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ORIGINAL RESEARCH

How knowledgeable is the recovery room nurse you entrust your patient to about postoperative airway emergencies?

J Scribante,[1] H Perrie,[1] S Chetty[2]

[1] Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, South Africa
[2] Department of Anaesthesiology and Critical Care, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa
Corresponding author, email: *juan.scribante@wits.ac.za*

Introduction: Respiratory complications remain an important cause of morbidity and mortality in the post-anaesthetic period. This study aimed to describe the knowledge of postoperative airway emergencies of recovery room nurses attending two separate anaesthetic symposia held in Cape Town and Johannesburg.

Methods: A cross-sectional research design was followed by means of an anonymous, self-administered, previously described questionnaire using a convenience sampling method.

Results: A total of 309 nurses took part in the study, 116 (37.5%) and 193 (62.5%) in Cape Town and Johannesburg, respectively. Of the nurses, 279 (90.3%) were female, had a mean (SD) age of 44.6 (10.4) years (n = 198) and had 11.5 (9.2) years of operating room experience (n = 304). One hundred and fifty (50.8%) were registered nurses and 196 (62.5%) worked in the private sector. The overall mean score obtained by the nurses was 40.4% (SD 17.9), with a range of 0–88%. This is 30% below the predetermined competency score of ≥ 70%, which was achieved by only 24 (7.8%) nurses. The lowest median (IQR) scores, 16.7% (0–33.3) and 16.7% (0–50) were obtained in the clinical signs and treatment sections of the questionnaire, respectively.

Conclusion: This study showed that the nurses sampled had poor knowledge of postoperative airway emergencies in the recovery room. Legal action in the healthcare environment is a reality in South Africa. The anaesthetist remains accountable for ongoing patient care in the recovery room until discharge. Therefore, it is of the utmost importance that anaesthetists know how knowledgeable the recovery room nurses whom they entrust their patients to are regarding postoperative airway emergencies.

Keywords: postoperative airway emergencies, recovery room, nurse, knowledge

Introduction

Respiratory complications remain an important area of concern as morbidity and increased mortality in the post-anaesthetic period contribute directly to increased length of hospital stay and cost of care. Cheney et al.[1] noted that adverse outcomes related to respiratory complications are a leading cause of malpractice claims in anaesthesiology. The most common postoperative respiratory complications include post-extubation hypoxaemia, acute respiratory failure, pulmonary oedema and atelectasis, with an incidence of approximately 10%.[2]

The period immediately following surgery or a procedure is critical to a patient's recovery.[3] The purpose of a recovery room, therefore, is to provide a safe environment for an anaesthetised patient to recover postoperatively. This requires vigilant observation of patients, timeously recognising deterioration and starting treatment to either prevent complications or reduce their severity.[3] To achieve a safe recovery room environment, it is essential that the recovery room should be adequately staffed by competent and trained nurses. It is also advisable that recovery room nurses receive continuous education and evaluation of their knowledge and skills of post-anaesthesia care.[4]

The South African Society of Anaesthesiologists (SASA) Practice Guidelines[4] specify that the anaesthetist remains accountable for ongoing patient care in the recovery room until discharge. However, in practice, the anaesthetist entrusts patient care to the recovery room nurse. It is, therefore, important for the anaesthetist to have an understanding of recovery room nurses' knowledge of respiratory complications. This study aimed to describe the knowledge of postoperative airway emergencies of recovery room nurses attending two nursing anaesthesia symposia held in Cape Town and Johannesburg.

Methods

Approval to conduct the study was obtained from the Human Research Ethics Committee (Medical) (M130302) of the University of the Witwatersrand and other appropriate authorities. A cross-sectional research design was followed. Convenience sampling was used as nurses attending two nursing anaesthesia symposia (one held in Cape Town and the other held in Johannesburg) were invited to take part in the study. All nurses (except student nurses) who care for patients in the recovery room were eligible to take part in the study. These nurses included recovery room, anaesthetic and scrub nurses who were either registered or non-registered nurses. The sample size was determined by the number of nurses who completed the questionnaire.

