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A new laryngoscope with a force sensor that alerts the anaesthetist during laryngoscopy

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A new laryngoscope with a force sensor that alerts the anaesthetist during laryngoscopy

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A new larygoscope with a force sensor that alerts the anaesthetist during laryngoscopy

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A new laryngoscope with a force sensor that alerts the anaesthetist during laryngoscopy

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Summary

This paper presents a new laryngoscope that includes in the handler a custom made force sensor. The device connects to a computer using a wireless communication and is able to generate sound feedback in real-time to help the practitioner.

To access the importance of the force feedback, forty-two anaesthetists performed two series of laryngoscopies, with and without the audible signal, in a manikin. Maximum peak force, laryngoscopy time, experience and gender of the operator were registered. Comparing the laryngoscopies without and with the audible signal, it was observed a reduction of the maximum force (40.6 N *vs* 31.0 N; $p<0.001$), shorter laryngoscopy time with an average decrease of 8 seconds ($p<0.001$) and lower force for the most experienced ($p=0.019$). Results suggest that when the digital laryngoscope with an audible signal is used, alerting to the applied force, the anaesthetist executes laryngoscopy with lower force.

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The airway management is a constant concern for the anaesthetist [1], since failure in this process can increase mortality and morbidity [2]. In many situations it is imperative the use of tracheal intubation, despite the emergence of new techniques for handling with the airway [2].

The conventional laryngoscopy remains the fastest and economical technique to achieve tracheal intubation [3]. However both, intubation and laryngoscopy, can induce hemodynamic alterations such as tachycardia, cranio-cervical extension, leading to increased intracranial hypertension, soft tissue trauma and dental injuries [4, 5]. Cardiovascular alterations related to laryngoscopy may be proportional to the force applied to the tongue base and supraglotic tissues [4].

The force applied during laryngoscopy is influenced by the professional's experience and technique and by factors related with the patient, such as age, weight, height, length of the maxillary incisors and the application of manual in-line stabilization [4].

Nowadays, there are a lot of different devices for handling airway that may induce different hemodynamic responses [6]. Although, a previous study that compared hemodynamic alterations with GlideScope® videolaryngoscopy (GSVL) and Macintosh direct laryngoscopy (MDLS), had demonstrated that the GSVL had no advantages over MDLS in attenuating the hemodynamic responses to orotracheal intubation [6].

Silva A. et al [7] developed a new digital laryngoscope that is capable of measuring the force applied during laryngoscopy. This new digital laryngoscope connects with the common blades to eliminate the necessity of inserting any sensor in the laryngoscope blade like in other studies [8]. This aspect represents a great improvement compared with the existing solutions since it can be used consecutively by only replacing the laryngoscope blade.

The main goal of this study was to compare the force changes during the laryngoscopy procedure with and without audible force feedback mechanism. For this purpose it was used a new Laryngoscope (WO2014109659 A1) capable of measuring the force in real time and produce a sound to alert the user when an excessive force is applied.

Methods

The participants performed laryngoscopies on the manikin used for handling airway (*Ambu* type 186000; serial number 61380847F; Made in Denmark).

The "Digital Laryngoscope" [7] was used with blade Macintosh number 3 and powered by a 3V battery; the illumination source was replaced by a white LED. This model is 12 mm longer and 1.7 mm larger in diameter than a conventional handle, figure 1 [7]. The laryngoscope handle includes a custom load cell in the interior to measure the force applied in the laryngoscope blade. The measured force is transmitted to a computer using a wireless protocol – Bluetooth - and saved using a LabVIEW custom-made application. The computer program analyses the data and produces an audible signal (AS) with a frequency from 0 Hz (for 0 Newton force) increasing 1000Hz for each 10N of additional force.

During the tests, each participant performed six laryngoscopies using the digital laryngoscope with modified handle: the first three without AS and the last three with AS.

In the last test of each series, the applied force was measured during laryngoscopy, and the time required to visualize the vocal cords was registered. The gender and experience of the operator that performs the laryngoscopy was also collected.

After the laryngoscopies, it was asked to the participants if they noticed changes in the light of the new digital laryngoscope. Then they ranked from 0 to 10 the light by comparing the conventional with the new laryngoscope, figure 2 [7]. The software that recorded the data from the laryngoscopy has also the ability to analyse the recorded data and visualize the entire procedure [7]. During the analyses, this software was used to obtain the maximum force obtained with (appendice 1a) and without AS (appendice 1b) and the time of laryngoscopy. The mean value and standard-deviation (SD) was also calculated for the above referred variables.

T Student's test was used to compare the group with and without AS according to peak maximum force, laryngoscopy time and conventional / digital light. Normality was tested with Kolmogorov-Smirnov/Lilliefors test.

A Multivariable linear regression analysis was performed to estimate the effect of experience and gender in the average maximum force and laryngoscopy duration. Results of these models are shown using β coefficients with 95% confidence intervals (95% CI).

All statistical analysis was calculated with the software Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM, Amarte, NY, USA). A value of $p < 0.05$ was considered statistically significant.

Results

For this study were recruited forty-two anaesthetists from a university hospital, including specialists and residents in anaesthesia to perform two series of classic direct laryngoscopies. Seven participants were excluded due to incomplete data, remaining 35 anaesthetists records.

