Author's response to reviews

Title: Bougies as an aid for endotracheal intubation with the Airway Scope: bench and manikin comparison studies

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Author’s response to reviews:

Re: Manuscript Title: "Comparison of available bougies as an aid for tracheal intubation with the Airway Scope: bench and manikin studies" (BANE-D-17-00046R1)

Corresponding Author: Ichiro Takenaka

Dear Dr. Meyer,

Thank you very much for your kind letter of 18th July, 2017 concerning our paper entitled "Comparison of available bougies as an aid for tracheal intubation with the Airway Scope: bench and manikin studies" (BANE-D-17-00046R1).

We have tried to revise the manuscript as much as possible in line with your and reviewers’ suggestions. All authors attest to the validity and legitimacy of data and accuracy of its interpretation and presentation, and approved of the revision. We hope all these corrections and revisions will be satisfactory.

Yours sincerely,

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For Dr. Meyer (Editor)

Thank you very much for your appropriate and valuable suggestions. We rewrote as much as possible in line with your suggestions. We hope all these corrections and revisions will be satisfactory.

# Were the seven anesthesiologists who did the bench-study the same as the ones who did the manikin study? Did they bring their biases from the initial study with them? Did they know the cumulative results from the bench study prior to the manikin study?

According to your suggestion, we newly added “In addition, the 7 anesthesiologists --- manikin study,” in lines 13-16 page 9 in the discussion section regarding study limitation in the second revised version.

# Please explain why "esophageal" intubation is 121 seconds and failed intubation is 120 seconds. Since you are averaging the values together and creating a mean, there should be a rationale for this one second penalty or they should be equal and an "esophageal intubation" should simply be valued identically as a "failed intubation" since it functionally is one.

We calculated both esophageal and failed intubations as equal time (121 s), like our previous studies (EJA 2011 28:164-8, Anesthesiology 2009 110:1335-40). We are sorry in the sentence that is easy to cause misunderstanding. However, according to Reviewer #1’s suggestion, we calculated the differences in intubation times only from the successful intubations. We deleted “-- which was calculated as 121 seconds.” (Line 43 Page 5 in old version) and revised the description “intubation time“ (Line 49 Page 5, table 4 in old version) as “time required for successful intubation” (methods: Line 29 Page 5; results: Line 32 Page 6; new table 3 in the second revised version). Also, intubation times were re-calculated after excluding the data “121 s”(intubation time for esophageal and failed intubations) and re-analyzed statistically. In addition, Table 3 was revised in the second revised version.

# In the results section please give numbers when appropriate and not just descriptions--angles of rotation, time of intubation, etc.

According to your suggestion, we newly added “The rotation angles of the tips of Venn reusable --- an angle of 180°. “ (Lines 18-21 Page 6), “---, the rotation achieved --- measured.” (Lines 24-26 Page 6), and “ Mean times --- 69(22) s, respectively.” (Lines 32-2 Pages 6-7) in the second revised version.

# (7:35) The phrase "clinically acceptable rotational force" is used--please explain / define.

According to your suggestion, we newly added the definition of "clinically acceptable rotational force" in the discussion section, too. We revised as “by applying clinically acceptable rotational force” (Lines 33-34 Page 7 in old version) as “by applying an easy or moderate --- clinically acceptable, -- ” in lines 22-23 page 7 in the second revised version.
According to your suggestion, we revised the paragraph regarding factors contribute to rotating a bougie in the first submission version and added “Several factors --- studies are needed.” in lines 21-32 page 8 in the discussion section in the second revised version.

[Lines 21-32 Page 8 in the second revised version: “Several factors contribute to rotating a bougie in the lumen of a tracheal tube; these comprise the construction material, size, curvature, structure of the inner surface of the tracheal tube, lubrication, and the construction material of the bougie. In this study, the tracheal tube and lubricant were identical in all tests. We believe that the construction material of the bougie may influence its rotation in the tracheal tube. The four bougies tested were constructed with different polymers (Table 1), which had different torsion strength properties. The polymers of Portex single-use and Frova bougies might tend to twist against the friction that occurred during rotation in the narrow curved lumen of the tube, compared with those of Venn reusable and Boussignac bougies. We consider that the difference in their properties is a possible explanation for difficult rotation. Further studies are needed.”]

