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Determinants of Mortality Outcome after Major Laparotomy in a Tertiary Hospital: An Observational Study

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Abstract

Background: Laparotomy surgery carries significant risk of postoperative mortality due to patient related factors and perioperative events. This observational study was aimed to find out how these factors affect the mortality outcome in patients undergoing laparotomy surgeries. *Methods:* All patients who underwent major laparotomy and shifted to Intensive Care Unit / Post Anaesthesia Care Unit (ICU / PACU) were analyzed. The parameters studied were age, gender, American Society of Anaesthesiologists' Physical Status (ASA PS), elective or emergency nature of the surgery, anaesthetic technique used and major complications. The study was conducted over a period of 18 months. The data was analyzed using statistical software version 21.0 and significance was tested by setting the p value at 0.05. *Observations:* Out of 486 patients, the overall mortality was 37 (7.6%). Females predominated (62.1%) with a higher mortality rate of 9.6%. There was no statistically significant difference in mortality amongst the different age groups. The mortality rate was observed as steadily increased as per increased ASA PS score. Patients operated as elective procedure were higher (65.6%), but the mortality was higher in those patients operated as emergency procedures (18%). Most of the surgeries (93.4%) were under general anaesthesia, but the choice of anaesthetic technique did not affect the mortality. The patients who required vasopressors therapy and mechanical ventilation were higher in the non survivors. *Conclusion:* The mortality rate of patients undergoing major laparotomy was comparable with similar studies. Females formed the majority and had an increased mortality. Mortality did not increase with age in this study, but increased with higher ASA PS score and emergency surgical procedures. Majority of the surgeries were done under general anaesthesia, but the choice of anaesthetic technique did not affect the outcome. Patients who were dependant on vasopressors and mechanical ventilation had higher mortality rates.

Keywords: Mortality Outcome; Major Laparotomy; Type of Anaesthesia.

Introduction

Patients undergoing major laparotomy form a high risk group and are mostly shifted to Intensive Care Unit (ICU / PACU) for continuous postoperative monitoring and management. The post operative morbidity and mortality are often high in these patients due to their physiological derangements caused by associated co-morbidities & the surgical conditions. Other factors such as increasing age, emergency surgery, higher American Society of Anaesthesiologists' Physical Status (ASA PS) grade [1], and perioperative complications are also the major contributing factors that may affect the surgical outcome. This observational study was aimed at identifying the perioperative factors that affect the outcome of patients undergoing major elective and emergency laparotomy surgery & who were shifted to the ICU for postoperative management.

Methods

This study was conducted at the department of Anaesthesiology, Government Medical College, Thrissur, India. It is a 1500 bedded

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tertiary care teaching hospital. Details of all the patients who underwent major laparotomy and shifted to the ICU / PACU (attached to the operating suite) postoperatively were studied over a period of 18 months. Paediatric and gynecological laparotomy procedures were excluded as most of them were shifted to their respective ICUs postoperatively. The preoperative data collected were gender, age and ASA-PS score. Whether the patient was operated as an elective or emergency procedure and the nature of anaesthetic technique (General or regional anaesthesia) used were also noted. Requirement of hemodynamic support e.g. vasopressors and mechanical ventilation during the perioperative period were also recorded.

The collected data were analyzed using statistical software version 21.0. Frequency and percentage analysis was done as preliminary analysis. Cross tabulation was done for finding the mortality rates among the subgroups based on the parameters studied. Association of the independent variables on mortality rate was done using chi square test. The significance was tested by setting the level of significance at 0.05 levels.

Results

A total of 486 patients underwent major laparotomy and were shifted to the ICU postoperatively during the study period. Majority of these (302, 62.1%) were female patients and the remaining (184, 37.9%) were males. The age distribution of these patients was as given below. Patients of age 20 years and below were 12 (2.5%), 21-40 years were 89 (18.3%), 41-60 years were 198 (40.7%) and 187 (38.5%) were above 60 years of age. Patient distribution according to their preoperative ASA-PS score were as follows. Only 5 (1.0%) were of ASA-PS grade I and the majority, 191 (39.3%) were of grade II. 155 (31.9%) patients belonged to grade III, 117 (24.1%) to grade IV and 18 (3.7%) to grade V.

Most of the patients, 319 (65.6%) were operated as elective procedure, whereas 167 (34.4%) were operated as emergency. Majority of patients, 454 (93.4%) were operated under general anaesthesia, and remaining 32 (6.6%) were operated under regional anaesthesia (epidural, subarachnoid or combined).

