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ASSESSMENT OF NURSES' KNOWLEDGE AND PRACTICE REGARDING PEDIATRIC ENDOTRACHEAL TUBE SUCTIONING IN PUBLIC SECTOR HOSPITALS OF DISTRICT CHARSADDA, KHYBER PAKHTUNKHWA, PAKISTAN

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Abstract

Background: *Endotracheal suctioning (ETS) is an essential invasive procedure performed by critical care nurses (CCNs) to clear pulmonary secretions in patients, crucial for maintaining airway patency and ensuring adequate ventilation and oxygenation in intubated individuals.*

Methodology: *A cross-sectional study in Charsadda involved 119 nurses out of 171 nurses in public sector hospitals of district charsadda, conducted over 5 months. The sample size was determined with a 95% confidence level and a 5% significance level using Raosoft software and convenient sampling.*

Results: *In a study of 119 nurses, 97% were female, primarily aged 36 to 47, with 66.4% holding diplomas. Notably, 80% lacked ICU training, The knowledge assessment showed that 27% of respondents had excellent knowledge, 60% had good knowledge, and 13% inadequate knowledge. In suctioning practices, 85% reported excellent practices, 15% good practices, and none had inadequate practices.*

Conclusion: *District charsadda hospital employees demonstrate high proficiency in endotracheal suctioning but show significant gaps in safety compliance and specialized training. Hand hygiene and PPE adherence are low, and the predominantly female workforce lacks formal ICU training. Targeted interventions are required to enhance patient safety, with hospital administrators needing to enforce infection control procedures and mandate ICU training programs.*

Recommendations: *In pediatric care, standardizing suctioning protocols, ensuring resource availability, and conducting regular skills audits for nurses are essential. Recommendations include enhancing education through in-service training and updated curricula, alongside policy improvements such as standardized guidelines and better staffing ratios. Future research should assess intervention effectiveness, barriers to best practices, and the link between nursing practices and patient outcomes. Collaborative efforts are vital for improving suctioning safety and effectiveness.*

INTRODUCTION

The early 1900s witnessed the reliable use of the endotracheal tube (ETT), made from polyvinyl chloride (PVC). This medical apparatus is specifically intended for placement between the vocal cords and into the trachea, enabling the

direct delivery of inhaled gases and oxygen to the lungs. Moreover, the ETT plays a critical protective role by obstructing the ingress of harmful substances into the airways. This dual function enhances pulmonary function and substantially improves patient safety during various medical procedures, making it a vital tool in airway management and respiratory care.(1)

The Australian Incident Monitoring Study analyzed the first 2000 documented incidents related to endotracheal tubes, identifying 189 cases (9%) of complications. The most prevalent issue was endobronchial intubation, which accounted for 42% of the complications and often resulted in arterial desaturation. Other notable complications included obstructions and esophageal intubation, each representing 18% of the cases. Additionally, disconnections and leaks were involved in 7% of the incidents, as were misplacements not classified under other categories, which made up 4%. Other findings included inappropriate tube choice (3%), cuff herniation (1%), and rare occurrences of failure to deflate the cuff and presence of foreign bodies, both at 0.5%. This study underscores the importance of vigilance in endotracheal tube management to minimize complications.(2)

Endotracheal suctioning (ETS) is a vital invasive procedure conducted by critical care nurses to remove pulmonary secretions from the airways of patients. This procedure is crucial for maintaining airway patency and ensuring effective ventilation and oxygenation in intubated patients. Additionally, ETS is instrumental in preventing atelectasis, a condition that involves the collapse of alveoli, which is essential for the respiratory health of critically ill individuals. The successful execution of ETS by healthcare providers significantly improves patient outcomes in critical care settings, highlighting its importance in patient management within this specialized area.(3)

Endotracheal tube suctioning (ETS) is vital in Intensive Care Units (ICUs) for ensuring airway patency and optimizing gas exchange. This procedure plays a crucial role in mitigating risks associated with complications such as atelectasis and ventilator-associated pneumonia (VAP). The importance of employing evidence-based practices in ETS is emphasized, along with the continuous education and clinical guidelines that equip nurses to perform the procedure safely and effectively. The overarching aim of these strategies is to enhance patient outcomes in critical care environments, underscoring the necessity for ongoing professional development and adherence to established best practices in nursing care.(4)

