

DIFFICULT AIRWAYS AND MENDELSON'S SYNDROME IS ULTRASONOGRAPHY ABLE TO PREVENT THEM?

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Abstract—Every anesthesiologist has fallen into difficulty maintaining the airway. The purpose of this summary is present ability to perform prevention of aspiration of gastric contents of patients at risk for a difficult intubation and ventilation mask. Mendelson's syndrome is still in first place as cause of death related to anesthesia. At present there are neither quantitative criteria or scales, which would assess the potential risk of this complication at induction of anesthesia, but in recent years, with the widespread use of abdominal ultrasonography by calculating the antral surface and the amount of gastric contents, relatively accurately can predict the risk of regurgitation and development of the syndrome of Mendelson.

Index Terms—Component, formatting, style, styling, insert. (key words)

I. PURPOSE

With the development of the technologies and the pharmacy, the airways-related incidents' percentage was dramatically lowered. Nevertheless, the risk is not eliminated and persists. Every anesthesiologist has faced a difficulty with the support of the airways.

The purpose of this review is to discuss using Ultrasound method to prevent of aspiration of stomach contents of patients at risk of difficult mask ventilation and intubation.

II. DISCUSSION

Labored ventilation by a face mask is defined as an inability to support Oxygen saturation more than 92% by using mechanical ventilation with positive pressure. There are trials which report a different percentage of difficulty with face mask ventilation. It varies between 2 and 8% (1). However, it is more interesting to see what is the percentage of the unpredicted difficulties, related to this condition. Lavery and Mc Closkey report that according to their research among 1502 patients, only 75 of them (5%) suffered from difficult ventilation. Barely in 13 of these 75, the difficult intubation was unpredicted (2). There is a scale to determine a difficult face mask ventilation, which includes following parameters:

- a) Age above 55 years old
- b) Body Mass Index more than 26
- c) Presence of beard
- d) Absence of teeth
- e) Inability for mandibular protrusion
- f) Snore

The presence of two or more factors is related to a possible difficulty of the ventilation mask.

What is the definition for a difficult endotracheal intubation? Commonly, it is an inability to perform the act of intubation after multiple attempts with the absence of tracheal pathology (3). There are also other more accurate definitions as 3 or more unsuccessful attempts for endotracheal intubation or laryngoscopy within 10 minutes, according to the scale of Cormack-Lehane 3 or 4. There also are other scales to predict the eventually difficult intubation and the most used is the scale of Mallampati. The difficulties in an endotracheal intubation could be divided into 2 groups:

A. From the anamnestic data:

- 1) Anamnestic data of previously labored intubation
- 2) Anamnestic data of arthroses and rheumatological disease
- 3) Burn injuries
- 4) Previous surgical interventions due tumors in the face's and neck is areas
- 5) Traumatic injuries of the head and the neck
- 6) Dysphagia, dyspnoea, and Sleep-apnoea

B. Data of difficult intubation at the clinical examination:

- 1) Pregnancy
- 2) Obesity
- 3) Sleep-apnoea
- 4) Chemo- and radiotherapy
- 5) Prognathism, retrognathism, micrognathism
- 6) Thyromental distance less than 6cm

- 7) Neck girth on the level of the thyroid gland more than 60cm and more than 45cm Sleep apnoea is present
- 8) Inability for head deflection more than 60 °
- 9) Opening of the mouth less than 3cm

Labored intubation is always related to a higher risk of stomach content's regurgitation, especially in high-risk patients, undergoing emergent surgical treatment – in a comatose state after the trauma of the cranial nerves.