# I agree with Dr. Riegel that the labeling and descriptions of "proximal" and "distal" in Figures 1 and 2 (as well as legends to Figures 1 + 2 and in the methods where the process of performing the study is described). I think some of the confusion may come from Figure 1 with the "proximal" label being identified inside the ETT and the figure legend states "the anesthesiologist then rotates the proximal portion..." My understanding is that the anesthesiologist's hand is rotating the end of the bougie that is closest to the ETT airway adaptor for the machine circuit. Please clarify this process in the figure, legend and methods. I would combine Figures 1+2 into Figure 1a,b and place them side-by-side and make sure the correct terminology is used on both figures. These figures are paramount to readers understanding of the methodology.

According to your and Reviewer #1’s suggestions, we deleted all descriptions "proximal" and "distal" and revised “proximal portion of the bougie” and “distal end of the bougie” as “the end of the bougie” and “the tip of the bougie”, respectively. And, we newly added the definition of the bougie end “ --- closest to the airway adaptor of the tracheal tube” in lines 13-14 page 2 (Abstract), line 26 page 3 (Background), lines 25-26 page 4 (Methods), line 13 page 7 (Discussion), and lines12-13 page 13 (Figure legend) in the second revised version.

Also, we combined Figures 1+2 into Figure 1 a,b and revised the legend for Figure 1 a,b in lines 4-17 page 13 in the second revised version.
# Figure 3 "c" is used to describe p<0.05 -- since you applied the Bonferroni correction, I do not believe this should be included. If you feel it should be included, please explain?

According to your suggestion, we deleted Figure 3 "c" in old version.

# Table 2 is unnecessary.

According to your suggestion, we deleted table 2 in old version and adjusted the other tables accordingly.

For Dr. Riegel (Reviewer 1)

Thank you very much for your appropriate and valuable suggestions. We rewrote as much as possible in line with your suggestions. We hope all these corrections and revisions will be satisfactory.

Abstract:

# "Types of bougie" or "types of bougies" (?) I am not a native speaker, but this would sound more familiar to me.

We revised “types of bougie” in line 22 page 6 in old version as “types of bougies” in line 12 page 2 in the second revised version in line your suggestion.

[Line 22 Page 6 in old version: “Bench study: Seven anesthesiologists inserted each of the four above-listed types of bougie into a 7.0 mm tracheal tube ---“]

-> [Line 12 Page 2 in the second revised version: “Bench study: Seven anesthesiologists inserted each of the four above-listed types of bougies into a 7.0 mm tracheal tube ---“]

# P. 6 line 22: Please label in Figure 1 and 2 also the "proximal" end with "proximal". Please consider to delete the "proximal" in Figure 1 " since this is very confusing. The definition of your proximal and distal ends should be explained in your methods section since also the other way round (the closer to the middle of the body facing part would be labeled as proximal would make sense). Alternatively you could use "upper" and "lower" end ((or "oral" and "aboral")) or something similar. Please follow the recommendations of the Editor. If he thinks, its clear enough, I am fine with leaving it the way it is, however please label then "proximal" to the proximal ends in Figure 1 and 2.

According to your and Editor’s suggestions, we deleted all descriptions of "proximal" and "distal", and revised “proximal portion of the bougie” and “distal end of the bougie” as “the end of the bougie” and “the tip of the bougie”, respectively. And, we newly added “--- closest to the airway adaptor of the tracheal tube”, which was the definition of the bougie end, in lines 13-14.
Although there were no significant differences in success rate between the four bougies, some anesthesiologists failed to intubate with the Portex single-use and Frova bougies. It seems impossible. If with Portex and Frova some anesthesiologists failed, then there must be a difference in success rate?

According to your suggestion, we revised “All anesthesiologists --- single-use and Frova bougies.” in lines 47-54 page 6 in old version as “There were --- the four bougies.” in lines 26-27 page 2 in the second revised version.

[Lines 47-54 Page 6 in old version: All anesthesiologists achieved intubation with Venn reusable and Boussignac bougies. Although there were no significant differences in success rate between the four bougies, some anesthesiologists failed to intubate with the Portex single-use and Frova bougies.]

-> [Lines 26-27 Page 2 in the second revised version: “There were no significant differences in success rate between the four bougies.”]

# Conclusion: I would correct it to: "Venn reusable and Boussignac bougies are a useful aid for intubation with an AWS. Frova and Portex bougies seem to be less suitable for this technique. It should be cautioned that all bougies are not of equal value when difficulty is encountered with intubation with an AWS.”

According to your suggestion, we revised “Venn reusable and Boussignac bougies --- intubation with an AWS.” in lines 57-2 pages 6-7 in old version as “Venn reusable and --- with an AWS.” in lines 29-32 page 2 in the second revised version.

[Lines 57-2 Pages 6-7 in old version: “Venn reusable and Boussignac bougies are a useful aid for intubation with an AWS. However, it should be cautioned that all bougies are not of equal value when difficulty is encountered with intubation with an AWS.”]