Endotracheal suction (ETS) is a vital procedure for pediatric patients who have endotracheal tubes, specifically designed to facilitate the removal of secretions and prevent airway obstruction. This intervention is crucial for maintaining adequate oxygenation and ventilation, particularly in vulnerable pediatric populations. However, the procedure is not without risks; improper or insufficient suctioning can lead to serious complications, including cardiopulmonary arrest. It is essential for healthcare providers to exercise caution during ETS due to the inherent risks associated with the procedure, which can include bradycardia, atelectasis, hypertension, and hypoxaemia—especially in high-risk pediatric patients. These potential adverse effects highlight the critical need for diligent monitoring throughout the suctioning process to reduce risks and ensure patient safety.(5)

Improper endotracheal suctioning is associated with significant risks, including hypoxemia and airway trauma. In order to reduce these potential complications, it is essential to follow established guidelines, which emphasize the importance of conducting thorough patient assessments prior to the procedure. The choice of appropriate catheter type is also critical, as well as the consistent application of aseptic techniques to prevent infections. Additionally, continuous monitoring of the patient's condition during suctioning is vital, as it enhances patient safety and ensures timely interventions if complications arise. These practices collectively contribute to safer endotracheal suctioning and improved patient outcomes.(6)

A study conducted in Hodeida city, Yemen, assessed the adherence of Critical Care Nurses to Endotracheal Suctioning guidelines from May to August 2019. The findings highlighted a concerning trend, with 55% of nurses exhibiting poor adherence, indicated by scores below 50%.

Alarmingly, none of the participants reached the desirable adherence threshold of 70%. While the analysis revealed no significant correlation between the nurses' demographic characteristics and their adherence levels, it was noted that training and the availability of information played a crucial role in improving adherence. Specifically, enhanced training was associated with a statistically significant increase in adherence ($p = 0.010$), as was the provision of information ($p = 0.028$).(7)

This study evaluated the knowledge and practices of 150 staff nurses in Lahore, Pakistan. The results revealed that 39.3% of the nurses demonstrated good knowledge regarding their roles, while 35.7% exhibited moderate knowledge, and 25.0% were characterized by poor knowledge levels. Regarding their practices, 52.0% of the nursing staff reported engaging in good practices, in contrast to 48.0% who displayed poor practices. These findings underscore significant discrepancies between the knowledge and practices of the nurses, indicating an urgent need for enhancements in training and educational programs to bridge these gaps effectively.(8)

Problem Statement

Pediatric endotracheal tube suctioning is an essential procedure for ensuring airway patency and preventing complications such as hypoxemia and infection in critically ill children who are on mechanical ventilation. Despite its importance, improper techniques and gaps in knowledge among healthcare providers can lead to serious adverse outcomes. Research has highlighted that nursing staff frequently exhibit inconsistent practices and do not adhere strictly to established guidelines, particularly in the region of Khyber Pakhtunkhwa, Pakistan. Notably, there is a significant lack of localized studies focusing on nurses' knowledge and practices within public hospitals, which poses challenges in creating effective training programs tailored to address these issues. This study is designed to evaluate the competence of nurses in performing pediatric endotracheal tube suctioning in District Charsadda. The primary objective is to identify specific gaps in their knowledge and skills, thereby facilitating improvements in nursing practices that are aimed at enhancing patient safety and the overall quality of care provided to critically ill children.

Study Gap

Pediatric endotracheal tube suctioning is an essential nursing practice that requires thorough knowledge and adherence to evidence-based guidelines to minimize complications and improve patient outcomes. Previous international research has primarily focused on nurses' knowledge and practices in developed nations and tertiary care hospitals. However, scarce research exists in Pakistan, particularly in the Khyber Pakhtunkhwa region, regarding the practices of nurses in private sector hospitals, especially in District Charsadda. This lack of local evidence creates challenges in identifying gaps in knowledge and practice, which in turn affects the development of tailored educational and clinical initiatives. The current study seeks to address this gap by assessing nurses' knowledge and practices related to pediatric endotracheal tube suctioning in private hospitals in District Charsadda. The findings aim to provide crucial evidence that could lead to improved clinical training, adherence to evidence-based guidelines, and the overall enhancement of care quality for pediatric patients.

Rationale of the Study

Inadequate practice and knowledge gaps among nurses present serious threats to patient safety and rehabilitation outcomes. To effectively mitigate these risks, it is essential for nurses to keep their knowledge current and comply with evidence-based suctioning protocols. Neglecting to stay informed of best practices not only endangers patient safety but also undermines the success of rehabilitation efforts. Therefore, continuous education and adherence to established protocols are paramount in ensuring safe and effective patient care.