They suffer from a higher risk to develop Mendelson's syndrome which is still №1 cause of anaesthesia-related death (41). Annually, it is observed within 1/7 000 – 1,4/10 000 general anesthetics and the risk rises to 1/900 – 1/3 900 during emergent surgical interventions. The mortality rate of Mendelson's syndrome is about 5-9% (5,6). The established protocol to keep the patient away from eating and drinking before a planned surgical intervention (6 hours for food and 2 hours for drinks) aims to prevent an eventual regurgitation and Mendelson's syndrome development. Nevertheless, there are diseases which delay the evacuation of the stomach's content: pregnancy, obesity, diabetes mellitus, acute pain, etc. Moreover, despite the established protocol for preoperative prepayment and the careful approach, the risk of regurgitation is still hard to be predicted. (7) There are neither quantitative criteria, neither scales, which could determine the future risk of this complication of the introduction to anesthesia. (8)

In recent years is observed a tendency for expansion of the list of medical specialists and wards using the ultrasonography for different conditions of various organs and systems as a routine practice. Ultrasonography of the stomach is rapid, easy to perform and non-invasive diagnostic method for patients with a full stomach. At first, this approach has been used to evaluate patients with diabetes, dyspepsia, and obstetrics, as well. (9)

The stomach is divided into 3 parts: fundus, corpus, and antrum. Because of this anatomical feature, the ingested food falls directly into the antrum. This could be confirmed by a ultrasonography of all the stomach's parts.



Figure №1 Orientation of the convex transducer 2-5MHz (subxiphoid) in the epigastrum to visualize the antrum



Figure №2 Echographic image of epigastric structures

1. Left lobe of liver
2. Antrum
3. Blood vessel - V.cava inferior.
4. Pancreas

Perlas et al. demonstrate full stomach in 100% of echographic examinations of the antrum, 77-89% in the corpus ventriculi and only 44-67% in examination of the cardia. (10).

Bouvet et al. confirm the received data from the examination of 183 patients.(11)

Bolondi et al. offer a formula to determine the content of the stomach, based on data from the ultrasonography of the antrum, which included:

- 1) posterior-anterior diameter
- 2) craniocaudal diameter

Formula: $AR = D \text{ (anterior-posterior)} * D \text{ (craniocaudal)} * \pi/4$

There's a regurgitation risk if the antral surface is more than 340mm².



$$AR=45.6*16*(3.14)/4=572.7\text{mm}^2$$

Figure №3 Example for an echographic examination of a patient with full stomach, evaluated by the formula, suggested by Bolondi et al.

There is another formula, based on the Bolondi's:

Stomach content(SC)(ml)=27+14.6*AR-1.26*patient's age(12)
There's a regurgitation risk if SC is more than 1.5ml/kg. This approach is suggested by Parlas et al. and its accuracy has a median difference of 6ml between the beforehand and the measured. It could be used among patients with BMI less than 40 and could evaluate SC more than 500ml. (13)



Figure №4 An example for echographic examination of the patient's antrum: before and after drinking 1L of fluids(A - before, B-after)

After finishing prospective trial, Bouvet et al. suggest alternative formula, based again on the antral surface, evaluated and calculated in half sitting position of the patient.(11)

$SC(ml) = -125+57\log(AR)-0.78(\text{age in years})-0.16(\text{height in cm})-0.25(\text{weight in kg})-0.8(\text{ASA})+16\text{ml}(\text{in case of emergency})$ or $+10(\text{in case of preoperatively premedicated with } 100\text{ml anti acidic patient})$

Table. №4 Comparative characteristics of both formulas, based on AR(13)

Formula	Bouvet et al.	(CC)(ml)=27+14,6xAR-1.28x patient's age
Patient is position	Half sitting	Right sided
Age	18-95 years old	18-85 years old
BMI	14-31	19-40
Beforehand amount	250 ml	500ml
Correlacton coefficient(r)	0.72	0.86

III. CONCLUSION

Echographic examination of the abdomen is a “trademark” of the gastroenterologists and intern medicine specialists in the past 20-30 years in Bulgaria. With the indications' expansion and the types of echographic imaging, this kind of examination became widely used by the anesthesiologists and intensive care specialists too. Ultrasonography of the antrum is highly reliable, non-invasive, rapid and easy to perform diagnostic

method for patients with a full stomach having a high risk of Mendelson's syndrome. Echographic examination of the antrum has been carried out for the first time in pregnant women and patients with diabetes mellitus and is recommended by the European guidelines as a preventive measure against Mendelson's syndrome.

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