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## Spectrum of pediatric surgical cases and their outcome in a tertiary care hospital

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### Abstract

**Introduction:** Pediatric surgical cases are operated by general surgeon due to lack of pediatric surgeons. Complex cases in neonates and infants is being referred to other centers with pediatric surgical services. This study aims to compare the spectrum of pediatric surgical cases and their outcomes before and after the availability of pediatric surgeon.

**Method:** This retrospective study was conducted at the Patan Hospital, Nepal, over a period of 4 years. Group 1 (G1) included surgeries during 1<sup>st</sup> 2 y before and Group 2 (G2) during 2<sup>nd</sup> 2 y period after the availability of pediatric surgeon. Ethical approval was obtained. Patient age, sex, diagnosis, operative procedure, type of surgery, and outcome were analyzed.

**Result:** Of 1157 cases, 369 were in G1 and 788 in G2. The male to female ratio was 2.8:1. Laparotomies 270(23.2%) was the most performed inpatient surgery and herniotomies (221(19.1%) in day care. There were 52 (4.5%) neonates; 2(4%) in G1 and 50(96%) in G2. Among total cases, the mortality rate was 8(0.7%) in G2, due to preterm birth, delayed presentation, and septicemia.

**Conclusion:** Laparotomy and incision & drainage were the most commonly performed surgeries. There was a 96% increment in neonatal cases (50 v/s 2) after the availability of pediatric surgeon. Mortality was 8(0.7%) in group-2 due to delayed presentation and septicemia.

**Keywords:** Daycare surgery, mortality, neonatal surgery, outcome, pediatric surgical services

## Introduction

Pediatric surgery is one of the demanding subspecialties requiring specialized case management. However, the care of pediatric surgical cases has been overlooked resulting in life-long disability and a higher risk of mortality.<sup>1</sup> According to the global statistics, pediatric surgical cases are almost half of the global surgical burden which is amendable.<sup>2</sup>

An absolute volume of pediatric surgical cases is much higher compared to the number of pediatric surgeons, indicating the need to increase pediatric surgeons. A survey done in the United States reported half of the pediatric surgical cases were performed by general surgeons without pediatric subspecialty training. It has raised the question, the need for subspecialty training who operate on children, and these conditions should be limited to high-level care institutes.<sup>3</sup> Paediatric surgery is established itself as an independent subspecialty in developed countries. However, there is still a high burden of unmet surgical need in the pediatric population in developing countries.<sup>1</sup>

Owing to the lack of proper documentation and reporting, the data regarding the distribution and outcome of pediatric surgical conditions is sparse. This makes it difficult to assess the case burden and design strategy to improve hospital setup for these groups of patients.

This study aims to audit the spectrum of pediatric surgical cases, and outcomes before and after the availability of pediatric surgeons, which may help for further planning and resource allocation.

## Method

This is the retrospective analysis conducted at the Department of Surgery, Patan Hospital, Patan Academy of Health Sciences, Nepal, over 4 years. Group 1 was categorized as all pediatric surgical cases managed by the general surgeon from Jan 2017- Dec 2018, and

Group 2 as pediatric surgical cases after the availability of pediatric surgeons from Jan 2019 till Dec 2020. Patients with incomplete information in the operative theatre register and medical record, and all pediatric ENT and orthopedics cases were excluded.

Approval from Institutional Review Committee of Patan academy of health sciences. Patient information was collected from the operative theatre register and medical record section. Information on age (<1 mo, >1 mo to ≤1 y, >1 y to ≤5 y and 5 y to ≤14 y), sex, system-wise diagnosis (Abdominal wall defect, Thorax, Hepatobiliary, Upper GI tract, lower GI tract, Inguinoscrotal, Skin and soft tissue, Urogenital), operative procedure, type of surgery (daycare surgery and inpatient surgery) and outcome (Cured, Improved, No change, Worsening, Mortality, Leave Against Medical Advice) noted in proforma and analyzed.

Clinical profile and outcome were analyzed descriptively and compared for number and percentage.

## Result

During the 4 years study period, as per the operative register, the total number of pediatric surgery was 1157. In group 1 there were 369 cases (January 2017- December 2018) and 788 in group 2 (January 2019-December 2020). The male:female ratio of 2.8:1.