As it can be seen in figure 3, the mean maximum force during intubation with the digital laryngoscope with audible signal off was 40.6 N (SD=11.4), whereas with it on was 31.0 N (SD=7.5). The difference between the mean maximum forces of 9.6 N is statistically significant ($p<0.001$). The average time of laryngoscopy with the digital laryngoscope with AS off was 28 seconds (SD=14) and with it on was 20 seconds (SD=11). The difference between these two sets, of 8 seconds, was statistically significant ($p<0.001$). As described in table 1, the more is the anaesthetist's experience, the lower is the mean difference of the maximum force during laryngoscopy with and without AS ($p=0.019$ $\beta=-0.284$; 95% CI: -0.518;-0.051).

The gender of the operator has no influence on the mean difference peak maximum force made during the laryngoscopy ($p=0.079$). The anaesthetist's experience and gender did not influenced the time of the laryngoscopy ($p=0.649$ and $p=0.301$, respectively).

Concerning the light, all anaesthetists preferred the digital laryngoscope to the conventional. In figure 2 is compared the light visibility [7]. The mean rating on the digital was 9.10/10 (SD=0.672), while the mean of rating of the conventional was 6.54/10 (SD=1.491). This rating difference was also statistically significant ($p=0.038$). The light rating was not affected by the years of experience ($p=0.401$) neither the gender of the operator ($p=0.217$).

Discussion

The force applied during laryngoscopy can induce hemodynamic alterations [4] and it increases the risk of dental injury and consequently the risk of aspiration [5]. These are the most common incident reported [5].

The previous studies use very thin force sensors, commonly flexiforce from teckscan® [8]. However, these sensors lack of the repeatability and precision when compared with the developed custom load cell [9]. Furthermore, they set a small sensitive area in the laryngoscope blade which may not represent the amount of force applied to the patient. Instead, in the digital laryngoscope is measured the total force applied to the blade**.**

The sound warning from the digital laryngoscope, at first impression, can be viewed as a disadvantage for some users since they may be distracted from the critical laryngoscopy procedure. However, this was not reported from any of the subjects that performed the test. The audible signal proved to be an advantage: when the anaesthetist uses a digital laryngoscope with an AS alerting to the force applied, he executes a laryngoscopy with lower force in a shorter time.

Fukuda T. et al. [5] studied the force applied to the maxillary incisors during direct laryngoscopy when performed by experienced anaesthetists and residents in anaesthesia. It was demonstrated in this study that the experience level of the anaesthetists influenced both, peak force and the laryngoscopy time required. In our study also experienced users applied lower force. More precisely, the average of the average maximum force at the laryngoscopy was only 76% of the force required without audible signal. For the time of intubation, it was observed a reduction of 8 seconds by turning on the audible signal, representing a reduction of 30%.

Notably, the anaesthetists preferred the light from the digital laryngoscope than the conventional to see the vocal cords, as the light is brighter and white.

The handle of the new digital laryngoscope is slightly heavier than the conventional, although the participants did not report any discomfort or inconvenient.

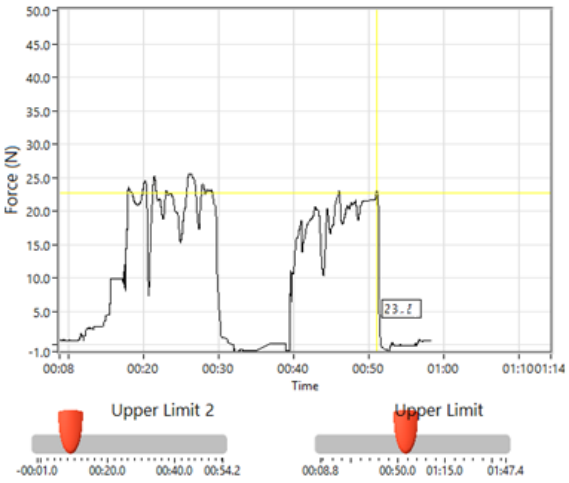
There are many factors related to patients that influence the force applied during laryngoscopy [4] such as height, weight, age, gender and the presence of maxillary incisors [5]. To overcome heterogeneity of the patients, it was used a manikin, allowing the evaluation of the anaesthetist's ability.

It would be important in the future to develop the same concept in videolaryngoscopy to compare the same parameters and to establish which one needs less force.

In conclusion, our study showed that anaesthetists need less force and shorter time to perform the laryngoscopy with the new digital laryngoscope with the audible signal on.

Appendice 1 Laryngoscopy data.

a) Maximum force in laryngoscopy with AS (23.2 N)



b) Maximum force in laryngoscopy without AS (25.6 N)

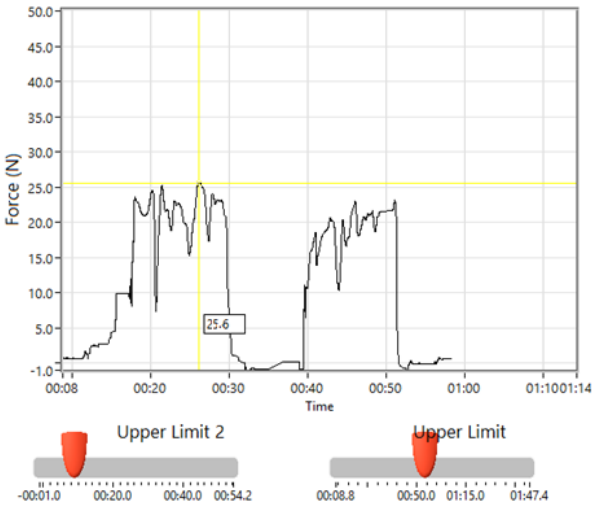


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Table 1 – Factors associated with mean differences between maximum peak force of the digital laryngoscope during laryngoscopy with audible signal (AS) on and off, laryngoscopy time with AS on and off and conventional or digital light rating.

