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Early Diagnosis of Esophageal Intubation: Primary Auscultation of the Armpits Versus Epigastrum

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ABSTRACT

Esophageal intubation is a common accident and failure to detect it can result in fatality. The objective of this study is to suggest the primary the auscultation of the epigastric area as mean of rapid diagnosis of esophageal intubation. A cross sectional study was carried out at the N'djili hospital in Kinshasa from June to September 2020.

The sampling was randomly made and two groups of the population were selected. In the study group, the endotracheal intubation was indirectly confirmed by the absence of borborygmi on auscultation of the of epigastric area whereas in the control group, it was confirmed by the presence of vesicular murmur in armpits.

After intubation, the investigator counted the time from the moment the chest piece of the stethoscope was placed in the armpit to confirm tracheal intubation or on the epigastric area to rule out esophageal intubation. The chest compression was also performed to check fogging of endotracheal tube. The time counted was the time between the placement of the chest piece of the stethoscope and the diagnosis of esophageal intubation.

Seven cases of esophageal intubation were recorded out of sixty-two patients intubated. The average time for diagnosing esophageal intubation was 15 ± 5.6 seconds in the study group and 24 ± 3.2 seconds in the control group ($Z = 8.035$; $p < 0.0001$).

Based on the time recorded, the primary auscultation of the epigastric area can quickly detect esophageal intubation as opposed to the auscultation of the armpit. "The sign the cross" could be used as chronogram to confirm tracheal placement of the tube.

Keywords

Intubation, Esophageal, Auscultation, Armpits, Epigastrium.

Introduction

Esophageal intubation is a common incident and it is an emergency. Its delayed diagnosis can result in cardiac arrest. It should therefore its management is an emergency [1]. In a study in Holland, Kalmar et al. (2012) found more than 17% of cases of esophageal intubation out of all the intubations performed [2]. If in many situations capnography is a useful tool to detect esophageal intubation [3], the high cost limits its use in most of developing countries. Furthermore, capnography is not a systemic remedy in pre-hospital medicine. As result, tracheal intubation is confirmed clinically using three methods. The first is the compression of the chest to expel mist through the tracheal tube. The last two second are the auscultation for vesicular murmur of the epigastrium and of the armpit.

Due to the presence of air in the tracheal and the esophagus, it might prove difficult to confirm with certainty tracheal or esophageal placement of the tube by relying on the presence of mist in the tracheal tube, the vesicular murmur or the borborygmi.

The systematic use of pulse oximeter is beneficial as it is the reflection of tissue is useful. However due to the S-shape of the hemoglobin dissociation curve, the pulse oximeter does not provide a rapid diagnosis of esophageal intubation [4].

The aim of this study is to provide a way for rapid clinical diagnosis of esophageal intubation. It compares the time taken to detect esophageal intubation when auscultating of the epigastric area versus when the auscultating of the armpit.

Methods

A four months cross-sectional observational study was carried at the N'djili referral hospital of Kinshasa from June 01, 2020 to 30, September 2021.The study was granted authorization and clearance from the hospital ethics committee. In addition to the hospital authorization, an informed consent was obtained from all the patients involved in the study. Patients who did not consent were obviously excluded from the study. Patients were randomly assigned in two groups using a coin: the study group and the control group. Passive observation was the investigation technique.

After each intubation, chest compression was performed to observe mist from the endotracheal tube. Then using a chronometer (Seiko QHY001Y), the observer could count the time elapsed between the beginning of the auscultation (the placement of the chest piece stethoscope is placed in the axilla or in the epigastric area) and the end of the auscultation (chest piece removed) confirming the esophageal intubation.

In the study group, esophageal intubation was ruled out by the absence of borborygmi on the auscultation of the epigastric area. Once the esophageal intubation was ruled out, the armpits was auscultated for symmetry of vesicular murmurs.

In the control group, the placement of the tube was routinely checked by the auscultation of symmetric of vesicular murmurs in both armpits. The average time to detect the esophageal intubation in the two groups was compared.

Ethical considerations

We have submetted this protocol for approval of the ethics committee of the school of public health of the university of Kinshasa, approval number ESP/CE/027B/2021. In addition, each patient had to sign an informed consent form to confirm their agreement to participate in the study.

