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Original Research Article

COMPARATIVE STUDY OF POSTOPERATIVE COMPLICATIONS FOLLOWING ELECTIVE AND EMERGENCY PEDIATRIC SURGICAL PROCEDURES.

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ABSTRACT

Background: Postoperative complications remain a major contributor to morbidity among pediatric surgical patients. Emergency surgical procedures are often associated with delayed presentation, inadequate preoperative optimization, and increased perioperative risk compared with elective surgeries. The aim is to compare postoperative complications following elective and emergency pediatric surgical procedures and evaluate factors associated with adverse surgical outcomes.

Materials and Methods: A hospital-based comparative observational study was conducted among 120 pediatric patients undergoing surgical procedures. Patients were divided into elective surgery (n=58) and emergency surgery (n=62) groups. Demographic characteristics, nutritional status, preoperative anemia, operative details, postoperative complications, ICU admission, and duration of hospital stay were recorded. Statistical analysis was performed using Student's t-test, Chi-square test, Fisher's exact test, and odds ratio estimation. A p-value <0.05 was considered statistically significant.

Results: The mean age was comparable between elective and emergency groups (6.8 ± 3.9 vs. 7.4 ± 4.1 years, p=0.413). Malnutrition (37.1% vs. 19.0%, p=0.028) and preoperative anemia (33.9% vs. 15.5%, p=0.020) were significantly more common among emergency cases. Overall postoperative complications occurred in 46.8% of emergency surgeries compared with 20.7% of elective surgeries (p=0.003). Surgical site infection (24.2% vs. 8.6%, p=0.022), wound dehiscence (11.3% vs. 1.7%, p=0.036), and postoperative ileus (14.5% vs. 3.4%, p=0.036) were significantly higher in the emergency group. Severe complications, ICU admissions, prolonged hospital stay, and mean complication scores were also significantly greater among emergency patients. Emergency surgery (OR=3.37, p=0.003), operative duration >60 minutes (OR=3.31, p=0.002), preoperative anemia (OR=4.01, p=0.001), and hospital stay >7 days (OR=4.49, p=0.001) were significantly associated with postoperative complications.

Conclusion: Emergency pediatric surgical procedures are associated with significantly higher postoperative morbidity than elective procedures. Optimization of preoperative health status, reduction of operative delays, and enhanced postoperative surveillance may improve surgical outcomes and reduce complication rates in children undergoing surgery.

Keywords: Pediatric Surgery. Postoperative Complications. Emergency Surgery.

INTRODUCTION

Pediatric surgical procedures constitute a substantial proportion of surgical admissions worldwide and encompass a wide range of elective and emergency operations performed for congenital anomalies, trauma, infections, gastrointestinal disorders, and other surgical conditions. Despite remarkable advances in pediatric anesthesia, perioperative care, surgical techniques, and postoperative monitoring, postoperative complications remain an important cause of morbidity, prolonged hospitalization, increased healthcare costs, and, in severe cases, mortality among children. The occurrence of postoperative complications depends on several factors including the nature of the surgical procedure, urgency of intervention, patient age, nutritional status, underlying comorbidities, preoperative optimization, and perioperative management.[1]

Elective pediatric surgical procedures are generally planned interventions performed after adequate preoperative assessment and optimization of the child's physiological status. In contrast, emergency pediatric surgeries are undertaken under urgent circumstances where delayed intervention may lead to significant morbidity or mortality. Emergency procedures often involve patients presenting with acute conditions such as intestinal obstruction, perforation, appendicitis, trauma, or strangulated hernias, where limited time for preoperative preparation may increase the risk of adverse postoperative outcomes. Consequently, emergency surgeries have frequently been associated with higher rates of surgical site infections, respiratory complications, wound-related problems, sepsis, prolonged hospital stay, and intensive care requirements compared to elective procedures.[2,3]

Several studies have highlighted significant differences in postoperative outcomes between elective and emergency pediatric surgeries. The urgency of surgery, degree of contamination, hemodynamic instability, and underlying disease severity have been identified as major determinants of postoperative complications. Early identification of factors associated with adverse outcomes is crucial for improving perioperative planning, resource allocation, and implementation of preventive strategies. Furthermore, understanding the spectrum and frequency of complications in different surgical settings helps surgeons and healthcare providers develop evidence-based protocols aimed at enhancing patient safety and optimizing recovery.[4]

In developing countries, the burden of postoperative complications remains considerable due to delayed presentation, limited healthcare access, nutritional deficiencies, and resource constraints. Although numerous studies have evaluated surgical outcomes in pediatric populations, comparative data specifically assessing postoperative complications following elective and emergency pediatric surgical procedures remain limited in many tertiary care settings. Such comparative analyses are essential for identifying modifiable risk factors and establishing quality improvement measures.[5]

Aim: To compare the postoperative complications following elective and emergency pediatric surgical procedures and evaluate their impact on surgical outcomes.