The system-wise distribution of the total number of cases in the different age groups, lower GI tract was commonest in ≤1 mo, skin and soft tissue in >1 mo to ≤ 1 y, inguinoscrotal in >1 y ≤5 y and lower GI tract in >5 y ≤14 y, Figure 1.

The total number of daycare surgery was 724(62.2%) and 433(37.4%) inpatient surgery with the lower GI tract (appendicitis) being the common cause in inpatient surgery and skin and soft tissue(abscess) in daycare surgery, Table 1. In group 1 there were 227(61%)

daycare surgery and 142(39%) inpatient surgery. We had a similar finding in group 2 there were 497(62.9%) daycare surgery and 291(36.7%) inpatient surgery.

Laparotomy 270(23.2%) was the most performed surgery followed by Incision and drainage 228(19.7%) and herniotomy 221(19.1%), Figure 2.

There was a total number of 1123(97%) cases cured and 8(0.7%) had mortality. All mortality cases were in neonates and the cause of death was preterm, delayed presentation, associated anomalies, and septicemia. There were 18 (1.6%) laparotomy (3) and surgical site infections (15), and all improved. Complications were seen in 6(0.8%) like urethrocutaneous fistula and wound dehiscence in group 2.

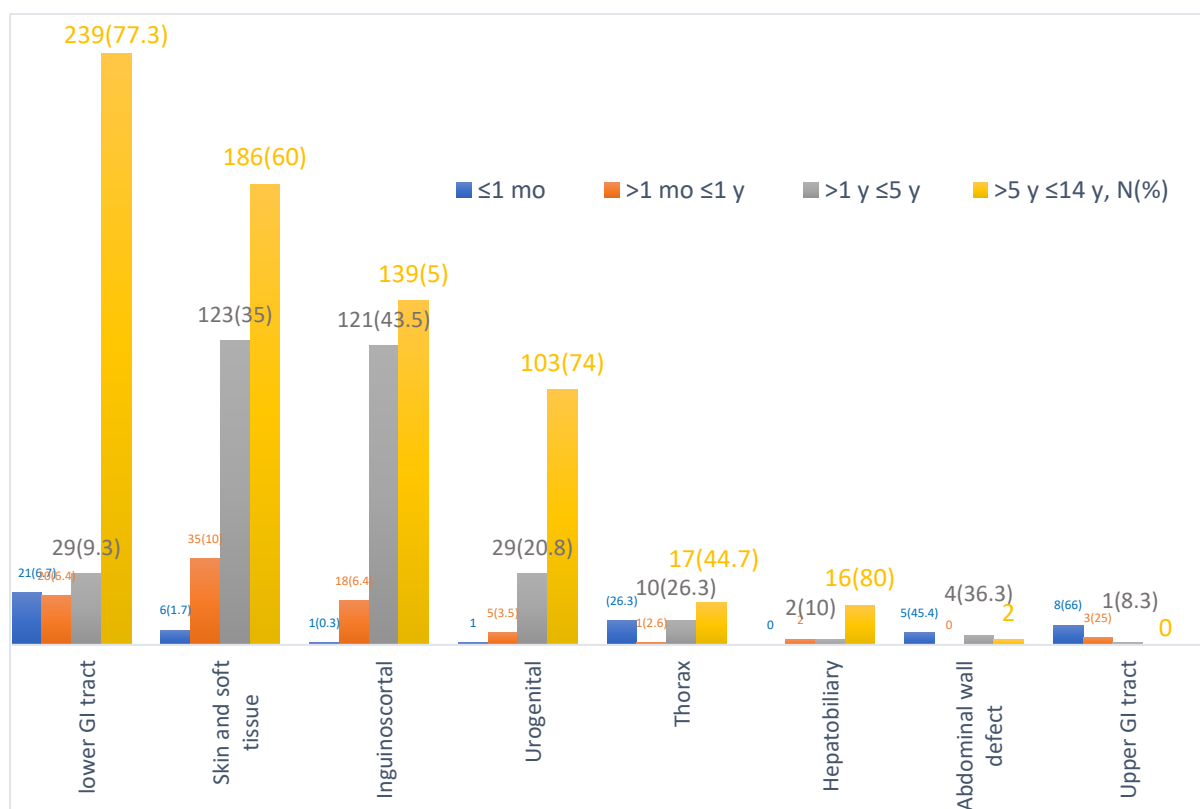
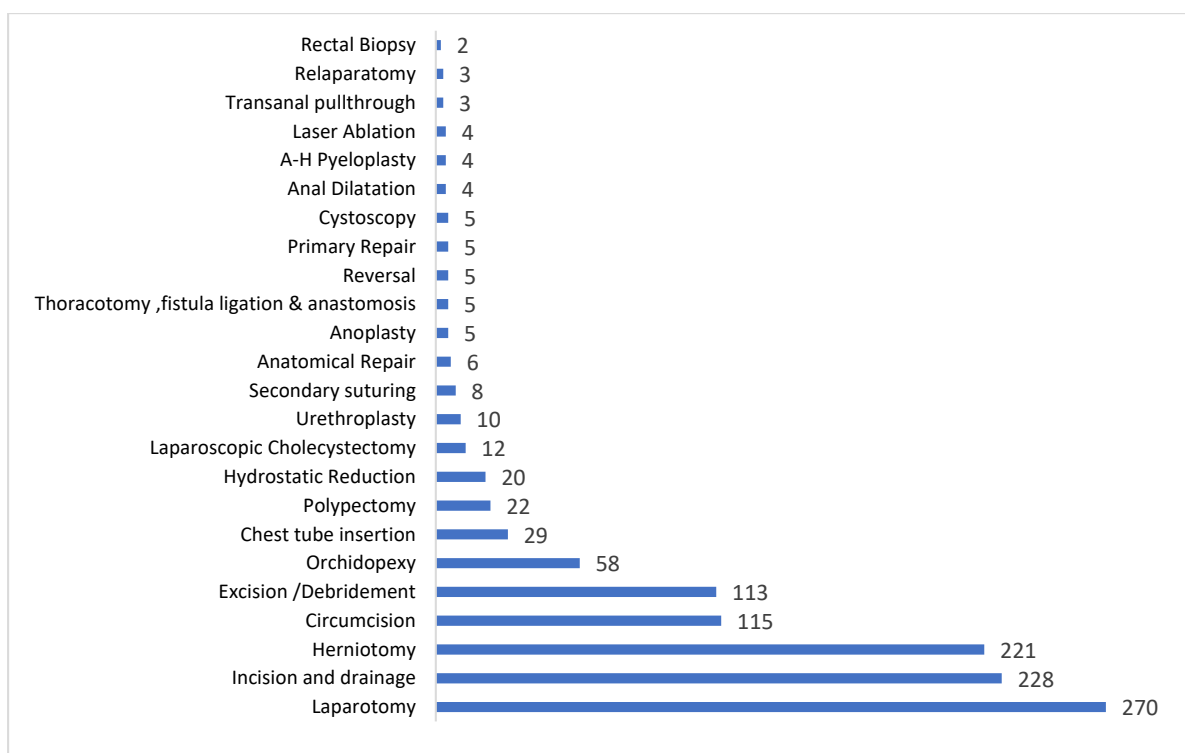


Figure 1. System-wise distribution of total pediatric surgical cases in different age groups

Table 1. System wise distribution of inpatient and daycare pediatric surgical cases

Type of surgery	Inpatient N(%)	Daycare N(%)	total
Skin and soft tissue	17(4.8)	333(95.2)	350
Lower GI tract	280(90)	29(20)	309
Inguinoscrotal	40(14.4)	238(85.6)	278
Urogenital	17(12.2)	122(87.8)	139
Thorax	38(100)	0	38
Hepatobiliary	20(100)	0	20
Upper GI tract	12(100)	0	12
Abdominal wall defect	9(81.1)	2(18.9)	11
Total	433(37.4)	724(62.2)	1157



**Figure 2. Frequency of different operative procedures in total pediatric surgical cases**

**Table 2. Comparison of group 1 and group 2 according to Age-wise distribution, type of surgery, system-wise distribution, and their outcome**