	Peak maximum force		Laryngoscopy time		Light rating	
	β coef. (95% CI)	P value	β coef. 95% CI	P value	β coef. 95% CI	Pvalue
Gender						
Female	1		1		1	
Male	5.364 (0.664;11.392)	0.079	4.532 (-4.268; 13.332)	0.301	0.631 (-0.388;1.649)	0.217
Year's experience	-0.284 (-0.51;-0.051)	0.019	0.075 (-0.257;0.406)	0.649	0.016 (-0.023;-0.055)	0.401

Figure 1 Left – Standard laryngoscope; Right – Digital laryngoscope [7]

Figure 2 Light visibility comparison [7]

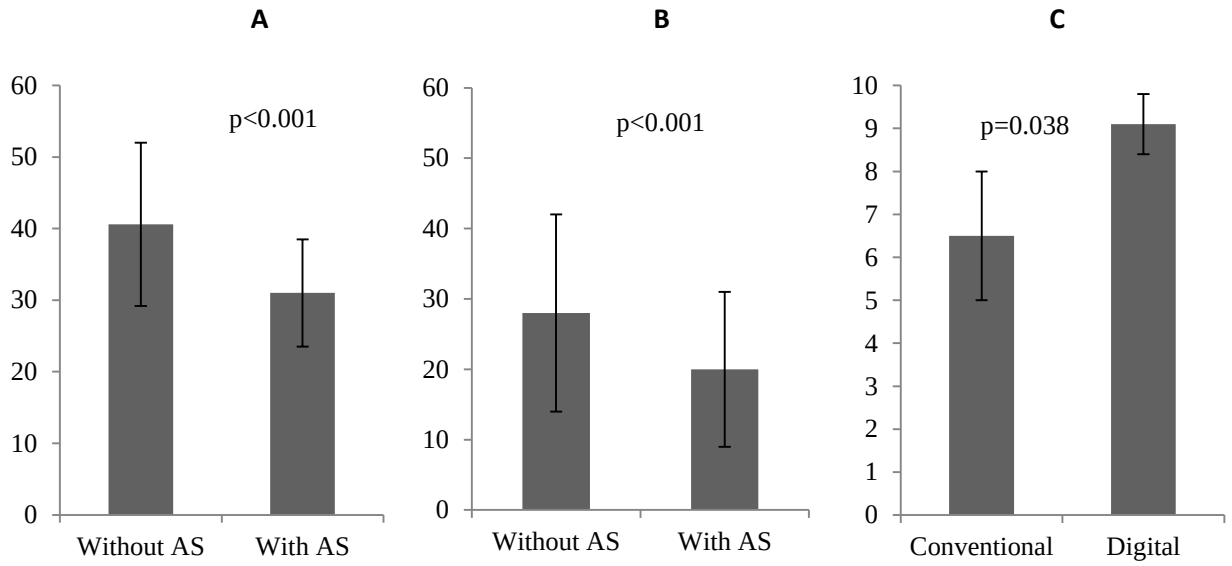

Figure 3 Mean difference between A) maximum forces with and without audible signal (AS); B) laryngoscopy time with and without AS; C) conventional and digital light rating (bars represent standard deviation of the mean).

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Anexos

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Acknowledgments

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Number references (including articles in press) consecutively in the order they appear in the text, using Arabic numerals enclosed in square brackets on the line (not superscript). Use [1-4] instead of [1,2,3,4]. Abstracts may be quoted as references so long as they have been published in peer-reviewed journals. Internet sites may be quoted as references by listing them in the normal way in the text (using Arabic numerals). Unpublished observations, personal communications and abstracts published only in proceedings of meetings should be quoted within the text of the manuscript, in parentheses. Please submit copies of any articles accepted for publication but not yet published. Information from manuscripts submitted but not yet accepted should be cited in the text as unpublished observations. References cited for the first time in Tables or Figures should be numbered in the sequence established by the first mention of the particular Table/Figure in the text. All references (including those in press) should be listed at the end of the text in the order they are quoted. For internet sites, please include the date accessed in parentheses. List all authors unless there are seven or more, in which case give the first three followed by 'et al.'. Spell out the names of all journals in full, and give the first and last page number, not just the first. Examples:

1. Author AB, Author CD. Title of paper. *Journal Title Written Out in Full in Italics* 2010; **12**: 123-4.
2. Author AB, Author CD. Title of paper published as 'ePub ahead of print'. *Journal Title Written Out in Full in Italics* 2010 Dec 15; doi xx.xxxx/xxx.xxxxxx.
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Tables

Include the Tables in the same file as the text, but after the References not in the middle of the text. Each Table should be on a separate page. Number the Tables consecutively with Arabic numerals. Each Table should have a brief Caption immediately above it; the Caption should provide enough information for readers to follow it without having to look through the text (e.g. 'Characteristics of patients receiving vecuronium or rocuronium for caesarean section' rather than just 'Patients' characteristics'). The Caption should explain whether the values refer to mean (SD), number (proportion), etc. Abbreviations should not be mentioned in the Caption without explanation. Abbreviations used in the body of the Table should be explained as footnotes in the order in which they are first mentioned, using the following symbols (nb not superscript) in the following order: *, †, ‡, §, ¶, **, ††, ‡‡, etc. The study groups should form the columns

rather than the rows. If statistical comparisons are being made, a separate column with exact p values should appear.