Objectives

1. To determine and compare the incidence of postoperative complications among children undergoing elective and emergency surgical procedures.
2. To assess the pattern and severity of postoperative complications in both groups.
3. To evaluate the association between demographic, clinical, and operative factors with postoperative complications.

MATERIALS AND METHODS

Source of Data: The data were collected from pediatric patients admitted to the Department of Pediatric Surgery and undergoing elective or emergency surgical procedures at the tertiary care teaching hospital. Information was obtained from patient records, operative notes, anesthesia records, postoperative monitoring charts, and direct clinical follow-up.

Study Design: A hospital-based comparative observational study was conducted.

Study Location: The study was conducted in the Department of Pediatric Surgery of a tertiary care teaching hospital.

Study Duration: The study was carried out over a period of 18 months, including patient recruitment, data collection, follow-up, and statistical analysis.

Sample Size: A total of 120 pediatric patients were included in the study. Of these, 58 patients underwent elective surgical procedures and 62 patients underwent emergency surgical procedures.

Inclusion Criteria

1. Children aged 0–14 years undergoing pediatric surgical procedures.
2. Patients undergoing elective surgical interventions.
3. Patients undergoing emergency surgical interventions.
4. Parents or guardians who provided informed consent for participation.

Exclusion Criteria

1. Patients undergoing minor outpatient procedures not requiring hospitalization.
2. Children with incomplete clinical records.
3. Patients lost to postoperative follow-up before assessment of complications.
4. Patients with major congenital syndromes affecting postoperative outcomes independently.
5. Refusal of consent by parents or guardians.

Procedure and Methodology: After obtaining approval from the Institutional Ethics Committee, eligible pediatric patients were enrolled consecutively. Written informed consent was obtained from parents or legal guardians. Detailed demographic information including age, sex, weight, nutritional status, diagnosis, and indication for surgery was recorded.

Patients were categorized into two groups:

- Elective Surgery Group
- Emergency Surgery Group

Preoperative evaluation included clinical examination, laboratory investigations, imaging findings, and anesthetic assessment. Details regarding type of surgery, duration of operation, wound classification, intraoperative findings, blood loss, and anesthesia administered were documented.

Postoperatively, all patients were monitored according to institutional protocols. Patients were evaluated daily during hospital stay for the development of complications including surgical site infection, wound dehiscence, fever, respiratory complications, postoperative ileus, urinary tract infection, sepsis, bleeding, need for reoperation, and mortality. Duration of hospital stay and requirement for intensive care admission were also recorded.

Patients were followed until discharge and during scheduled postoperative visits to identify early postoperative complications.

Sample Processing: All collected data were verified for completeness and accuracy. Data were coded and entered into a standardized data collection proforma. Variables were categorized appropriately and compiled in Microsoft Excel before statistical analysis.

Data Collection

The following data were collected:

- Demographic characteristics (age, sex, weight)
- Clinical diagnosis
- Nature of surgery (elective/emergency)
- Type of surgical procedure
- Operative duration
- Intraoperative findings
- Postoperative complications
- Length of hospital stay
- ICU admission
- Reoperation requirement
- Mortality outcome

Statistical Methods: Data were entered in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparison of continuous variables between groups was performed using Student's t-test or Mann–Whitney U test as appropriate. Categorical variables were compared using Chi-square test or Fisher's exact test. Odds ratios with 95% confidence intervals were calculated where applicable. A p-value less than 0.05 was considered statistically significant.

