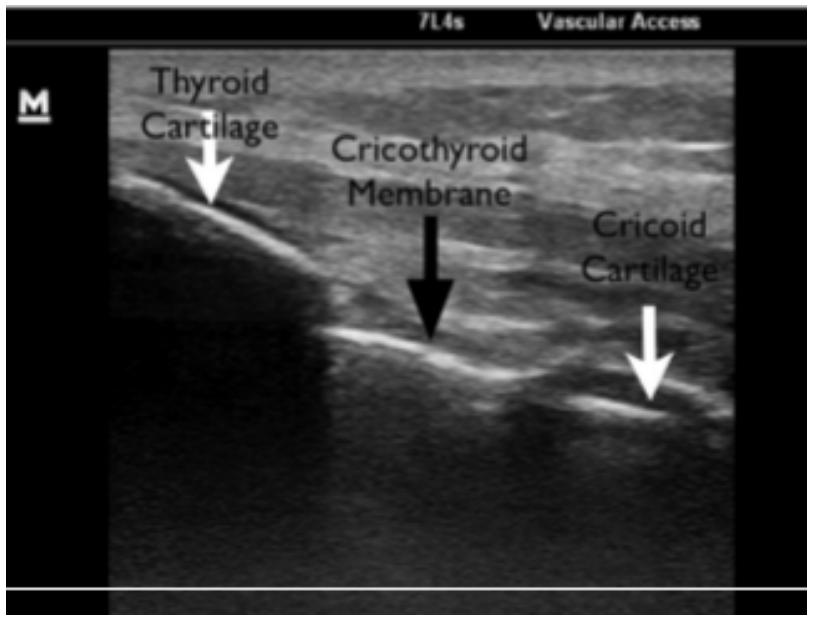
journal homepage: www.elsevier.com/locate/ajem

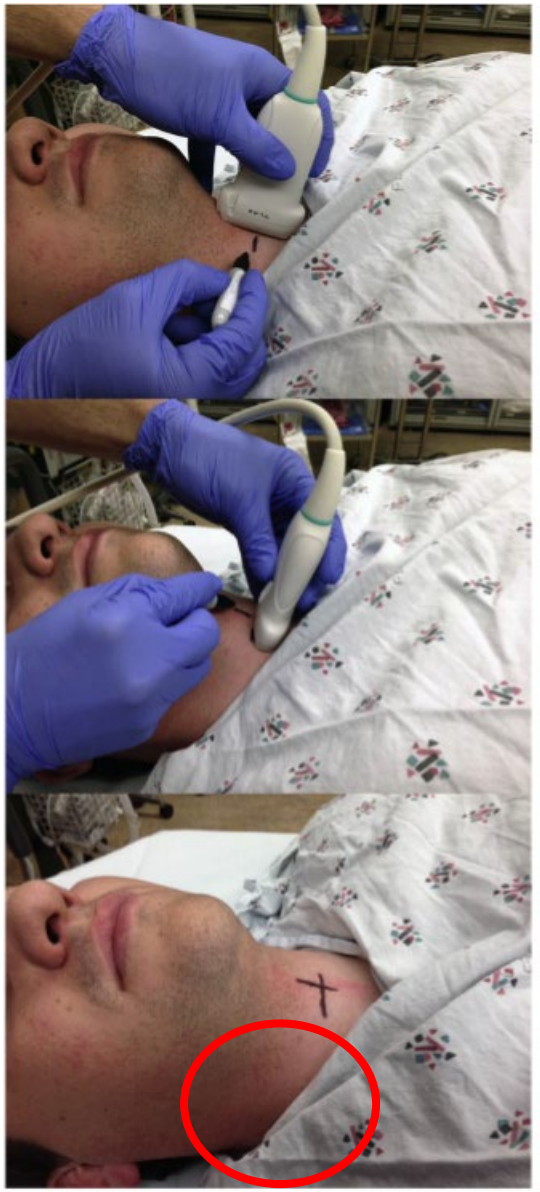
Brief Report

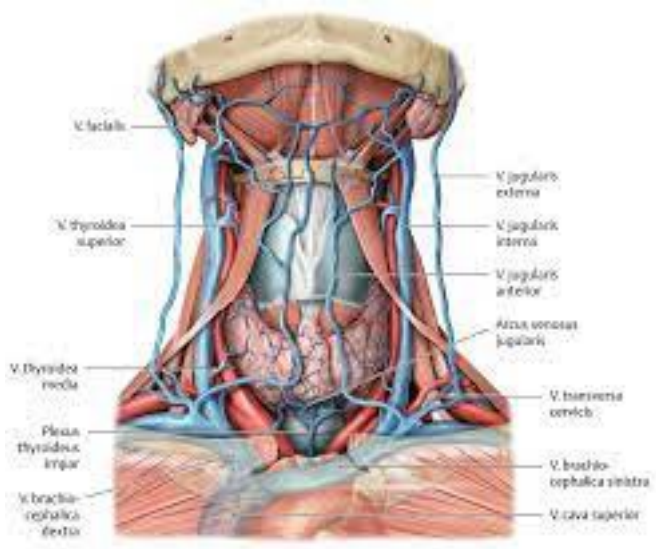
Accuracy of ultrasound-guided marking of the cricothyroid membrane before simulated failed intubation☆,☆☆,★

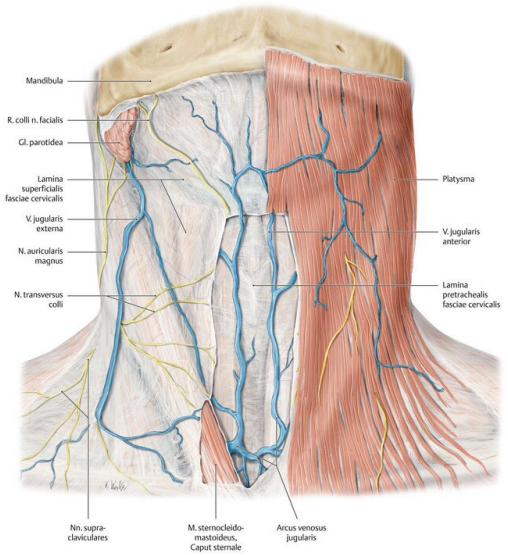
Michael Mallin, MD [a,*], Keith Curtis, MD [a], Matthew Dawson, MD [b], Patrick Ockerse, MD [a], Matthew Ahern, DO [a]

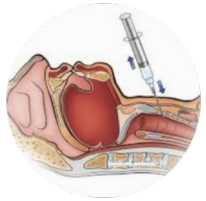
[a] University of Utah, Salt Lake City, UT
[b] University of Kentucky, Lexington, KY






V. facialis
V. jugularis externa
V. thyroidea superior
V. jugularis interna
V. jugularis anterior
Arcus venosus jugularis
V. thyroidea media
V. transversa cervicis
Plexus thyroideus impar
V. brachio-cephalica sinistra
V. brachio-cephalica dextra
V. cava superior


Mandibula
R. colli n. facialis
Gl. parotidea
Lamina superficialis fasciae cervicalis
V. jugularis externa
N. auricularis magnus
N. transversus colli
Platysma
V. jugularis anterior
Lamina pretrachealis fasciae cervicalis
Nn. supra-clavicularis
M. sternocleido-mastoideus, Caput sternale
Arcus venosus jugularis



acta Anaesthesiologica Scandinavica — An international journal of anaesthesiology, intensive care, pain, and critical emergency medicine — SSAI

Implementation of percutaneous dilation tracheotomy – value of preincisional ultrasonic examination?

J. Bonde, N. Nørgaard, K. Antonsen, T. Faber,

First published: 19 January 2002 | https://doi.org/10.1034/j.1399-6576.1999.430207.x | Citations: 20

Anaesthesia, 1999, **54**, pages 660–663

APPARATUS

Portable ultrasonic scanning of the anterior neck before percutaneous dilatational tracheostomy

A. Hatfield[1] and A. Bodenham[2]

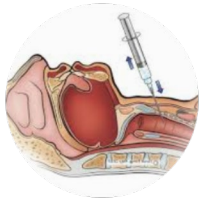
The role of ultrasound in percutaneous dilatational tracheostomy

Máté Rudas
MD, FCICM, DDU
(Critical Care)

AJUM November 2012 15 (4)

Conclusion: Current literature supports that using ultrasound for percutaneous tracheostomy is quick, safe, reliable and offers a plausible advantage over the traditional landmark guided procedure, especially in select patient groups, such as those who are morbidly obese or have difficult to palpate cervical anatomy.