Significance of the Study

This study evaluates pediatric endotracheal tube suctioning, focusing on the essential knowledge and skills required by nurses to maintain airway patency and prevent respiratory complications in critically ill children. It examines nursing practices in District Charsadda's public

hospitals, highlighting knowledge gaps affecting patient safety. The study aims to minimize risks like hypoxemia and airway trauma, while supporting hospital administrators in training program development, guiding policymakers in forming clinical guidelines, improving nursing education, and providing foundational data for future research in pediatric airway management in Khyber Pakhtunkhwa, Pakistan.

Research Question

What are the levels of nurses' knowledge and practice regarding pediatric endotracheal tube suctioning in public sector hospitals of district charsadda, khyber pakhtunkhwa, pakistan

Research Objectives

1. To assess the level of knowledge of nurses' regarding endotracheal tube suctioning in public sector hospitals of district charsadda, khyber Pakhtunkhwa, pakistan
2. To determine the practice level of nurses' regarding endotracheal tube suctioning in public sector hospitals of district charsadda, khyber Pakhtunkhwa, Pakistan.

Operational definitions

Nurse

A registered nurse (RN), licensed practical nurse (LPN), or staff nurse currently working in a hospital/clinical setting and providing direct patient care.

Knowledge

Understanding of: indications, contraindications, complications, standard procedure steps, infection control measures, suction pressure, catheter size, and pre/post-oxygenation as per AARC guidelines.

Practice

Proper hand hygiene, use of PPE, assessment of patient, pre-oxygenation, aseptic insertion of catheter, correct suction pressure and duration, post-suctioning assessment, and documentation.

Endotracheal tube suctioning

The procedure of removing pulmonary secretions from a patient's airway through an endotracheal tube using a sterile suction catheter and negative pressure, to maintain airway patency and oxygenation.

LITERATURE REVIEW

A literature review reveals prior research gaps and methodologies. A mixed-method study conducted from September 2021 to April 2022 examined suction episodes in mechanically ventilated children with respiratory infections following the PAWS guideline implementation in a pediatric ICU. An analysis of 439 suctions showed a 41% reduction in inappropriate endotracheal tube interventions (from 99% to 58%). Significant decreases were also noted in open suction systems (48%), sodium chloride use (23%), and manual bagging practices, with clinicians finding the PAWS guideline beneficial for improving intervention appropriateness.(9)

The RAND Corporation and UCLA used the Appropriateness Method to develop criteria for pediatric endotracheal suction interventions. This involved defining terms, conducting a literature review, forming an expert panel, creating case scenarios, and gathering appropriateness ratings. The panel rated the scenarios from 1 (harm outweighs benefit) to 9 (benefit outweighs harm), categorizing them as appropriate, uncertain, or inappropriate. This systematic method provides foundational classifications for these interventions in pediatric patients.(10)

The systematic review indicates low-quality evidence for PICO questions, resulting in recommendations based on low-level evidence and expert opinions. The Clinical Practice Guidelines (CPG) rely on anecdotal evidence and committee expertise, hindered by inconsistencies in artificial airway types, patient demographics, clinical settings, and study designs. The committee's goal is to assist clinicians in safe artificial airway suctioning, aligning with the 2010 AARCCPG recommendations.(11)

In a cross-sectional survey of PICU nurses from 20 countries with 446 responses, 80% reported having local guidelines for endotracheal suctioning. Findings showed that 63% pre-oxygenated patients, 71% maintained suction depth within 0.5 cm of the tube, and 59% used appropriately sized catheters. Additionally, 78% applied continuous negative pressure, while

24% used sedatives before suctioning. However, only 26% of nurses adhered to all four components of evidence-based practice.(12)

An anonymous questionnaire of 134 UK physiotherapists specializing in respiratory practice identified key suctioning practices. On average, respondents performed nasal pharyngeal (NP) and oropharyngeal (OP) suctioning three times in the past month, with 92% reporting successful outcomes. Techniques included manual airway clearance (78%) and mechanical ins/insufflation (61%). Practitioners commonly used lubricant (98%) and nasal pharyngeal airways (95%). However, significant adverse effects such as bleeding (80%), hypoxemia (63%), and tachycardia (58%) were reported, underscoring the invasive nature of NP/OP suctioning and the necessity for safer alternatives in physiotherapy.(13)