Age	Total cases, N=1157 N(%)	Group 1, N=369 N(%)	Group 2, N=788 N(%)
<b>Age-wise distribution</b>			
≤1 month	52(4.5)	2(4)	50(96)
>1 month to ≤1 year	84(12.6)	16(19)	68(81)
1 year to ≤5 years	319(27.6)	94(29.4)	225(70.5)
5 years to ≤14 years	702(55.5)	257(36.4)	445(63.5)
<b>Type of surgery</b>			
Inpatient	433(37.4)	142(39)	291(36.7)
Daycare	724(62.6)	227(61)	497(63.3)
<b>System wise distribution</b>			
Abdominal wall defect	11(0.9)	2(18.18)	9(81.81)
Hepatobiliary	20(1.7)	7(35)	13(65)
Inguinoscrotal	278(24.1)	86(30.9)	192(69.1)
Lower GI tract	309(26.7)	84(27.5)	225(72.5)
Skin and soft tissue	350(30.2)	109(31.1)	241(68.9)
Thorax	38(3.2)	17(44.7)	21(55.3)
Upper GI	12(1.1)	0(0)	12(83.4)
Urogenital	139(12.1)	64(46)	75(54)
<b>Outcome</b>			
Cured	1122(96.97)	362(32.4)	760(67.6)
Improved	19(1.64)	7(36.8)	12(63.2)
No change	6(0.51)	0(0)	6(100)
Withdrawal of support	1(0.086)	0	1(100)
Worsening	1(0.086)	0	1(100)
Expired	8(0.6)	0	8(87.5)

## Discussion

At our center, the pediatric surgical cases have been managed by general surgeons before the availability of a pediatric surgeon. However, there was an increase in the number of pediatric surgical cases especially neonates and infants after a pediatric surgeon became available 2 y ago. The data shows a total of 1157 cases of pediatric surgeries were performed during 4 y, 369 during the 1<sup>st</sup> 2 y before the specialist pediatric surgeon was available, and 788 during 2<sup>nd</sup> 2 y following availability of pediatric surgeon, with an increase in complex surgeries in both neonate and infants. A study done in Nepal reported that due to a limited number of pediatric surgeons, general surgeons have been providing surgical services to the children since the inception of the hospital six decades ago.<sup>5</sup> Survey done by American Pediatric Surgical Association estimated that general surgical providers performed 21% of surgery on children, except for the more complex cases in neonates and infants.<sup>6</sup>

Out of the 1157 surgical cases during 4 y, 52(4.5%) were neonates. A study from Nepal showed 205 neonatal surgeries over 2 years.<sup>7</sup> This study was done in the only government children's hospital located in Kathmandu that manages referrals from all over the country. Studies from India showed 986 neonatal surgeries in 3 y and Rwanda 77 cases in 1 y.<sup>8,4</sup> In the present study, the neonatal surgeries increased from 2 in the 1<sup>st</sup> 2 y (before the specialized pediatric surgeon became available) to 50 in the 2<sup>nd</sup> 2 y. Among 1157 cases, 853(73.7%) were male and 304(26.3%) were female with a male:female ratio of 2.8:1. Similar male predominance was seen in other studies done in Somaliland and Uganda.<sup>9,10</sup>

A study done in Nigeria showed 1156(57%) cases were managed on an outpatient and daycare basis.<sup>11</sup> In our study also we had a similar finding there was 724(62.2%) daycare surgery. Skin and soft tissue 333(46%) followed by inguinoscrotal 238(32.8%) were most performed daycare surgery. A study from Nepal reported daycare pediatric inguinal

hernia surgery is safe, economic, and well accepted by both child and parents<sup>12</sup>. Similarly, a study done in Pakistan showed inguinal hernia accounts for 220(58.5%) of total daycare surgery.<sup>13</sup> But a study was done in India showed the rate of inpatient surgical procedures was high. This study gave reasoning like lack of local service and lengthy travel.<sup>8</sup>

The most common system involved was skin and soft tissue 228(30.2%), presenting with an abscess in both groups. The second most common surgeries were inguinoscrotal inguinal hernia 86(30.9%) in group 1 and lower GI tract appendicitis 224(72.5%) in group 2. A study done in Pakistan showed the most common diseases were burns 1465(37.8%), followed by trauma cases 925(23.9%) and acute appendicitis.<sup>14</sup> In our center we lack neurosurgical service and we have just started plastic surgical service. Another study done in Maharashtra, India showed inguinal hernias are the most common encounters.<sup>8</sup> we had a similar finding of 150 cases of inguinal hernia. A study from Ethiopia showed gastrointestinal condition (appendicitis), trauma, and congenital anomalies (inguinal hernia) were the common cause.<sup>15</sup> But in our cases, abscess were more common followed by appendicitis and inguinal hernia. A similar finding was reported in other studies done in Africa which showed among skin and soft tissue injury abscess, pyomyositis were more common.<sup>16</sup> This could be due to tropical climate, malnutrition, and lower socioeconomic status.