State of the art: percutaneous tracheostomy in the intensive care unit

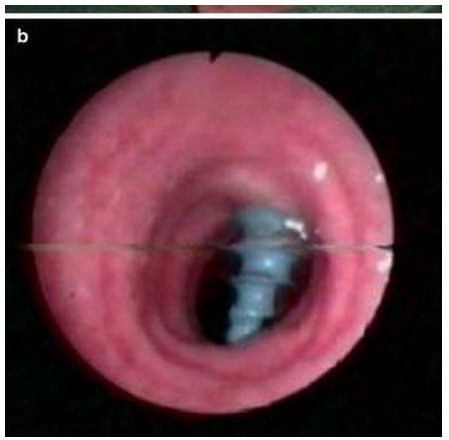


J Thorac Dis 2021;13(8):5261-5276 | http://dx.doi.org/10.21037/jtd-19-4121

Christian Ghattas[1], Sammar Alsunaid[1], Edward M. Pickering[2], Van K. Holden[2]

Ultrasound (US) use in PDT

Ultrasonography is a useful adjunct in PDT for the pre-procedural evaluation, intraoperative use, and post-procedure assessment of complications. US is an inexpensive, noninvasive tool that is readily available in most ICUs, and its use may improve the safety of PDT. It has been used prior to the procedure to select the puncture site and avoid injury to aberrant blood vessels (25,26) and during the procedure as real-time guidance at the puncture site and to monitor for cranial misplacement of the tracheostomy tube (27-30). One of the limitations of intraoperative use of US alone is the inability to visualize the posterior wall of the trachea due to intraluminal air; thus, injury to the posterior membrane cannot be completely avoided (31).



Post-procedure use

US can also be used post-procedurally to evaluate for a pneumothorax; however, there have been no studies to date specifically evaluating its use post-PDT. More prospective studies are needed to determine the impact of US use for PDT.

Clinical Case Report

Medicine®

OPEN

Ultrasound-guided superior laryngeal nerve block assists in anesthesia for bronchoscopic surgical procedure

A case report of anesthesia for rigid bronchoscopy

Yu-Chen Liao, MD[a], Wei-Ciao Wu, MD[b], Ming-Hui Hsieh, MD[a], Chuen-Chau Chang, MD, PhD[a,c,d], Hsiao-Chien Tsai, MD[a,e,*]

Tzu Chi Medical Journal 25 (2013) 161–163

Contents lists available at SciVerse ScienceDirect

Tzu Chi Medical Journal

journal homepage: www.tzuchimedjnl.com

Original Article

A new method for ultrasound-guided superior laryngeal nerve block

Cing-Hung Lan [a,b], Wei-Chun Cheng [a,b], Yao-Lin Yang [a,b,*]

[a] Department of Anesthesiology, Buddhist Tzu Chi General Hospital, Hualien, Taiwan
[b] School of Medicine, Tzu Chi University, Hualien, Taiwan

Fig. 1. The probe is placed under the submandibular area in a longitudinal orientation.

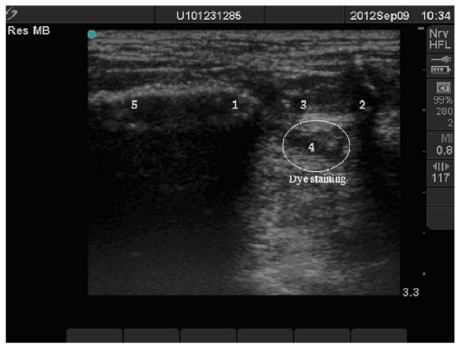


Fig. 3. Postinjection sonography. (1) Superior border of the thyroid cartilage. (2) Greater horn of the hyoid bone. (3) Thyrohyoid muscle. (4) Thyrohyoid membrane. (5) Thyroid cartilage lamina.

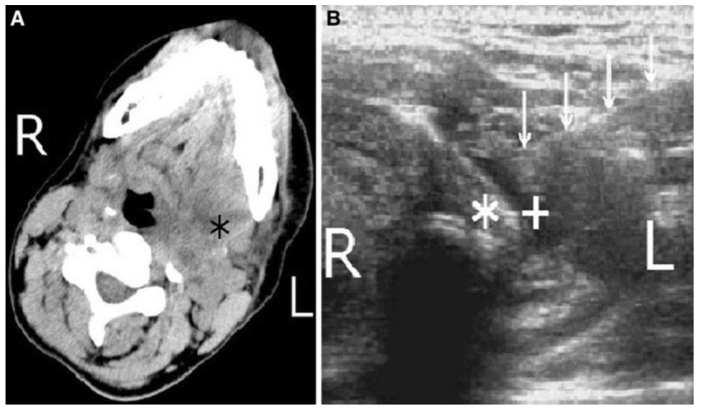
3. Results

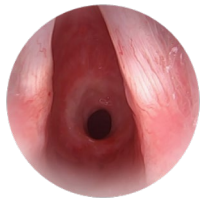
J Anesth (2013) 27:309–310
DOI 10.1007/s00540-012-1492-5

LETTER TO THE EDITOR

Ultrasound-guided superior laryngeal nerve block and translaryngeal block for awake tracheal intubation in a patient with laryngeal abscess

Takafumi Iida · Akihiro Suzuki · Takayuki Kunisawa · Hiroshi Iwasaki





Assessment of functionality of vocal cords using ultrasound before and after thyroid surgery: An observational study

Amarjeet Kumar, Chandni Sinha, Ajeet Kumar, Akhilesh Kumar Singh, Harsh Vardhan[1], Kranti Bhavana[1], Ditipriya Bhar[2]

