

Original Research Article

Study of early post-operative complications in relation to nature of anaesthesia and type of surgery

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ABSTRACT

Background: Many people have complications after surgery; some transient, others serious, but all are important to patients. The likelihood of postoperative complications is influenced by the type of surgery, the patients pre-existing comorbid state and perioperative management. Anaesthesia result in a variety of metabolic and endocrine responses, but conventional wisdom maintains that anaesthetic technique has little long-term effect on patient outcomes. There is accumulating evidence that, on contrary, anaesthetic management may in fact exert a number of longer-term effects in postoperative outcome.

Methods: A prospective study of early post-operative complication in 100 patients', who underwent major surgery, was done in the Department of Surgery in a tertiary care teaching hospital, Indore. Therefore, the present study was carried out prospectively to study the incidence of postoperative complications in relation to age, sex and other factors which influence them and correlation of post-operative complications with the nature of anaesthesia, duration of operation, type of surgery and in surgery above diaphragm or below diaphragm.

Results: The incidence of post-operative complications was more in patients operated with general anaesthesia (48.38% and 12.9% respectively) the morbidity and mortality in patients who were operated under spinal anaesthesia was lower than general anaesthesia, but morbidity was higher in patients who were operated under epidural anaesthesia, but mortality was lower than epidural.

Conclusions: There is accumulating evidence that anaesthetic management may indeed exert a number of influences on longer term postoperative outcomes. Further prospective, randomized, large scale, human trials with long-term follow-up are required to clarify the association between anaesthesia technique and postoperative outcome.

Keywords: Anaesthesia, Emergency surgery, Elective Surgery, Morbidity, Mortality, Post-operative complications, Surgical complications

INTRODUCTION

Anaesthesia can cause many complications, but in general we can think of them as centred on the airway, respiratory or circulatory systems. For some there is debate about where 'anaesthesia' complications end and 'surgical' complications start. For example, postoperative

pneumonia may be caused by the abnormal ventilation that occurs under anaesthesia as well as the positioning for surgery and the surgical incision that makes breathing and coughing painful, shallow and ineffective. Modern anaesthetic practice is aimed at being safe and avoiding complications.^{1,2} Anesthesia is commonly classified into two main techniques: general anesthesia in which drugs

achieve central neurologic depression, and regional anesthesia, in which drugs are administered directly to the spinal cord or nerves to locally block afferent and efferent nerve input.^{3,4} After surgery, the risk of fatal or life threatening events like deep vein thrombosis, pulmonary embolism, myocardial infarction, transfusion requirements, pneumonia and renal failure are increased several fold, but there is debate about whether the type of anesthesia has any substantive effect on these risks. Neuraxial blockade has several physiological effects that provide a rationale for expecting to improve outcome with this technique.⁵ It is logical to hypothesize that a “stress-free” perioperative period may attenuate or prevent detrimental physiologic responses and decrease resultant morbidity.² Progress is rapid, and dissemination of such information is unprecedented.

Never before has our means of communications within the medical profession been better. Ideally, no-one would have a complication after surgery. Some complications may be avoidable whilst others inevitable in some circumstances. In some circumstances patients may choose not to proceed with their surgery once they at all stages of the patients perioperative ‘journey’ there are techniques and strategies that health care professionals can use to help stop postoperative complications. Some of these are generally accepted (eg timely antibiotics) whilst others are gaining increasing prominence such as the concept of a ‘perioperative physician’.^{1,2}

For the purpose of description, the post-operative complications are divided into early and late. Early complications, if neglected may be hazardous and increase hospitalization time and mortality in a given series of operations. But if known and managed accordingly, will decrease the mortality and morbidity in post-operative phase. Therefore, the present study was carried out prospectively with aims and objectives: to study the incidence of postoperative complications in relation to age, sex and other factors which influence them and to study correlation of post-operative complications with the nature of anaesthesia, duration of operation, type of surgery and in surgery above diaphragm or below diaphragm.