A study involving 38 nurses in a Canary Islands hospital assessed discomfort and knowledge related to tracheostomy care. It found that 34.22% of participants experienced discomfort, and 47.37% sought assistance from colleagues. There were uncertainties in pre-feeding measures and decannulation practices, reflecting moderate knowledge levels. The study recommends ongoing training and interactive educational methods, including simulations and virtual reality, to improve clinical competencies.(14)

A cross-sectional study of 315 nurses in a Saudi Arabian tertiary medical center found that while over 30% cared for tracheostomy patients, two-thirds felt inadequately trained. Most participants were middle-aged females with foreign nursing degrees, and higher confidence in patient care correlated with work experience and patient volume. The study highlights the need for continuous training and competency evaluations, emphasizing the importance of further research to inform policy and practice.(15)

This quasi-experimental study evaluates the effects of a structured educational program on ICU nurses at Omdurman Hospital. It reveals a significant improvement in nurses' knowledge and practices, especially in endotracheal suctioning, leading to enhanced skills and better patient outcomes.(16)

A study in Sana'a City, Yemen, evaluated the knowledge of respiratory therapists through a questionnaire. Results showed 68% of participants were male, predominantly aged 21-30, and 98% had a three-year diploma. While 83% received training in airway clearance, only 5% had high knowledge of endotracheal tube (ETT) suctioning, with 84% showing low knowledge. A significant correlation was found between educational level and ETT suctioning knowledge ($p=0.025$), but no associations with age or experience. The findings underscore the need for ongoing, evidence-based training to enhance airway clearance knowledge.(17)

The study evaluated emergency room nurses' compliance with Emergency Tracheal Suctioning (ETS) guidelines, noting widespread non-adherence, particularly in hand hygiene, which caused catheter contamination. Problems identified included oversized catheters and excessive suction pressures. Interviews indicated a need for customized training to clarify the rationale behind guidelines, underscoring significant gaps in adherence and the necessity for focused educational enhancements.(18)

A study of 140 critical care nurses in Jordan found an average knowledge score of 10.7 on endotracheal suction. Knowledge correlated significantly with age, income, experience, gender, and education level. Factors such as higher income, education, and being male were strong predictors of knowledge. While understanding was adequate, further education is essential, particularly for female nurses, those with lower incomes, and nursing graduates. Continuous education is recommended.(19)

A quasi-experimental study in the ICUs of Imam Al-Hussein Medical City and Imam Al-Hassan Al-Mujtaba Teaching Hospital assessed mechanically ventilated patients undergoing endotracheal suctioning with and without normal saline from September 2024 to July 2025. Results showed that the saline group had a notably shorter ICU stay and better arterial blood gas metrics. The study concluded that normal saline enhances gas exchange and is beneficial for patients with thick secretions, while advising against its routine use. It also recommended standardized suction protocols and further investigation into humidification and inhaled saline effects.(20)

METHODOLOGY

This descriptive cross-sectional study assessed the knowledge and practice of 119 nurses regarding pediatric endotracheal tube suctioning in public hospitals in district Charsadda, Pakistan, over five months. Registered nurses who consented were included, while those on long-term leave or in non-clinical roles were excluded. Data collection used a structured questionnaire with demographic, knowledge (13 items), and practice (15 items) sections, scoring responses as poor, good, or excellent. Analysis was conducted using SPSS version 22, focusing on descriptive statistics such as frequency and percentage.

RESULTS

Of the 119 participants, 97% were women and 3% were men. The largest age group (57%) consisted of people between the ages of 36 and 47, followed by people between the ages of 24 and 35 (30%) and 48 and 57 (13%). The majority of participants (66.4%) held a diploma, while 0.8% had an MSN degree and 32.8% had a BSN/Post RN qualification. Of the participants, only 20% said they had received ICU training, while 80% said they had not. Most participants had no ICU training, were female, between the ages of 36 and 47, and had a diploma.

