



STUDY OF RISK FACTORS AFFECTING INCIDENCE OF EARLY POST-SURGICAL COMPLICATIONS IN GENERAL SURGERY PATIENTS.

General Surgery

Dr. Satshil

Chandrakant

Abhang*

Assistant Professor, Department of General Surgery, Bharatratna Atal Bihari Vajpayee Medical College, Pune. *Corresponding Author

Dr. Prajakta

Satshil Abhang

Senior Resident, Department of Anesthesiology and Critical care, B J Government Medical College and Sasoon Hospital, Pune

Dr. Nilesh Namdeo

Muntode

General Practitioner, Pune.

ABSTRACT

Background: Post-surgical complications have every potential to deleteriously undermine the superlative effect of the surgical team. The outcome of these post-surgical complications is wide, ranging from minor incidents those do not require any medical/surgical interventions and may resolve without any harm to more serious life threatening incidents necessitating multiple interventions. The present study was conducted with an aim to evaluate risk factors and to determine incidence post-surgical complications in patients undergoing major surgical procedure. **Methodology:** Cross-sectional descriptive study was prospectively conducted for a period of two years in Department of General Surgery. It included patients undergoing major surgery (elective and emergency). Post-operatively, patients were followed for a period of one month and complications if developed were recorded. The Clavien-Dindo classification was used for grading the complication. Patient's demographic features, comorbid conditions, American Society of Anesthesiologists (ASA) score, surgical approach, surgical indication, duration of surgery, intraoperative complications and wound class were recorded. **Results:** Post-operative complications were noted in 32.7%. As per the Clavien-Dindo system, the incidence of Grade I, Grade II, Grade IIIA, Grade IIIB, Grade IVA and Grade V were 65.4%, 13.5%, 8.7%, 3.8%, 3.8% and 4.8% respectively. High ASA scores and comorbidities are significant risk factors for development of post-operative complications. **Conclusion:** Post-operative complications negatively affect the outcome of surgical intervention. In the present study, high ASA scores and comorbidities like diabetes, high Body mass index and contaminated wounds were significant risk factors for development of post-operative complications. The negative impact of these risk factors on outcome of surgery can be prevented or at least minimized by careful preoperative evaluation and appropriate therapeutic measures.

KEYWORDS

American Society of Anesthesiologists (ASA) score, comorbidities, Clavien-Dindo system, post-surgical complications.

INTRODUCTION.

Across the globe, annually, millions of patients are subjected to minor or major surgical interventions for various medical and surgical reasons. Although the surgical intervention is conducted to with an aim to have beneficial outcomes in patients, unexpected outcomes and complications are not rare events to various surgical specialties.²

Post-surgical complications are reported in 2 to 3 out of 10 patients undergoing elective surgeries whereas the mortality rates associated with it varies between 0.5 to 7%.³ Post-surgical complications may be specific to surgical procedure, nature of disease for which surgical intervention was needed, comorbid condition of patient, anesthesia, interventions related to intensive care and prolonged recumbency.² It may affect several anatomical sites including cardiopulmonary, renal, hepatobiliary, gastrointestinal, neural and hemopoietic.⁴

The outcome of these post-surgical complications is wide, ranging from minor incidents those do not require any medical/surgical interventions and may resolve without any harm to more serious life threatening incidents necessitating multiple interventions.^{2,4}

Major surgical complications significantly increase hospital stay and healthcare costs and at times are associated with high morbidity and mortality.^{2,4} It may also harm patient emotionally and negatively affect the quality of life. Therefore for better outcome of any surgical intervention, it is very essential to understand the risk factors that predispose to post-surgical complications. The present study was conducted with an aim to evaluate risk factors and to determine incidence post-surgical complications in patients undergoing major surgical procedure at tertiary care academic hospital of western Maharashtra.

MATERIAL AND METHODS.

The present cross-sectional descriptive study was prospectively conducted for a period of two years in Department of General Surgery of tertiary care teaching hospital of Pune, Maharashtra.

This study included patients undergoing major surgery (elective and

emergency). Surgeries conducted on day care basis were excluded. The patients were informed about the study and consent was obtained before enrolling them in this study.