Laparotomy 270(23.3%) was the most performed surgical procedure followed by incision and drainage 228(19.7%) and herniotomy 221(19.7%). In this study, we had a total of 3(2.3%) morbidities like relaparotomy with a prolonged hospital stay, wound dehiscence, urethrocutaneous fistula. A study done in Ethiopia showed 53(17.2%) relaparotomy for postoperative intra-abdominal collection and anastomotic leak.<sup>17</sup> Indication of relaparotomy in our case was peritonitis and ileus which improved at the time of discharge. There was 1 case of bladder exstrophy with wound dehiscence (33%). A

study done in the United Kingdom showed no dehiscence while two other studies showed dehiscence and attributed it to delayed closure.<sup>18,19,20</sup> In our case, the probable cause might be primary closure without osteotomy and delayed closure as the patient was referred from another center. Other complications like urethrocutaneous fistula and wound dehiscence 4(40%) were seen in cases of hypospadias. A study done in Lahore reported 31(32.6%) had a urethral fistula and they gave the reason being the use of inappropriate suture material.<sup>21</sup> But a study from China observed only 299(4%) incidence of urethrocutaneous fistula.<sup>22</sup> The surgery performed by an experienced pediatric urologist might be contributing factor in other studies for a better outcome. In comparison to other studies, we have a higher percentage of complications possibly due to increased operative age, proximal penile hypospadias, and penile dressing.

Among neonates, the most common surgery performed was lower gastrointestinal tract 21(40.4%) followed by thorax 10(19.2%) in group 2 and 2(4%) cases of abscess in group 1. Most cases were anorectal malformation, Hirschsprung disease, small bowel atresia, necrotizing enterocolitis, tracheoesophageal fistula. There was a total of 8(0.7%) mortality seen. The cause of mortality was prematurity, relaparotomy, and septicemia, and delayed presentation. Report from Ethiopia showed a 10(7.46%) mortality rate and probable cause was delay presentation, lack of awareness of parents, delay in referral system.<sup>23</sup> Necrotizing enterocolitis was a leading cause of mortality in a study done in India, and contributing factors sepsis secondary to peritonitis, prematurity, and shock.<sup>24</sup> Another study done in India reported tracheoesophageal fistula was the commonest cause of neonatal death.<sup>8,25</sup> We had a similar result and the contributing factors were a delayed presentation leading to gastric perforation and septicemia. Antenatal screening, awareness about congenital anomalies is crucial to both parents and medical personnel to decrease late presentation. Some studies have observed a 20% - 60% mortality rate in the Middle East,

South East Asian and African countries, and other developing countries, compared to <5% in high-income countries.<sup>26,27,28</sup>

The dedicated and specialized pediatric surgical team, trained staff, support system from neonatal and pediatric ICU, pediatric anesthesiologist, parenteral nutrition, and sustainable infrastructure are important factors to decrease morbidity and mortality. There is a need for more studies of pediatric surgical cases to help clarify interventions to improve pediatric surgical services locally. Our study has limitations for being a retrospective review of a limited period with limited sample size and didn't include follow-up after discharge.

### Conclusion

Many pediatric surgical cases are managed by general surgeons except for complex and neonatal cases. Lower GI tract and skin and soft tissue were most common system involved and laparotomy and incision and drainage was most performed surgery both before and after availability of pediatric surgeon. There was a substantial increment in neonatal cases after the availability of a pediatric surgeon.

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### Conflict of Interest

None

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None

### Author Contribution

Concept, design, planning: ALL (AM, PK, NG, SC, SK, SP, ST, SP); Literature review: ALL; Data collection: AM, PK, NG, SC, SP, ST, SK; Data analysis: AM, PK, NG, SC, SP; Draft manuscript: ALL; Revision of draft: ALL; