

Magnitude of Airway Problems at a University Teaching and Referral Hospital Recovery Room of Low Resource Setting-A Cross Sectional Study

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Abstract

Background: Airway management is a basic life-saving intervention which is used when the patient's breathing effort is compromised due to various reasons. Postsurgical patients are at risk of developing airway problems due to co-morbidities, intraoperative complications, surgery and anaesthetic drug effects. The severity of illness, analgesic drugs like narcotics and postoperative standard of monitoring may impact on breathing process of the patients. We aimed to assess the magnitude of airway problems at the recovery room.

Methods and material: Cross sectional study conducted at a referral hospital recovery room, 2014. Standardized checklist used for data collection. All patients with airway problem who admitted at the recovery room during the study period were included in the study. Descriptive statistics and Chi-square were used.

Results: One hundred seventy seven patients developed airway problems over five months duration. Of these, 47.5%, 32.2%, and 20.3% patients developed mild, moderate and severe airway problems respectively. The major airway problems were desaturation (62.7%), respiratory arrest (14.7%), aspiration (18.1%), bronchospasm (3.4%) and laryngospasm (1.1%) respectively. Factors associated with severity of airway problems were ASA status ($P=0.031$), type of trauma ($P=0.026$), intraoperative analgesia ($P=0.020$) and type of patient ($P=0.049$). The interventions made were ETTI or LMA (35%) patients, nasopharyngeal airway insertion (21.5%), oral airway (14.1%), oxygen supplementation (10.2%), surgical airway (9.6%), recovery position (7.3%) and emergency airway manoeuvre (2.3%) respectively. Anaesthetists involved in airway management in 30.5% of patients.

Conclusion: The magnitude of airway problem was high. We recommend the availability of well trained staff for airway management and fulfilment of basic equipments and drugs for patient monitoring and resuscitation. High airway problems are an alarm for the need for well-equipped recovery room with well trained staff, patient monitoring and resuscitation materials.

Keywords: Airway; Anaesthesia; Surgery; Trauma; Recovery

Abbreviations: ASA: American Society of Anesthesiologists; AVPU: Alert Verbal Response Pain Unresponsive; ECG: Electrocardiography; GCS: Glasgow Coma Scale; ENT: Ear Nose Throat; ETTI: Endotracheal Tube Intubation; GA: General Anaesthesia; LMA: Laryngeal Mask Airway; OPV: Oropharyngeal Visualization; RA: Regional Anaesthesia.

Introduction

The first 24 h after surgery and anaesthesia is a period of liability even for a relatively healthy surgical patient. The immediate postoperative period is a time when patients are at significant risk of experiencing anaesthetic and surgical complications [1-3]. Approximately 10% of anaesthetic complications occur in the recovery room [4]. The potential causes are co-morbidities, anaesthetic drug residual effects, intraoperative surgical and anaesthetic related complications, factors related with recovery room facility such as monitoring equipments, resuscitation materials and skill of recovery room staffs [5,6].

Moreover, the incidence of complications is more common in patients with mild or moderate co-existing disease where morbidity

occurred in 7-30% of the recovery room admissions [7,8]. This implies the need for further advancement of the recovery room facility as respiratory complications remain the main cause of increased hospital stay, health costs and are associated with high morbidity and mortality rates [9,10].

Moreover, poor identification of risky patients, poor or incomplete planning, inadequate provision of skilled staff and equipment to manage these events successfully, delayed recognition of events, and failed rescue due to lack of or failure of interpretation of capnography impact negatively on patient outcome [11-16].

Establishing a secure airway in a trauma patient is one of the primary essentials of treatment and any error in airway management may lead to severe morbidity and mortality [17,18]. Airway management is a core skill of emergency medicine and physicians in the emergency department must be able to provide definitive resuscitative care to all patients who presented with an acute threat to life [18-22].

Postsurgical patients and trauma patients have been admitted and managed in our hospital recovery room until they become stable, and be discharged either to home or wards. Respiratory complications in postsurgical and trauma patients can be affected by recovery room

facilities such as the availability of monitoring equipments, drugs, the location and the design of the recovery room in relation to the operation theatre. Moreover, the number and skill of recovery room staff are the main factors. These adverse airway problems will be tremendous in resource-limited settings like our country. We assessed the magnitude of airway problems and contributing factors at the recovery room of teaching and referral hospital.