Results

Out of 62 patients intubated for various type of surgery (study group: 37 patients; control group: 25 patients), seven cases of esophageal intubation were observed of which 4 from the study group and 3 from the control group. The average age of patients was 40,7 ± 16 years whereas sex ratio was 3.2 in favor of female gender.

In the study group, the average time to detect the esophageal intubation was 15 ± 5.6 seconds whereas in the control group it was 24 ± 3.2 seconds (X2=3.67; p=0.03). The pulse oximeter was used in all the patients of the study. The saturation (SpO_2) was greater than 90% and no death was recorded.

Discussion

On intubation, the tube can be placed either in the tracheal or in the esophagus. In the first scenario, whether the intubation is selective or not, we could only have hypoxia [5,6]. With such an incident, the operator has time to rectify the mistake by placing the tube in the right position. However, in the second scenario whereby the tube has been placed in the esophagus, the resulting anoxia if not urgent addressed can lead to cardiac arrest and endanger patient's life [1,7].

There is therefore risk of anoxia with esophageal intubation and risk of hypoxia with selective tracheal intubation. The finding of this study was that the diagnosis of esophageal intubation was fast diagnosed on the auscultation of the epigastric area than it was on the auscultation of the armpits. (p=0.03).The difference can be due to the listening time on auscultation [1]. The clinical diagnosis is referred to as the absence of the vesicular murmurs or the presence of the borborygmi [1]. If there is no vesicular murmur, the tendency in most instance would be to prolong the listening time as to ascertain either the tracheal intubation or to rule out esophageal intubation. But as soon as one hears borborygmi on the auscultation of the epigastric area, it is an obvious indication the tube has been placed in the esophagus [1].

This could explain why, in this study the borborygmi sounds were immediately heard on time. But it took a little longer to notice the absence of vesicular murmur.

We could not find in the literature any suggestion of primary auscultation of the epigastric area as a way of rapid diagnosis of esophageal intubation. However, because anoxia carries more risk as compared to hypoxia [1], primary auscultation of the epigastric area can take priority over the auscultation of the armpits.

Taking into account the two consequences (anoxia and hypoxia), the right attitude would therefore be to first rule out the anoxia by successively seeking the presence of mist by the compression of chest and the absence of borborygmi on the auscultation of the epigastric area [1]. While the epigastric area is being auscultated, one can still be able to see whether the chest is rising or not. It is only after ruling out the esophageal intubation that one can ascertain symmetry of ventilation by first auscultating the left lung and then the right.

The four elements of the diagnostic sequence of the endotracheal intubation are aligned in a chronological order as follows: two are in longitudinal order (the presence of mist on compression of the chest and the absence of borborygmi on auscultation of the epigastrium) and the other two are in transversal order (the auscultation of the left and right armpit to confirm symmetry of vesicular). By chance, it was noted that the combination of the longitudinal and the transversal axes form roughly of a cross

which was named “the sign of cross”.

Capnography is the most conventional tool to quickly detect esophageal intubation [3,8]. However, because of its cost limits its use in low-income countries. Furthermore, capnography is not a systemic remedy in pre-hospital medicine [9]. Although of paramount importance for the confirmation of endotracheal intubation, capnography has some limitations, especially in the event of a significant circulation deficit: cardio-circulatory arrest and shock [10,11]. This leads James (2001) to assert that capnography alone is imperfect for endotracheal confirmation during emergency intubation [10].

Some authors have suggested the use of ultrasound as tool to confirm the presence of the tube in the tracheal [12,13]. Other authors propose the measurement of the endotracheal tube cuff pressure [14].

However, Nd’jili hospital with its limited resources, a capnography is luxury. Moreover, the hospital has only two ultrasound machines available for obstetrics and gynecology and the imaging departments. They cannot be released to be used for just an endotracheal intubation. Hence none of the above tools were used in our study to ascertain the location the tube.

Other techniques which are not yet in use include tracheal palpation to assess the endotracheal depth [15-17], the endotracheal cuff pressure measurement.

Conclusion

In our study, auscultating first the epigastric area seems to diagnose esophageal intubation rapidly that auscultating the two armpits. The described “sign of the cross” could serve as a chronogram in checking efficiently the endotracheal placement of the tube. Given limited resources in low income countries and the resulting shortage and the scarcity of monitoring equipment including the capnography, the suggested chart can help in early detection of esophageal intubation and prevent the complication thereof.

However, our results need to be confirmed with further studies using larger population samples.

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