

A Prospective Study of Postanaesthesia Recovery Room Complications: Incidence and Treatment

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Objectives: To audit the incidence and nature of post-anaesthesia recovery room complications, their treatment, and review the role of recovery room in modern anesthetic practice. **Methods:** 3151 patients who received general or regional anaesthesia were admitted to the recovery room during six months period (August 01, 1995 to January 31, 1996). Information noted on forms by recovery nurse by encircling the pre-coded complication. **Results:** Out of 3151 patients, 2716 patient's data forms could be collected. Therefore results reflect 86% of the patients passing through the recovery. The overall incidence of complications in our population was 36.26%. Complications referable to CNS were 15.2.29%, the commonest of which was pain (51.26%); agitation (0.18%) and excessive drowsiness (1.01%). The second commonest system was GIT (25.07%) nausea (14.31%) and vomiting (12.18%). The third system was CVS (21.52%), bradycardia (5.48%), tachycardia (7.61%), hypertension (4.26%), hypotension (2.53%), myocardial ischaemia (0.81%) myocardial infarction (0.10%) and new arrhythmias (1.41%). The fourth system was Respiratory system (5.58%), hypoventilation (1.42%), bronchospasm (0.81%), laryngospasm (0/1%) and desaturation (SpO₂ < 90%) in (0.1%). 0.6% patients had to be reintubated. Two patients had oliguria. Miscellaneous complications were (9.94%). More than one complication was observed in some patients. The incidence of mortality in our study during this period was 0.40%. **Conclusion:** Every third patient is susceptible to get some form of complications in the immediate post-anaesthesia recovery period. It reflects the importance and need of a specialized designated area called recovery room with qualified staff.

Key words: Post anaesthesia, recovery room, complications

Recovery from anaesthesia is the process of reversal of the effects of the anaesthetic drugs used and of other physiological derangements due to anaesthetic techniques. It starts at the end of operation and post-operatively patients are shifted to the recovery room, adjacent to the operating room, where they remain for some time and recover from the immediate effects of their operation and anaesthetics till haemodynamically stable, conscious and ready to be shifted to ward. This period is called the primary recovery period and is very important because maximum morbidity and mortality occurs during this period.¹ Recovery from an anaesthetic is usually much quicker than recovery from the operation, but the anaesthetic complications that occur intra-operatively or early in the recovery period may be the cause of prolonged morbidity or late mortality. Usually standards of monitoring and health care during operative period are not extended into early post-anaesthesia or postoperative period. According to The national confidential enquiry into the perioperative deaths 1990, in several cases the absence of suitable facilities like recovery room, high dependency unit, intensive care unit, contributed to some deaths.² Unfortunately very few hospitals in Pakistan have the facilities of recovery room available.

Studies have been carried out abroad to define the incidence and nature of complications occurring in the recovery room^{3,4,5}. In Pakistan no prospective study done, only one retrospective audit carried out in 1991 at the Aga Khan University Hospital.

The present study carried out to look at the incidence and nature of complications occurring in the recovery room prospectively at the Aga Khan University Hospital during a six-month period (August 01, 1995 to January 31, 1996) where the workload of recovery room was between 500 to 600 patients per month.

Aims and objectives

- To audit the incidence and nature of post anaesthesia recovery room complications in a Pakistani hospital since a significant number of our patients have concomitant medical problems and in some of them disease is at a far advanced stage compared to the western population where the patient's problems are picked up earlier by the health services.
- To see the effectiveness of care and treatment in the immediate post anaesthesia recovery period in decreasing the morbidity and mortality related to anaesthesia.
- To review the current literature regarding role of recovery room in modern anaesthetic practice.

Methodology

This was a clinical audit and observational study, ethical approval was not required. 2716, consecutive patients entering the recovery room after general or regional anaesthesia during a six months period from August 01, 1995 to January 31, 1996 were included

Exclusion criteria Following a review of patients were not included in the study. Those who were shifted directly to intensive care unit from the operating room (on left side) or to the intensive care unit from the operating room without any general or regional anaesthesia, change of dressing or procedures done under local anaesthesia.

Staffing and design of the recovery room of Aga Khan University Hospital (AKUH).

The recovery room at the Aga Khan University Hospital is located next to the operating rooms. The design of recovery room is such that all the patients can be visualized from the nursing counter. The patient's head is close to the wall where monitoring equipments, oxygen outlet and suction apparatus are available. After completion of operation patients are shifted from the operating room to the recovery room by two persons: one of them is always the anaesthetist. The charge of patient's condition is handed over to recovery room nurse by the anaesthetist while taking the initial vitals. A nurse:patient ratio of one nurse to one unresponsive patient is maintained. Recovery room is supervised by an anaesthetist present in the recovery room or in the immediate vicinity.

