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Complications of the Endotracheal Tubes for Adult Patients in the ICU

Afzal Shamsi [1], Mahsa Hamidi [2], Noor Alimardan [3], Asaad Hayder Jasim [4]

[1] Department of Anesthesiology, School of Medicine, Tehran Heart Center, Tehran University of Medical Sciences, Iran. Nursing and Midwifery Care Research Center, Tehran University of Medical Sciences, Tehran, Iran

[2] Assistant profess of Anesthesiology and critical care, Shariati Hospital, Tehran University of Medical Sciences, Tehran

[3] FIBMS Anesthesia and intensive care, Head of operations rooms at Alnaser Hospital, Kirkuk, MOH, Iraq

[4] Department of Anesthesia, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran

Abstract: **Background:** Patients use intubated endotracheal tubes (ETTs) since they ensure more accurate monitoring of breathing parameters and better ventilation itself. The present work sought to ascertain for adult ICU patients the problems of ETTs.

Aims: Assessment the Complications of the Endotracheal Tubes for Adult Patients in the ICU.

Methods: This cross-sectional study was conducted on 120 patients hospitalized to Tehran University of Medical Sciences hospitals (Shariati and Imam Khomeini Hospitals) who satisfied the inclusion criteria during 2014–2015 were the subjects of this cross-sectional study. We looked at intubation's problems in them. Data were gathered from a researcher-made questionnaire. Descriptive and inferential statistical tests as well as SPSS version 25 program were used in data analysis. Considered noteworthy was a P-value less than 0.05.

Results: The average age of participants was 38.12 ± 9.52 years. The male group had the highest percentage of participants, reaching 56.7%. The average heart rate before the operation was 83.64±9.05, while after using ETT and after the operation, the average heart rate was 79.47±6.44 ($p \leq 0.05$). The average systolic pressure before the ETT was 125.56±10.19, while after using endotracheal tubes, the mean systolic pressure was 118.83±9.17 ($p \leq 0.05$). The infection rate after using ETT was 31.7%, and it's the most common complication in patients, followed by bleeding, which reached 17.5% of patients after ETT use. On the other hand, the least common complication among patients using ETT was esophageal intubation, which amounted to 1.7%. The most common reasons for intubation were shock, accounting for 47.5%, and acute respiratory failure, accounting for 32.5%.

Conclusions: Finally, the results of this study showed that endotracheal intubation causes changes in the hemodynamic status of patients. Also, the most common problems that can happen during intubation are infection, bleeding, pharyngeal injury, aspiration, laryngospasm, laryngotracheal soiling, and esophageal intubation.

Key points: Intensive Care Unit; Endotracheal Intubation, Patients.

1. INTRODUCTION

Abbreviations

ICU: Intensive Care Unit

VAP: ventilator-associated pneumonia

ETT: endotracheal tube

TUMS: Tehran University of Medical Sciences

HR: heart rate

2. INTRODUCTION

Maintaining the airway's patent is crucial in the critical care unit (ICU). Intensive care patients have few and erratic physiological reserves. Apart from this, the intubation duration is likewise limited [1, 2]. Usually, these issues affect the rate between 39% and 41% [3]. An earlier analysis conducted at the same clinic found a 41% [4] complication rate. Research indicates that after training the complication rate dropped [5]. In the USA, around 500,000 patients with acute respiratory failure have invasive mechanical ventilation annually [6]. Particularly ventilator-associated pneumonia (VAP), the most common complications arising during mechanical breathing are those related to the ventilator. VAP is connected to higher morbidity and death [7]. Megil introduced an airway and inhalation anesthesia using the endotracheal tube into anesthesia in 1929. Ayri pioneered this approach for children's anesthesia. Either the mouth or the nose can be used to insert the endotracheal tube. Children frequently use intubated endotracheal tubes (ETTs) because they offer better ventilation and more precise ventilation parameter monitoring [8, 9]. They also strictly control breathing parameters and minimize ETT fluctuations to stop aspiration of stomach contents and leaks. If placed incorrectly, nevertheless, cuff ETT may compromise children's airways [10, 11]. All doctors who handle children's airways must be aware of how a child's age affects the larynx size. The trachea is funnel-shaped in infancy and widens with age from the top end to become cylindrical from the bottom end. In patients less than eight years of age, the growing airway anatomy is a main factor influencing endotracheal intubation [12]. In terms of technique, endotracheal tube placement (ETT) is a difficult process for youngsters; in this sense, one of the primary situations is the installation of an endotracheal tube at the suitable depth. The endotracheal tube's distal end should be positioned correctly between the trachea and the carina. When the chip length is shorter it also raises the possibility of inappropriate placement. Many of these injuries arise from the way endotracheal tubes are handled. As was already mentioned, intubation opens the airways and offers a direct supply of air by means of endotrachea. Made of polyvinyl chloride, standard endotracheal tubes run in width from 6.00 to 8.00 mm. Their tip is beveled, they have a small curvature, and they feature depth marks. A cuff of an endotracheal tube is among its most crucial components. Attached close to the end of the tube, the cuff is a balloon that can be inflated through the outlet port close to the ETT opening [13, 14].