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/ija.IJA_197_18

Quick response code

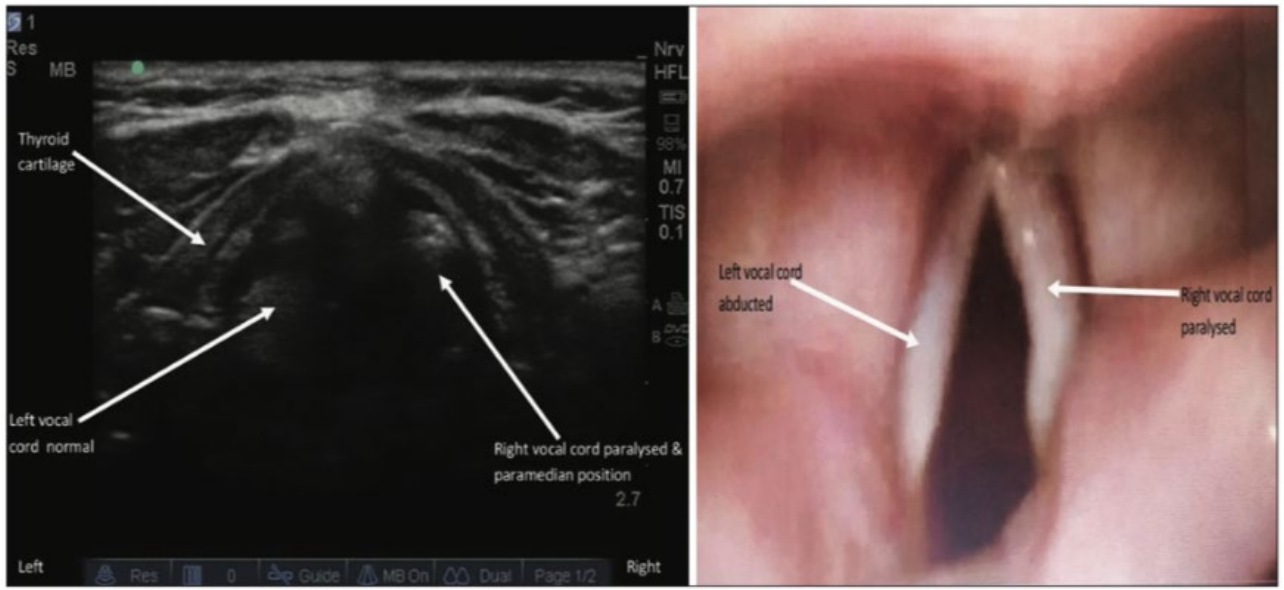


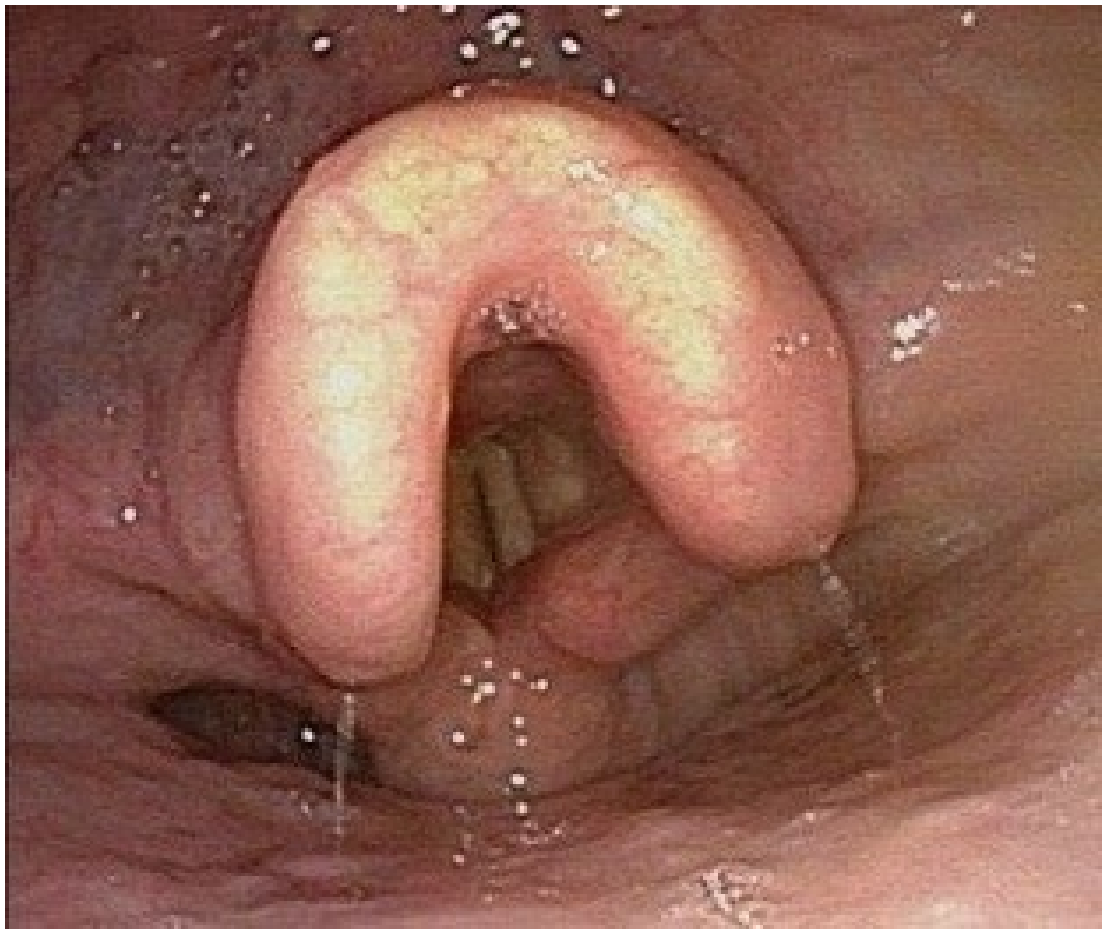
Figure 3: Vocal fold palsy as seen on video rhinolaryngoscope (VRL)

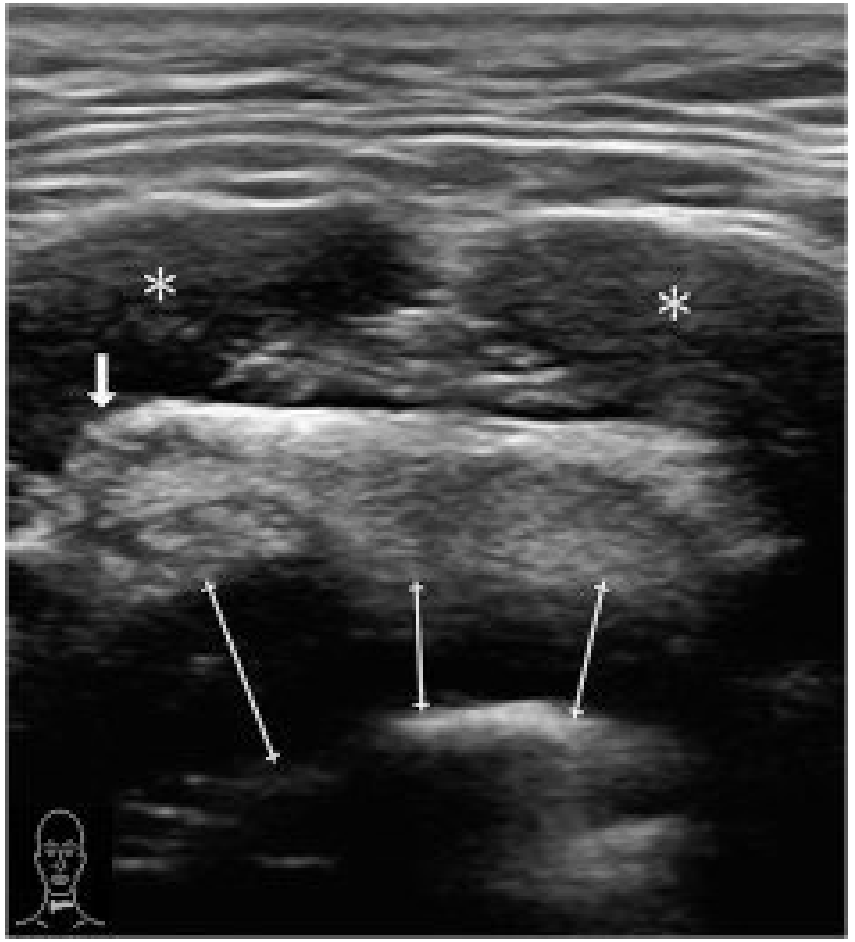
CONCLUSION

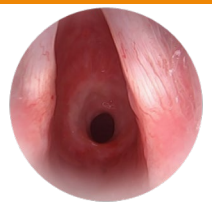
USG might prove to be a noninvasive alternative to VRL to visualise the VCs in perioperative period. Future studies can help to substantiate results of this pilot study.

Airway obstruction

(personal case, courtesy Dr. S. Falcetta)

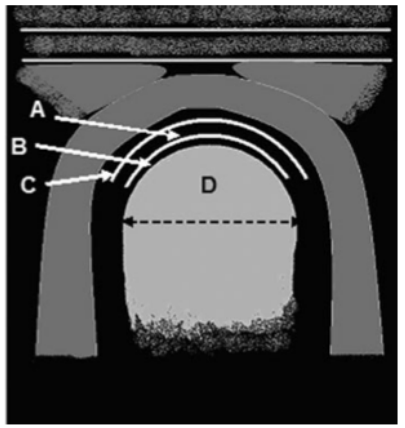






ULTRASOUND GLOTTIC DIAMETER MEASUREMENT

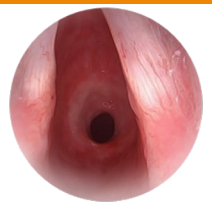
- US vd MNR: **0,33 mm resolution**
- Results limited to young healthy adults



Karim Lakhal, MD*
Xavier Delplace, MD*
Jean-Philippe Cottier, MD†
François Tranquart, MD‡
Xavier Sauvagnac, MD*
Colette Mercier, MD*

The Feasibility of Ultrasound to Assess Subglottic Diameter

(Anesth Analg 2007;104:611-4)



