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The body constitution of patients and intubation scales as predictors of difficult intubation considered in relation to the experience of the intubator

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The aims of the study were to identify factors that may result in difficulties in intubation, and to compare the results obtained when an experienced and when a less experienced anaesthesiologist was involved. The 96 patients included in the study were evaluated for difficult intubation according to the following scales: Mallampati, upper lip bite test (ULBT) and Patil. The mobility of the cervical segments of the vertebral column, the distance between the jugular notch of the sternum and the chin and the anatomical constitution of the body were other factors that were taken into consideration. Statistical analysis was performed in order to identify factors that may result in difficulties in intubation for an experienced and for a less experienced anaesthesiologist. (Folia Morphol 2008; 67: 171–174)

Key words: intubation, morphometry, medical procedures, anaesthesiology

INTRODUCTION

Tracheal intubation is a minimally invasive procedure consisting of insertion of the plastic intubation tube through the mouth or nose, pharynx and larynx into the trachea. Intubation is performed by direct laryngoscopy. After insertion the tube is sealed within the trachea by means of a pneumatic cuff. Intubation is a procedure that is commonly used during induction of general anaesthesia to allow surgical operations, as well as resuscitation procedures, to be performed. It enables treatment with a respirator to be initiated and helps in maintaining the patency of the respiratory pathways. Moreover, it prevents the content of the alimentary tract, blood, saliva and foreign bodies from being aspirated and enables secretion to be removed from the bronchial tree.

Difficult intubation occurs when it is either difficult or impossible to visualise the aditus of the larynx and laryngoscopy takes place, or it is impossible to insert the intubation tube into the larynx or trachea despite compliance with the proper

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algorithms and procedures and the use of all possible auxiliary actions, such as the 'burp'.

Difficult intubation is defined by the American Society of Anesthesiologists as more than three attempts or as laryngoscopy of more than 10 min. Cormack and Lehane [2] based their definition on the following views as seen in direct laryngoscopy: 1 — the aditus to larynx is fully visible; 2 — only the posterior part of the aditus to the larynx is visible; 3 — only the epiglottis is visible; 4 — the soft palate is visible. The definition developed by Wilson is based on the following five-degree scale: 1 — the vocal folds are visible; 2 — half the vocal folds are visible; 3 — the arytenoid cartilage is visible; 4 — the epiglottis is visible; 5 — the epiglottis is not visible.

Although there are many definitions, that put forward by Benumof in 1995 seems the best, as it defines difficult intubation on the basis of the degree of larynx visualisation in laryngoscopy, duration of laryngoscopy and the number of intubation attempts, and so is, in fact, a compilation of the definitions by both ASA and Cormack and Lehan.

As difficult intubation is a serious medical problem, tests enabling it to be predicted have been developed. The effectiveness of these scales and tests varies and it is debatable whether they should be utilised by specialists in their daily practice.

The most popular scale is the Mallampati classification, which takes into consideration the relationship between the root of the tongue and the edge of the pharynx. Examination of the patient may be conducted in the sitting or lying position, the mouth open to its maximum extent and the tongue protruding. The view is divided into four grades, and difficult intubation is considered likely when grades III and IV are identified. The sensitivity of this method is estimated as approximately 50% (modification by Samsoon and Young) [7, 10].

Equally popular and easy to perform is Patil's test, also known as thyromental distance. The regular length of the thyromental distance is 6 cm to 6.5 cm, amounting to the width of three fingers of an adult male. A length less than this may predict difficulties during laryngoscopy. The upper lip bite test (ULBT) is an attempt to bite the upper lip with the teeth of the jaw [5]. The test results are estimated on a three-degree scale. Degree III includes those cases where difficult intubation is likely to occur.

The first aim of the study was to estimate the usefulness of quick screening tests, in which the examination takes approximately 3 min, as well as several constitutional parameters in predicting difficult intubation. The second aim was to compare the influence of various laryngoscopic conditions on intubation performed by experienced and less experienced specialists and in anaesthesiology.

MATERIAL AND METHODS

Intubations performed in 96 patients (mean age: 53.7 ± 14.1, M:F = 47:49) were evaluated. Of these, 50 intubations were performed by a doctor preparing for qualification in anaesthesiology (Am. resident) and 46 by a specialist anaesthesiologist.

The following parameters were assessed for each patient: the circumference of the neck [cm], the patient's body weight [kg] and height [cm], the distance between the lips and the vocal folds [cm] and the distance between the lips and the carina [cm]. Three recognised scoring systems were also utilised: ULBT [score range: 1–3], Mallampati [score range 1–4], and Patil's score, thyromental distance expressed by the number of finger breadths [score range 1–3].

Intubation procedures included in the study were performed by one specialist in the field of anaesthesiology and intensive care and by four resident doctors who had worked in the field of anaesthesiology for approximately three months to one year and whose professional skills and experience differed widely, some having performed only a few procedures and others several dozen. Before the intubation all patients were administered succinylcholine chloride at a dosage of 1 mg per kg. The intubation was performed using a laryngoscope of the Macintosh type and standard intubation tubes, with additional equipment if needed.

Statistical analysis was performed with SPSS 15.0, SPSS Inc, Chicago, IL. The χ^2 test was used to compare qualitative data, and Student's t test for quantitative data. Values of $p \leq 0.05$ were considered to be significant.