Example:

Table 2 Characteristics of intrathecal blocks with levobupivacaine or bupivacaine in patients undergoing knee replacement. Values are mean (SD), median (IQR [range]) or number (proportion).

	Levobupivacaine *(n=40)*	**Bupivacaine *(n=40)***	**p value**
Time to T10; min	7.8 (1.9)	6.4 (2.0)	0.002
Time to peak sensory block; min	26.4 (7.2)	21.8 (5.7)	0.002
Time to two-segment regression; min	80.3 (9.9)	78.3 (10.9)	0.41
Time to maximum motor block; min	19.1 (5.4)	9.5 (4.2)	0.0001
Time to motor block regression; min	145.6 (18.5)	139.9 (22.4)	0.22
Time to L5; min	245.5 (30.1)	239.7 (32.9)	0.41
VAS for discomfort/pain during surgery*	7 (6-8 [5-9])	6 (5-7 [4-8])	0.011
Supplementation with fentanyl	8 (20%)	6 (15%)	0.77

*VAS; visual analogue score

Figures

Please supply each Figure as a separate file, rather than embed them within the body of the Word document, and preferably in TIFF or high-resolution JPEG format. We ask that they are both supplied at a resolution of 300 pixels per inch for photographs and 600 pixels per inch for line art or a combination of photograph and labelling. Please do not send image files larger than 10MB.

Please ensure related graphs have the same format (fonts, use of symbols, etc), and that the groups are presented in the same order in each graph (and in the same order as in the rest of the manuscript). The same requirements for abbreviations and units apply as for those in the text. The title, plot frame, gridlines and legend box within the graph itself should be removed, with symbols and error bars explained in the Caption. Avoid the use of 3-D unless absolutely necessary. Please note that colour Figures (e.g. photographs, complex flow diagrams, etc) may be used without charge, but only if the Editors consider that the use of colour is crucial.

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Each Figure Caption should include an explanation of the symbols used to provide enough information for readers to follow it without having to look through the text.

Thus this:

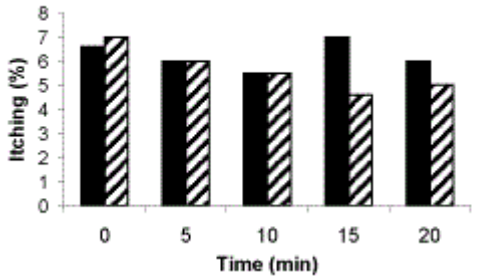

Figure 1 Itching after surgery in patients receiving saline (■) or chlorphenamine (▨). No significant difference between groups.

Is preferable to this:

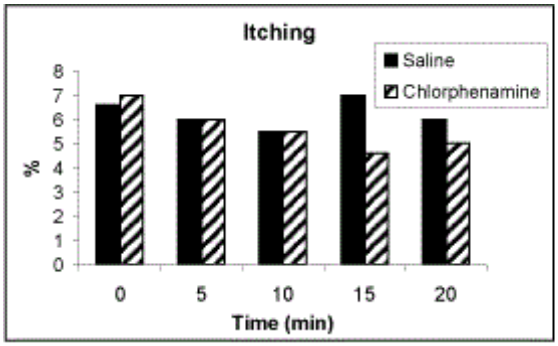

Figure 1 Itching after surgery.

See notes below for ethical considerations relating to photographs.

Supporting Information (online only)

Additional material such as video clips, lengthy Appendices (e.g. extensive reference lists or mathematical formulae/calculations), etc, that are relevant to a particular article but not suitable or essential for the print edition of the Journal, may also be considered for publication. Please refer to all supporting information in the manuscript using Table S1, Figure S1, etc, and supply such information as separate files (i.e. not embedded within the main manuscript). Further information on suitable file formats etc may be found here

Language

Please note that Anaesthesia uses UK English spelling eg “ise” not “ize”, “anaes” not “anes” etc. In general, we prefer a clear, precise style to jargon. Please avoid long, complicated sentences and the passive voice when the active is more appropriate (e.g. ‘We chose epidural anaesthesia because...’ instead of ‘Epidural anaesthesia was chosen by the authors because...’). Remove unnecessary clutter and focus on the actual message of each sentence; thus ‘Hypotension is important because...’ instead of ‘It would be remiss of us not to mention hypotension because...’). Remember that lungs are ventilated, not patients (nor are they intubated – their tracheas are). Similarly, patients are not induced – anaesthesia is – or put on ventilators. Correct terms are tracheal (not **endo**tracheal) tube and neuromuscular blocking drugs (not muscle relaxants). Please refer to recent issues of the Journal for preferred wording/spelling, e.g. “manikin” is preferred to “mannequin”, and “supraglottic airway device” is preferred to “extraglottic airway device”.