-> [Lines 29-32 Page 2 in the second revised version: “Venn reusable and Boussignac bougies are a useful aid for intubation with an AWS. Portex single-use and Frova bougies seem to be less suitable for this technique. It should be cautioned that all bougies are not of equal value when difficulty is encountered with intubation with an AWS.”]

Background:

# P. 7 Line 13: Suggestion: " The Airway Scope (AWS, HOYA-Pentax, Tokyo, Japan), belongs to the family of channeled videolaryngoscopes with a built-in monitor (like the Airtraq® or optional the King Vision® videolaryngoscope). The blade is designed to match the anatomy of the upper airway and provides an excellent view of the glottis, even in patients with difficult airways [1,2]"
I would suggest to mention it early in the text, that the Airway Scope is a channeled videolaryngoscope, and maybe also mention alternative similar products, it helps immensely that people who know channeled videolaryngoscopes or Airtraq or the channeled King vision immediately know what you are talking about. Thank you also for adding the excellent picture / figure 2 to your manuscript. It clarifies perfectly visual what you are talking about and simplifies understanding of your study a lot.

According to your suggestion, we revised “The Airway Scope --- with difficult airways [1,2].” in lines 13-19 page 7 in old version and “We believe that --- the glottis.” in lines 26-33 page 12 in old version as “The Airway Scope --- with difficult airways [1,2].” in lines 3-8 page 3 in the second revised version and “We believe --- toward the glottis.” in lines 17-20 page 8 in the second revised version, respectively.

[Lines 13-19 page 7 in old version: The Airway Scope (AWS, HOYA-Pentax, Tokyo, Japan), which consists of a blade designed to match the anatomy of the upper airway, provides an excellent view of the glottis on a built-in monitor screen, even in patients with difficult airways [1,2].”]

-> [Lines 3-8 Page 3 in the second revised version: “The Airway Scope (AWS, HOYA-Pentax, Tokyo, Japan) belongs to the family of channeled videolaryngoscopes with a built-in monitor, like the Airtraq® (Prodol Meditec S.A., Vizcaya, Spain) or the King Vision® videolaryngoscope (Ambu Inc., Ballerup, Denmark). The blade is designed to match the anatomy of the upper airway and provides an excellent view of the glottis, even in patients with difficult airways [1,2].”]

[Lines 26-33 page 12 in old version: We believe that our findings are applicable to addressing difficult intubation using many different videolaryngoscopes, particularly those with anatomically-shaped blade and a guiding groove that is designed to direct the tracheal tube toward the glottis.]

-> [Lines 17-20 Page 8 in the second revised version: “We believe that our findings are applicable to addressing difficult intubation using the family of channeled videolaryngoscopes with anatomically-shaped blade and a guiding groove that is designed to direct the tracheal tube toward the glottis.”]

# P.7 Line 41-43: …AWS blade and can be advanced into the…” would be my suggestion.

We revised “--- AWS blade and advanced into the --” in lines 41-43 page 7 in old version as “…AWS blade and can be advanced into the…” in line 21 page 3 in the second revised version in line your suggestion.

[Lines 41-43 page 7 in old version: “Such a bougie can be passed through the narrow curved lumen of the tracheal tube that is attached to the AWS blade and advanced into the glottis and trachea, even when the target symbol cannot be aligned with the glottis or the epiglottis cannot be lifted directly with the tip of the AWS blade [4-6].”]
-> [Lines 20-24 Page 3 in the second revised version: “Such a bougie can be passed through the narrow curved lumen of the tracheal tube that is attached to the AWS blade and can be advanced into the glottis and trachea, even when the target symbol cannot be aligned with the glottis or the epiglottis cannot be lifted directly with the tip of the AWS blade [4-6].”]

Methods:

# P.8 Line 13: 5 years' ? or 5 years? I never saw years with an " ‘ " before

We revised “5 years” in line 13 page 4 in old version as “5 years” in line 6 page 4 in the second revised version in line your suggestion.

[Line 13 Page 8 in old version: “Seven anesthesiologists with at least 5 years’ experience participated in this study as follows (Figs. 1 and 2).”]

-> [Lines 6-7 Page 4 in the second revised version: “Seven anesthesiologists with at least 5 years experience participated in this study as follows (Fig. 1).”]

# P 8. Line 32-34: Please explain to me more what you mean with "The tip of the AWS blade was set 15 mm above the circular protractor that was lying horizontally on a flat surface." In your figures I do not see a protractor which lies horizontally on a flat surface.