Materials and Methods

Ethical clearance was obtained from institutional ethical review board of our University. Official permission letter also obtained from the hospital. Written informed consent was obtained from each study subject and/ or attendants after explanation of what they will take part in the research and any involvement was after their complete consent. Anyone not willing to participate in the study had had full right not to participate. Confidentiality was ensured from all the data collectors and investigators by avoiding personal identification on the questionnaire and keeping questionnaires locked. Those patients who have had any airway problem at the time of data collection were given treatment by investigators and data collectors in collaboration with responsible recovery room nurses, interns and physicians. Hospital based cross sectional study was conducted at a university of teaching and referral hospital recovery room from February 15 to August 20, 2014. All consecutive patients with airway problems who admitted at the recovery room during the study period.

Dependent variable

Presence of airway problem (yes/no).

Independent variables

Socio-demographic variables: Age, sex, educational status, religion, ethnicity and occupation.

Factors related with preoperative status: American Society of Anesthesiologist (ASA) status, preoperative oropharyngeal visualization (OPV) status, and Glasgow comma Scale (GCS) or Alert, Verbal, Pain, Unresponsive (AVPU) level either at admission, presence of medical co-morbidity and documented electrolyte imbalance.

Factors related with anaesthesia: Seniority of anaesthetist, type of anaesthesia (General Anaesthesia(GA): Endotracheal Tube Intubation (ETI), Laryngeal Mask Airway (LMA), sedation and Regional Anaesthesia (RA): epidural, spinal, caudal and peripheral nerve blocks), duration of anaesthesia, type of induction and maintenance anaesthetic drug, analgesic drug used (opioid, tramadol, diclofenac, paracetamol and nerve block), difficult intubation, difficult extubation, episode of desaturation during anaesthesia, aspiration and level of consciousness immediately after anaesthesia.

Factors related with surgery: Seniority of surgeon, type of operation (elective vs. emergency, minor vs. major, inpatient vs. Outpatient Department (OPD), trauma vs. non trauma, ENT-abdominal, orthopedic, urology and plastic), duration of surgery, intraoperative complication and intraoperative vital sign.

Factors related with trauma: Presentation, duration of complaint, intervention done, vital sign at admission, type of trauma (head, facial, neck, upper/lower limb, chest, abdominal etc), GCS or AVPU, associated problems (aspiration, desaturation).

Type of airway problem occurred and interventions done: Desaturation episode, oxygen supplementation (face mask, nasal probe), aspiration, bronchospasm, laryngospasm, and intubation.

Factors related with equipment availability at recovery room: Blood Pressure (BP) apparatus, pulseoximetry, capnograph, Electrocardiography (ECG), thermometer, suction machine with catheter, oxygen source (pipeline, cylinder), ambu bag, face mask, laryngoscope, endotracheal tube, airway (oral and nasal), heater, nebulizer, defibrillator, mechanical ventilator and emergency drugs.

Operational definitions

Airway problem or adverse airway incident: Defined when there is any intervention required including chin support and controlled oxygen therapy, with or without the use of an oral airway. It includes airway obstruction not relieved by these methods, hypoventilation as defined by a respiratory rate of less than 8 breaths per minute or bronchospasm.

Additional intervention: When treatment used to relieve the airway problems such as suction of secretions or blood from the airway, insertion of a nasopharyngeal airway, administration of drugs such as doxapram, neostigmine or bronchodilators and artificial ventilation using a bag and mask, and intubation using endotracheal tube and LMA.

Severity of airway problem: Will be graded as minor if there will be no immediate threat to life and the incident will be dealt with by recovery staff alone. And serious if recall of anaesthetic staff will be needed.

Data collection procedures and data quality control

A pre-tested and standardized checklist used for observation in the recovery room and to collect data from the patients' chart and anaesthetic record sheets. And patients were observed for 2-4 h starting from at the time of admission to decide whether the patient has any airway problem. Recovery room head nurse was interviewed about the facilities available at the recovery room. Two BSc holder data collectors were selected and one day training was given.

To ensure the quality of data, training was be given for data collectors and the investigators directed and monitor the whole data collection processes for consistency, completeness and accuracy. Pre-test was done, data was cleaned and checked every day, and double data entry technique was used during data entry.

Data processing and analysis

The returned questionnaires were checked for completeness, cleaned manually and entered in to SPSS windows version 20.0 for analysis. Chi-square used to determine the association between severity of airway problem and risk factors. Frequencies and cross tabulations were used to summarize descriptive statistics of the data and tables and graphs used for data presentation.