These patients were followed for a period of one month and complications, if developed were recorded. A Complication was defined as any undesirable or unintended event that was developed in patient as a direct result of a surgical procedure that would not have taken place had the surgery gone well as could reasonably be expected. The Clavien-Dindo classification was used for grading the complication.⁵

As per this classification system, the complication was graded from Grade I to Grade V. The Clavien-Dindo classification is summarized in following table.

Table 1: The Clavien-Dindo system for classification of surgical complications.⁵

Grade of surgical complication	Description
I Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological intervention	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological intervention
II	Requiring pharmacological treatment with drugs than those allowed for grade I complications. In this grade, blood transfusion and total parenteral nutrition are included.
III Requiring intervention (surgical, endoscopic or radiological)	Requiring intervention (surgical, endoscopic or radiological)
A	Intervention not under general anesthesia
B	Intervention under general anesthesia

IV	Life-threatening complications (including central nervous system (CNS) complications) that require management in intensive care unit (ICU)
A	Single organ dysfunction (including dialysis)
B	Multi-organ dysfunction
V	Death of patient

Patient's demographic features (age, sex, body mass index (BMI)), comorbid conditions, American Society of Anesthesiologists (ASA) score for grading surgical risk, type of surgery (elective (planned)/emergency/ semi-emergency), surgical approach (laparoscopy/open), surgical indication (diagnostic/therapeutic/palliative), duration of surgery, intraoperative complications if any and wound class (clean/clean contaminated/contaminated/dirty) were recorded.

RESULTS.

A total of 318 patients qualifying the above mentioned inclusion criteria were included. The age of the patients ranged between 14 to 87 years with mean ($\pm$ SD) 44.6($\pm$ 13.9) years. Out of 318 patients, 192 (60.4%) were males whereas 126 (39.6%) were females.

The age and gender wise distribution of patients is shown in table 1. Majority of patients belong to age group 21 to 40 years. In males, majority of patients were from age group 31-40 years (27.1%) followed by 21-30 years (22.9%) whereas in females majority of patients belonged to age group 31-40 years (28.6%) followed by 41-50 years (19.4%). The mean age of male patients was 39.8 ($\pm$ 9.6) years whereas in female patients it was 41.9 ($\pm$ 6.7) years. The mean BMI was 24.8 ($\pm$ 2.18).

Table 1. Age and gender wise distribution of patients.

Age group (years)	Male (%)	Female (%)	Total
≤ 20	16 (5.1)	08 (6.3)	24 (63.2)
21-30	44 (22.9)	21 (16.7)	65 (20.4)
31-40	52 (27.1)	36 (28.6)	88 (27.7)
41-50	31 (16.1)	25 (19.4)	56 (17.6)
51-60	24 (12.5)	22 (17.5)	46 (14.5)
>60	25 (13.1)	14 (11.1)	39 (12.3)
Total	192	126	318

Out of 318 surgeries, 195 (61.3%) were planned/elective surgeries, 68 (21.4%) were done on emergency basis whereas 55 (17.3%) surgeries were performed on urgent basis. The details of surgeries performed is shown table 2.

Table 2. Types of surgeries

Surgery	Number (%)
Inguinal hernia	61 (19.2)
Ventral hernia	56 (17.6)
Appendectomy	62 (19.5)
Colectomy	24 (7.5)
Cholecystectomy	20 (6.2)
Mastectomy	26 (8.2)
Thyroidectomy	14 (4.4)
Distal pancreatectomy	09 (2.8)
Whipple	06 (1.9)
Stoma reversal	12 (3.8)
Gastrostomy	10 (3.1)
Exploratory laparotomy for intestinal obstruction/peritonitis	08 (2.5)
Soft tissue infections	10 (3.1)
Total	318

Out 318 surgeries, 185 (58.2%) were laparoscopic surgeries, whereas 133 (41.8%) were open surgeries. A total of 299 (94.1%) surgeries were therapeutic, 12 (3.8%) were conducted for diagnostic purpose, and 7 (2.2%) were palliative surgical procedures. A total of 104 (32.7%) patients had previous history of surgery.

A total of 225 (70.8%) patients had one or other comorbid condition. Hypertension (43.6%) followed by diabetes (21.8%) and chronic kidney disease (8%) were the common comorbidities (Figure 1).