Monitoring in the recovery room: Routine monitoring in the recovery room includes continuous ECG, heart rate, Pulse oximetry, skin colour, Respiratory rate, level of consciousness, and blood pressure (every 15 minutes). Invasive blood pressure or central venous pressure and temperature are monitored when specifically requested.

Study observation: Data record form included patient's name, age, medical record number, surgery performed, duration of surgery, type of anaesthesia whether general anaesthesia with spontaneous or IPPV (intermittent positive pressure ventilation) or regional anaesthesia (spinal or epidural).

The recovery room nurse recorded post anaesthetic complications by encircling the code assigned to each complication according to predefined criteria (Table I) on a specially designed form (Table II). Any treatment given and preoperative baseline readings noted in the column under treatment and comments.

Results

During six months period from August 01, 1995 to January 31, 1996, total 315 patients were admitted in the recovery room who received general or regional (spinal, epidural) anaesthesia. Only 271 (86.19%) patients the data forms could be collected forms were either incomplete or could not be collected in 435 (13.81%) patients. The results analyzed therefore only reflect 86% of

the patients passing through the recovery. Out of 2716 patients who received general or regional anaesthesia, 985 patients had one or more complications. The overall post anaesthesia recovery room complication rate was 36.26% (Table II). Further analysis of the results showed that 321 (52.89%) patients had complication referable to central nervous system, 212 (21.52%) to cardiovascular system, 55 (5.58%) to respiratory system, 247 (25.07%) to gastrointestinal system, 2 (0.02%) to renal and 98 (9.94%) to miscellaneous problem like hypoglycaemia, hyperglycaemia, shivering, urticaria etc. Some patients exhibited more than one complication. There was single mortality in the recovery room during this period, an eleven years boy who was involved in a road traffic accident, with crushed abdomen and pelvis, rushed to the operation room for emergency exploratory laparotomy and haemostasis. In the operating room, cardiopulmonary resuscitation with internal cardiac massage performed for an hour before start of surgery. Post operatively he remained on ventilator in the recovery room for 4-5 hours and expired.

Central Nervous System: CNS problems noted in 521 patients, 52.89% who developed complications and 19.18% of total admitted patients. The most common problem in the recovery room was pain, 505 patients, 51.26% who developed complications and 18.59% of total admitted patients. It means every fifth patient was in pain, who received analgesia. Of these 42% were female. Pain frequency was less in patients who received regional anaesthesia (epidural or caudal especially in children) for intra and postoperative pain management. Agitation noted in eight (0.81%) patients. In five of them it settled by giving analgesics presuming pain to be a cause. In the other three who were children between 5-9 years agitation settled by reassuring and presence of their parents.

Excessive drowsiness was noted in 10 (1.01%) patients. One of them remained unresponsive for up to half an hour with stable haemodynamic variables but requiring an oropharyngeal airway. In all of them inhalational anaesthetics were used with opioid analgesics intra operatively.

Cardiovascular System

Cardiovascular problems noted in 212 patients, 7.80% of total admitted patients and 21.52% of those who developed complication. Bradycardia noted in 54 (5.48%) patients who developed complications. The frequency was significantly higher in males especially those who were on beta-blockers preoperatively. Patients who had base line preoperative heart rate less than 60/min were not included in the analysis. Tachycardia found in 75 (7.61%) patients who developed complication. Thirty of them required analgesia and in 16 patients, intravenous fluids required for correction of hypovolaemia. Seven patients had axillary temperature more than 38°C and settled by fanning only.

Hypertension occurred in 42 (4.26%) patients, required treatment in the recovery room. In two-third (67%) of these patients there was a history of preoperative hypertension, About 75% patients, settled by giving intravenous opioids and in rest of them specific antihypertensive (Hydrallazine, propranolol etc) had to be used.

Hypotension found in 25 (2.53%), patients who developed complication. In most of them hypovolaemia was the cause and intravenous fluids or blood transfusion were given. Intravenous ephedrine was used in two patients (both had received spinal anaesthesia)

Myocardial ischaemia and infraction; Eight (0.81%) patients had myocardial ischaemia on E.C.G and in six of them it was temporary and reversed without any specific treatment. One 44 years old female who underwent para-umbilical hernial repair, showed persistent ischaemia on E.C.G and was shifted to the I.C.U for overnight observation, her ischaemia reversed and cardiac enzymes came out to be normal. She was discharged from I.C.U the next day. One 46 years old male patient underwent radical gastrectomy and was electively ventilated in recovery room. He remained in the recovery room for four days and was then shifted to I.C.U. on availability of bed in ICU.