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In general, the Journal does not encourage the use of abbreviations, especially in the Summary, since their frequent use makes papers cluttered and difficult to read. However, we will accept abbreviations in the following circumstances:

- Universal abbreviations that do not need to be written out in full when first mentioned in the text. These include abbreviations that appear in a large proportion of the articles published in the Journal, e.g. ASA, BMI, ECG, ICU, HDU, SD, SEM, 95% CI, IQR, ANOVA, S_pO_2, F_IO_2, pH.
- Acceptable common abbreviations that can be used but should be written out in full at their first mention, e.g.: CNS, CSF, HME, PEEP, PCA, SCBU, CTG, EEG, BIS, CVP, PAP, PCWP, ECT – unless they’re only mentioned a few times, in which case please spell them out throughout. Please do not use abbreviations that are clumsy or will be unfamiliar to the majority of readers, e.g. DI (difficult intubation), TTFB (time to first breath), etc
- Acceptable abbreviations that do not need to be written out in full when first mentioned but whose use should be restricted to situations where space is limited, such as in formulae or in Tables and Figures, e.g.: O_2, CO_2, N_2O, HCO^{3-}, Na^+, K^+, Mg^{2+}.

Numbers and units

Numbers should be spelled out in full when they start a sentence, and when they are less than 10 (unless they are followed by units of measurement). Thus: 'Thirteen days later, five patients each received 7 ml solution...' Commas are not used to indicate thousands; thus 2000 and 20 000 instead of 2,000 and 20,000. Please give costs in sterling (£) with equivalent Euros and US dollars (€/$) in brackets.

Use the format $mg.kg^{-1}$ not mg/kg for all units. Use SI units throughout the text except for vascular pressure measurements (mmHg or cmH_2O) and haemoglobin concentration ($g.l^{-1}$). Litres are indicated by lower case 'l' not upper 'L'. Use the 24-hour clock for times.

Ethical considerations

Whatever their other merits, manuscripts will only be considered for publication in *Anaesthesia* if they adhere to the highest ethical standards. These are detailed in two editorials published in the journal, that are available here and here and which potential authors are strongly advised to consult. In brief:

- Approval by a Research Ethics Committee (REC) or equivalent (e.g. Institutional Review Board) must be obtained prospectively for all studies on human subjects, including studies in which participants' skills are tested using manikins. While some audit and epidemiological surveys, some assessments of medical equipment, and some studies involving NHS staff may be exempt from this stricture if participants are appropriately protected against coercion and there is due regard to confidentiality, publication of the results would usually still require informed consent and assurances regarding confidentiality (including approval by theCaldicott Guardian for patient data in the NHS, or equivalent if not), even if the REC and/or R&D Department has indicated that formal submission is unnecessary.
- While an essential preliminary step, REC approval does not guarantee that the ethical standards of a study will meet the requirements of the Editorial Board of *Anaesthesia*. If authors have any concerns that ethical issues might compromise publication, they are invited to contact the Editor-in-Chief before embarking on the study.
- The Editorial Board supports the view of the General Medical Council that full prospective written informed consent should be obtained from all subjects of clinical trials, including participants in manikin studies (see above). As incorporated in regulatory procedures around the world, e.g. in The International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) international standards 'Good Clinical Practice', this would normally comprise provision of written information to potential research participants, allowance of adequate time for them to consider their involvement and ask questions, and the use of specific consent forms (for the study, not just for routine surgery/anaesthesia) that should be signed by the participants to indicate their consent and then stored in case they require examination later. Authors who do not follow this guidance will need to be able to mount a robust defence of their decision.
- Submission of a case report requires the written consent of the subject to publication, using the specific form which may be found here (NB please do not submit this document together with your manuscript/Declaration Form – though please note that authors may be asked to provide the signed form as evidence, should a complaint result in a subsequent investigation). While the Editorial Board recognises that it might not always be possible to seek such consent (or the assent of the next-of-kin if the patient has died), the onus will be on the authors to demonstrate that this exception applies in their case. Please state in an Acknowledgement at the end of the text: 'Published with the written consent of the patient(s)' or similar, as appropriate.
-
- Studies of novel treatments, in particular drug studies where the agent used is given via unlicensed routes (especially spinal and epidural), may have received approval from the REC or equivalent, but the Editorial Board is likely to reject such studies if it considers that the risks posed outweigh the potential benefits. Such a conclusion is more likely to be reached if the drug in question is not widely used in routine practice (as evidenced by inclusion in standard textbooks), if the study participants are especially vulnerable (e.g. children, women in labour), if there are questions over consent, or if only modest improvements in outcome are expected where other, well established methods already exist.
- Animal studies will only be considered for publication if they have ethical and Home Office (or local equivalent) approval, and have been conducted under appropriate standards of care. Researchers will be expected to follow the ARRIVE guidelines for experimentation in animal research.

Statistics

The following guidelines have been prepared by the Editorial Board of *Anaesthesia* to help authors avoid the common statistical errors that frequently lead to rejection of work submitted for publication. This should not be regarded as an exhaustive list and, of course, the Editorial Board and reviewers of manuscripts may ask authors for revisions that are not detailed here. However, adherence to these guidelines in a paper that is otherwise acceptable will give researchers a good chance of publication and help ensure that their work is statistically valid.

Methods

Randomisation methods must minimise the possibility of predicting or breaking the code.

Blinding must be as good as possible.

Where there are several outcomes to be reported, the most important (primary) outcome should be clearly stated.