According to your suggestion, we revised “The tip of the AWS blade --- horizontally on a flat surface. “ in lines 32-34 page 8 in old version as “The tip of the AWS blade --- vertically on a floor.” in lines16-18 page 4 in the second revised version and newly added “-- that lies vertically on a floor (a)” in line 7 page 13 (Figure legend) in the second revised version.

[Lines 32-34 Page 8 in old version: “The tip of the AWS blade was set 15 mm above the circular protractor that was lying horizontally on a flat surface.”]

-> [Lines 16-18 Page 4 (Methods) in the second revised version. “The tip of the AWS blade was set 15 mm from the circular protractor that was lying vertically on a floor.”]

[Lines 4-7 Page 13 (Figure legend) in the second revised version: “According to the instruction manual [3], a 7.0 mm internal diameter standard tracheal tube is attached to the guiding groove of an Airway Scope blade, the tip of which is set 15 mm from the circular protractor that lies vertically on a floor (a).”]

# P.8 Line 55-57: Please explain more in detail: "The bougie was then exchanged and the rotation angles at the distal end were measured in the same fashion." Does this mean you inserted the bougie the other way round again?

According to your suggestion, we revised “The bougie was --- for each bougie. “ in lines 55-3 pages 8-9 in old version as “The degree of --- in the same fashion.” in lines 29-1 pages 4-5 in the second revised version.
The bougie was then exchanged and the rotation angles at the distal end were measured in the same fashion. The degree of force required to rotate the proximal portion was subjectively classified as easy, moderate, difficult, and impossible for each bougie.

The degree of force required to rotate the bougie end was subjectively classified as easy, moderate, difficult, and impossible for each bougie. The bougie was then exchanged in accordance with a predetermined sequence and the rotation angles of its tip were measured in the same fashion.

Persons who calculated the rotation angles on the circular protractor were not anesthesiologists who participated in this study but assistants who were blinded to the purpose of the study. Because they measured only the angles on the circular protractor, it was possible to blind to the type of bougie being used. We are sorry in the sentence that is easy to cause misunderstanding.

Thus, we revised “Other anesthesiologists, --- the circular protractor.” In lines 3-4 page 9 in old version as “Assistants, who were --- the circular protractor.” in lines 1-3 page 5 in the second revised version. We did not delete the discussion regarding study limitation for blinding (Lines 11-13 Page 9 in the second revised version).

According to your suggestion, we revised “…accordance with a predetermined sequence (Table 2), the anesthesiologist attempting intubation with each of them in the same fashion.” In lines 45-47 page 9 in old version as “…accordance with --- same fashion. “ in lines45-47 page 9 in old version as “…accordance with a predetermined --- the same fashion.” in lines 26-28 page 5 in the second revised version.

The bougies were exchanged in accordance with a predetermined sequence and the anesthesiologist attempting intubation with each of them in the same fashion.”
-> [Lines 26-28 Page 5 in the second revised version: “The bougies were exchanged in accordance with a predetermined sequence and the anesthesiologists were attempting intubation with each of them in the same fashion.“]

# P. 9. Line 26-29: I would suggest changing: "The manikin was placed supine without a pillow on a flat table, after which the anesthesiologist inserted an AWS blade into its mouth until its tip was positioned in the vallecula like a Macintosh blade." Into "The manikin was placed supine without a pillow on a flat table. Next, the anesthesiologist inserted an AWS blade into its mouth until its tip was positioned in the vallecula." Since the insertion ways are most likely midline for AWS and different for Macintosh blade, I would skip "like a Macintosh blade" even if you most likely just want to say that for Macintosh and AWS positioning the vallecular region is the aim.

According to your suggestion, we revised “The manikin was --- like a Macintosh blade. “ in lines26-29 page 9 in old version as “The manikin was --- in the vallecula.” in lines 14-17 page 5 in the second revised version.

[Lines26-29 Page 9 in old version: “The manikin was placed supine without a pillow on a flat table, after which the anesthesiologist inserted an AWS blade into its mouth until its tip was positioned in the vallecula like a Macintosh blade.“]

-> [Lines 14-17 Page 5 in the second revised version: “The manikin was placed supine without a pillow on a flat table. Next, the anesthesiologist inserted an AWS blade into its mouth until its tip was positioned in the vallecula.“]

# Please follow the recommendations of the Editor in the following point: to me, esophageal intubation should not be counted as 121 seconds. Also an intubation trial without success cutted of at 120 seconds should not be counted as an intubation. This should be reflected in the successful - unsuccessful table. The differences in intubation times should be calculated only from the successful intubations.

According to your suggestion, we calculated the differences in intubation times only from the successful intubations. We deleted “-- which was calculated as 121 seconds.” in line 43 page 5 in old version and revised the description “intubation time“ (line 49 page 5 and table 4 in old version) as “time required for successful intubation” (methods: line 29 page 5; results: line 32 page 6; new table 3 in the second revised version). Also, intubation times were re-calculated after excluding the data “121 s” and re-analyzed statistically. In addition, Table 3 was revised in the second revised version.

# Tracheal tube cuff passing the vocal cords: how did you assess this? How could the assistant see the cuff?

According to your suggestion, we newly added “Passage of the cuff was confirmed on the monitor screen of the AWS.” in lines 23-24 page 5 in the second revised version.

[Lines 23-24 Page 5 in the second revised version: “Passage of the cuff was confirmed on the monitor screen of the AWS.”]
Results:

# P. 11 Line 4: suggestion: …failed to achieve tracheal intubation…

We revised “—- failed to achieve intubation —-” in line 4 page 11 in old version as “…failed to achieve tracheal intubation…” in lines 5-8 page 7 in the second revised version in line your suggestion.

[Line 4 Page 11 in old version: “Although there was no significant difference in success rate between the four bougies, two and three anesthesiologists failed to achieve intubation with Portex single-use bougies and Frova intubating catheters, respectively.” ]

-> [Lines 5-8 Page 7 in the second revised version: “Although there was no significant difference in success rate between the four bougies, two and three anesthesiologists failed to achieve tracheal intubation with Portex single-use and Frova bougies, respectively.”]

Discussion:

# P.12 Line 24: "For example, bougies are reportedly useful for assisting intubation with an Airtraqs"

→ please change to singular "Airtraq".

We revised “Airtraqs ” in line 24 page 12 in old version as “Airtraq” in line 17 page 8 in the second revised version in line your suggestion.

[Line 24 Page 12 in old version: “For example, bougies are reportedly useful for assisting intubation with an Airtraqs [14,15].”]

-> [Lines 16-17 Page 8 in the second revised version: “For example, bougies are reportedly useful for assisting intubation with an Airtraq [14,15].”]

# P.12 Line 41-44: "Moreover, there have been some cases of displacement of the epiglottis and its prolapse into the trachea beside the tracheal tube during attempts at intubation an AWS" does not sound correct to me. Please consider changing to: "Moreover, there have been some cases of displacement of the epiglottis and its prolapse into the trachea beside the tracheal tube during attempts of intubation with an AWS."

According to your suggestion, we revised “Moreover, there have --- intubation an AWS “ in lines 41-44 page 12 in old version as “Moreover, there have been --- with an AWS [17].” in lines 4-6 page 9 in the second revised version.

[Lines 41-44 Page 12 in old version: “Moreover, there have been some cases of displacement of the epiglottis and its prolapse into the trachea beside the tracheal tube during attempts at intubation an AWS [17].“]
Moreover, there have been some cases of displacement of the epiglottis and its prolapse into the trachea beside the tracheal tube during attempts of intubation with an AWS [17].

# Figure 2: Is the "distal" protractor aligned correctly? It seems like the inferior corner is not aligned to the middle of the protractor on the picture. Please correct it accordingly.

According to your suggestion, we took new photograph again and revised Figure 2 in old version as Figure 1b in the second revised version. Please note that we combined Figures 1+2 in old version into Figure 1 a,b in the second revised version in line with Editor’s suggestion.

# Maybe this was a misunderstanding? Was it asked if you could tell us more about the material properties and possible explanations for difficult rotation. Could you please add this?

According to your and Editor’s suggestions, we revised the paragraph regarding factors contribute to rotating a bougie in the first submission version and added “Several factors --- studies are needed.” in lines 21-32 page 8 in the discussion section in the second revised version.

[Lines 21-32 Page 8 in the second revised version: “Several factors contribute to rotating a bougie in the lumen of a tracheal tube; these comprise the construction material, size, curvature, structure of the inner surface of the tracheal tube, lubrication, and the construction material of the bougie. In this study, the tracheal tube and lubricant were identical in all tests. We believe that the construction material of the bougie may influence its rotation in the tracheal tube. The four bougies tested were constructed with different polymers (Table 1), which had different torsion strength properties. The polymers of Portex single-use and Frova bougies might tend to twist against the friction that occurred during rotation in the narrow curved lumen of the tube, compared with those of Venn reusable and Boussignac bougies. We consider that the difference in their properties is a possible explanation for difficult rotation. Further studies are needed.”]