New arrhythmias; Eleven (1.11%) patients had **premature ventricular contraction**. Six of them had PVC's intraoperatively but there was no evidence of PVC's on the preoperative E C G. There PVC's settled without any specific treatment. One 16 years old male in whom open reduction and internal fixation for humerus fracture was performed, developed **supraventricular tachycardia** in the recovery room, settled with carotid massage and intravenous verpamil. One 14 year old boy who had ligation of external carotid artery and lateral rhinotomy for angiofibroma of the nose, went into **ventricular tachycardia** and treated successfully by giving intravenous lignocain. One eleven year old boy who suffered a road traffic accident and rushed to operating room for exploratory laparotomy and haemostasis and in whom one hour CPR (with internal cardiac massage) was done before operation, expired in recovery room as a result of **cardiac arrest** secondary to irreversible haemorrhagic shock.

Respiratory System

Respiratory system problems noted in 55 patients, 2.02% of total admitted patients and 5.58 % of those who developed complication. **Hypoventelation** noted in 14(1.42%) patients. Only two needed intravenous naloxone for opioid antagonism. Eight (0.81%) patients developed **bronchospasm** requiring intravenous aminophylline and ventoline nebulization. One patient developed **laryngospasm** that settled simply by applying jaw thrust movement and positive airway pressure with oxygen on a facemask. **Desaturation** noted in 15(1.52%) patients by pulse oximeter. One 48 year old male who

underwent below knee amputation under combined spinal and general anaesthesia desaturated (SaO₂ 80-85% with 15 liter O₂ by facemask) in the recovery room with bilateral basal crepitation and X-ray evidence of **pulmonary aspirate** (on left side) and **pulmonary oedema**. Pulmonary oedema treated by increasing FI_{O₂} intravenous frusemide. He was later shifted to I.C.U for further observation. One 46 years old female who underwent laparoscopic cholecystectomy, desaturated (SaO₂ 80-85% with 15 liters O₂ by face mask) in the recovery room. On auscultation there was decreased air entry on right lung basis. X-ray chest showed **atelectasis** of right lower lung lobe. Analgesia and physiotherapy was advised. Rest of the patients showed mild desaturation only (SaO₂ 91-93%) and needed supplemental oxygen.

Six patients **reintubated**, four of them needed **ventilatory support** and two put on T-piece. Patients who were electively ventilated postoperatively were not included. One 42 year old female, who had total thyroidectomy was reintubated because of vocal cord paralysis. One 12 years boy who was a known case of non hogkin lymphoma came to the operating room for central venous line insertion under general anaesthesia, was unable to maintain his airway in the recovery room and reintubation and shifted to I.C.U.

Eight (0.81%) patients complained of **persistent cough** and settled with humidified oxygen; only in one patient strepsil lozenges were given.

Gastrointestinal system

Gastrointestinal problems noted in 247 patients (9.09% of total admitted and 25.07% of those developing complication). 141 patients had **nausea** only and 120 patients had **vomiting**. 14 patients who vomited also complained of nausea before. Nausea and vomiting was more frequently in those who underwent abdominal procedures, laparoscopic procedures, received opioids for intraoperative analgesia and did not receive anti-emetics in the operating room. Nausea and vomiting had slight predominance in female (58%)

Renal complication

Only two patients showed **oliguria** (urine output less than 0.5 ml/kg/hr). One had undergone nephrectomy and the other exploratory laparotomy. Both improved by giving intravenous fluids.

Miscellaneous complication

Miscellaneous problems occurred in 98(9.94%) patients. **Hypothermia** occurred in 7 and **hyperthermia** in 7, **hypoglycaemia** in one patient, **hyperglycaemia** in 24, **shivering** in 44, **sore throat** in 12 and **urticaria** in three patients. All treated accordingly.