Power analysis:

- Justification of sample size should always be performed before randomised controlled trials are started. Details provided should include the power level; the significance level at which a result is sought; and the expected control and study group proportions or mean and pooled SD, in order to allow reviewers and readers to follow the calculation.
- The power of study should be at least 80%.
- The 'clinically important difference' that the study is designed to detect should be clinically relevant and should not be set unreasonably large (sometimes done to justify small sample size).

Descriptive statistics:

- Use mean (SD) unless:
    - Data are discrete (e.g. Apgar scores, sedation scores) or grossly non-normally distributed: use median (IQR [range]).
    - You are interested in the 'true' value for the population (use SEM).
- Visual analogue scores (VAS) for pain may be treated as continuous data and be subjected to parametric tests as long as:
    - The sample size is large (> 50).
    - The data appear normally distributed.
- VAS for other modalities (nausea, drowsiness) have not been so extensively validated and are best treated as ordinal data.

Inferential statistics:

- Use simple tests where possible.
- Avoid multiple comparisons, or correct for them if used.
- Reference unusual tests.
- Include details of any computer package/version used.

When looking for relationship between variables:

- Possible simple descriptive association between two variables: correlation.
- Possible relationship between two or more variables, especially where one is predictive and other(s) dependent: regression.
- To compare two methods of measurement: Bland-Altman method.

Results

- In randomised trials, baseline data (age, ASA physical status, duration of operation, etc.) should not be subjected to statistical comparison, since it is already known that the subjects were randomly allocated and that any difference is therefore due to chance. Describe characteristics and, if possible, allow for differences in the analysis and discussion.
- All outcomes mentioned in the Methods section must be reported in the Results section, and in the same order.

- The number of decimal places used to describe data should be appropriate to the method of measurement (e.g. a mean systolic blood pressure of 124.75 mmHg is too precise).
- 95% CI are often useful when reporting differences between groups. 95% CI must be used when reporting low or zero incidences (e.g. no headaches after 300 uses of a new spinal needle).
- When reporting the effect of an intervention, absolute risk (AR), relative risk (RR) and 'number needed to treat' (NNT) are more easily understood by readers and may be preferable to odds ratio (OR).
- Post-hoc comparisons should be avoided (comparing or categorising results in ways that were not stated in the original protocol).
- Graphs and tables should be appropriate for the data to be displayed. Tables usually convey more precise numerical information; graphs should be reserved for highlighting changes over time or between treatments.
- Avoid judgemental terms such as 'very' or 'highly' significant.
- Report actual p values, rather than ranges or limits (e.g. p=0.032, rather than p<0.05)

Conclusions

All conclusions should be warranted by the results and not extend beyond the confines of the study conditions. A negative result does not mean that there is definitely no difference (confidence in the conclusion is dependent upon the power of the study), and a positive result does not mean that there definitely is a difference (confidence in the conclusion is dependent upon the alpha error).

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All papers, editorials and letters are reviewed by the Editor-in-Chief and at least one Editor, plus external reviewers as deemed appropriate. The Editor-in-Chief's verdict on acceptance or rejection is final. Papers submitted with one of the Editorial Board members as an author require an additional external review before acceptance. The median time from submission to preliminary verdict is under a week; the time from full acceptance to online publication is usually 1-2 months and to print publication is usually 2-3 months. When a paper is accepted, the author identified as the formal corresponding author for the paper will receive an email prompting him/her to login into Author Services, where he/she can complete a copyright form or licence agreement on behalf of all authors on the paper via the Wiley Author Licensing Service (WALS). The type of licence/agreement will depend on whether the paper is to be published Open Access, and whether (and by whom) the study has been funded. More details can be obtained here .
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Journal of the Association of Anaesthetists of Great Britain and Ireland

Apêndices

UM NOVO LARINGOSCÓPIO QUE ALERTA O ANESTESIOLOGISTA PARA A FORÇA APLICADA

Tânia Amaral[1], Mariana Duarte[2], António Silva[3], Joaquim Gabriel Mendes[3], Joana Mourão[1,2]

[1] Serviço de Anestesiologia do Centro Hospitalar de São João, EPE; [2] Faculdade de Medicina da Universidade do Porto;
[3] Faculdade de Engenharia da Universidade do Porto

INTRODUÇÃO

A laringoscopia direta convencional continua a ser a técnica de manuseamento da via aérea mais rápida e económica para se conseguir entubação traqueal[1].

Desenvolveu-se um laringoscópio digital (Fig. 1) com um sensor de força embutido no cabo que deteta a força aplicada na base da língua durante a laringoscopia. O sensor está acoplado a um sinal sonoro (SS) cuja frequência aumenta 1000 Hertz (Hz) por cada aumento de 10 Newton (N) na força aplicada [2].

O objectivo deste estudo foi comparar a força aplicada pelo anestesiologista durante a laringoscopia quando utiliza o laringoscópio digital com o SS ligado e desligado.