METHODS

A prospective study of early post-operative complication in 100 patients’, who underwent major surgery, was done in the Department of Surgery in a tertiary care teaching hospital, Indore. Patients who underwent major surgery during the period of year 2014-2015 were taken for the study in the present series. Major surgery was considered when operation was done under anaesthesia, where duration of Surgery was prolonged, and risk of complications were more or where the vital organ was operated upon.

But not one of the above criteria makes an operation major but taking into consideration of all above and other factors the surgery was defined as major. Each case was studied under following heads from the available case records like demographic data, presenting complaints, past illness, personal history, general, local and systemic examination findings.

Study of investigations was done for the confirmation of diagnosis and screening of patients for associated diseases. A detailed study of operation notes for the type of operation, duration of operation, type of anaesthesia, elective or emergency surgery and any complications during operation or during recovery from anaesthesia were noted. Appearance of complications was recorded in chronological order. The study was done correlating the various factors which influenced the mortality and morbidity in postoperative phase.

RESULTS

In the present study 100 cases who underwent major surgery were included out of which 70 patients underwent elective surgery and 30 patients were operated in emergency. Out of them 80 were males and 20 were females. Out of 100 cases surgery below diaphragm was performed in 95 patients and above diaphragm was operated in 5 patients. Out of 100 patient’s complications occurred in 40 patients (40%) and the mortality were 10% of all operations.

Table 1: Sex wise distribution of complications.

Sex	No. of operation	Percent of total	No. of complications	Percent	Mortality	Percent
Male	80	80	30	37.5	8	10
Female	20	20	10	50	2	10
Total	100	100	40	40	10	10

Table 1 show that incidence of post-operative complications is much higher in females 50% but the incidence of mortality is equal 10%.

Table 2 shows that the incidence of post-operative complications is predominantly higher in patients below the age of 10 years (80%) and patients above 51 years of age; similarly, mortality was high in patients under 10

years and above 51 years of age as compared to other age groups of patients. Table 3 represents that incidence of post-operative complications is much higher in above diaphragm (60%) then in patients who underwent surgery

below diaphragm (38.94%), from the same table it is also evident that the incidence of mortality is high in above diaphragm surgery (20%) than patients below diaphragm surgery (9.47%).

Table 2: Age wise distribution of complications.

Age (years)	Number	Percent	Complications	Percent	Mortality	Percent
0-10	5	5	4	80	3	60
11-20	13	13	4	30.76	-	0
21-30	20	20	4	20	1	5
31-40	16	16	5	31.25	1	5
41-50	21	21	8	38.09	2	9.52
51-60	15	15	8	53.33	1	6.66
61-70	8	8	6	75	2	25
>70	2	2	1	50	-	0
Total	100	100	40	40	10	10

Table 3: Type of surgery above or below diaphragm.

Type of surgery	No.	Percent of total	No. of complications	Percent	Mortality	Percent
Above diaphragm	5	5	3	60	1	20
Below diaphragm	95	95	37	38.94	9	9.47
Total	100	100	40	40	10	10

Table 4 represents that the incidence of early post-operative complications is higher in patients undergoing emergency surgery (60%) as compare to patient of elective surgery (31.42%).

From the same table it is evident that mortality in emergency group is higher (23.33%) than patient of elective surgery (4.2%).

Table 4: Type of surgery elective/emergency.

Type of surgery	No.	Percent of total	No. of complications	Percent	Mortality	Percent
Elective surgery	70	70	22	31.42	3	4.28
Emergency surgery	30	30	18	60	7	23.33
Total	100	100	40	40	10	10

Study showed the patients who are associated with predisposing systemic disease in them the incidence of post-operative complications and mortality is higher.

The present study also revealed that post-operative complications are more in patient having systemic disease 72.72% as compare to patients who have no systemic disease 35.59% as well as it is evident that mortality is more in group of patients having systemic disease 27.27% and less in normal group of patients 7.8%.

It showed that in patients with hypertension incidence of post-operative complications is high 83.33% whereas 33% had post-operative complications directly related to

hypertension and out of them 33% died indicating high mortality.

In patients with chronic lung disease the incidence of post-operative complication was seen in 66.66% whereas respiratory complications were present in 66% of these cases the mortality was same as in hypertension that is 33% in patients with diabetes mellitus high incidence of infection was observed (50%) but mortality in this group was nil.