Laryngeal air column width ratio in predicting post extubation stridor

Pradeep M. Venkategowda, Kranthi Mahendrakar, S. Manimala Rao, Dnyaneshwar P. Mutkule, Chetan G. Shirodkar, H. Yogesh

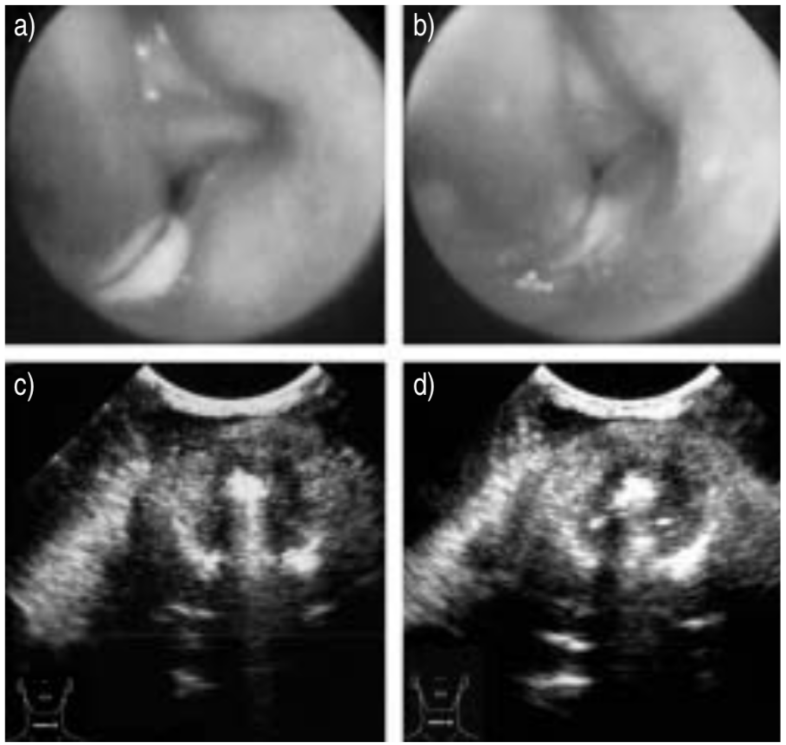
Abstract

Aim: Correlation of upper air column width ratio in postextubation stridor patients. **Materials and Methods:** A prospective observational study was conducted in a tertiary hospital between January and December 2013. Patients who were admitted in Intensive Care Unit and intubated for >24 h were included (72 patients). The upper airway air column width ratio (air column width before extubation/air column width after intubation) was calculated and compared in patient with or without postextubation stridor. **Results:** The incidence of stridor was 6.9% (5/72). The duration of mechanical ventilation was 5.60 ± 1.14 days and 3.91 ± 1.45 days in stridor and nonstridor group respectively. In all 5 patients who had stridor, the upper airway air column width ratio was 0.8 or less. **Conclusion:** Air column width ratio of 0.8 or less may be helpful in predicting postextubation stridor, which should be confirmed by large observational studies.

Keywords: Air column width, cricothyroid membrane, cuff leak test, postextubation stridor, ultrasound

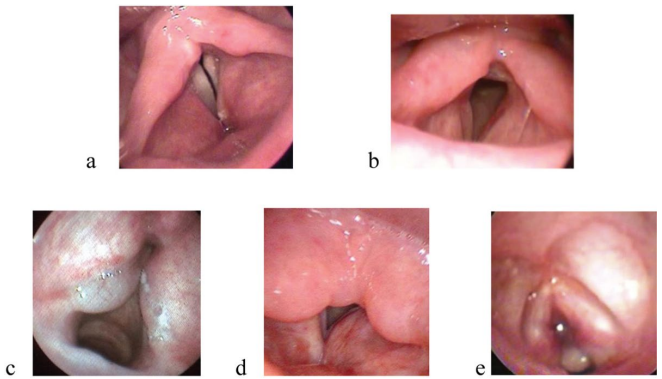
Access this article online
Website: www.ijccm.org
DOI: 10.4103/0972-5229.152763
Quick Response Code:

Eur Respir J 2006; 27: 384–389
DOI: 10.1183/09031936.06.00029605



Laryngeal ultrasound: a useful method in predicting post-extubation stridor. A pilot study

L-W. Ding*,#, H-C. Wang*,¶, H-D. Wu+, C-J. Chang§ and P-C. Yang*



Ultrasonography is a useful and non-invasive tool for the evaluation of vocal cords and laryngeal morphology in intubated patients. The air-column width measured by US may potentially identify patients at risk of post-extubation stridor, in whom caution should be taken after extubation. This

Anaesthesia 2019 doi:10.1111/anae.14867

Original Article

An international survey about rapid sequence intubation of 10,003 anaesthetists and 16 airway experts*

M. Zdravkovic,[1,2] J. Berger-Estilita,[3] M. Sorbello,[4] C. A. Hagberg[5] and contributors#

(a)

10,003 respondents – 141 countries

Brazilian Journal of ANESTHESIOLOGY xxxx;xxx(xx):xxx–xxx

Sociedade Brasileira de Anestesiologia

Brazilian Journal of ANESTHESIOLOGY

NARRATIVE REVIEW

A way forward in pulmonary aspiration incidence reduction: ultrasound, mathematics, and worldwide data collection

Marko Zdravkovic [a,b], Joana Berger-Estilita [c,*], Jozica Wagner Kovacec [b], Massimiliano Sorbello [d], Dusan Mekis [b]

British Journal of Anaesthesia **113** (1): 12–22 (2014)
Advance Access publication 3 June 2014 · doi:10.1093/bja/aeu151

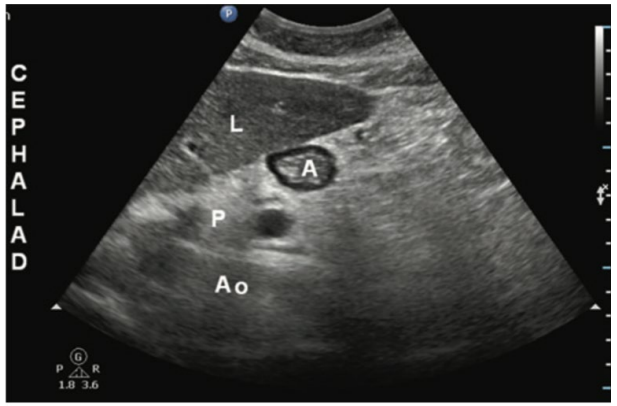
BJA

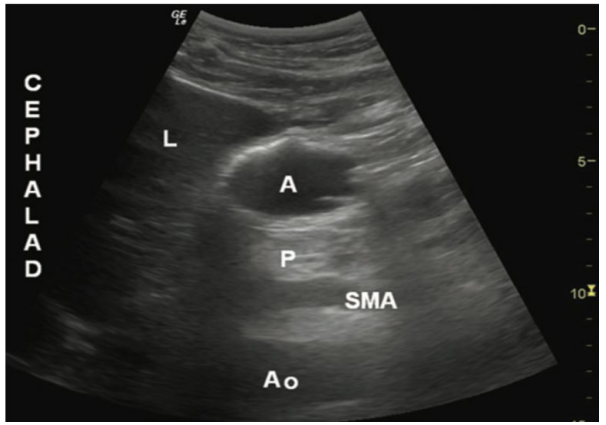
REVIEW ARTICLES

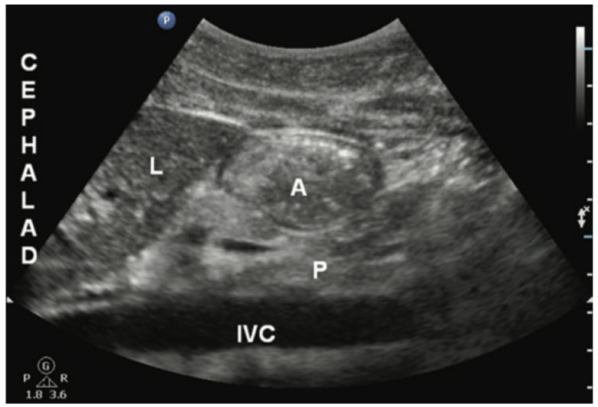
Ultrasound assessment of gastric content and volume