Table I: Definitions of complications

System	Parameter	Reporting criteria
Cardiovascular	Bradycardia	Heart rate < 60 bpm or 20% below baseline
	Tachycardia	Heart rate > 100 bpm or 20% above baseline for ten minutes or more
	Hypertension	Systolic blood pressure > 170 mm Hg or 20% above baseline for ten minutes or more
	Hypotension	Systolic blood pressure < 90 mm Hg or 20% below baseline for ten minutes or more
	Myocardial ischaemia	Chest pain, ECG evidence (reversible and non-progressive ST segment depression and T wave inversion)
	Myocardial infarction	Chest pain, ECG evidence (persistence and progression of ST segment and T wave changes like ST elevation and T wave inversion. New Q wave, more than 30 ms in duration & 25% of R wave amplitude). Evidence of myocardial cell necrosis (elevated cardiac enzymes like CPK-MB, LDH 1)
	New arrhythmias	ECG evidence of PVCs (premature ventricular contractions), SVT (supraventricular tachycardia), AF (atrial fibrillation), cardiac arrest etc.
Respiratory	Bronchospasm	Wheeze or rhonchi on auscultation
	Laryngospasm	Clinical (stridor, hypoxaemia, tachycardia, retraction sternal & intercostals, no air flow despite ventilatory efforts, increase in pharyngeal secretions).
	Hypoventilation	Respiratory rate less than seven per minute.
	Pulmonary oedema	Clinical (acute onset or worsening of dyspnea at rest, tachycardia, diaphoresis, cyanosis, rhonchi and crepitations on chest auscultation). Radiological (pulmonary vascular redistribution, Kerly B lines, characteristically butterfly pattern of alveolar oedema)
	Aspiration	Suspected
	Reintubation	Required
	Ventilation	Required
Gastrointestinal	Cyanosis	Clinical
	Desaturation	Mild (91-95%), Moderate (85-90%), Severe (<85%)
Gastrointestinal	Nausea	Volunteered
	Vomiting	Observed
CNS	Pain	Volunteered
	Agitation	Observed
	Convulsions	Observed
	Unresponsive	To verbal command 15 minutes after arrival in recovery room.
Renal	Oliguria	Urine output < 20ml/hr or < 0.5ml/Kg/hr
Neuromuscular function	Residual paralysis	Clinical (not able to do sustained head lift for five seconds) Nerve stimulator (less than four equal twitches on train of four)
	Miscellaneous	
	Hypothermia	Temperature < 35.0 °C (axillary)
	Hyperthermia	Temperature > 38.0 °C (axillary)
	Hypoglycaemia	Blood glucose < 50 mg/dl.
	Hyperglycaemia	Blood glucose > 200 mg/dl.
	Hyperglycaemia/Acidosis	Blood glucose > 400 mg/dl and signs and symptoms of acidosis (acidotic breathing, drowsiness, nausea, vomiting, ketone bodies in urine).
	Urticaria	Clinical
	Shivering	Clinical

Table II: PAR (Post-anaesthesia recovery) Complications and

Serial No.	Date	Patient's Name	ASA Grade	Surgery	Duration	Anaesthesia	Time arrival in RR:	Time discharge from RR:	Complications	Code
						General (spinal/epidural)			Bradycardia	
									Tachycardia	
									Hypertension	
									Hypotension	
									Myocardial ischaemia	
									New Arrhythmias	
									PVCs	
									SVT	
									AF	
									Atrial flutter	
									Ventricular tachycardia	
									Cardiac arrest	
									Others	
									Hypoventilation	
									Bronchospasm	
									Laryngospasm	
									Pulmonary oedema	
									Aspiration	
									Reintubation	
									Ventilation	
									Cyanosis	
									Desaturation	
									Others	
									Nausea	
									Vomiting	
									Pain	
									Agitation	
									Convulsions	
									Unresponsive	
									Others	
									Oliguria	
									Residual paralysis	
									Hypothermia	
									Hyperthermia	
									Hypoglycaemia	
									Hyperglycaemia	
									Hyperglycaemia/Acidosis	
									Urticaria	
									Shivering	
									Others	

*PVCs (premature ventricular contractions)
**SVT (supraventricular tachycardia)
***AF (atrial fibrillation)

The overall incidence of complications in our population was 36.26%. (Out of 2716 patients, 985 developed one or more complications) Distribution of complications according to physiological systems is as follow.