When ASA grading was used for measuring anesthesia risk, majority of patients were in ASA were in ASA grade I (N=265, 83.3%), a total of 31 (9.7%) had ASA grade II and 22 (6.9%) had ASA grade III. When

surgical wound was classified, a total of 218 (68.6%) were clean wound, 68 (31.3%) were clean contaminated whereas 32 (10.1%) were dirty/infected wounds. Intraoperative complications were noted in 12 (3.8%) cases, these included 4 patients who developed intraoperative hypotension, 3 cases of bowel injury and 5 cases who developed hyperglycemia.

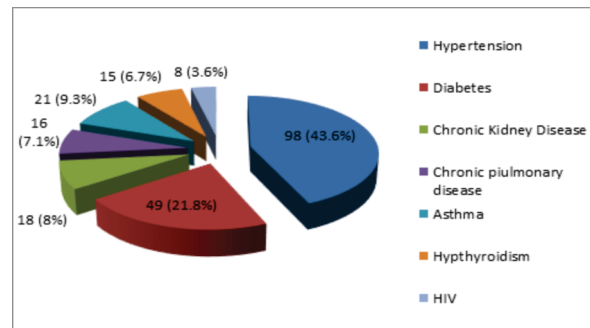


Figure 1. Comorbid conditions seen in patients.

Post-operative complications were noted in 104 (32.7%). These included 69 males (66.3%) and 35 (33.7%) females. Cases developing post-operative were further categorized in V classes as per the Clavien-Dindo system.

Table 3. Distribution of patients developing postoperative complications on the basis of the Clavien-Dindo classification system.

Grade	Number (%)
I	68 (65.4)
II	14 (13.5)
III A	09 (8.7)
III B	04 (3.8)
IV A	04 (3.8)
V	05 (4.8)

When bivariate analysis was done to assess risk factors for development of post-operative complications, risk factors advanced age (above 60 years) (Chi square test $P < 0.05^*$), diabetes mellitus (Chi square test $P = 0.01^*$), hypertension (Chi square test $P = 0.001^*$), ASA score III (Chi square test $P < 0.0001^*$), emergency surgeries (Chi square test $P < 0.0001$), dirty/infected wound (Chi square test $P < 0.05^*$), high BMI (Chi square test $P < 0.05^*$) and open surgeries (Chi square test $P < 0.05^*$) were significantly associated with development of post-operative complications.

DISCUSSION.

In any field of medicine prevention of injury and illness has a great significance. This aspect is highlighted in the maxim "primum non nocere" that means "First do no harm" which forms the basis of non-maleficence, one of the concepts of bioethics and reminds every doctor to consider the possibility of harm that may induced during any intervention (medical/surgical) done in the benefit of the patient.⁶

Although highly undesirable and unintended, post-operative complications do occur. However knowledge of risk factors predisposing to post-operative complications will definitely aid in planning preventive measures/strategies. In the present study, post-operative complications were noticed in 32.7% of patients who underwent surgical procedure. Various researchers across the world have reported incidence post-operative complications in range varying between 5.8-43.5% in general surgery patients.²

When classification of post-operative complications was done as per the Clavien- Dindo classification, the incidence of minor complications (Grade I and Grade II) was 78.8% (N=82/104) whereas major complications (Grade III and Grade IV) were noted in 16.3% (N=17/104). As compared to other system of classification of post-operative complications, the scheme proposed by Clavien-Dindo is more comprehensive, user -friendly, objective and reproducible. It is based on scale of morbidity induced by therapeutic outcome of complications.⁵

When 104 who developed post-operative complications were classified as per the Clavien-Dindo system, the incidence of Grade I,

Grade II, Grade III A, Grade IIIB, Grade IVA and Grade V were 65.4%, 13.5%, 8.7%, 3.8%, 3.8% and 4.8% respectively. Similar to Bolliger *et al* (2018)⁷ and Dharap *et al* (2022)⁴, Grade IV B was, that indicates death due to multi-organ dysfunction was not observed in the current study. The mortality rate in this study due to post-operative complication was 4.8% (Grade V). Research studies have reported mortality rates ranging from 0.79% to 5.7% in patients with post-operative complications.^{2,4}

Although not statistically significant, the incidence of post-operative complications was in males compared to female patients. This observation is in accordance to that of Al-Taki *et al* (2018).⁸ Contrast to observation noted in this study Myles *et al*⁹ and Dharap *et al*⁴ reported high incidence of post-operative complications in females compared to male patients. In the study of Myles *et al* post-operative (minor) complications like nausea, headache and vomiting to be more common in females compared to males.⁹

