Can the fluctuation observed in the endotracheal tube with compression applied to the epigastric region be used as a confirmation method for endotracheal intubation?

STUDY PROTOCOL

This study was planned prospectively in the emergency department of a tertiary hospital. Ethics committee approval was obtained from the ethics committee of Düzce University (Date: 18/01/2021, Decision no: 2021/05). The relatives of the participants included in the study were informed about the procedure and written informed consent was obtained. The procedure does not pose any additional risk to the routine procedure and the question "Can the tube position be confirmed by epigastric manual compression method in addition to the currently used confirmation methods?" was sought.

Participants

Patients admitted to the emergency department between 01/05/2021 and 30/05/2022, who were older than 18 years of age and who underwent ETE outside the hospital or within the first hour of arrival to the emergency department were included in the study. Patients in whom ETE was previously confirmed by USG or PETCO2, in whom elective intubation was decided, who were referred from another center, and who had known airway stenosis were excluded from the study. In the literature, it has been shown that >80% of ETE applications in the first attempt are successful [10,11]. This rate is 70% for out-of-hospital cardiac arrest cases [5]. In our clinic, an average of 300 ETE procedures are performed annually and the success rate is similar. Therefore, in order to include an equal number of successful and unsuccessful ETE procedures, the first 40 successful and the first 40 unsuccessful ETE procedures were included in the study. One participant from each group was excluded due to missing data.

Workflow

Patients who underwent ETE outside the hospital or in the first hour of arrival to the emergency department were evaluated after the procedure. Out-of-hospital ETE was performed by experienced paramedics working in the emergency ambulance service, and ETE in the emergency department was performed by emergency medicine residents or emergency medicine specialists with at least 2 years of emergency department experience. Out-of-

hospital procedures were performed at the first visit to the emergency department, and procedures performed in the emergency department were confirmed by ETE immediately after the procedure.

Statistical analysis

Descriptive statistics were presented as numbers and percentages. Demographic data were presented as mean±standard deviation (SD) for normally distributed variables and median, IQR (25-75%) for non-normally distributed variables. Pearson's chi-square test and Fisher's exact test (when the expected number of cells was less than five) were used for independent categorical variables. Bonferroni correction was used for subgroup analyses and p<0.016 was considered significant. Sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, positive predictive value and negative predictive value were calculated at 95% CI for the index tests of gastric compression fluctuation, epigastric sound and lung sounds based on the reference test of ultrasound confirmation. Statistical analyses were performed using IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. A P value less than 0.05 was considered statistically significant.

Confirmation was performed single-blind by emergency medicine specialists with at least 5 years of experience, without knowing who performed the procedure and where (in or out of the hospital). Confirmation was performed by auscultation of lung sounds (from the anterior and lateral sides of both lungs, upper and lower zones), evaluation of equal participation of both thoraxes in breathing by inspection, auscultation of the epigastric region, placement of capnography, monitoring of water vapor in the tube, manual compression of the epigastric region at least three times and evaluation of fluctuation in the tube, and pulse oximetry monitoring.

Epigastric compression was performed by applying pressure to the epigastric region at least three times with the volar side of the intubated patient while the patient was ventilated with a balloon-valved mask. During this procedure, the fluctuation of the air and fluid in the stomach inside the esophageal tube can be observed and its sound can be heard. It can be applied from the first inhalation.

The USG procedure was evaluated by placing a linear ultrasound probe [SonoSite M-Turbo linear probe (13-6 MHz), Sonosite, Inc, Bothell, WA, USA] in the transverse position on the anterior side of the neck, just above the suprasternal notch, and observing the position of the tube (presence of a double path sign) and pleural sliding movement. While a single semicircular echogenic area is observed when the tube is in the trachea, a second semicircular echogenic area is observed when the tube is located in the esophagus.. USG was performed immediately after the ETE procedure. In patients in whom double pathway sign was observed and pleural sliding motion was not observed, the patient was re-intubated by the experienced specialist performing USG. It was confirmed by USG again. These procedures were categorized as "failed".

ETCO2 measurement by capnography was performed using a mainstream EMMA® Capnograph (PHASEIN AB Svärdvägen, Danderyd, Sweden) for intubated patients. It was assessed by the detection of PETCO2 greater than 5 mmHg after five breaths and the appearance of a typical square waveform.

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