Table 1: Frequency Table of Patient Parameters (n = 486)

Parameter	Number	Percentage
Gender		
Male	184	37.9
Female	302	62.1
Age (years)		
≤ 20	12	2.5
21-40	89	18.3
41-60	198	40.7
> 60	187	38.5
ASA-PS score		
Grade I	5	1.0
Grade II	191	39.3
Grade III	155	31.9
Grade IV	117	24.1
Grade V	18	3.7
Nature of Surgery		
Elective	319	65.6
Emergency	167	34.4
Anaesthetic technique		
General Anaesthesia	454	93.4
Regional Anaesthesia	32	6.6
Vasopressors therapy		
Yes	56	11.5
No	430	88.5
Mechanical ventilation		
Yes	244	50.2
No	242	49.8
Patient outcome		
Survivors	449	92.4
Expired	37	7.6

While 56 (11.5%) patients required vasopressors therapy for hemodynamic instability in the perioperative period, most of them, 430 (88.5%) did not require vasopressors. 244 (50.2%) patients required postoperative mechanical ventilation while the others 242 (49.8%) were not ventilated postoperatively. Out of the total 486 post laparotomy patients managed in the ICU, 449 (92.4%) improved and were either shifted to the step down surgical ICU or to their respective postoperative wards. The remaining 37 (7.6%) expired during their stay in the ICU. (Table 1).

The outcomes of those survivors and the expired were observed, which were as follows. Female patients were the majority, amongst which, there was a mortality of 29 (9.6%) out of the total 37 deaths, compared to those of males with only 8 (4.3%) deaths, which was statistically significant (Table 2).

Table 2:

Gender	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
Male	176	95.7	8	4.3	184
Female	273	90.4	29	9.6	302
Total	449	92.4	37	7.6	486

Chi square = 4.489*; P-value = 0.034* *significant at 0.05 level*

Regarding the age group, all the 12 patients of ≤ 20 years age survived. Mortality was 6 (6.7%) in the 21-40 age group, 20 (10.1%) in the 41-60 age group and 11 (5.9%) in those above 60 years of age. The mortality as per age distribution was not statistically significant (Table 3).

All the patients belonging to ASA PS Grade I survived. There was a steady increase in the mortality rates with increasing ASA PS grades, which was statistically significant (Table 4). The mortality was 1 (0.5%) in Grade II, 7 (4.5%) in Grade III, 15 (12.8%) in Grade IV and 14 (77.8%) in Grade V.

Table 3:

Age (years)	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
≤ 20	12	100.0	0	0.0	12
21-40	83	93.3	6	6.7	89
41-60	178	89.9	20	10.1	198
> 60	176	94.1	11	5.9	187
Total	449	92.4	37	7.6	486

Chi square = 3.624^{ns}; P-value = 0.305*ns* *non significant at 0.05 level*

Table 4:

ASA PS Grade	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
I	5	100.0	0	0.0	5
II	190	99.5	1	0.5	191
III	148	95.5	7	4.5	155
IV	102	87.2	15	12.8	117
V	4	22.2	14	77.8	18
Total	449	92.4	37	7.6	486

Chi square = 146.675**; P-value < 0.001, ** Significant at 0.01 level

There was a statistically significant increase in the mortality rates in those operated as emergency cases compared with elective surgeries (Table 5). While 30 (18.0%) patients operated as emergency expired during their ICU stay. It was only 7 (2.2%) in those who underwent the procedure as elective cases.

The technique of anaesthesia i.e. general anaesthesia or regional anaesthesia did not have statistically significant effect in the mortality outcomes (Table 6). Among the 420 patients operated under general anaesthesia, the mortality was 34 (7.5%), whereas it was 3 (9.4%) among the 29 patients operated under regional anaesthesia.

Table 5:

Nature of Surgery	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
Elective	312	97.8	7	2.2	319
Emergency	137	82.0	30	18.0	167
Total	449	92.4	37	7.6	486

Chi square = 38.756**; P-value < 0.001** *Significant at 0.01 level*

Table 6:

Anaesthetic Technique	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
General	420	92.5	34	7.5	454
Regional	29	90.6	3	9.4	32
Total	449	92.4	37	7.6	486

Chi square = 0.151^{ns}; P-value < 0.001*ns non significant at 0.05 level*

Poor patient status with perioperative complications necessitating vasopressors therapy or respiratory support/ mechanical ventilation had statistically significant effects in the mortality rates of the patients. 33 (58.9%) patients who expired in the ICU required vasopressors therapy, whereas only 4 (0.9%) who expired did not receive it (Table 7).

36 (14.8%) patients who expired in the ICU received mechanical ventilation. Only 1 (0.4%) patient expired at ICU was not on mechanical ventilation, which was also statistically significant (Table 8).

Table 7:

Vasopressors therapy	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
Yes	23	41.1	33	58.9	56
No	426	99.1	4	0.9	430
Total	449	92.4	37	7.6	486

Chi square = 228.786**; P-value < 0.001** *Significant at 0.01 level*

Table 8:

Mechanical Ventilation	Outcome				Total
	Survivors		Expired		
	No.	%	No.	%	
Yes	208	85.2	36	14.8	244
No	241	99.6	1	0.4	242
Total	449	92.4	37	7.6	486

Chi square = 35.526**; P-value < 0.001** *Significant at 0.01 level*

Discussion

Patients undergoing major laparotomy and being shifted to ICU for postoperative management form a high risk group carrying significant morbidity and mortality. This study was aimed at identifying these factors, and compared with the available literature to find out our demographic profile and standards of care. The study was done in a three bedded PACU / ICU attached to the operation suite. The PACU / ICU are under the control of department of anaesthesiology. A total number of 486 patients were admitted during the study period of 18 months. The overall mortality of the patients in the study was 7.6%, which was within the acceptable range with these high risk patients. Mortality rate varies in different studies ranging from as low as 1.6% reported by Bennett et al [2] to as high as 14.5% in the study by David et al [3].