Aims of the study

Assessment the Complications of the Endotracheal Tubes for Adult Patients in the ICU.

3. METHODOLOGY

Design of the study

Conducted on patients housed in Tehran's special care department of Tehran University of Medical Sciences facilities, including Shariati Hospital and Imam Khomeini Hospital, this cross-sectional descriptive-analytical study covers 2024–2025. We looked at the intubation's problems in them. Every patient detail—including demographic data, etc.—was gathered using a researcher-made questionnaire. Patients aged 18 to 70 years admitted to the critical care unit, body mass index less than 30, high-volume, low-pressure polyvinyl chloride endotracheal tubes, patients who had spent more than three days and less than two weeks in the intensive care unit, and so on comprised the

inclusion criteria. Patients having coronavirus, influenza, pulmonary hypertension, congestive heart failure, or known allergies to any of the drugs were excluded.

Administrative arrangement and ethical consideration

Ethical approval for the study was obtained from an ethics committee of the Tehran University of Medical Sciences (TUMS). With (ethical code: IR.TUMS.SEP.REC.1403.135) in all procedures of study. All of the collected information lacked personal information such as name, ID number and any other identity.

Sample of the Study

Non-probability (purposive sample) patients were admitted to intensive care units in hospitals affiliated with the Tehran University of Medical Sciences (Shariati Hospital and Imam Khomeini Hospital), which was selected based on the study criteria. The number of patients included in the study is (120) patients. All patients were examined daily by an anesthesiologist.

Statistical data analysis:

Descriptive and inferential statistical tests were employed to evaluate the data using SPSS software version 25. P-values below 0.05 were regarded as significant.

4. RESULTS

The high percentage of participants was found in 31-40 years' group that reach to 39.2%. while, the low percentage of participants was found in more than 60year group that reach to 7.5%, The average age of participants was 38.12±9.52 years. the high percentage of participants was found in blood pressure group that reach to 40.0%. while, the low percentage of participants was found in asthma group that reach to 5.8% (table1).

Table (1): the number and percentage of participants according to gender, chronic diseases

Variable		Participants (n=120)	
		No.	(%)
Gender	Male	68	56.7%
	Female	52	43.3%
Chronic diseases	Diabetes	26	21.7%
	Asthma	7	5.8%
	Blood pressure	48	40.0%
	Liver diseases	39	32.5%

The average heart rate before the operation was 83.64±9.05, while after using endotracheal tubes and after the operation the average heart rate was 79.47±6.44. There were no significant ($p \leq 0.05$) differences in the heart rate before and after ETT use. The average Heart rate was compared between each gender before and after the surgery and there were no significant ($p \leq 0.05$) differences. The average systolic pressure before the ETT was 125.56±10.19, while after using endotracheal tubes, the mean systolic pressure was 118.83±9.17. There were no significant ($p \leq 0.05$) differences in the heart rate before and after ETT use. The mean of systolic pressure was compared between each gender before and after the surgery and there were no significant ($p \leq 0.05$) differences. The average systolic pressure before the ETT was 80.04±5.21, while after using endotracheal tubes, the mean diastolic pressure was 70.21±9.31. There were no significant ($p \leq 0.05$) differences in the heart rate before and after ETT use. The mean of diastolic pressure was compared between each gender before and after the ETT use and there were no significant ($p \leq 0.05$) differences (Table 2). The mortality rate when using ETT was 1.7%, while without using ETT it was 10%. The Glasgow coma scale levels ranged to upper good recovery level in patients who used ETT at 24.2%, while the rate was 16.7% without using ETT.

Table (2): heart rate, systolic pressure, diastolic pressure, before and after Endotracheal tubes using according to gender

Variable	ETT	Gender		P value
		Male	Female	
Heart rate	Before	83.61±8.07	81.05±10.15	P<0.05
	After ETT	80.41±8.75	78.15±13.59	
Systolic pressure (mm Hg)	Before ETT	129.83±9.13	121.91±11.84	P<0.05
	After ETT	119.83±8.18	113.29±13.93	
Diastolic pressure (mm Hg)	Before ETT	84.41±3.42	81.13±5.11	P<0.05
	After ETT	78.13±5.31	77.13±4.28	

The infection rate after using ETT was 31.7% and it's the most common complication in patients, followed by bleeding which reached 17.5% of patients after ETT using. On the other hand, the least common complication in patients using ETT was Esophageal intubation, which amounted to 1.7%. (table3).

Table 3: the complications of ETT using in patients

Complications	Participants (n=120)	
	No.	%
Infection	38	31.7%
Bleeding	21	17.5%
Vocal cord injury	6	5.0%
Aspiration	13	10.8%
Esophageal intubation	2	1.7%
Laryngotracheal soiling	8	6.7%
Pharyngeal injury	19	15.8%
Laryngospasms	13	10.8%

5. DISCUSSION

This study found that laryngoscopy with ETT insertion had a hemodynamic response raising heart rate and MAP. Still, the response from laryngoscopy with ETT implantation was really strong. MAP and ETT group heart rates exceeded those before induction. These results were similar to those of a Scottish study in which it was found that heart rate increased significantly and arterial pressure dropped significantly during anesthetic induction. Other prior studies had produced the same findings [15]. This result could be related to the hypotensive properties of the used induction drugs. In the ETT group of the trial, the H.R. and MAP were all rather higher than pre-intubation values once the endotracheal tube was placed. After the five minutes of elevation, the parameters returned to their pre-intubation levels. These results line up with those reported by Millar and colleagues, who found that laryngoscopy and tracheal tube insertion immediately follow an average increase in mean arterial pressure of 25 mmHg [16] in normotensive patients. The observed changes most likely come from the sympathoadrenal reaction triggered by supraglottic and tracheal stimulation. These results fit studies aimed at investigating the cardiovascular effects related to the implantation of the implant. Comparatively to those following the insertion of the cerebral laryngeal mask and the Guedel oral airway, there was no change between the two groups at any point in time in arterial pressure or heart rate following the laryngeal mask and Guedel oral airways [17]. Given neither of the two devices passed through the trachea, it is expected that they would be somewhat similar. This response could be explained by the hemodynamic response reflex activating under stimulation of the supraglottic region. Given neither gadget traveled via the trachea, one expects such parallelism between the two. The hemodynamic response reflex triggered by stimulus of the supraglottic region could help to explain this reaction [18]. The work by et al. supports this notion by showing that direct stimulation through a tracheal tube has more serious cardiovascular consequences than stimulation of the glottis by laryngoscopy alone. This study's findings were identical to those of

Griffin and associates, who showed that hemodynamics [19] in with and without ETT groups were statistically significantly different. The results of this investigation were not different from those of Griffin and colleagues, who demonstrated that there was no statistically significant variation in hemodynamics between the with and without ETT groups. Like their study results, the rise in heart rate of the ETT group continued longer in our study. Our findings indicated that while developing clinical standards, group heterogeneity should be observed in ICU patient investigation. Patients with traumatic brain injury were included in two groups of GCS 3–5 (n=99) and GCS 6–8 (n=49), then compared in predictors of endotracheal intubation success. Patients with GCS <9 should thus be regarded as heterogeneous populations, they came to decide. Bendinelli's study has a too small sample size to enable subgroups of analysis [20]. Our investigation revealed hidden links with mortality in the subgroups and expanded the idea of heterogeneity of patient groups to diagnostic categories. Studies indicated that other elements including disease trajectory, diagnosis, and prognosis should be taken into account in order to justify the endotracheal intubation of patients with medical difficulties based on a GCS score [21].

6. Conclusion

At last, the findings of this study revealed that alterations in the hemodynamic condition of patients result from endotracheal intubation. In sequence of frequency, intubation's complications also include infection, hemorrhage, pharyngeal damage, aspiration, laryngospasm, laryngotracheal soiling, and esophageal intubation.

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Conflict of Interest

There are no conflicts of interest regarding this study.

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