Fig. 1 : Laringoscópio clássico (esquerda) e digital (direita)

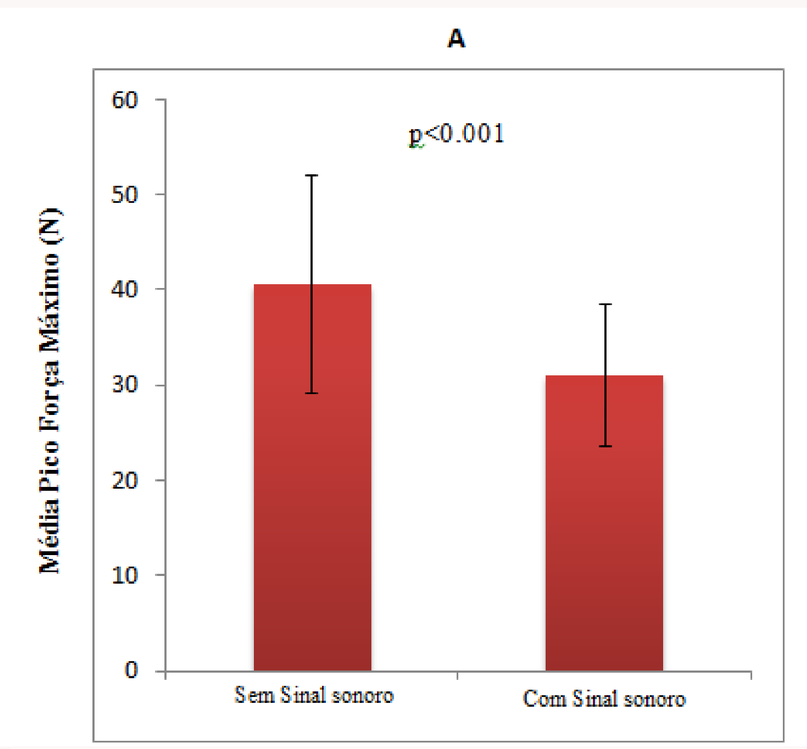
METODOLOGIA

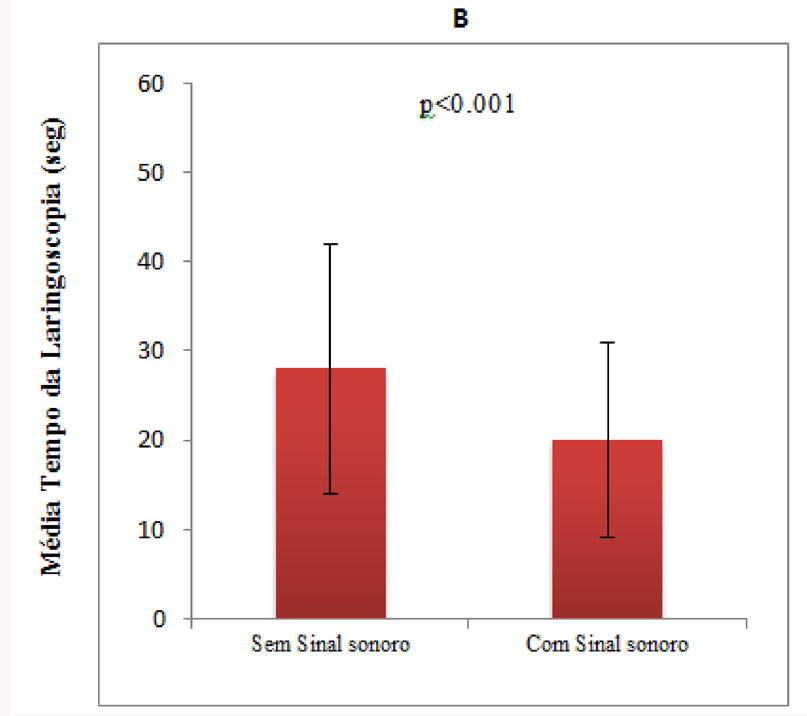
- Realização de duas séries de 3 laringoscopias com o laringoscópio digital, com e sem SS, efetuadas num manequim de manuseio da via aérea.
- Foram registados os seguintes dados da última laringoscopia de cada série:
  - pico de força máximo,
  - tempo da laringoscopia,
  - anos de experiência e o género dos operadores.
- Análise estatística: Teste T Student, Teste Kolmogorov-Smirnov/Lilliefors e Análise regressiva linear. A significância estatística foi definida para **p<0.05**.

RESULTADOS

Participaram 42 Anestesiologistas dos quais 7 foram excluídos por registos incompletos.

TABELA 1		PICO DE FORÇA MÁXIMO		TEMPO DE LARINGOSCOPIA	
		β coef. (95% CI)	Valor P	β coef. 95% CI	Valor P
GÉNERO	FEMININO	1		1	
	MASCULINO	5.364 (0.664;11.392)	0.079	4.532 (-4.268; 13.332)	0.301
ANOS DE EXPERIÊNCIA		-0.284 (-0.51;-0.051)	**0.019**	0.075 (-0.257;0.406)	0.649





DISCUSSÃO E CONCLUSÕES

Os nossos resultados sugerem que quando o anestesiologista utiliza um laringoscópio que o alerta para a força exercida, este realiza menos força e demora menos tempo para executar a laringoscopia.

REFERÊNCIAS

[1] T. Russell, S. Khan, J. Elman, R. Katznelson. Measurement of forces applied during Machintosh direct laryngoscopy compared with GlideScope videolaryngoscopy. Anesthesia 2012, 67, 626-631.

[2] A. Silva, P. Amorim, M. Quintas, L. Mourão, J. Gabriel. Digital Laryngoscope A new force measuring laryngoscope. BIODEVICES'12. 368-371. 2012

Estimado(a) autor(a) de resumo proposto ao congresso anual da Sociedade Portuguesa de Anestesiologia (SPA), a realizar nos dias 12 a 14 de Março de 2015, no Hotel Cascais Miragem.