A self-administered, anonymous questionnaire developed by Van Huyssteen and Botha[5] and adapted by McCallum[6] was used in this study. Permission to use the questionnaire was obtained from one of the authors (Botha). The questionnaire consisted of three sections. Section 1 covered the characteristics of the participating nurses. Section 2 consisted of 24 questions

Table I: Summary of Section 2 of the questionnaire

Column 1	Column 2
Anatomical and or physiological disorder	
1. Passage of regurgitated gastric contents or other foreign material into the trachea and down to the smaller air units	A. Soft tissue obstruction
2. Characterised by spasmodic contractions of the bronchial tubes	B. Laryngeal oedema
3. Pharynx is blocked and air cannot flow in or out; tongue common cause	C. Laryngospasm
4. Increased total lung water, commonly caused by an upper airway obstruction	D. Bronchospasm
5. Swelling of the laryngeal tissue; extubation is common cause	E. Noncardiogenic pulmonary oedema
6. Reflex contractions of the pharyngeal muscles with spasms of the vocal cords	F. Aspiration
Clinical signs	
7. Stridor, retractions, hoarseness and croup-like cough, restlessness	A. Soft tissue obstruction
8. Respiratory distress, tachypnoea, production of frothy sputum, rales and rhonchi sounds on auscultation, desaturation with hypercarbia	B. Laryngeal oedema
9. Tachypnoea and hypoxaemia, wheezing, coughing, dyspnoea, hypotension, apnoea and bradycardia	C. Laryngospasm
10. Dyspnoea, hypoxia, hypoventilation, absence of breath sounds, hypercarbia	D. Bronchospasm
11. Snoring, respiratory workload, tachycardia, decreased oxygen saturation level	E. Noncardiogenic pulmonary oedema
12. Wheezing, noisy shallow respirations, chest retractions, use of accessory muscles, dyspnoea, hypertension and tachycardia	F. Aspiration
Treatment	
13. Removing any possible irritants or drugs; initialising of bronchodilators	A. Soft tissue obstruction
14. Hyperextension of head, positive pressure ventilation instituted with ambubag, mask and oxygen; removal/reversal of stimulus	B. Laryngeal oedema
15. Placing patient in upright position, use of cool, humidified oxygen, inhalation of adrenaline solution	C. Laryngospasm
16. Lowering of patient's head, if possible, positioning on side, CPAP and supplemental oxygen	D. Bronchospasm
17. Stimulation of patient, hyperextension of the head by nonreactive patient, insertion of oral/nasal airway	E. Noncardiogenic pulmonary oedema
18. Maintenance of an unobstructed airway and supplemental oxygen to correct hypoxaemia, CPAP or re-intubation and mechanical ventilation	F. Aspiration
19. Which of the following statements are true with reference to soft tissue obstruction? • Patients who undergo spinal anaesthesia are at high risk of soft tissue airway obstruction. • The tongue can be relaxed due to general anaesthesia, narcotics and muscle relaxants administered during surgery, causing a postoperative soft tissue airway obstruction. • Soft tissue airway obstruction never occurs in the recovery room. • Patients displaying signs of soft tissue airway obstruction can be left unattended as it will resolve spontaneously.	
20. Which of the following statements are true with reference to laryngeal oedema? • Laryngeal oedema presents with slow quiet breathing, good chest movement and air entry, a calm and comfortable patient who saturates well on room air. • The usual onset of presentation is delayed – over 24 hours postoperative and thus is never seen in the recovery room. • Patients with laryngeal oedema should be given **adrenaline intravenously** (IV), and **steroid nebulisation** routinely. • Patients with laryngeal oedema should be given **steroids intravenously** (IV), and **adrenaline nebulisation** routinely.	
21. Which of the following statements are true with reference to laryngospasm? • Common risk factors for the development of laryngospasm include secretions, vomitus or bleeding in the airway, upper respiratory tract infection, and airway manipulation under "light anaesthesia". • Children never develop laryngospasm. • The most appropriate management for laryngospasm is to immediately paralyse the patient and re-intubate them as soon as possible. • Recognition and diagnosis of laryngospasm is only possible once the patient is cyanosed (blue).	
22. Which of the following statements are true with reference to bronchospasm? • Bronchospasm only occurs in asthmatic patients. • Bronchospasm can be triggered by certain drugs such as morphine, as well as allergic reactions. • Patients with bronchospasm will be breathing slowly and quietly, talking calmly in full sentences. • Management of bronchospasm includes nebulisation.	
23. Which of the following statements are true with reference to non-cardiogenic pulmonary oedema? • Non-cardiogenic pulmonary oedema requires oxygen therapy with or without ventilatory support and treatment directed at the cause. • Patients in pulmonary oedema present with shortness of breath with laboured breathing, hypoxia and hypoxaemia. • Non-cardiogenic pulmonary oedema is always mild and self-limiting. • A patient in pulmonary oedema will always have a "silent chest" on auscultation.	
24. Which of the following statements are true with reference to aspiration? • Aspiration of foreign material can occur in the operating theatre, recovery room or during transfer from the operating theatre to recovery room. • To prevent aspiration in a patient who is actively vomiting, lie them flat on their back (supine) with an oxygen mask on their face. • Patients at highest risk for aspiration are starved patients who undergo neuraxial (i.e. spinal/epidural) procedures only. • Aspiration pneumonia will develop only if a patient is vomiting blood.	