TOTAL KNOWLEDGE

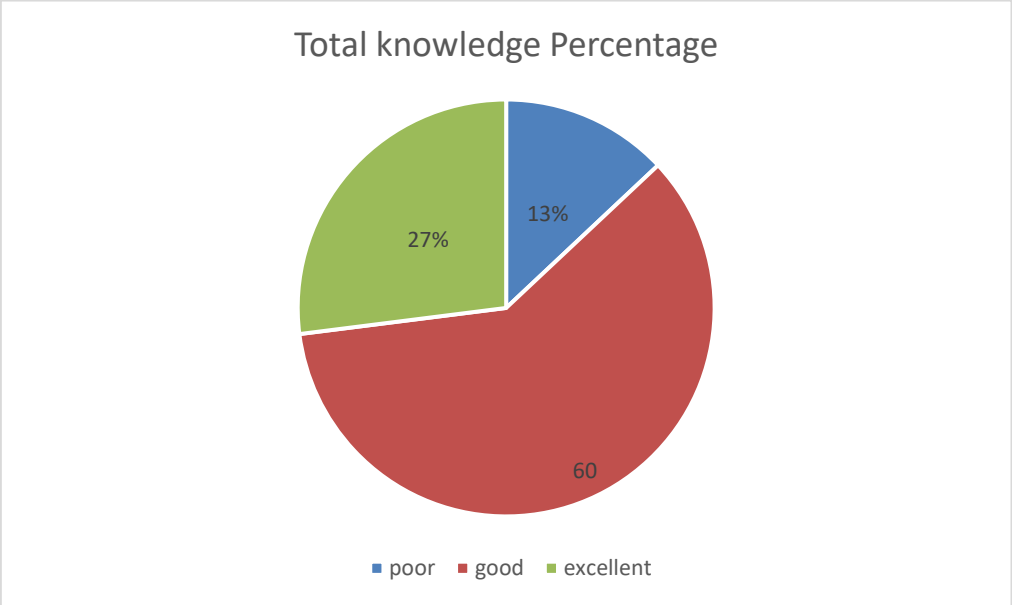


Table 14:

knowledge	Percentage	Frequency
Poor	13	15
Good	60	71
excellent	27	33
Total	100	119

Table 15:

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Knowledge	119	9	15	24	19.0504	2.29165	5.252
Valid N (listwise)	119						

The study involved 119 nurses in all. In terms of total knowledge, 33 (27%) had outstanding knowledge, 71 (60%) had good knowledge, and 15 (13%) had bad knowledge. This suggests that most of the participants had a solid understanding of pediatric endotracheal tube suctioning.

The knowledge score was acquired from 119 individuals, according to the descriptive statistics. With a range of 9, the scores varied from 15 to 24. With a variation of 5.252 and a standard deviation of 2.29, the average knowledge score was 19.05 (Mean = 19.0504). These results imply that, on the whole, the individuals exhibited a high degree of knowledge with comparatively little score variability.

TOTAL PRACTICE



Table 31:

Practice	Percentage %	Frequency
Poor	0	0
Good	15	18
Excellent	85	101
Total	100	119

Descriptive Statistics
Table 32:

	N	Range	Minimum	Maximum	Mean	Std. Deviation Variance
Total practice	119	10	20	30	25.5294	1.96073
3.844						
Valid N (listwise)	119					

The study involved 119 nurses in all. In terms of overall practice, 101 participants (85%) had excellent practice, 18 participants (15%) had good practice, and none of the participants (0%) had poor practice. According to these results, the great majority of participants showed a high degree of proficiency with pediatric endotracheal tube suctioning.

The practice score was obtained from 119 participants, according to the descriptive

statistics. With a range of 10, the scores varied from 20 to 30. The mean practice score was 25.53 (Mean = 25.5294), with a standard deviation of 1.96 and a variance of 3.844. These results suggest that the participants had a high level of practice with relatively low variability in their practice scores.

DISCUSSION

A cross-sectional study in district charsadda included 119 nurses, predominantly female (97%), with a major age group of 36–47 years (57%). Most held diplomas (66.4%), and 80% lacked ICU training. Knowledge assessment showed 27% with excellent, 60% with good, and 13% with inadequate knowledge. Suctioning practices were evaluated, revealing 85% with excellent practices. A study in Sana'a City found respiratory therapists (69% aged 21-30, 68% male) had low ETT suctioning knowledge despite training. A PICU nurse survey showed 80% had local guidelines but only 26% adhered to all EBP components. A Jordanian study of 140 nurses showed average knowledge scores of 10.7, correlating with age and education. Turkish nurses' training improved suctioning knowledge and skills, while an observational study on 63 ICU nurses revealed satisfactory understanding of suctioning systems. Recommendations for ongoing training and larger research samples were emphasized throughout the studies.

CONCLUSION

This cross-sectional study assesses nurses' knowledge and practices regarding pediatric endotracheal tube suctioning in public sector hospitals in District Charsadda. It finds that the nurses generally have satisfactory knowledge and excellent suctioning practices, although most lack formal ICU training. The study highlights that while competency has been gained through experience, some nurses show inadequate knowledge. It stresses the need for ongoing education, skill-based workshops, and continuous professional development to enhance evidence-based practices and improve patient care quality and safety.

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