It also revealed that post-operative complication and mortality are more in patients who are addicted as compare to the patients in whom there is no history of addiction.

Table 7 signifies that the incidence of post-operative complication is significantly higher in patients with unsatisfactory health status (71.87%), similarly the mortality also significantly higher in the same group (21.87%), as compared with the morbidity and mortality of patients with satisfactory preoperative health status (25% and 4.41% respectively).

Table 5: Distribution of cardiovascular, urinary and wound complications in groups of major surgery elective/emergency.

Cardiovascular complications	Number	Percent
Arrhythmias	1	1
Peripheral circulatory failure, Other than haemorrhagic shock	9	9
Haemorrhagic shock	2	2
Cardiac arrest	1	1
Total	14	14
Thrombophlebitis	6	6
Urinary complications		
Retention of urine	8	8
UTI	9	9
Uraemia	1	1
Acute renal failure	1	1
Total	19	19
Wound complications		
Infection	13	13
Minor gaping	8	8
Burst abdomen	1	1
Total	22	22

Table 6: Distribution of respiratory, gastrointestinal and miscellaneous complications in groups of major surgery elective/emergency.

Respiratory complications	Number	Percent
Pneumonia	7	7
Pleural effusion	2	2
Respiratory arrest	1	1
Pneumothorax	1	1
Total	11	11
Gastrointestinal complications		
Vomiting	6	6
Diarrhoea	1	1
Peritonitis	2	2
Anastomotic leak	2	2
Fistulae	1	1
Total	12	12
Miscellaneous complications		
Toxaemia and septicaemia	5	5
Hyperpyrexia	1	1
Meningitis	1	1
Bed sores	1	1
Total	9	9

Table 8 denotes that the incidence of post-operative complication and mortality is higher in patients with history of previous operations (50% and 33.33% respectively), then in patients who had no history of previous operations (39.36% and 8.51% respectively).

Table 7: Complications in relation to preoperative general condition of patients.

Preoperative general condition	No.	% of the total	No. of complications	%	Mortality	%
Satisfactory	68	68	17	25	3	4.41
Not satisfactory	32	32	23	71.87	7	21.87
Total	100	100	40	40	10	10

Table 8: Complications in relation to previous major operations in the past.

History of operation	No.	% of the total	No. of complications	%	Mortality	%
Yes	6	6%	3	50%	2	33.33%
No	94	94%	37	39.36	8	8.51%
Total	100	100%	40	40%	10	10%

Table 9: Complications in relation to type of anaesthesia

Anaesthesia	No.	% of the total	No. of complications	%	Mortality	%
General	62	62%	30	48.38%	8	12.9%
Spinal	25	25%	8	32%	1	4%
Epidural	13	13%	2	15.38%	1	7.69%
Total	100	100%	40	40%	10	10%

Table 9 represents that the incidence of post-operative complications was more in patients operated with general

anaesthesia (48.38% and 12.9% respectively) the morbidity and mortality in patients who were operated

under spinal anaesthesia was lower than general anaesthesia, but morbidity was higher in patients who were operated under epidural anaesthesia, but mortality was lower than epidural.

Table 10 shows that out of 93 complications 53 complications developed during the first 3 days of post-operative period. These complications were mostly

pertaining to cardiovascular system, gastrointestinal system and urinary complications where the respiratory system was affected almost uniformly from 1 to 8 post-operative day. Retention of urine was the commonest urinary system complications observed during post-operative period on the 1st day, the same table also shows that maximum number of complications occurred on 3rd post-operative day.

Table 10: Complications in relation to day of occurrence in 40 patients in whom 93 complications occurred.