In 1996, ASA classification and perioperative variables were put forward as predictors to determine the postoperative outcomes.⁵ In present study, post-operative complications were significantly high in patients having ASA score III. High BMI was found to be significantly associated post-operative complications. Generally obesity is considered as an important risk factor for post-operative complications like wound infection, intra-operative blood loss and longer time required for surgery.¹⁰

Diabetes mellitus (DM) is identified as an important factor for development of any post-surgical complications, increased hospital stay after non-cardiac surgery.¹¹ In the present study, similar to the observation of other researchers, DM was significantly associated with high risk of post-operative complications.^{4,12,13}

Surgeries performed on emergency basis were also found to be associated with high risk of developing post-operative complications. In the study of McCoy *et al* high incidence of post-operative complications like surgical site infection (SSI), pneumonia, stroke, myocardial infarction and massive bleeding with high mortality rates were noted in surgeries that were performed on emergency basis.¹⁴ Therefore, this study also highlights that high ASA scores and comorbidities are significant risk factors for development of post-operative complications.

CONCLUSION.

Post-operative complications negatively affect the outcome of surgical intervention. They have every potential to deleteriously undermine the superlative effect of the surgical team. In the present study, high ASA scores and comorbidities like DM, high BMI and contaminated wounds were significant risk factors for development of post-operative complications. The negative impact of these risk factors on outcome of surgery can be prevented or at least minimized by careful preoperative evaluation and appropriate therapeutic measures.

Conflict of interest: Nil

REFERENCES

1. Weiser TG, Regenbogen SE, Thompson KD, Haynes AB, Lipsitz SR, Berry WR, et al. An estimation of the global volume of surgery: a modelling strategy based on available data. *Lancet*. 2008 ;372:139-144.
2. Tevis SE, Kennedy GD. Postoperative complications and implications on patient-centered outcomes. *J Surg Res*. 2013; 181:106-113.
3. International Surgical Outcomes Study group. Global patient outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. *Br J Anaesth*. 2016;117(5):601-609.
4. Dharap SB, Barbaniya P, Navgale S. Incidence and Risk Factors of Postoperative Complications in General Surgery Patients. *Cureus*. 2022; 14:e30975.
5. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004; 240:205-213.
6. Hughes G. First do no harm; then try to prevent it. *Emerg Med J*. 2007; 24:314.
7. Bolliger M, Kroehnert JA, Molineus F, Kandoler D, Schindl M, Riss P. Experiences with the standardized classification of surgical complications (Clavien-Dindo) in general surgery patients. *Eur Surg*. 2018; 50:256-261.
8. Al-Taki M, Sukkari HG, Hoballah JJ, Jamali S, Habbal M, Masrouha K, et al. Effect of Gender on Postoperative Morbidity and Mortality Outcomes: A Retrospective Cohort Study. *The American Surgeon*™. 2018; 84:377-386.
9. Myles PS, Hunt JO, Moloney JT. Postoperative 'minor' complications. Comparison between men and women. *Anaesthesia*. 1997; 52:300-306.
10. Tjeertes E, Hoeks S, Bekk S, Tabita T, Anton A, Robert J. Obesity – a risk factor for postoperative complications in general surgery?. *BMC Anesthesiol* 2015; 15: 112.
11. Zhang X, Hou A, Cao J, Liu Y, Lou J, Li H, Ma Y, et al. Association of diabetes mellitus with postoperative complications and mortality after non-cardiac surgery: a meta-analysis and systematic review. *Front Endocrinol (Lausanne)* 2022;13:841256.
12. Kotagal M, Symons RG, Hirsch IB, Umpierrez GE, Dellinger EP, Farrokhi ET, et al. Perioperative hyperglycemia and risk of adverse events among patients with and

without diabetes. *Ann Surg*. 2015; 261:97-103.

13. Liao KH, Aung KT, Chua N, Ho CK, Chan CY, Kow A, Earnest A, Chia SJ. Outcome of a strategy to reduce surgical site infection in a tertiary-care hospital. *Surgical infections*. 2010; 11:151-159.
14. McCoy CC, Englum BR, Keenan JE, Vaslef SN, Shapiro ML, Scarborough JE. Impact of specific postoperative complications on the outcomes of emergency general surgery patients. *J Trauma Acute Care Surg*. 2015; 78:912-918.