RESULTS

No significant differences in difficulty of intubation were found on the grounds of a patient's constitutional type or gender. Detailed data is presented in Tables 1 and 2.

Of the patients' body parameters only the mean neck circumference discriminated significantly between simple and difficult procedures when the procedure was conducted by a specialist anaesthesiologist. Neck circumference, body height and lips-carina distance were all significantly higher in difficult intubations with a qualifying doctor. Detailed data is presented in Table 3. A cervical extension angle

Table 1. Distribution of simple and difficult intubations in study groups in relation to patient gender. No statistically significant differences were observed

Gender	Intubation					
	Specialist in training			Specialist		
	Simple	Difficult	Total	Simple	Difficult	Total
Female	18	6	24	21	4	25
Male	19	7	26	17	4	21
Total	37	13	50	38	8	46
χ^2		0.746			0.227	
p		0.387			0.869	

Table 2. Distribution of simple and difficult intubations in study groups in relation to patient body constitution. No statistically significant differences were observed

Body constitution	Intubation					
	Specialist in training			Specialist		
	Simple	Difficult	Total	Simple	Difficult	Total
Athletic	9	3	12	10	3	13
Leptosomic	15	6	21	12	2	14
Picnic	13	4	17	16	3	19
Total	37	13	50	38	8	46
χ^2		0.137			1.144	
p		0.933			0.564	

Table 3. Means and standard deviations of the measured parameters in simple and difficult intubations. p values of < 0.05 were considered significant

	Intubation	Specialist in training			Specialist		
		Mean	SD	p	Mean	SD	p
Neck [cm]	Simple Difficult	37.30 40.88	5.11 5.90	0.003	37.91 42.38	6.20 4.56	0.009
Lips — vocal folds [cm]	Simple Difficult	13.67 14.08	3.93 2.67	0.621	13.91 13.25	3.97 1.77	0.523
Weight [kg]	Simple Difficult	78.95 83.54	19.48 22.75	0.308	76.19 78.88	16.61 16.61	0.571
Height [cm]	Simple Difficult	164.94 172.54	15.58 11.44	0.022	169.15 167.25	10.01 9.15	0.500
Lips — carina [cm]	Simple Difficult	27.83 29.38	5.06 2.25	0.025	27.48 27.88	4.28 2.09	0.724
ULBT [1º–3º]	Simple Difficult	1.17 1.54	0.38 0.86	0.002	1.63 1.50	0.83 0.89	0.592
Mallampati [1º–4º]	Simple Difficult	1.83 2.38	0.78 1.17	0.005	1.74 2.13	0.76 0.81	0.083
Patil [1–3]	Simple Difficult	2.83 2.62	0.38 0.50	0.008	2.89 2.38	0.32 0.72	0.013

< 35° significantly influenced the difficulty of the procedure involving a trainee anaesthesiologist (p = 0.002). All patients with a cervical extension angle < 35° were identified by a qualifying anaesthesiologist as difficult to intubate. Among the patients intubated by an experienced anaesthesiologist, there were also four patients with the angle < 35°; two of these were classed as difficult to intubate and two as difficult.

The means of all the intubation scales used differed significantly between simple and difficult intubations when anaesthesiology residents were involved, but only the Patil scale differentiated them for the specialist anaesthesiologist. Weak statistically significant correlations were identified between the parameters evaluated and difficulty of intubation.

DISCUSSION

Difficulties faced by the physician during intubation of the patient and misdiagnosed difficult intubation are the most common causes of serious anaesthetic complications, including severe hypoxia, cardiac arrest and death. Fortunately, difficult intubations are uncommon and situations in which it is impossible to intubate a patient arise only sporadically [4]. At the same time, correctly followed medical procedures prevent any adverse outcome for the patient. The prevalence of difficult intubation is estimated at between 0.5% and 2% [1, 6, 9], and the absolute impossibility of performing this procedure is put at approximately 0.1% by some authors and by others at between 1% and 4% and between 0.05% and 0.35% respectively. Cormack and Lehane [2] analysed 100 000 anaesthetic charts, and found that difficult intubation occurred in 1% of all cases. The percentage of difficult intubations is markedly increased in pregnant women.

The study shows that intubation difficulty scales may be useful for doctors undergoing their final training in anaesthesiology and for specialists in predicting possible problems with the procedure. Previous studies show that a measure of thyromental distance (the Patil test) is most effective if combined with other tests [3]. Previous research has also shown that the ULBT test combined with thyromental distance, sternomental distance and the Mallampati score were effective in assessing difficulty [8]. Another research article found the sternomental distance to be more sensitive then the modified Mallampati score, thyromental distance, and forward protrusion of the mandible [11]. On the basis of this data a viable approach would be to combine the most popular test, the Mallampati, with sternomental distance as a solid foundation for discovering which combination of tests would be ideal. Specialists generally have fewer problems during intubation then trainees. In our opinion further studies should include more types of test, a combination of tests and measurement of the efficiency of tests by calculating a time for assessment and accuracy.

For both specialist and qualifying anaesthesiologists the Patil test proved to be the most effective single test for assessing difficulty of intubation. The reason for the other scales being ineffective in predicting difficult intubation for the experienced anaesthesiologist remains unclear. Further research is therefore encouraged to analyse in more detail the relationship between difficulty of intubation and the morphometric parameters and body constitution of patients.

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