Results

Socio-demographic characteristics of study participants

A total of 177 patients with airway problem were admitted to the recovery room during the study period. Of these, 123 (69.5%) and 54 (30.5%) were males and females respectively. One hundred and sixty

one out of 177 (91%) patients were ASA1, ASA2 (n=5, 2.8%), ASA3 (n=6, 3.4%), and ASA5 (n=5, 2.8%) respectively. The minimum, maximum and mean age of the study participants were 2, 80 and 28.52 ± 16.67 years respectively (Table 1).

Variable	Frequency (n)	Percentage (%)
Educational status		
Illiterate	65	36.7
Only write and read	24	13.6
Primary education	49	27.7
Secondary education	17	9.6
Certificate and diploma	18	10.2
Degree and above	2	1.1
Not applicable	2	1.1
Occupation		
Government employee	20	11.3
Merchant	10	5.6
NGO employee	3	1.7
House wife	31	17.5
Daily labourer	3	1.7
Student	52	29.4
Farmer	56	31.6
NA	2	1.2
Medical co-morbidity		
No	166	93.8
Yes	11	6.2

Table 1: Baseline variables of study participants.

Factors related with anaesthesia

One hundred twenty four out of 177 (n=124, 70.1%) patients underwent operation. Of these, 84 out of 124 were anaesthetized by junior anaesthetists. The majority of patients (n=107, 60.5%) were operated under general anaesthesia with endotracheal intubation (GA with ETTI). Five patients were given GA with LMA (Laryngeal mask airway), 10 with GA with sedation and two patients spinal anaesthesia. The majority of patients (n=119, 67.2%) were induced with intravenous anaesthetics and four patients were induced with inhalational anaesthetics. Seventy eight patients were given non opioid analgesia, 24 opioid analgesia whereas 14 combined opioid and non-opioid analgesics during operation. Sixty out of 124 patients were given no analgesia. One hundred fifteen patients were maintained with intravenous anaesthetics whereas four with inhalational anaesthetics. The minimum, maximum and median duration of anaesthesia was 30 min, 240 min and 50 ± 43.19 minutes respectively. Intraoperative desaturation occurred in 6 patients (Table 2).

Variable	Frequency (n)	Percentage (%)
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Difficult intubation		
No	96	89.7
Yes	11	10.3
Difficult extubation		
No	101	94.4
Yes	6	5.6
Intraop desaturation		
No	101	94.4
Yes	6	5.6
Intraop aspiration		
No	96	89.7
Yes	11	10.3
Recovery status		
Fully awake	89	83.2
Not fully awake	18	16.8

Table 2: Factors related with anaesthesia.

Factors related with surgery

The majority of operations were performed by residents (n=128, 94.8%) whereas the rest (n=7, 5.2%) by senior surgeons. Seventy five out of 135 operations were major surgery (Table 3). The minimum, maximum and median duration of surgery was 30 min, 210 min and 30 ± 42.30 min respectively. The majority of operations were head and neck (Figure 1).

Variable	Frequency (n)	Percentage (%)
Urgency of operation		
Emergency	126	93.3
Elective	9	6.7
Extent of operation		
Major	75	55.6
Minor	58	42.9
Type of operation		
Trauma	120	88.9
Non trauma	15	11.1
Seniority of surgeon		
Resident	128	94.8
Senior	7	5.2

Table 3: Factors related with surgery.

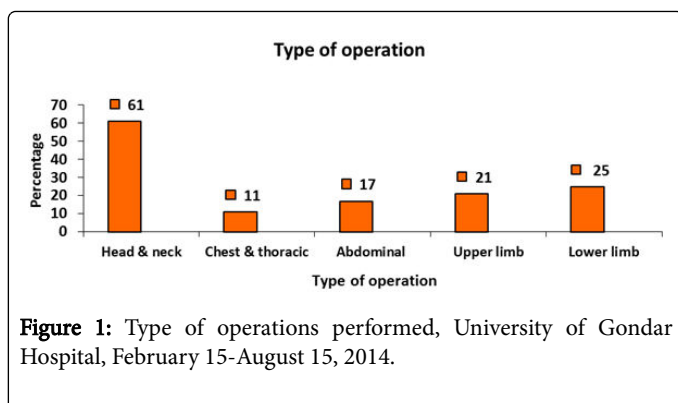


Figure 1: Type of operations performed, University of Gondar Hospital, February 15-August 15, 2014.

Factors related with trauma

Of the total study patients, trauma accounts 159 (89.8%) patients whereas the rest of the patients are surgical patients. Human violence (n=62, 38.9%) was the leading cause followed by car accident (n=39, 24.5%), fall down injury (n=39, 24.5%) sharp object (n=6, 3.8%), fire accident (n=5, 3.1%), bajaj injury (n=4, 2.5%) and animal injury (n=4, 2.5%) (Table 4). The minimum, maximum and median (SD) of time from accident to arrival to recovery room were 0.5 h, 1 year and 7 ± 678.82 h respectively.