regarding the anatomy and/or physiology, clinical signs and treatment of postoperative airway emergencies. There were 18 questions where the airway emergency had to be matched to the statement that most accurately described it. In the further six questions, true statements regarding the airway emergency had to be indicated. A summary of the questions from Section 2 is shown in Table I. In Section 3, participants rated their perceived competence regarding the identification and treatment of airway emergencies, using a four-point Likert scale, as either poor, basic, intermediate or advanced/expert.

The questionnaires were handed out at the beginning of a session at the two respective symposia and participants were allowed half an hour to complete the questionnaire. The authors and assistants were present to prevent data contamination and to answer any queries. Completed questionnaires were placed in a sealed box to maintain confidentiality and anonymity. Return of the questionnaire was considered implied consent for participation. Adequate knowledge (pass mark) as determined by van Huyssteen and Botha[5] was regarded as obtaining a score of 70% or more. Questions not answered were considered incorrect.

Data were analysed using GraphPad InStat version 3.1 (GraphPad Software, La Jolla California, USA). Categorical variables were described using frequencies and percentages, and continuous variables using means and standard deviations or medians and interquartile ranges depending on the distribution of the data. Comparisons between groups were made using either an independent t-test or a Mann–Whitney U test. A p-value of < 0.05 was considered statistically significant. An indication is given in the results for questions where not all nurses responded.

Table II: Characteristics of the nurses

Characteristics	*n*	%
Sex		
• Male	20	6.5
• Female	279	90.3
• Not reported	10	3.2
Sector		
• Public	111	35.9
• Private	193	62.5
• Not reported	5	1.6
Highest qualification		
• Auxiliary nurses	43	13.9
• Staff nurses	108	35.0
• Registered nurses	91	29.4
• Theatre trained nurses	50	16.2
• ICU trained nurses	6	1.9
• Other	5	1.6
• Not reported	6	1.9

	Mean %	SD	Range
Age (years) $n = 198$	44.6	10.4	20–65
Operating room experience (years) $n = 304$	11.5	9.2	< 1–37

Results

A total of 309 nurses took part in the study, 116 (37.5%) and 193 (62.5%) in Cape Town and Johannesburg, respectively. The characteristics of the nurses are shown in Table II.

The overall mean score obtained by the nurses was 40.4% (SD 17.9), with a range of 0–88%. This mean score is 29.6% below the predetermined competency score of ≥ 70%, which was achieved by only 24 (7.8%) nurses. The median score for each section of the questionnaire is shown in Table III and illustrated in Figure 1.

Table IV shows a comparison of scores obtained by nurses in the different sectors and by professional status. The number of participants answering individual questions correctly is presented in Table V.