(n=Total number of patients developing complications referable to a system)

Table III: Results

System	Complications	n	%age
CVS	Pain	505	51.26
	Agitation	08	0.81
	Excessive drowsiness	10	1.01
	Nausea	141	14.31
	Vomiting	120	12.18
	Bradycardia	54	5.48
	Tachycardia	75	7.61
	Hypertension	42	4.26
	Hypotension	25	2.53
	Myocardial ischaemia	88	8.81
	Myocardial infarction	10	1.01
	Pulmonary embolism	11	1.11
	PVCs	10	1.01
	SVT	01	0.10
	V tachycardia	01	0.10
	Cardiac arrest	01	0.10
	Hypoventilation	14	1.42
	bronchospasm	80	8.01
	Laryngospasm	10	1.01
	Pulmonary oedema	10	1.01
	Desaturation	15	1.52
	Reintubation	00	0.00
	Put on ventilator	04	0.40
	Vomiting	10	1.01
	Pain	80	8.01
	Cough	02	0.20
	Oligurea	02	0.20
	Hypothermia	07	0.71
	Hyperthermia	07	0.71
	Hypoglycaemia	10	1.01
	Hyperglycaemia	24	2.43
	Shivering	44	4.46
	Sore throat	12	1.21
	Urticaria	03	0.30

Discussion

After the completion of surgery, anaesthesia is reversed and patients recover from the immediate effects of anaesthesia either in the operation theatre or in a specialized area called recovery room. To save the operation theatre time they are shifted to recovery room. Very few hospitals in Pakistan have recovery room facilities but in abroad this kind of provision can be traced to 1801 when an area was built at the Newcastle Infirmary⁶. During the 1930s several events like severe nursing shortage experienced during World War II and more complex surgical procedures requiring better post operative care provided the impetus to centralize the sources and develop recovery rooms.³ The

obligatory use of recovery room was first summarized in a supreme court discussion in 1969 in the United States of America⁷.

An overall incidence of complications in our study was 36.26%, means that every third patient was susceptible. The commonest complication was pain, 19.18% patient complained of pain out of total admitted patients in the recovery room and 51% out of those who developed complication. This is almost the same as shown in the audit done six years before in the same hospital.⁸ Zelcer and Wells noted the pain to be about 30% among recovery room patients who developed complications.³ This probably reflects the non availability or restricted availability of short acting narcotics in our country and the anaesthetists are therefore reluctant in using the longer acting agents due to fear of side effects. Also the facility of facility of PCA (patient controlled analgesia) was not available at the time of study.

The next common complication was nausea and vomiting. It occurred in 247 patients. Its incidence was 25.06% among those who developed complications. It occurred in one patient out of every ten admitted to the recovery room. The incidence of nausea and vomiting in various studies ranges from 25% to 80%.⁹ In the previous audit done six years back the incidence of nausea and vomiting was 34.10%.⁸

Third common complications were referable to cardiovascular system, 212 patients (21.52% of all who developed complications and 7.80% of all admitted patients). The incidence of cardiovascular complications was higher than in the previous audit done six years back where it was 14.6% but lower than noted by Farman (55.6%)⁵ and Zelcer and Wells (51%)³. Hypertention and tachycardia were the commonest and most of these got relieved by analgesics showing that pain was the contributing factor leading to sympathetic stimulation. Hypotension was noted in 25 patients and corrected with intravenous fluid boluses which emphasize the need of careful perioperative fluid and blood replacement. In two patients intravenous ephedrine was given. Bradycardia was noted in those who were already on beta blockers. Rare arrhythmias like supraventricular tachycardia, ventricular tachycardia also occurred which shows that vigilant observation is essential postoperatively. As eight patients had myocardial ischaemia with one developing myocardial infarction, close observation and prompt management is essential in preventing morbidity and mortality. Out of these eight patients three had a history of ischaemic heart diseases (Angina) and were also hypertensive. One 44 years female was obese and diabetic. The patient who developed myocardial infarction did not have any history

of ischaemic heart disease or other associated risk factors. One patient who expired secondary to irreversible hemorrhagic shock was in a moribund condition and labeled ASA V preoperatively, had had one hour CPR preoperatively.

Respiratory problems were noted in 55 patients (5.58% of all who developed complications and 2.20% of all admitted patients) comparable with incidences reported by Beard et al (1.9%), Farman (3.3%)⁵, Gewolb et al (3.6%)⁴, Khan et al (2.3%)⁸, Hypoventilation was mainly because of residual drug effects. Other respiratory problems observed were desaturation, bronchospasm and laryngospasm which emphasize the use of supplemental oxygen in the recovery room. One patient developed pulmonary edema and treated with intravenous frusemide. Maroof et al also noted pulmonary oedema in a patient postoperatively in recovery room.¹⁰ Re-intubations needed in six patients reflecting the importance of recovery room and close observation. Miscellaneous problems like shivering, hypo or hyperglycemia and urticaria were also noted and treated timely.

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