P. Van de Putte[1] and A. Perlas[2,3]*

Several areas require further investigation including defining the minimum training requirements to ensure accurate assessments. In addition, most of the current published data pertains to adult individuals. Volume assessment models in particular have only been validated for adult non-pregnant patients and further work is required in the paediatric and obstetric patient populations. In addition, 3D and 4D ultrasonography are newer imaging modalities that may have a future role in ultrasound gastric assessment.[62]







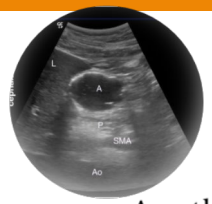
Preoperative gastric residual volumes in fasted patients measured by bedside ultrasound: a prospective observational study

Anaesth Intensive Care 2018 | **46:6**

Y. Ohashi*, J. C. Walker†, F. Zhang‡, F. E. Prindiville§, J. P. Hanrahan**, R. Mendelson††, T. Corcoran‡‡

Summary

The purpose of this prospective observational study was to measure gastric volumes in fasted patients using bedside gastric ultrasound. Patients presenting for non-emergency surgery underwent a gastric antrum assessment, using the two-diameter and free-trace methods to determine antral cross-sectional area. Gastric residual volume (GRV) was calculated using a validated formula. Univariate and multivariable analyses were performed to examine any potential relationships between 'at risk' GRVs (>100 ml) and patient factors. Two hundred and twenty-two successful scans were performed; of these 110 patients (49.5%) had an empty stomach, nine patients (4.1%) had a GRV >100 ml, and a further six patients (2.7%) had a GRV >1.5 ml/kg. There was no significant relationship between 'at risk' GRV and obesity, diabetes mellitus, gastro-oesophageal reflux disease or opioid use, although our study had insufficient power to exclude an influence of one or more of these factors. Our results indicate that despite compliance with fasting guidelines, a small percentage of patients still have GRVs that pose a pulmonary aspiration risk. Anaesthetists should consider this background incidence when choosing anaesthesia techniques for their patients. While future observational studies are required to determine the role of preoperative bedside gastric ultrasound, it is possible that this technique may assist anaesthetists in identifying patients with 'at risk' GRVs.



Anesth Pain Med. 2021 February; 11(1):e109732. doi: 10.5812/aapm.109732.

Published online 2021 February 3. **Research Article**

Gastric Residual Volume Assessment by Gastric Ultrasound in Fasting Obese Patients: A Comparative Study

Atef Mohammad Khalil [1,*], Safaa Gaber Ragab [1], Joseph Makram Botros [1], Hazem Ali Abd-aal [1] and Maged Labib Boules [1]

SUMMARY

Ultrasonograhic imaging is a useful tool not only for regional anaesthesia or in intensive care units but it also enables an objective, easy, quick and bedside assessment of gastric retention, based on which the risk of aspiration of gastric contents can be determined. The evaluation of gastric retention in patients undergoing surgical procedures facilitates therapeutic decisions, the selection of optimal types of anaesthesia or techniques of induction and should be more widely used as a routine element of preoperative evaluation of patients.

Ultrasound assessment of gastric emptying and the risk of aspiration of gastric contents in the perioperative period

Wojciech Gola, Michał Domagała, Adam Cugowski

Anaesthesiology Intensive Therapy
2018, vol. 50, no 4, 297–302
ISSN 1642–5758
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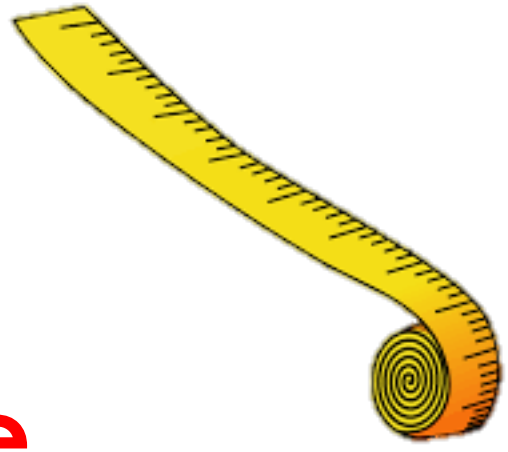
www.ait.viamedica.pl

US Measurements



above Hyoid bone

DCH = Distance Chin to Hyoid Bone (Oral Cavity)

Tongue = Width & Volume

TMJ = Temporo Mandibular Joint Motility

below Hyoid bone

DSH = Distance Skin to Hyoid Bone

DST = Distance Skin to Thyroid cartilage (vocal cords)

DSE = Distance Skin to Epiglottis

MSD Medical Science and Discovery
2019; 6(12):321-6

Research Article Doi: 10.36472/msd.v6i12.329

The Evaluation of Upper Airway: Point of Care Ultrasound vs. Traditional Tests

Burak Yıldız[1], Banu Çevik[1]*, Yılmaz Karaduman[1], Özlem Sezen[1], Kemal Tolga Saraçoglu[1]

Abstract

Objective: The ultrasound-guided interventions have gained widespread popularity in several aspects of anesthesia practice. In this study, we aimed to compare the preoperative evaluation tests and sonographic measurements of the upper airway for the prediction of a potentially difficult airway.

Material and Methods: In this prospective observational study, we enrolled 136 adult patients undergoing elective surgery under general anesthesia. The Modified Mallampati classification, thyromental distance, sternomental distance, and Cormack-Lehane scores were recorded. Sonographic measurements included pre-epiglottic space (PES), the distance between the midpoints of vocal cords and epiglottis (EVC). The ratio was interpreted. Main outcome is to determine the sensitivity and specificity of the upper airway ultrasound for the prediction of a potentially difficult airway.

Results: There was no statistically significant relationship between body mass index value and thyromental distance, Thyromental/Sternomental Ratio and PES/EVC ratio, Cormack-Lehane, Mallampati classification and thyromental/sternomental distance ratio ($p>0.05$). The sonographic measurements of airway have no significance to predict the difficult intubation and the comparison between PES, EVC and the PES/EVC ratio and assessment tests (Cormack-Lehane, Mallampati classification, thyromental and sternomental distances) was insignificant. The sternomental distance measurement was predictive for the difficult airway only in patients having body mass index more than 31.6 kg m-2.

Conclusion: Ultrasound is a useful tool for identifying the upper airway prior to anesthesia but the validity for the prediction of difficult airway is not clear. By increasing the clinical experiences and further investigations, a greater insight into its use will be gained.

Keywords: airway management; endotracheal intubation; laryngoscopy; ultrasonography

136 patients enrolled

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https://doi.org/10.1186/s13089-018-0083-6

Critical Ultrasound Journal

ORIGINAL ARTICLE Open Access

Ultrasound evaluation of the airway in the ED: a feasibility study

Elizabeth A. Hall[1,2*], Ibrahim Showaihi[3], Frances S. Shofer[4], Nova L. Panebianco[1] and Anthony J. Dean[5]

Abstract

Background: Recognition of the difficult airway is a critical element of emergency practice. Mallampati score and body mass index (BMI) are not always predictive and they may be unavailable in critically ill patients. Ultrasonography provides high-resolution images that are rapidly obtainable, mobile, and non-invasive. Studies have shown correlation of ultrasound measurements with difficult laryngoscopy; however, none have been performed in the Emergency Department (ED) using a consistent scanning protocol.

Objectives: This study seeks to determine the feasibility of ultrasound measurements of the upper airway performed in the ED by emergency physicians, the inter-rater reliability of such measurements, and their relationship with Mallampati score and BMI.

Methods: A convenience sample of volunteer ED patients and healthy volunteers with no known airway issues, aged > 18 years, had images taken of their airway using a standardized ultrasound scanning protocol by two EM ultrasound fellowship trained physicians. Measurements consisted of tongue base, tongue base-to-skin, epiglottic width and thickness, and pre-epiglottic space. Mean and standard deviation (SD) were used to summarize measurements. Inter-rater reliability was assessed by intraclass correlation coefficients (ICCs). Analysis of variance with linear contrasts was used to compare measurements with Mallampati scores and linear regression with BMI.