Day	Complications								
	Total (%)	CVS (%)	Resp. (%)	Urinary (%)	GIT (%)	Thromb (%)	WI (%)	WC (%)	Misc. (%)
During surgery or recovery from anaesthesia	8 (8.6)	4 (50)	3 (37.5)	-	1 (12.5)	-	-	-	-
1 st	15 (16.12)	3 (20)	1 (6.66)	8 (53.33)	3 (20)	-	-	-	-
2 nd	11 (11.82)	2 (18.18)	1 (9.09)	2 (18.18)	3 (27.20)	1 (9.09)	-	-	2 (18.18)
3 rd	19 (20.43)	3 (15.78)	2 (10.52)	5 (26.31)	2 (10.52)	2 (10.52)	3 (15.78)	-	2 (10.52)
4 th	2 (2.15)	-	-	-	-	-	1 (50)	-	1 (50)
5 th	13 (13.97)	1 (7.69)	2 (15.38)	1 (7.69)	1 (7.69)	1 (7.69)	4 (30.76)	-	3 (23.07)
6 th	3 (3.22)	-	-	-	-	1 (33.33)	1 (33.33)	1 (33.33%)	-
7 th	8 (8.6)	-	1 (2.5)	1 (12.5)	-	-	1 (12.5%)	4 (50)	1 (12.5%)
8 th or more	14 (15.05)	1 (7.14)	1 (7.14)	2 (14.28)	2 (14.28)	1 (7.14)	3 (21.42)	4 (28.57)	-
Total	93 (100%)	14 (15.05)	11 (11.82)	19 (20.43)	12 (12.9)	6 (6.45)	13 (13.97)	9 (9.6)	9 (9.6)

Table 11: Complications per patients and relation to mortality.

Frequency of complication per patient	Number	% of 40 comp. patient	Mortality	%
Single complication	21	52.5	2	9.5
Two complications	6	15	1	16.66
Three complications	5	12.5	2	40
More than three complications	8	20	5	62.5

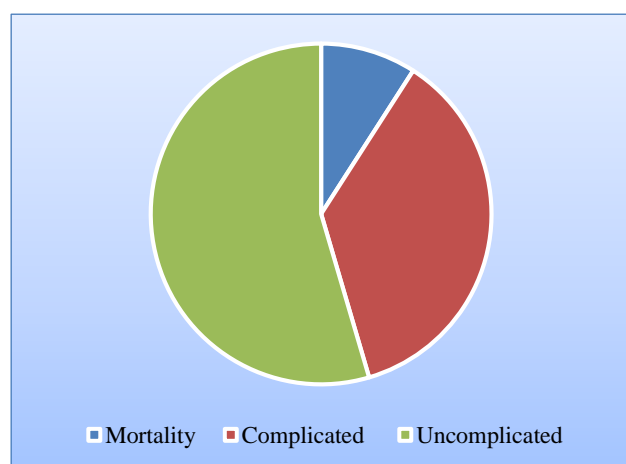


Figure 1: Distribution of cases in relation to morbidity and mortality.

Table 11 shows that most of the patient (52.5%) developed single complication and 2 or more complications were seen in less number of patients. The Table 11 also shows that there was high mortality (more than 50%) in patients who have more than one complication than in patients with single complication (9.5%).

The present study also showed that maximum number of patients died of septicaemia (50%), followed by haemorrhagic shock (20%) and other less common causes such as respiratory failure (10%), meningitis (10%) and cardiac arrest (10%) respectively (Figure 1).

DISCUSSION

Complications in surgery are always of concern to surgeon.

There have been various studies on the different aspects of post-operative complications like correlation of predisposing factors, risk groups of patients, relation to type of surgery and so on.

In the present study had 100 cases of major surgery for the incidence of early post-operative complications and their relation to various factors which influence the morbidity and mortality.

Table 12: Examples of strategies designed to prevent perioperative complications.

Preoperative	Preassessment clinic fitness and risk assessment correct diagnosis and treatment of comorbidities continue/ stop relevant drug
Theatre suite	Correct and timely antibiotics 'Cardiovascular Optimisation' Specific Drugs (eg anti emetics)
Postoperative	Enhanced recovery' programmes Good analgesia Early mobilisation Postoperative Intensive care / HDU / PACU Regular Postoperative ward rounds Perioperative Physician Local postoperative outcome data collection

Out of 100 patients subjected to major surgery 70 (70%) underwent elective surgery and 30 (30%) had emergency surgery. HDU: High Dependency unit; PACU: Post Anaesthetic Care Unit.^{1,6}

Haemorrhage can be classified as:

- 'Primary': occurring when a vessel is cut during surgery.
- 'Reactionary': occurring when rises in blood pressure at the end of the operation cause vessels that had previously not been bleeding to start to do so.
- 'Secondary': normally due to infection which causes damage to a vessel day after surgery. The increased risk of haemorrhage may be multi-factorial in origin.^{1,6}

Post-operative infections can be classified by both site and cause.