Magnitude of airway problems at the recovery room and interventions performed

One hundred seventy seven patients developed airway problems over five months duration in this teaching and referral hospital recovery room. Of these, 84 (47.5%), 57 (32.2%), and 36 (20.3%) patients developed mild, moderate and severe airway problems respectively (Table 4). The major causes for airway problems were desaturation 111 (62.7%), respiratory arrest (n=26, 14.7%), aspiration (n=32, 18.1%), bronchospasm (n=6, 3.4%) and laryngospasm (n=2, 1.1%) respectively (Table 4).

Variable 159	Frequency (n)	Percentage (%)
Type of trauma		
Human violence	62	39.9
Car accident	39	24.5
Fall down injury	39	24.5
Sharp object	6	3.8
Fire accident	5	3.1
Bajaj accident	4	2.5
Animal injury	4	2.5
Severity of airway problems		
Mild	47.5	93.3
Moderate	57	32.2
Severe	36	20.3
Causes for patient admission at the recovery room		

Desaturation	111	62.7
Aspiration	32	18.1
Bronchospasm	6	3.4
Laryngospasm	2	1.1
Respiratory arrest	26	14.7
Airway management in the recovery room		
Emergency airway maneuver	4	2.3
Recovery position	13	7.3
Oral airway	25	14.1
Nasopharyngeal airway	38	21.5
ETTI or LMA	62	35
Surgical airway	17	9.6
No intervention	18	10.2

Table 4: Factors related with airway problems and management in the recovery room.

The interventions made were ETTI or LMA 62 (35%) patients, nasopharyngeal airway insertion (n=38, 21.5%), oral airway (n=25, 14.1%), oxygen supplementation (n=18, 10.2%), surgical airway (n=17, 9.6%), recovery position (n=13, 7.3%) and emergency airway manoeuvre (n=4, 2.3%) (Table 4) Anaesthetist were involved for airway management only in 54 out of 177 patients (n=54, 30.5%).

Factors that contributed to airway problems at the recovery room

The majority of patients who operated under GA with ETTI developed moderate and severe airway problems (Figure 2).

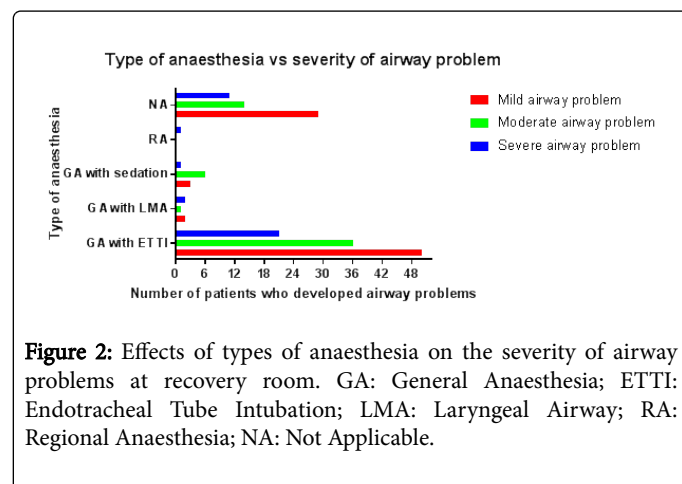


Figure 2: Effects of types of anaesthesia on the severity of airway problems at recovery room. GA: General Anaesthesia; ETTI: Endotracheal Tube Intubation; LMA: Laryngeal Airway; RA: Regional Anaesthesia; NA: Not Applicable.

Most patients with difficult intubation during anaesthesia developed severe airway problem (n=4/11, 36.4%). Patients with intraoperative episodes of desaturation are also at high risk of developing airway problems (moderate; n=3/4, 75% and severe; n=1/4, 25%). Patients who were not fully awake at the end of anaesthesia were also at high risk of such problem (severe; n=1/3, 25%). As the American Society of Anaesthesiologists' (ASA) status increases, the risk of airway problem

also increased (Table 5). There were only noninvasive blood pressure apparatus and pulseoximeter in the recovery room during the study period. Concerning emergency drugs, only atropine and adrenaline were available during the study period.