Table III: Median scores for each section of the questionnaire

Section	Median score %	IQR %
Anatomy and physiology	66.7	50–100
Clinical signs	16.7	0–33.3
Treatment	16.7	0–50
General knowledge	50.0	16.7–66.7

Table IV: Comparison of scores obtained by nurses

	n	Mean (SD) score %	*p*-value
Sector			
• Public	111	35.5 (16.3)	
• Private	193	43.3 (17.9)	
Total	304		0.0002
Professional status			
• Non-registered nurses	151	33.3 (16.0)	
• Registered nurses	152	47.4 (16.6)	
Total	303		0.0001

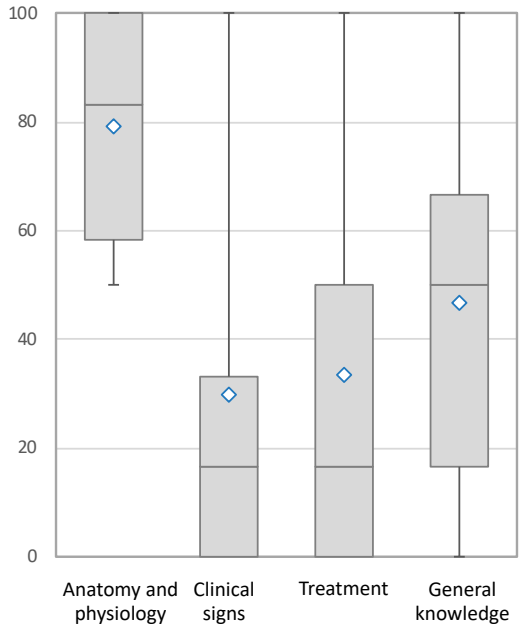

Figure 1: Median scores for each of the sections in the questionnaire

The ratings of nurses' perceived level of competence in identifying and treating an obstructed airway are shown in Table VI. Several nurses did not rate their competence at all, while others only rated some of the items. On average, 119 (38.2%) of the nurses did not rate their competence. Seventeen nurses rated themselves as having advanced/expert competence for all 12 of the items; these 17 nurses obtained a mean overall score of 57%.

Table V: Number of nurses answering individual questions correctly

Section	*n*	%
Anatomy and physiology		
Soft tissue obstruction	248	80.3
Laryngeal oedema	253	81.9
Laryngospasm	163	52.8
Bronchospasm	202	65.4
Non-cardiogenic pulmonary oedema	193	62.5
Aspiration	169	54.7
Clinical signs		
Soft tissue obstruction	43	13.9
Laryngeal oedema	99	32.0
Laryngospasm	67	21.7
Bronchospasm	58	18.8
Non-cardiogenic pulmonary oedema	117	37.9
Aspiration	16	5.2
Treatment		
Soft tissue obstruction	129	41.7
Laryngeal oedema	83	26.9
Laryngospasm	53	17.2
Bronchospasm	107	34.6
Non-cardiogenic pulmonary oedema	97	31.4
Aspiration	66	21.4
General knowledge		
Soft tissue obstruction	199	64.4
Laryngeal oedema	91	29.4
Laryngospasm	101	32.7
Bronchospasm	122	39.5
Non-cardiogenic pulmonary oedema	127	41.1
Aspiration	194	62.8

Discussion

The overall score obtained by the nurses in this study was 40.4%. This score is similar to the scores obtained in two previous studies using the same questionnaire. In 2004, private sector recovery rooms nurses in Pretoria[5] obtained a score of 43%, and in 2015 public sector recovery room nurses in Johannesburg[6] obtained a score of 46%. This study's results are also similar to knowledge studies done in critical skill topics among intensive care nurses (40.3%[7] and 40.6%[8]) and anaesthetists (50%[9] and 43.4%.[10]). In this study, there were statistically significant differences between the knowledge of nurses working in the public and private sectors and the professional status of nurses. However, the question arises whether, in practice, there is a difference between a mean score of 35.5% and 43.3% for the respective sectors and 33.3% and 47.4% between non-registered and registered nurses.

Only 7.8% of nurses obtained an overall score of 70% or more. This is similar to the previously reported 4.7% in Pretoria,[5] but lower than the reported 20.8% in Johannesburg.[6] A possible explanation for the difference is that the Johannesburg study[6] was done at two central hospitals and one tertiary hospital, whereas this study included nurses from various hospital levels. The results of this study are a concern, as the diagnosis and management of airway emergencies from a nursing perspective is a requirement according to the nursing Scope of Practice Regulation 2598.[11]

Broadwill[12] identified four stages of competence, namely, unconscious incompetence, conscious incompetence, conscious competence and unconscious competence. Several nurses did not score their competence regarding the identification and treatment of postoperative airway emergencies at all, while others only scored some of the items. On average, 38.2% did

Table VI: Perceived level of competence in identifying and treating an obstructed airway

	Not reported	Poor	Basic	Average	Advanced/Expert
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Identifying					
Soft tissue obstruction	117 (37.9)	18 (5.8)	62 (20.1)	49 (15.9)	63 (20.4)
Laryngeal oedema	122 (39.5)	30 (9.7)	64 (20.7)	52 (16.8)	41 (13.3)
Laryngospasm	121 (39.2)	15 (4.9)	57 (18.4)	48 (15.5)	68 (22.0)
Bronchospasm	113 (36.6)	18 (5.8)	58 (18.8)	60 (19.4)	60 (19.4)
Non-cardiogenic pulmonary oedema	120 (38.8)	36 (11.7)	82 (26.5)	40 (12.9)	31 (10.0)
Aspiration	107 (34.6)	14 (4.5)	51 (16.5)	66 (21.4)	71 (23.0)
Treatment					
Soft tissue obstruction	121 (39.2)	17 (5.5)	71 (23.0)	46 (14.9)	54 (17.5)
Laryngeal oedema	125 (40.5)	25 (8.1)	77 (24.9)	42 (13.6)	40 (12.9)
Laryngospasm	121 (39.2)	16 (5.2)	73 (23.6)	50 (16.2)	49 (15.9)
Bronchospasm	123 (39.8)	10 (3.2)	68 (22.0)	55 (17.8)	53 (17.2)
Non-cardiogenic pulmonary oedema	123 (39.8)	35 (11.3)	77 (24.9)	42 (13.6)	32 (10.4)
Aspiration	113 (36.6)	6 (1.9)	54 (17.5)	70 (22.7)	66 (21.4)

not rate their competence. A possible explanation might be that these nurses were in the consciously incompetent stage and were aware that their knowledge was lacking. It is of concern that there seems to be a group of unconsciously incompetent nurses in this study. Only 5.2% of nurses could correctly answer the question on the signs and symptoms of aspiration, but 44.4% rated their competence to identify aspiration as average or advanced/expert and only 4.5% rated their competence as poor. Similarly, 17.2% of nurses could correctly answer the question on the treatment of laryngospasm, but 32.1% rated their competence to treat laryngospasm as average or advanced/expert and only 5.2% rated their competence as poor. Also, the 17 nurses who rated all 12 of the perceived competence items as having advanced/expert competence obtained a mean overall score of 57%. When individuals are in the unconscious incompetence stage, they must first recognise their incompetence as well as the value of the new skill, before moving on to the next stage. Therefore, subjecting the nurses to an educational intervention only may have limited benefit.

To date, there is no South African Nursing Council accredited course for recovery room nurses. Some institutions offer in-house training courses or individual anaesthetists teach nurses informally. SASA offers educational activities such as the annual national congress nursing programme and workshops addressing various aspects of recovery room nursing. This study has shown that there is a desperate need for a standardised and preferably accredited recovery room nursing educational programme. SASA has attempted to establish such a course in conjunction with the South African Nursing Council but has not succeeded. A group of anaesthetists and nurses under the auspices of SASA is, in the meantime, in the process of developing a national standardised SASA course.

It is important to be cognisant of the fact that the completion of a national standardised anaesthetic course will ensure that recovery room nurses will be able to function as an advanced beginner. Scribante et al.[13] illustrates the nurse's development process (Figure 2) and how important it is for nurses to maintain expertise and competence throughout their careers. The nurse develops fairly rapidly from being a novice to an advanced beginner to a competent, proficient nurse. The expert nurse usually develops more slowly, but development in this phase is of the utmost importance. If the development is not maintained, a decline is inevitable, and the nurse descends the competency curve. It is, therefore, essential for recovery nurses to embark on a journey of lifelong learning.