Results: Of 39 participants, 50% were female, 50% white, 42% black, with median age 32.5 years (range 19–90), and BMI 26.0 (range 19–47). Mean ± SD for each measurement (mm) was as follows: tongue base (44.6 ± 5.1), tongue base-to-skin (60.9 ± 5.3), epiglottic width (15.0 ± 2.8) and thickness (2.0 ± 0.37), and pre-epiglottic space (11.4 ± 2.4). ICCs ranged from 0.76 to 0.88 for all measurements except epiglottis thickness (ICC = 0.57). Tongue base and tongue base-to-skin thickness were found to increase with increasing Mallampati score ($p = .04, .01$), whereas only tongue-to-skin thickness was loosely correlated with BMI ($r = .38$).

Conclusions: A standardized ultrasound scanning protocol demonstrates that the airway can be measured by emergency sonologists with good inter-operator reliability in all but epiglottic thickness. The measurements correlate with Mallampati score but not with BMI. Future investigation might focus on ultrasound evaluation of the airway in patients receiving airway management to determine whether ultrasound can predict challenging or abnormal airway anatomy prior to laryngoscopy.

Keywords: Point-of-care ultrasound, Upper airway ultrasound, Airway management

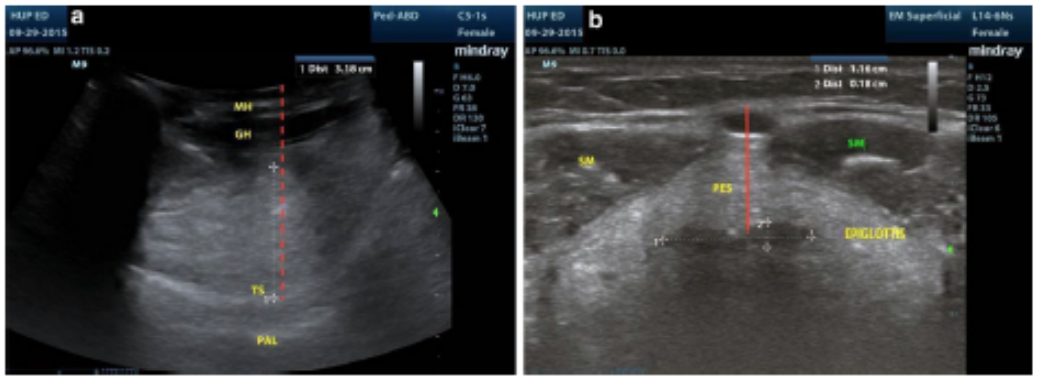


Fig. 1 **a** Sagittal paramedian view of the tongue from the submental area with the white dotted line representing the tongue base measurement and the red dotted line as tongue base-to-skin thickness. The patient's face would be in the direction of the right of the screen. *MH* mylohyoid muscle, *GH* geniohyoid muscle, *TS* tongue surface, *PAL* palette. **b** Transverse ultrasound image at the level of the thyrohyoid membrane. The pre-epiglottic space (red line, PES) is measured from the anterior surface of the epiglottis to the anterior margin of the strap muscles (SM) midway between the hyoid bone and the thyroid cartilage. The epiglottis is indicated by the two white caliper lines showing width (dotted line #1) and thickness (dotted line #2)

EJA

Eur J Anaesthesiol 2018; **35**:1–8

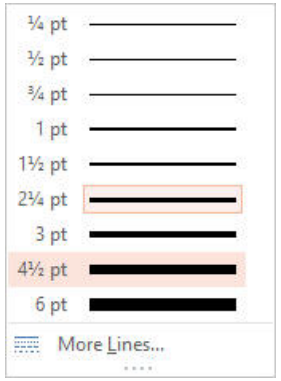
ORIGINAL ARTICLE

Evaluation of two neck ultrasound measurements as predictors of difficult direct laryngoscopy

A prospective study

Stefano Falcetta, Simona Cavallo, Vincenzo Gabbanelli, Paolo Pelaia, Massimiliano Sorbello, Ivana Zdravkovic and Abele Donati

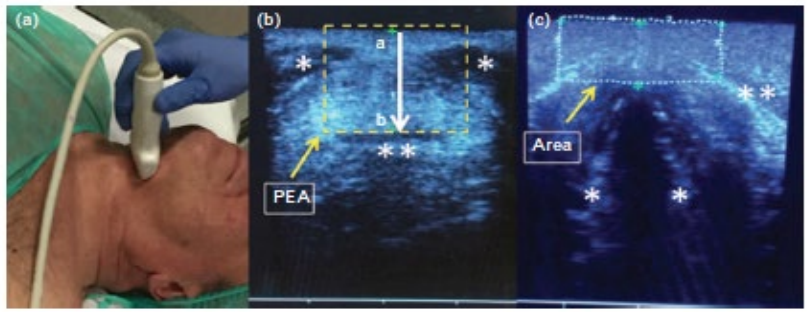
301 patients enrolled



EJA

Ultrasound and prediction of difficult airways 3

Fig. 1



(a) Ultrasonography at the level of thyrohyoid membrane and vocal cords. (b) 'The small face sign' (pre-epiglottic space) at the level of thyrohyoid membrane. *Thyrohyoid muscles; **epiglottis; a-b, median distance skin to epiglottis; ***pre-epiglottic area. (c) *Vocal cords: a-b, median distance skin-vocal cords; prevocal cords area.

Pre-laryngeal tissues thickness

EJA

Eur J Anaesthesiol 2019; **36**:509–515

ORIGINAL ARTICLE

Ultrasound as a new tool in the assessment of airway difficulties

An observational study

Francesco Alessandri, Giuseppe Antenucci, Edoardo Piervincenzi, Costantino Buonopane, Riccardo Bellucci, Chiara Andreoli, Danilo Alunni Fegatelli, Marco V. Ranieri and Federico Bilotta

CONCLUSION The prospective observational study confirms the relationship between ultrasound assessment of the anterior soft tissues of the neck and difficult laryngoscopy and DMV. DSHB and the other distances extend the available evidence, not only for difficult laryngoscopy but also for DMV.

META-ANALYSIS

DOI: 10.1213/ANE.0000000000005839

OPEN CME

Airway Ultrasound as Predictor of Difficult Direct Laryngoscopy: A Systematic Review and Meta-analysis

Andrea Carsetti, MD,*† Massimiliano Sorbello, MD,‡ Erica Adrario, MD,*† Abele Donati, MD, PhD,*† and Stefano Falcetta, MD†

15 studies for quantitative analysis of summary receiver operating characteristic (SROC).

- distance from **skin to epiglottis (DSE)**
- distance from **skin to hyoid bone (DSHB)**
- distance from **skin to vocal cords (DSVC)**

→ **Patients with difficult DL have higher DSE, DSVC, DSHB than patients with easy DL**

Table 2. Diagnostic Test Accuracy Results

Index test	Sensitivity	Specificity	LR+	LR–	AUC
DSE	0.82 (0.74–0.87)	0.79 (0.70–0.87)	3.91 (2.65–5.76)	0.23 (0.16–0.33)	0.87 (0.84–0.90)
DSHB	0.71 (0.58–0.82)	0.71 (0.57–0.82)	2.46 (1.50–4.04)	0.40 (0.25–0.66)	0.77 (0.73–0.81)
DSVC	0.75 (0.62–0.84)	0.72 (0.45–0.89)	2.63 (1.16–5.98)	0.36 (0.20–0.62)	0.78 (0.74–0.81)
Pre-E/E-VC	0.65 (0.22–0.93)	0.68 (0.43–0.85)	2.02 (1.0–4.07)	0.51 (0.63–6.11)	0.71 (0.67–0.75)

META-ANALYSIS

OPEN

CME

Airway Ultrasound as Predictor of Difficult Direct Laryngoscopy: A Systematic Review and Meta-analysis

Andrea Carsetti, MD,*† Massimiliano Sorbello, MD,‡ Erica Adrario, MD,*† Abele Donati, MD,
and Stefano Falcetta, MD†

KEY POINTS

- **Question:** Is preoperative upper airway ultrasound able to predict a difficult airway in adult patients undergoing elective surgery under general anesthesia without clear anatomical abnormalities suggesting difficult laryngoscopy?
- **Findings:** The distance from skin to epiglottis was the most extensively assessed index test in literature and seems accurate to predict difficult laryngoscopy.
- **Meaning:** The high heterogeneity performing ultrasound and the limited number of studies do not allow to reach a definitive conclusion, and the routine use of ultrasound to predict difficult laryngoscopy cannot still be recommended.