Surgical site infection (SSI)

SSIs can complicate recovery in 5% of patients; risk factors include intra-operative exposure to endogenous organisms (e.g. during bowel surgery), prolonged surgery and impaired immunity (e.g. diabetes, immunosuppression) (NICE, 2008).

Management may require antibiotics, suture removal and debridement with open wound care (NICE, 2008).^{6,7}

Central venous catheter infection

Infection of central venous catheters (CVC) may lead to catheter related blood stream infections (CRBSI) that can have a 25% mortality.

CVCs should be reviewed daily and CRBSI should be suspected when there is a CVC and signs of bacteraemia; a positive blood culture and growth of the same organism from the CVC would support the diagnosis. CVC's should always be removed as soon as they are not

needed. Inflammation around the CVC insertion is relatively uncommon, and its absence does not rule out CRBSI.⁶

Urinary tract infection

Urinary catheters are inserted perioperatively to facilitate surgery or to aid fluid balance management. They do, however, predispose patients to urinary tract infections that may need antibiotic treatment.

Abdominal collections

Abdominal collections are more likely if there is leak of bowel contents. They may present with nausea, malaise, pain, swinging fever, localised peritonitis or tenderness and altered bowel function and the onset of symptoms is determined by abscess location: pelvic abscesses tend to occur 4-10 days after surgery whilst subphrenic abscesses occur 7-21 days after surgery.⁶



Figure 2: Wound infection with abdominal distension.

Reduced bowel function

Constipation may occur post-operatively due to opioids or anti-cholinergics. Management involves adequate

hydration, appropriate nutrition and laxatives. Post-operative ileus may be caused by intra-operative bowel manipulation, pain, immobility, hypokalaemia and opioids. Features of ileus include reduced bowel function, abdominal distension, discomfort, nausea, vomiting and a reduced absorption of oral drugs. (Figure 2) Ileus usually resolves within 24-36 hours and management involves insertion of a naso-gastric tube, analgesia and reduced oral intake.⁶

Cardiovascular disease

Postoperative cardiovascular complications include acute dysrhythmias (e.g. atrial fibrillation), ischaemic injury, infarction, and left ventricular failure (with associated pulmonary oedema).⁶ Cardiac morbidity is the primary cause of death after anesthesia and surgery with reported incidences ranging from 2% to 15% in high risk surgical population.⁸ So anesthesia techniques that reduce cardiac morbidity should have greatest effect on improving surgical outcomes. Stress induced activation of the sympathetic nervous system may be partially responsible for perioperative cardiac events. Blockade of cardiac sympathetic innervation (T1-T5) by thoracic epidural local anaesthetics could reduce myocardial oxygen demand, ischemia and coronary vessel constriction.⁹ Compared with standard anaesthesia, a highly significant decrease in incidence of cardiovascular failure has been documented in patients undergoing high risk surgery who received epidural anaesthesia and analgesia.¹⁰ According to a meta-analysis by Svircevic et al.¹¹ epidural anaesthesia during cardiac surgery reduces postoperative supraventricular arrhythmias and respiratory complications. Hypercoagulability occurs in association with surgical procedures with resultant risk of formation of deep Venous Thrombosis (DVT) and potentially fatal Pulmonary Embolism (PE). Incidences for fatal PE were 0.1%-0.4% for general surgery, 0.5% for urological surgery, 0.1%-2% for joint replacement, and 2.5%-7.5% for hip fracture surgery.¹²

