An analysis of surgical complications; a tool to improve surgical outcome

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ABSTRACT

Complications in surgery are an important cause of morbidity and mortality. Complications may result in an increased length of stay in hospital, repeat surgery, additional medical treatment, legal issues and increased costs. Classification and regular audit of complications is a useful tool to improve patient safety and surgical outcome. The purpose of this study is to identify and classify surgical complications and evaluate the various contributing factors. The complications were categorized by Clavein Dindo system as Grade I:52(29.1%),Grade II :45 (25.1%),Grade IIIa:26(14.5%),Grade IIIB:25(14%), Grade IVa:5(2.8%),Grade IVb:0 and Grade V:26(14.5%) .The complication rate was 5.3 % and mortality rate was 0.8% in total 3336 surgical procedures. There was significantly higher mortality in complications due to patient related factors 23.4% (11/47), compared to technical factors 4.2%(2/48) and other factors 15.4%(13/84) (p value=0.024). The mortality was significantly higher in the patients who required ICU care,54% (20/37), in class B surgical procedures 22.4% (22/98) and those who developed complications after emergency procedures were 31%(14/45) . The mortality was significantly higher in the patients who required medical intervention for various medical complications 30.1% (19/63) compared to those who required surgical intervention 8.4%(5/59) or were managed conservatively 3.5%(2/57) (p value=0.0001).

Keywords: Analysis, complications, mortality, patient safety, surgery

INTRODUCTION

Quality assessment in surgery is still a neglected subject. Traditionally quality of surgical care has been measured in terms of operative time, estimated blood loss, transfusion requirements, cost, hospital stay and return to daily activities. Recently the focus is shifting to medical errors, complications and mortality. Complications are adverse events caused by pre-existing factors that were outside the doctor's control. A surgical complication is any undesirable, unintended, and direct result of an operation affecting the patient, which would not have occurred had the operation gone as well as could reasonably be hoped.[1]

Complications in surgery are an important cause of morbidity and mortality and may result in an increased length of stay in hospital, repeat surgery, additional medical treatment, legal issues and increased costs. Limited information is found on the consequences and severity of complications in the surgical literature. Different health institutes in our country have regular mortality meetings and discussion of various factors contributing to poor outcome. However, there have been very little reports published of medical errors and complications. Apart from mortality, complications should be the most frequently measured and reported outcomes used to evaluate surgical treatment. They can be used as an indicator of quality, and their continuous evaluation can identify possible flaws in the process of care. Moreover, when comparing outcomes of treatment, the severity of complications should be taken into account; differences in recorded severity may reveal differences in quality of care and subsequently provide opportunities for improving quality of care.

In 1992, Clavien and colleagues developed a classification system that defined the severity of the complication based on the actions necessary to treat it. The system initially was not widely used, although a modified version substantially gained popularity after it was validated in a large cohort of patients and was shown to have good reproducibility among surgeons. [2]

The Clavien Dindo system is useful to evaluate the safety of procedures, analyse learning curves of surgical techniques, standardise surgical errors, thereby improving management and prevention and can be used as the basis of internal quality control. From the results of these researches in surgical complications, we can infer crude complication rates can serve as indicators of quality of care and outcome measures in surgical practice and gradation of complications is obligatory for adequate comparison of outcomes. The spectrum of complications varies with different types of surgical procedures. The general surgical procedures are categorized into three categories for standarisation of comparison of complications in different procedures.3 The aim of our study was to prospectively evaluate the severity and consequences of all complications arising in a general surgical practice, to classify according to Clavein Dindo

system and to evaluate whether recorded complications had predictable and consistent contributing factors.

MATERIALS AND METHODS

Prospective database of all the surgical procedures was maintained in surgical register. Any adverse event including complications, medical errors, mortality and other outcome parameters were recorded in a different complication register. Any unforeseen mistakes and minor complications were collectively reported by the surgical residents and faculties on regular basis. All the surgical procedures performed under regional or general anaesthesia in the period of 2010 – 2012 in the Department of Surgery, Nepal Medical College and Teaching Hospital were evaluated. The complications were classified according to the Clavein Dindo system and the surgical procedures were grouped into three categories. The general surgical procedures were categorized into three categories for standardisation of comparison of complications in different procedures; Operation type A : Surgical procedures without opening of the abdominal cavity, Operation type B : Abdominal procedures except liver surgery and major surgery in the retroperitoneum and Operation type C : Liver surgery, operations on the esophagus, pancreas, rectum, and retroperitoneum.

RESULTS

There were a total of 3336 surgical procedures (2819 elective and 517 emergency) performed in the period of two years (2010-2012). Total of 179 complications (5.3%) were noted among all the patients and the complication rate was 8.7% in emergency procedures (45/517) and 4.7% in elective procedures (134/2819). (Figure 1)

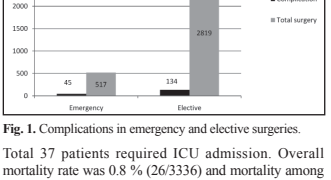

Fig. 1. Complications in emergency and elective surgeries.

Total 37 patients required ICU admission. Overall mortality rate was 0.8 % (26/3336) and mortality among the complicated patients was 14.5% (26/179). The mean age of the patients who developed complications was 46.4±17.5 years and mean hospital stay was 17.5 ±15.4 days. The complications were categorized by Clavein Dindo system as Grade I:52(29.1%),Grade II :45 (25.1%),Grade IIIa:26(14.5%),Grade IIIB:25(14%), Grade IVa:5(2.8%),Grade IVb:0 and Grade V:26(14.5%).(Table 1)

Table 1. Clavein Dindo classification

Clavein Dindo grade	Frequency	Percent
I	52	29.1
II	45	25.1
IIIa	26	14.5
IIIb	25	14
IVa	5	2.8
IVb	0	0
V	26	14.5
Total	179	100

The complications were managed conservatively in 57 patients (32%), medically in 63 patients (35%) and with surgical interventions in 59 patients (33%).(Figure 2)

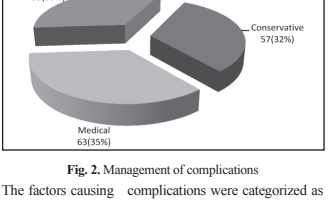

Fig. 2. Management of complications

The factors causing complications were categorized as patient factors like malnutrition, delayed presentation, advanced disease etc. in 47 patients (26.2%), technical factors (bleeding, anastomotic leak, burst abdomen etc) in 48 patients (26.8%) and others in 84 patients (47%).

There was significantly higher mortality in complications due to patient related factors 23.4% (11/47), compared to technical factors 4.2%(2/48) and other factors 15.4%(13/84) (p value=0.024). (Table 2)

Table 2. Factors causing complications

	Total	Morality	Percentage	P Value
Patient Factor	47	11	23.4%	0.024
Techical Factor	48	2	4.16%	
Others	84	13	15.4%	

The mortality was significantly higher in the patients who required ICU care 54% (20/37) compared to those who didn't require ICU care 4.2%(6/142) (p value=0.0001). (Table 3)

Table 3. ICU stay vs. mortality correlation

ICU stay	Mortality		P value
	Yes	No.	
Yes	20(54%)	17 (46%)	0.0001
No	6 (4.2%)	136(95.8%)	

The mortality rate was significantly higher in class B surgical procedures 22.4% (22/98) compared to class A 4.6% (3/65) and class C 6.2% (1/16) (p value=0.004). The mortality was significantly higher in patients who

had complications after emergency procedures 31% (14/45) compared to elective procedures 8.9%(12/134) (p value=0.0001).(Table 4)

Table 4. Type of surgery(emergency/elective) vs. mortality correlation

		Morality	Percentage	P Value
Emergency	45	14	31%	
Elective	134	12	8.9%	<0.0001
	179	26		

The mortality was significantly higher in the patients who required medical intervention for various medical complications 30.1% (19/63) compared to those who required surgical intervention 8.4%(5/59) or were managed conservatively 3.5%(2/57) (p value=0.0001). (Table 5)

Table 5. Type of management vs. mortality correlation

Type of management		Total Patients	Morality	P Value
Medical		63	19 (30.2%)	
Surgical	Conservative	57	2 (3.5%)	<00001
	Intervention	59	5 (8.4%)	

Presence of comorbidities (DM, Hypertension, coronary heart disease), and altered preoperative laboratory parameters (anaemia, jaundice, acute kidney injury, hypoprotenemia electrolyte imbalance and leucocytosis) had no correlation with mortality (Table 6)

Table .6. Correlation of mortality with co-morbidities and laboratory parameters

Parameters	Mortality group	Survivor group	P value
Comorbidities	6	10	>0.05
Leucocytosis	11	25	>0.05
Anemia	1	11	>0.05
Hypoprotenemia	4	6	>0.05
Acute kidney injury	1	3	>0.05
Jaundice	0	3	>0.05
Electrolyte imbalance	2	2	>0.05

Similarly there was no significant difference in mortality rate with type of anaesthesia (GA= 91 mortality 22 , Epidural =2 mortality 0 , spinal= 49 mortality 2 , iv anaesthesia = 8 mortality 1 and local anaesthesia = 7 mortality 0).

DISCUSSION

Patient safety is receiving growing attention worldwide. Numerous legal cases and media stories have highlighted the consequences of unintended adverse events (AEs), complications and mortalities after surgical procedures in many hospitals in our country more frequently than a decade back. Surgical care is an integral part of health care throughout the world, with an estimated 234 million operations performed annually.[4] One of the important indicators of patient safety is the rate of AEs among hospital patients. AEs are unintended injuries or complications that are caused by health care management, rather than by the patient's underlying disease, and that lead to death, disability at the time of discharge or prolonged hospital stay.[5,6] Some AEs are the unavoidable consequences of health care, such as an unanticipated allergic reaction to an antibiotic. However, 37%–51% of AEs have been judged in retrospect to have been potentially preventable.[6-12]

In various countries, hospital chart reviews have revealed that 2.9%–16.6% of patients in acute care hospitals experienced one or more AEs. 6- 13 The Canadian study of adverse events showed the AE rate of 7.5% in different Canadian hospitals and 36.9% of them were preventable.14 In the recent New Zealand study the AE rate was 12.9% among patients admitted to hospital.9 In the Quality in Australian Health Care Study, the AE rate was 16.6%; however, the study included AEs that could be linked to any previous hospital admission as well as those that occurred in the index hospital admission but were discovered in any subsequent hospital admission.6 Two large US studies found an incidence of 3.7% and 2.9% respectively.5-8 Thomas et al reported perioperative rate of death from surgery to be 0.4 to 0.8% and major complications 3 to 17%.8 These studies reflect the AE rate in total hospital admission in different specialties, however, our study includes only the patients who have undergone some surgical procedures. In our study, we found that the rate of AEs in our institute was 5.3 % and mortality rate was 0.8 % among the total patients who underwent surgical procedures. At least half of all surgical complications were avoidable.

The results of these studies have offered important data on a critical aspect of hospital performance and provided tool for the development of patient safety initiatives. However, the study and audit of AEs and complications is still a neglected subject in many health care institutes in our country. Our study provides the preliminary data and reflects the rate of AEs in our institute which may be similar to many other institutes in our country.

Growing demand for health care, rising costs, constrained resources, and evidence of variations in clinical practice have triggered interest in measuring and improving the quality of health care delivery. 15 Conclusive assessments of surgical procedures remain limited by the lack of consensus on how to define complications and to stratify them by severity. 16-20 Complications are the statistics that define surgical quality. Hence, regular audit of complications and departmental discussions regarding

the strategies to prevent avoidable complications should be done in regular basis. Study of complications needs a proper classification system. There are various systems to classify surgical complications. However, Clavien – Dindo Classification is the most widely accepted and useful system for stratification of complications. The complications graded as Clavien Dindo class I and II are usually managed easily with good outcome.

Whatever the place or period, surgical complications have been an inevitable part of surgical practice.21 Despite technically perfect operation, complications can still occur in severely ill patient due to nature of disease and general condition of the patient. Our study shows that complications resulting in mortality are significantly higher after emergency procedures. Similarly, the patient related factors are the most important factors contributing to mortality and complications. However, many surgical complications develop due to various factors in operating room. The complications developing in the operative rooms and postoperative period are often due to lapses in providing standard of care.22 The proportion of adverse events in the operating room appears to be remarkably high, comprising approximately 50 % of all adverse events within a hospital. This suggests that the operating room is a domain in which improved safety is an urgent and significant challenge.7,23,24 These are the adverse events which are usually avoidable.

The focus of performing audit of complications is to reduce and preferably eliminate these avoidable complications. Complications are costly in terms of loss of trust in the health care system by patients and diminished satisfaction by both patients and health professionals. Complications and AEs recur more frequently due to culture of silence, our indifferent behaviour to unexpected adverse events and various system constraints. We cannot change the human condition but we can change the conditions under which humans work. We can devise a more open reporting system where the discussions are focused on the root cause rather than individual causing the complications. Surgical complications are inevitable part of surgical practice and often preventable. Study of surgical complications is a useful tool to formulate the checklist or guidelines to decrease surgical complications and improve the patient outcome.

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