O seu resumo, identificado com o nº **P117 - S6607** e com o título **Um novo laringoscópio que alerta o anestesiologista para a força aplicada** , foi aceite pelo júri nomeado pela SPA na categoria (preliminar) de **POSTER**.

Conforme o regulamento, a apresentação do poster obedece às seguintes normas:

1. No mínimo, **o primeiro autor e/ou apresentador do poster terá obrigatoriamente de se inscrever como congressista** do congresso da SPA 2015, até ao dia 27 de Fevereiro. A não efetivação deste requisito implicará a desclassificação automática do poster.
2. As dimensões dos posters serão: Altura 1,00m; Largura 0,80m. Dispostos verticalmente.
3. A elaboração dos posters e a forma de fixação dos mesmos é da responsabilidade dos autores. Sugerimos que contactem o secretariado do congresso para informações sobre os métodos mais adequados.
4. Todos os posters terão se ser afixados, no local respetivo, no dia 13 de Março da parte da manhã até às 10h. Os congressistas que, por motivo de força maior devidamente justificada não o possam fazer, deverão comunicar esse facto à organização do congresso.
5. Caso o autor queira distribuir "handouts" do poster, em formato A4, cuja elaboração é também da responsabilidade dos autores, deverá levar uma bolsa para esse efeito.
6. Os posters serão discutidos um a um por um ou dois membros do júri, numa sessão de apresentação de posters
    - a. A data e hora da sessão de posters do seu poster será comunicada até ao dia 27 de Fevereiro de 2015.
    - b. O primeiro autor ou apresentador deverá fazer uma apresentação oral do seu trabalho diante do poster. Esta apresentação deverá ser efetuada no máximo em 4 minutos e será seguida de discussão num máximo de 4 minutos.
    - c. Algum impedimento do primeiro autor ou apresentador para estar presente na sessão de posters designada terá de ser forçosamente comunicada até ao dia (2 dias antes), à organização do congresso.
7. Até ao dia 27 de Fevereiro de 2015, o júri irá indicar quais os posters que serão objeto de comunicação oral, em formato power point, a efetuar em sessão plenária do congresso, no dia 14 de Março de 2015, nos mesmos moldes da apresentação do poster.

Com os melhores cumprimentos,
A coordenação do júri,
Pedro Amorim, António Augusto Martins, Paulo Sá Rodrigues

PO113-S6607

UM NOVO LARINGOSCÓPIO QUE ALERTA O ANESTESIOLOGISTA PARA A FORÇA APLICADAINGECTOMIAS TOTAIS

TÂNIA AMARAL[1], MARIANA DUARTE[2], ANTÓNIO SILVA[3], JORGE GABRIEL MENDES[3], JOANA MOURÃO[12]

1 - Centro Hospitalar de São João, EPE; 2 - Faculdade de Medicina da Universidade do Porto; 3 - Faculdade de Engenharia da Universidade do Porto

INTRODUÇÃO

A laringoscopia direta convencional continua a ser a técnica de manuseamento da via aérea mais rápida e económica para se conseguir entubação traqueal.[1] Desenvolveu-se um laringoscópio digital com um sensor de força embutido no cabo que deteta a força aplicada na base da língua durante a laringoscopia. O sensor está acoplado a um sinal sonoro (SS) cuja frequência aumenta 1000 Hertz (Hz) por cada aumento de 10 Newton (N) na força aplicada. [2] O objectivo deste estudo foi comparar a força aplicada pelo anestesiologista durante a laringoscopia quando utiliza o laringoscópio digital com o SS ligado e desligado.

METODOLOGIA

Anestesiologistas de um hospital universitário foram recrutados para realizar laringoscopias num manequim de manuseio da via aérea, modelo Ambu *type* 186000, número de série 61380847F, fabricado na Alemanha. Cada participante realizou duas séries de 3 laringoscopias utilizando o laringoscópio digital com cabo modificado e lâmina Macintosh número 3. Uma série foi realizada utilizando o laringoscópio digital sem SS e outra série com SS ligado. Dos participantes no estudo foi registado: o pico de força máximo, o tempo para visualizar as cordas vocais, os anos de experiência e o género dos operadores. Apenas os dados da última laringoscopia de cada série foram registados. Para comparação de resultados emparelhados foi aplicado o teste T Student. A normalidade foi avaliada através do teste Kolmogorov-Smirnov/Lilliefors. A análise regressiva linear multivariável foi realizada para estimar o efeito do género e dos anos de experiência nas variáveis analisadas.

RESULTADOS

Quarenta e dois anestesiologistas de um hospital universitário participaram no nosso estudo, contudo sete participantes foram excluídos devido a registos incompletos. O pico de força máximo exercido durante a laringoscopia utilizando o laringoscópio digital com o SS desligado foi de 40,6 N e com SS ligado de 31,0 N ($p<0,001$). A diferença de tempo para visualização das cordas vocais com e sem o SS foi de 7 segundos ($p<0,001$). Quanto maior o número de anos de experiência do anestesiologista, menor a diferença média do pico de força máximo na execução da laringoscopia com e sem SS (β= -0,284; 95% CI: -0,518;-0,051).

DISCUSSÃO E CONCLUSÕES

Os nossos resultados sugerem que quando o anestesiologista utiliza um laringoscópio que o alerta para a força exercida, este realiza menos força para executar a laringoscopia.

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