A national standardised SASA course will contribute towards recovery room nurses' knowledge of postoperative airway emergencies. It is, however, not a silver bullet. Nurses in recovery rooms do not function in silos. The performance of nurses, and healthcare workers in general, is not only influenced by skills and knowledge, but also by an array of factors such as systems and facility, or personal issues.[14] According to Dieleman and Harnmeijer,[14] examples of systems and facility issues include the availability of appropriate healthcare worker:patient ratios, infrastructure, equipment and support systems. Support systems should include systems such as effective management, information systems and accountability systems. Holding healthcare workers accountable for their performance might offer opportunities to improve performance. On a personal level, apart from lifelong learning, motivation and job satisfaction play important roles in the performance of healthcare workers. Demotivation and job dissatisfaction leads to poor attitudes that further undermine performance.

A limitation of this study is that it was done contextually at two anaesthetic nursing symposia in Cape Town and Johannesburg and may not reflect the knowledge of all recovery room nurses in South Africa. Convenience sampling was used, and this may result in bias, as certain elements may be either overrepresented or underrepresented. It is recommended that a more comprehensive national study should be done to evaluate recovery room nurses' knowledge. The results from such a study could assist with the development of the national standardised SASA course.

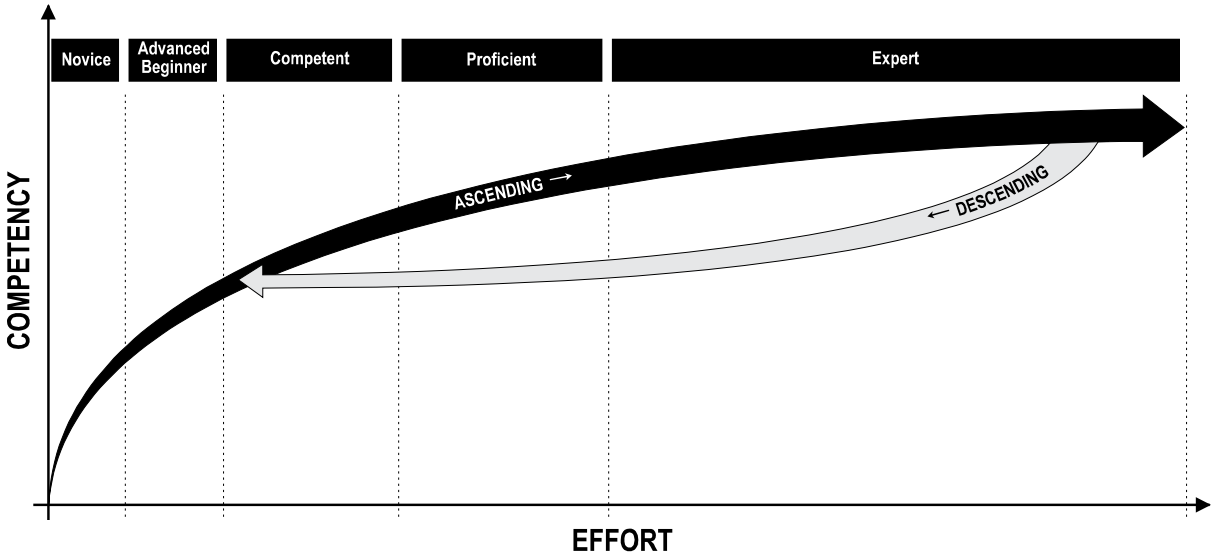

Figure 2: Development process[13]

Conclusion

This study showed that the nurses who responded to the questionnaire had poor knowledge of postoperative airway emergencies in the recovery room. Legal action in the health-care environment is a reality in South Africa. The anaesthetist remains accountable for ongoing patient care in the recovery room until the patient is discharged.[4] Therefore, it is of the utmost importance that anaesthetists know how knowledgeable the recovery room nurses whom they entrust their patients to are regarding postoperative airway emergencies.

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Conflict of interest

The authors declare that there are no financial or personal relationships, which may have inappropriately influenced the authors in writing this paper.

Ethical approval

Approval to conduct the study was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand and other appropriate authorities (M130302).

ORCID

J Scribante https://orcid.org/0000-0002-2221-5024
H Perrie https://orcid.org/0000-0002-9890-7887
S Chetty https://orcid.org/0000-0002-9878-5488

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