Pulmonary outcomes

After surgery, respiratory complications play major role for determining hospital stay, morbidity and mortality.¹³ Actually respiratory complications may cause at least 50% more costs than cardiac complications after adjustment for patient characteristics.¹⁴ Pathophysiological changes that occur under anesthesia and/or following surgery, can interact thereby contributing to respiratory complications. The reduction of lung inflation is one of the basic mechanisms of postoperative pulmonary complications. As well as during induction of anaesthesia, most of the general anaesthetics, except for ketamine, produce a further reduction of Functional Residual Capacity (FRC).^{15,16} So FRC and vital capacity are affected after anaesthesia, indicating the presence of a restrictive process. Cardiac arrest constitutes a rare fatal complication of all occurring post operatively. In the present series 1 patient (1%)

developed cardiac arrest post operatively who died immediately.^{17,18} In the present series myocardial infarction occurred in 1 (1%) patients who was above 60 years of age. Levin (1972) reported 9% incidence of post-operative haemorrhagic shock in extensive abdominoperennial resection discussed the various factors resulting in it.¹⁹ In present series 2% patients developed alarming haemorrhage. The low incidence in the present series was because operation done in whom the risk of haemorrhage was very little and during operation almost complete homeostasis was achieved which prevented haemorrhage.

Lodha R et al suggested that apart that apart from haemorrhagic shock the shock of septicaemia and toxemia was one of the most important causes of morbidity and mortality in post-operative phase.²⁰ In the present series 9 patients (9%) developed peripheral circulatory failure resulting from causes other than haemorrhage. In 5 patients it was related to anaesthesia, surgical manipulations, hypoxia and trauma acquired during or just after surgery. Bostedt H suggested that peripheral circulatory failure of septicaemia and toxemia is mostly associated with haemorrhagic necrosis of intestinal mucosa, aggravating the syndrome of shock.²¹ In the present series shock of septicemia was present in 5% patients of all patients developing peripheral circulatory failure excluding haemorrhage.

Post-operative pulmonary complications (PPCs) occur in 5–10% of patients undergoing non-thoracic surgery and in 22% of high risk patients.²² Postoperative pulmonary complications (PPCs) are common, costly, and increase patient mortality. Changes to the respiratory system occur immediately on induction of general anaesthesia: respiratory drive and muscle function are altered, lung volumes reduced, and atelectasis develops in > 75% of patients receiving a neuromuscular blocking drug. The respiratory system may take 6 weeks to return to its preoperative state after general anaesthesia for major surgery.^{23,24}

In the present series 11% incidence of all postoperative complications was that of chest complications similar to that of the previous workers. In emergency group of surgery however the incidence of post-operative chest complications is much higher 23.33% and this is due to preponderance of various predisposing factors like lack of assessment and management of co-existing pulmonary disease, upper abdominal surgery, peritonitis and septicaemia as confirmed by different studies. Post-operative chest complications occurred mostly in the first half of the first post-operative week and are due to less expansion of chest due to pain, decreased lung compliance and abdominal dressing.²⁵

GIT complications

Incidence of vomiting is affected by many factors like anaesthesia, age, electrolyte imbalance, uraemia, ketosis, post-operative hypotension and nature of surgery.^{26,27} In

the present series as observed the incidence of vomiting was 6% but significant correlation to factors maintained by various authors could not be made. Reported incidence of 5 to 20% anastomotic leak was observed.²⁸ In the present series only 10 patients out of 100 were subjected to one or the other type of resection surgery and if only those were considered 2% incidence of anastomotic leak which was much less than observations made by other authors.

CONCLUSION

Postoperative complications are always a concern to surgeon. Early postoperative complications after major surgery occurred in significant number and must be anticipated in time and proper measures instituted to control them. Incidence of early post-operative complications was significantly higher in emergency surgery than in elective surgery. Major risk factor was unhealthy preoperative status especially dehydration, anaemia, malnutrition, electrolyte imbalance and infection, which significantly increase the morbidity and mortality of postoperative complications. Morbidity and mortality was more in very young patients due to low birth weight, emergency surgery, technical error and the fact that children were more prone to complications of anaesthesia and in patients over 50 years age. Morbidity and mortality of postoperative complications increase with age.

Post-operative complications are an important cause of morbidity, mortality, extended hospital stay and increased costs. Complications can be general or specific to particular operations. There are many strategies to prevent postoperative complications. Assessment of surgical complications should include a focussed history with particular attention to risk factors.

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