Variable	Severity of airway problems			X ² (P-value)
	Mild	Moderate	Severe	
ASA status				
ASA1	79	53	29	0.031
ASA2	3	1	1	
ASA3	0	1	5	
ASA5	2	2	1	
Type of trauma				
Blunt	35	14	8	0.026
Penetrating	26	18	15	
Other	19	25	12	
NA	4	0	1	
Intraoperative analgesia				
Non opioid	28	28	22	0.02
Opioid	14	8	2	
Opioid and non-opioid	10	4	0	
Regional anaesthesia	0	1	0	
No	32	16	12	
Type of patient				
Surgical	16	5	2	0.049
Medical	1	0	2	
Trauma	67	52	32	

Table 5: Factors associated with the severity of airway problem in the recovery room, 2014 (X², α=0.05).

Discussion

In the current study, a large number of patients developed airway problems where 84 (47.5%), 57 (32.2%) and 36 (20.3%) patients developed mild, moderate and severe airway problems respectively. This could lead to patient morbidity and mortality unless early detection and appropriate interventions are made [18,23].

In this study, the major causes for airway problems were desaturation 111 (62.7%), respiratory arrest (n=26, 14.7%), aspiration (n=32, 18.1%), bronchospasm (n=6, 3.4%) and laryngospasm (n=2, 1.1%) respectively. This finding was comparable with previous studies [12-14] which might be due to anaesthetic, surgical and trauma effects on the respiratory system.

Furthermore, inadequate airway management has been a major factor in perioperative morbidity and mortality. Early detection and airway support are the key approaches to minimize adverse outcomes.

In this study, 54 out of 177 patients with respiratory problems were intubated in the recovery room which was low compared with a previous study that might attribute to our study population was postsurgical and trauma patients whereas the previous study's patients were ICU patients [14]. The other difference for low rate of intubation in our set up might be due to the low knowledge and skill of recovery room staff that may not detect the airway problems.

Of the total study subjects, trauma accounts 159 (89.8%) patients whereas the rest of the patients are surgical patients. Human violence (n=62, 38.9%) was the leading cause followed by car accident (n=39, 24.5%), fall down injury (n=39, 24.5%) sharp object (n=6, 3.8%), fire accident (n=5, 3.1%), bajaj injury (n=4, 2.5%) and animal injury (n=4, 2.5%). Establishing a secure airway in a trauma patient is one of the primary essentials of treatment and any mistake in airway management may lead to severe morbidity and mortality [17].

Moreover, our finding was also comparable with a study conducted in Nigeria where airway problem was very common in post-anaesthesia recovery room [22]. The interventions made were ETTI or LMA 62 (35%) patients, nasopharyngeal airway insertion (n=38, 21.5%), oral airway (n=25, 14.1%), oxygen supplementation (n=18, 10.2%), surgical airway (n=17, 9.6%), recovery position (n=13, 7.3%) and emergency airway manoeuvre (n=4, 2.3%) respectively.

In the current study, general anaesthesia with endotracheal intubation, intraoperative episode of desaturation, ASA3 and ASA5 patients, emergency surgery, trauma, not fully awake patients after anaesthesia and difficult intubation were the major risk factors for airway problems in the recovery room which was in agreement with previous studies [15-18].

Furthermore, there was lack of essential patient monitoring facilities in the recovery room during the study period. Noninvasive blood pressure apparatus, pulseoximeter were the only patient monitoring devices available. Concerning emergency drugs, only atropine and adrenaline were available. The availability of essential equipments and drugs are vital for proper patient monitoring and management according to the World Federation of Societies of Anaesthesiologists (WFSA) international standards for a safe practice of anaesthesia and Association of Anaesthetists of Great Britain and Ireland (AAGBI) recommendations for standards of patient monitoring during anaesthesia and immediate post anaesthesia recovery [24,25].

Lack of basic patient monitoring equipments, drugs and skilled manpower will impact negatively on the early detection of adverse respiratory events and patient management in the recovery room where the risk of respiratory and other complications are high particularly in the immediate postoperative period [18]. Moreover, the risks of airway problems are also high among trauma patients [11,18].

Conclusion

The magnitude of airway problem was alarmingly high in our hospital recovery room. ASA status, type of trauma, type of patient and intraoperative analgesia were the predictive factors for airway problems in the recovery room. General anaesthesia with endotracheal intubation, intraoperative episode of desaturation, emergency surgery, not fully awake patients after anaesthesia and difficult intubation were the major risk factors for airway problems in the recovery room although they didn't reach statistically significant. There was shortage of basic patient management facilities (monitoring equipments, resuscitation drugs and manpower) in the study area. We recommend

the availability of well trained staff for airway management and fulfillment of basic equipments and drugs for patient monitoring and resuscitation.

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