…laryngos-
…population with uncertain difficult
airways based on the clinical assessment. However, it is not currently possible to reach a definitive conclusion. Further studies are needed with better standard-

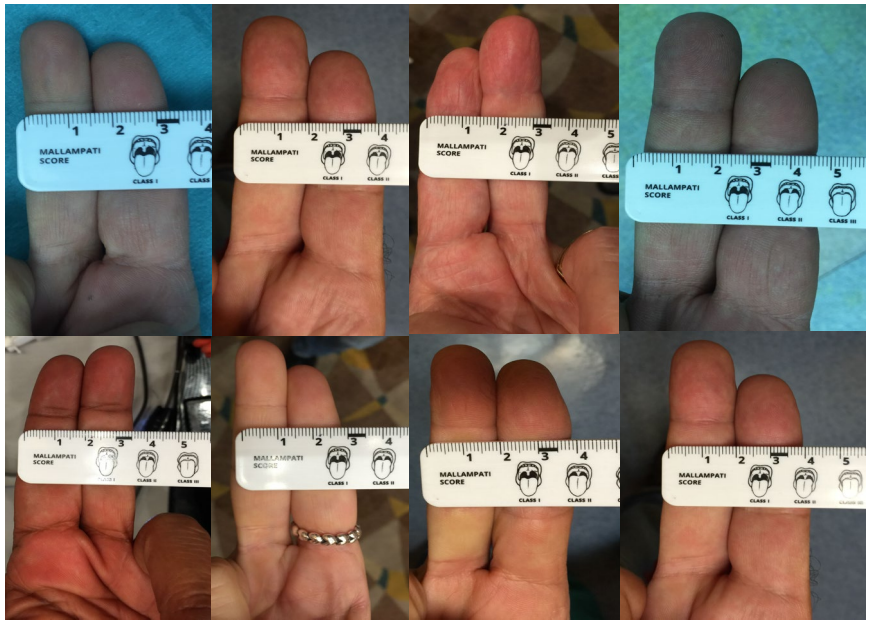
Anaesthesia
Journal of the Association of Anaesthetists of Great Britain and Ireland
Anaesthesia, 2009, **64**, pages 878–882 doi:10.1111/j.1365-2044.2009.05985.x

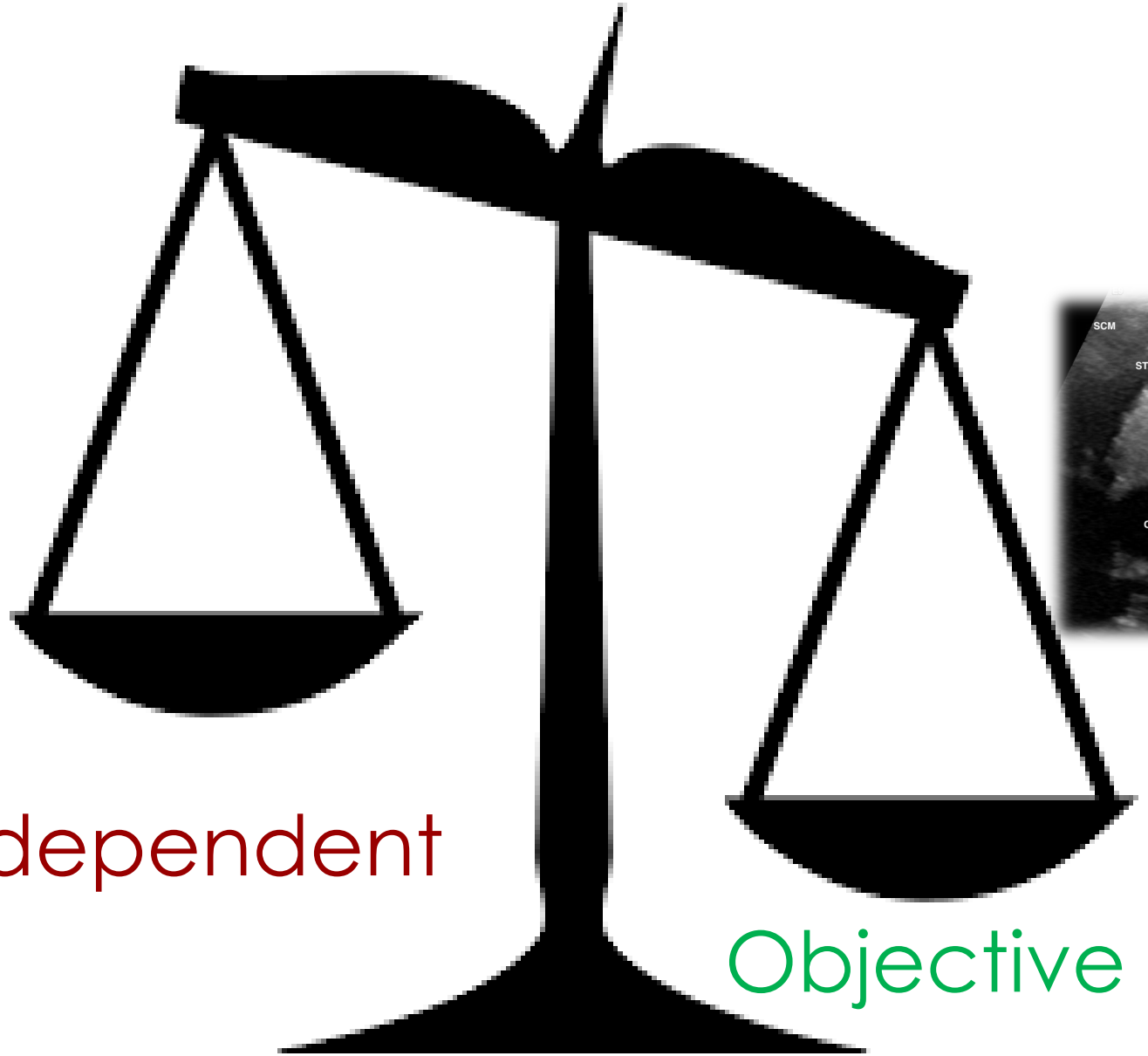
Thyromental distance measurement – fingers don't rule

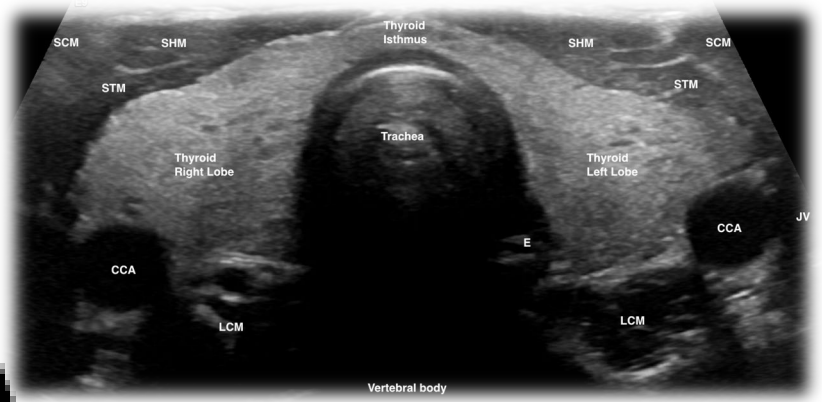
P. A. Baker,[1] A. Depuydt[2] and J. M. D. Thompson[3]

Three-fingers measurement

Range 4.6 – 7.0 cm (mean 5.9)







Operator-dependent

Objective measurements

Trends in Anaesthesia and Critical Care xxx (xxxx) xxx

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Editorial

Time to include ultrasounds in pre-procedural airway evaluation?