We had a predominance of female patients (62.1%) over males in this study. In the study by David et al [3] the male to female ratio was 2:1 among the study group of 76 patients. In the study by Vivekanand et al [4], 80 out of 100 emergency laparotomy were male

patients. In our study there was a statistically significant increased mortality amongst the female patients, which is found in similar studies of Yoshiko K [5] et al, the reason for which has to be further evaluated. Unlike other studies, we did not find statistically significant increase in mortality rates with the age of the patient. However in most of the studies, mortality rate increase as the age advances, probably due to the increased incidence of co morbidities. In the study by Vivekanand et al [4], the mortality rates steadily increased as the age advanced from 9% in those below 20 years, 11% in those between 20 to 40 years, 15% among 40-60 years and 80% in those above 60 years.

The mortality rates in our study steadily increased with ASA PS status with nil in grade I patients, 0.5% in grade II, 4.5% in grade III, 12.8% in grade IV, which went up to 77.8% in grade V patients. This was due to the deteriorating preoperative status and associated co morbidities with increasing ASA PS status. However, it may be noted that ASA PS Grade V patients are moribund and not expected to survive; mortality in this group indicates a better level of care to these patients. Howes et al [6] had a higher ASA PS score in the non survivors in a similar study, due to their worse preoperative status. Assessment of the risk may be by clinical judgment, use of risk assessment tools or evaluation of functional capacity. Clinical judgments may vary with individual and experience. Risk assessment tools are the most practical means of estimating risk in these patients, but no tool has been widely incorporated into routine practice. ASA PS scoring system, though not specific, is widely used to predict the preoperative morbidity and mortality and is not specific to any particular procedure or specialty and may vary due to subjective judgement of the assessor. APACHE II [7], and P-POSSUM [8] are other commonly used tools to assess the risk in patients undergoing laparotomy.

Though the total number of elective laparotomy was more in the study, there was a statistically significant high rate of mortality in those operated on emergency basis which matches with similar studies. Studies show that about one sixth of patients undergoing emergency laparotomy die within a month following the surgery. The mortality rates range from 13 to 18% at 30 days, increasing to 25% at 24 months [9]. Patients undergoing emergency laparotomy have also found to have a higher incidence of adverse postoperative events than those undergoing planned general surgery [10].

Before elective surgery there is ample time for preoperative assessment and preparation of the patient, whereas emergency laparotomy is a lifesaving procedure, undertaken mostly in acute cases, without much preparation of the patient. As patients undergoing emergency laparotomy are markedly heterogeneous, their postoperative morbidity or mortality varies according to their preoperative status and the procedures they are undergoing and delivery of perioperative care. Reduction of the morbidity and mortality after emergency laparotomy is the focus of several ongoing national and international audit and quality improvement programs. Identification of high-risk patients requires the assessment of pre-operative risk, which requires the mode of presentation, co-morbidities and operative procedures.

In our study, majority of cases (93.4%) were operated under general anaesthesia, and very few (6.6%) patients were operated under regional anaesthesia like epidural, subarachnoid and combined blocks. However the study did not demonstrate any statistically significant difference in the mortality rates depending upon the choice of anaesthetic technique. In most of similar studies surgeries are mostly carried out under general anaesthesia, as these high risk patients seldom tolerate regional anaesthesia due to their poor preoperative physical status.

Other perioperative factors studied regarding the outcome of these patients were hemodynamic instability necessitating vasopressors therapy and requirement for mechanical ventilation. Requirement of Ionotropic support was associated with statistically significant poor outcome in the study as evidenced by mortality of 58.9% of such patients. The requirement for inotropes, longer ICU stays, and the requirement for blood transfusion has been found to significantly increase the severity of sepsis with a poor outcome [11]. Requirement of mechanical ventilation has been found to improve the postoperative pulmonary function and clinical outcome in patients undergoing major abdominal surgery [12]. This study showed a poor outcome in those mechanically ventilated may be due to their poor physical health preoperatively necessitating ventilator therapy.

Conclusion

It was concluded that female patients outweigh the males in our centre for major laparotomy with higher risk of mortality. Though advancing age is considered as a bad prognostic factor, our study did not reveal such a difference. Increasing mortality was

observed for patients with higher ASA PS grade and those undergoing emergency laparotomy which was found in other similar studies. The choice of anaesthetic technique did not affect the outcome, Perioperative events e.g. requiring vasopressors therapy and mechanical ventilation were also of bad prognostic sign. However, the overall mortality in our series was at par with the literature, which proves the satisfactory level of care in these high risk patients.

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