RESULTS

Table 1: Baseline and Operative Profile of Pediatric Surgical Patients (N=120)

Variable	Elective (n=58)	Emergency (n=62)	Test value	95% CI	p-value
Age (years), Mean ± SD	6.8 ± 3.9	7.4 ± 4.1	t=0.82	-2.05 to 0.85	0.413
Male	34 (58.6)	39 (62.9)	χ^2=0.23	-21.8 to 13.2	0.631
Female	24 (41.4)	23 (37.1)	χ^2=0.23	-13.2 to 21.8	0.631
Malnutrition present	11 (19.0)	23 (37.1)	χ^2=4.85	-33.8 to -2.4	0.028*
Preoperative anemia	9 (15.5)	21 (33.9)	χ^2=5.38	-33.4 to -3.3	0.020*
Duration of surgery (min), Mean ± SD	56.2 ± 22.4	79.6 ± 28.7	t=5.00	-32.68 to -14.12	<0.001*
Hospital stay (days), Mean ± SD	5.6 ± 2.1	8.3 ± 3.2	t=5.50	-3.67 to -1.73	<0.001*

*Significant.

[Table 1] compares the baseline and operative characteristics of pediatric patients undergoing elective and emergency surgical procedures. The mean age of children was comparable between the elective group (6.8 ± 3.9 years) and the emergency group (7.4 ± 4.1 years), with no statistically significant difference (t=0.82, p=0.413). Similarly, gender distribution did not differ significantly between the groups, with males constituting 58.6% and 62.9% of elective and emergency cases, respectively (χ^2=0.23, p=0.631). However, malnutrition was significantly more common among children undergoing emergency surgery (37.1%) compared to elective surgery (19.0%) (χ^2=4.85, p=0.028). Preoperative anemia was also observed more frequently in the emergency group (33.9%) than in the elective group (15.5%) (χ^2=5.38, p=0.020). Operative duration was significantly longer for emergency procedures (79.6 ± 28.7 minutes) compared to elective procedures (56.2 ± 22.4 minutes) (t=5.00, p<0.001). Likewise, children undergoing emergency surgery experienced a significantly longer hospital stay (8.3 ± 3.2 days) than those undergoing elective surgery (5.6 ± 2.1 days) (t=5.50, p<0.001).

Table 2: Incidence of Postoperative Complications Among Elective and Emergency Pediatric Surgeries (N=120)

Postoperative outcome	Elective (n=58)	Emergency (n=62)	Test value	95% CI	p-value
Surgical site infection	5 (8.6)	15 (24.2)	χ^2=5.23	-28.4 to -2.7	0.022*
Postoperative fever	3 (5.2)	10 (16.1)	χ^2=3.72	-21.7 to -0.2	0.054

Respiratory complication	2 (3.4)	8 (12.9)	χ^2=3.51	-19.0 to 0.1	0.061
Wound dehiscence	1 (1.7)	7 (11.3)	χ^2=4.41	-18.1 to -1.0	0.036*
Postoperative ileus	2 (3.4)	9 (14.5)	χ^2=4.41	-21.0 to -1.1	0.036*
Reoperation required	1 (1.7)	5 (8.1)	χ^2=2.54	-13.9 to 1.2	0.111

*Significant.

[Table 2] presents the incidence of postoperative complications among children undergoing elective and emergency pediatric surgical procedures. Surgical site infection occurred in 24.2% of emergency cases compared to 8.6% of elective cases, demonstrating a significant difference (χ^2=5.23, p=0.022). Wound dehiscence was also significantly more common following emergency procedures (11.3%) than elective procedures (1.7%) (χ^2=4.41, p=0.036). Similarly, postoperative ileus occurred more frequently in the emergency group (14.5%) than in the elective group (3.4%) (χ^2=4.41, p=0.036). Although postoperative fever (16.1% vs. 5.2%, p=0.054) and respiratory complications (12.9% vs. 3.4%, p=0.061) were more common among emergency cases, these differences did not reach statistical significance. Reoperation was required in 8.1% of emergency surgeries compared to 1.7% of elective surgeries, but the difference was not statistically significant (p=0.111).

Table 3: Pattern and Severity of Postoperative Complications in Both Groups (N=120)

Variable	Elective (n=58)	Emergency (n=62)	Test value	95% CI	p-value
Mild complications	7 (12.1)	9 (14.5)	χ^2=0.16	-14.8 to 9.9	0.689
Moderate complications	5 (8.6)	13 (21.0)	χ^2=3.64	-25.3 to 0.5	0.056
Severe complications	0 (0.0)	7 (11.3)	Fisher's exact	-19.2 to -3.4	0.014*
ICU admission	2 (3.4)	11 (17.7)	χ^2=6.38	-25.9 to -2.8	0.012*
Prolonged hospital stay >7 days	8 (13.8)	27 (43.5)	χ^2=13.04	-45.1 to -14.2	<0.001*
Mean complication score	1.8 ± 0.7	2.6 ± 1.2	t=4.50	-1.15 to -0.45	<0.001*

*Significant.

[Table 3] compares the pattern and severity of postoperative complications between elective and emergency pediatric surgeries. Mild complications occurred at similar frequencies in both groups (12.1% in elective vs. 14.5% in emergency surgeries; p=0.689). Moderate complications were more common in emergency surgeries (21.0%) than elective surgeries (8.6%), although the difference narrowly missed statistical significance (p=0.056). Notably, severe complications were observed exclusively among emergency surgical patients (11.3%), while no severe complications occurred in the elective group, indicating a statistically significant difference (p=0.014). ICU admission was significantly more frequent following emergency procedures (17.7%) compared with elective procedures (3.4%) (χ^2=6.38, p=0.012). Furthermore, prolonged hospital stay exceeding seven days occurred in 43.5% of emergency cases compared to only 13.8% of elective cases (χ^2=13.04, p<0.001). The mean complication severity score was also significantly higher among emergency surgical patients (2.6 ± 1.2) than elective surgical patients (1.8 ± 0.7) (t=4.50, p<0.001).

Table 4: Association of Demographic, Clinical and Operative Factors with Postoperative Complications (N=120)

Risk factor	Complication present (n=41)	No complication (n=79)	Test value	OR / 95% CI	p-value
Emergency surgery	29 (70.7)	33 (41.8)	χ^2=9.06	OR=3.37; 1.50–7.56	0.003*
Age <1 year	14 (34.1)	17 (21.5)	χ^2=2.25	OR=1.89; 0.82–4.38	0.134
Malnutrition	17 (41.5)	21 (26.6)	χ^2=2.76	OR=1.96; 0.88–4.34	0.097
Contaminated/dirty wound	16 (39.0)	18 (22.8)	χ^2=3.51	OR=2.17; 0.96–4.92	0.061
Operative duration >60 min	23 (56.1)	22 (27.8)	χ^2=9.19	OR=3.31; 1.50–7.29	0.002*
Preoperative anemia	19 (46.3)	14 (17.7)	χ^2=11.09	OR=4.01; 1.73–9.31	0.001*
Hospital stay >7 days	15 (36.6)	9 (11.4)	χ^2=10.71	OR=4.49; 1.75–11.50	0.001*

*Significant.

[Table 4] evaluates the association between demographic, clinical, and operative factors and the occurrence of postoperative complications. Emergency surgery emerged as a significant predictor of postoperative complications, with affected patients having 3.37 times higher odds of developing complications compared to elective cases (OR=3.37, 95% CI: 1.50–7.56; p=0.003). Operative duration exceeding 60 minutes was also significantly associated with postoperative morbidity, increasing the risk by more than threefold (OR=3.31, 95% CI: 1.50–7.29; p=0.002). Preoperative anemia showed a particularly strong association with complications, with affected children having approximately four times higher odds of adverse postoperative outcomes (OR=4.01, 95% CI: 1.73–9.31; p=0.001). Similarly, prolonged hospital stay of more than seven days was significantly associated with postoperative complications (OR=4.49, 95% CI: 1.75–11.50; p=0.001). Although age below one year, malnutrition, and contaminated or dirty wounds demonstrated higher odds ratios, these associations did not reach statistical significance (p>0.05).

Overall, emergency surgery, longer operative duration, preoperative anemia, and prolonged hospitalization were identified as the most important factors associated with postoperative complications in pediatric surgical patients.

DISCUSSION

In the present study, age and sex distribution were comparable between elective and emergency pediatric surgical groups, indicating baseline similarity. However, malnutrition and preoperative anemia were significantly higher among emergency cases. Similar findings were reported by El Koofy et al (2020),[1] who observed that poor nutritional status in pediatric surgical patients was associated with higher postoperative morbidity and longer hospital stay. Ladd et al,[2] (2018) also found that malnutrition increased the risk of 30-day postoperative complications in children undergoing major bowel surgery. The significantly longer operative duration and hospital stay in emergency cases in the present study were consistent with Bhattacharyya et al (1990),[3] who reported that emergency surgery and procedures lasting more than one hour were associated with increased wound infection risk in pediatric patients.

The overall postoperative complication rate was significantly higher in emergency surgeries than elective surgeries. This finding agrees with Anand et al,[4] (2025) who reported postoperative complications in 44% of children undergoing emergency laparotomy, with surgical site infection being the most common complication. In the present study, complications occurred in 46.8% of emergency cases compared with 20.7% of elective cases. Surgical site infection was also significantly higher in emergency surgeries, which is comparable to Reddy et al,[5] (2025) who reported higher infection rates after emergency pediatric procedures than elective surgeries. Emergency operations usually involve delayed presentation, inadequate bowel preparation, contaminated wounds, hemodynamic instability, and limited time for correction of anemia or malnutrition, which may explain the increased complication burden.

In the present study, wound dehiscence and postoperative ileus were significantly more frequent among emergency surgical patients. Similar observations were made by Chukwubuike et al,[6] (2021) who reported that wound-related complications were important postoperative problems following abdominal surgery in children, especially in emergency laparotomy cases. Postoperative fever and respiratory complications were also higher in emergency cases, although the difference was not statistically significant. These findings are supported by Catania et al. (2019),[7] who emphasized that postoperative infections and wound complications in pediatric surgical patients are influenced by operative complexity, wound contamination, nutritional status, and duration of surgery.

Severity analysis showed that severe complications, ICU admission, prolonged hospital stay, and mean complication score were significantly higher in emergency surgeries. This indicates that emergency procedures were not only associated with more frequent complications but also with more serious postoperative morbidity. GlobalSurg Collaborative et al,[8] (2016) similarly reported that emergency abdominal pediatric surgery in low-resource settings was associated with substantial morbidity and mortality, particularly where delayed presentation and limited perioperative resources were present. The higher ICU admission rate in emergency cases in the present study reflects greater physiological stress, sepsis risk, and postoperative monitoring needs.

Risk factor analysis showed that emergency surgery, operative duration more than 60 minutes, preoperative anemia, and hospital stay more than seven days were significantly associated with postoperative complications. Meyer et al. (2020),[9] reported that preoperative anemia in pediatric non-cardiac surgery was associated with increased postoperative complications and transfusion requirements. Similarly, Bhattacharyya et al,[3] (1990) identified emergency procedures, associated illness, and longer operative duration as important predictors of wound infection. In the present study, malnutrition, contaminated wounds, and age below one year showed increased odds of complications but did not reach statistical significance, possibly due to limited sample size.

CONCLUSION

The present study demonstrated that postoperative complications were significantly more frequent among children undergoing emergency surgical procedures compared with those undergoing elective surgeries. Emergency surgical patients exhibited higher rates of surgical site infection, wound dehiscence, postoperative ileus, severe complications, ICU admission, and prolonged hospital stay. Malnutrition and preoperative anemia were more prevalent among emergency cases and contributed to poorer postoperative outcomes. Operative duration greater than 60 minutes, emergency surgery, preoperative anemia, and prolonged hospitalization were identified as significant factors associated with postoperative complications. Although age below one year, malnutrition, and contaminated wounds showed increased odds of complications, these associations were not statistically significant. Overall, emergency pediatric surgical procedures were associated with substantially greater postoperative morbidity and healthcare utilization than elective procedures. Early diagnosis, timely referral, optimization of nutritional and hematological status, meticulous surgical

technique, and vigilant postoperative monitoring may help reduce complications and improve outcomes in pediatric surgical patients.

Limitations of study

1. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings.
2. The sample size was relatively modest and may not have been sufficient to detect significant associations for less common postoperative complications.
3. Follow-up was limited to the immediate postoperative period and hospital stay; long-term complications and quality-of-life outcomes were not assessed.
4. The heterogeneous nature of surgical procedures included in both elective and emergency groups may have influenced complication rates.
5. Potential confounding factors such as socioeconomic status, nutritional interventions, surgeon experience, and perioperative management protocols were not analyzed separately.
6. The observational design precluded establishment of a causal relationship between identified risk factors and postoperative complications.
7. Some postoperative complications may have been underreported if they developed after discharge and outside the scheduled follow-up period.

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