M. Sorbello and S. Falcetta, Trends in Anaesthesia and Critical Care, https://doi.org/10.1016/j.tacc.2021.02.006

EJA

Eur J Anaesthesiol 2024; **41:**1–35

GUIDELINES

Preoperative assessment of adults undergoing elective noncardiac surgery

Updated guidelines from the European Society of Anaesthesiology and Intensive Care

Massimo Lamperti, Carolina S. Romero, Fabio Guarracino, Gianmaria Cammarota, Luigi Vetrugno, Boris Tufegdzic, Francisco Lozsan, Juan Jose Macias Frias, Andreas Duma, Matthias Bock, Kurt Ruetzler, Silvia Mulero, Daniel A. Reuter, Luigi La Via, Simon Rauch, Massimiliano Sorbello and Arash Afshari

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GUIDELINES

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Airway evaluation

What should be the minimum number of tests required for effective planning of airway management?

R6.1: We recommend assessing the patient's airway before any procedure. (1C)

R6.2: We recommend performing multiple tests to improve the positive-predictive and negative-predictive values of preprocedural airway assessment. (1A)

R6.3: We suggest using the minimum set of airway assessment tests that may vary among patients depending on specific underlying pathologies. (2C).

R6.4: For a comprehensive risk assessment, including the postanaesthesia care, the minimum set of airway assessment tests should include, apart from anatomical tests, the evaluation of physiology, environment, devices and the individual and team expertise. (1C).

R6.5: More evidence is required before recommendations can be made regarding the need for instrumental tests (e.g. ultrasound) for airway assessment. (CPS)

R6.6: In case of predicted and previously experienced difficult airway, we recommend informing the patient adequately and obtaining consent for specific procedures (e.g. awake intubation), and an alert form should be given to the patient in case of future procedures requiring airway management. (1C)

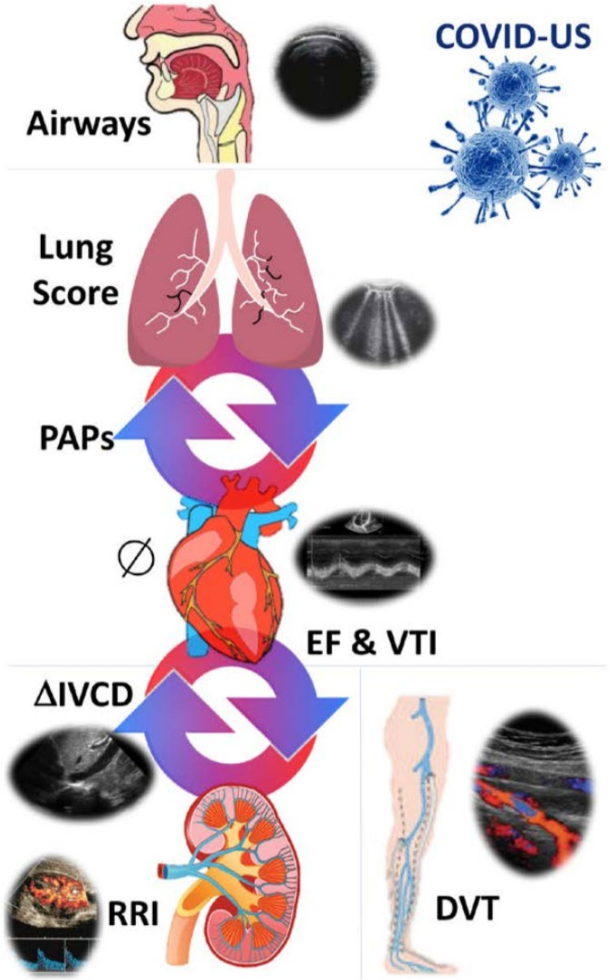
Technological evolution

Reduced costs & Increased availability

Familiarity & Training

Tailored Prediction approach

COVID-19: The New Ultrasound Alphabet in SARS-CoV-2 Era



C: cardiac evaluation

1. Cardiac chambers diameters and kinesis
2. Pericardium (effusion, tamponade)
3. pulmonary artery pressure
4. ejection fraction%
5. inferior vena cava diameter variations differentia

O: outputs

1. renal resistive index
2. velocity-time integral

V: ventilation

1. B-lines patterns
2. B-lines spatial distribution
3. Hyperinflation and recruitment response
4. Lung score
5. Search for pneumothorax/effusion

I: intubation

1. Prediction of difficult laryngoscopy/intubation
2. Endotracheal intubation confirmation

D: Doppler and deep venous thromboembolism/ pulmonary embolism

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ANESTHESIOLOGY

Artificial Intelligence and Machine Learning in Anesthesiology

Christopher W. Connor, M.D., Ph.D.

ANESTHESIOLOGY 2019; 131:1346–59

ABSTRACT

Commercial applications of artificial intelligence and machine learning have made remarkable progress recently, particularly in areas such as image recognition, natural speech processing, language translation, textual analysis, and self-learning. Progress had historically languished in these areas, such that these skills had come to seem ineffably bound to intelligence. However, these commercial advances have performed best at single-task applications in which imperfect outputs and occasional frank errors can be tolerated.

The practice of anesthesiology is different. It embodies a requirement for high reliability, and a pressured cycle of interpretation, physical action, and response rather than any single cognitive act. This review covers the basics of what is meant by artificial intelligence and machine learning for the practicing anesthesiologist, describing how decision-making behaviors can emerge from simple equations. Relevant clinical questions are introduced to illustrate how machine learning might help solve them—perhaps bringing anesthesiology into an era of machine-assisted discovery.

(ANESTHESIOLOGY 2019; 131:1346–59)

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Artificial intelligence in ultrasound

Yu-Ting Shen [a] · Liang Chen [b] · Wen-Wen Yue [a] · Hui-Xiong Xu [a]

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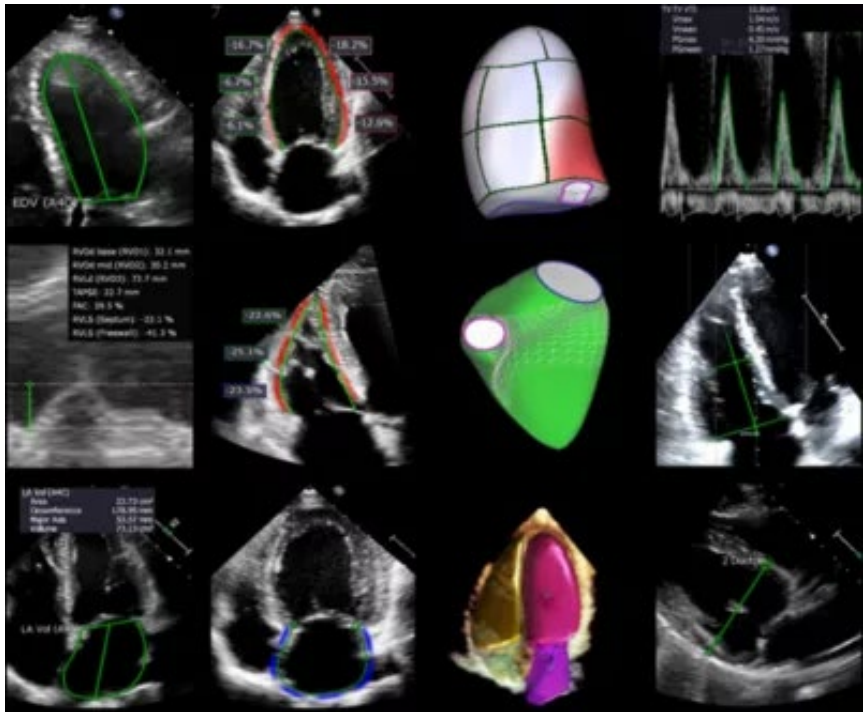

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AI applications to medical images: From machine learning to deep learning

Isabella Castiglioni [a,b,1] · Leonardo Rundo [c,d,1] · Marina Codari [e,1] · ... · Andrea Cozzi [i] · Natascha Claudia D'Amico [j,k] · Francesco Sardanelli [f,i] ... Show more

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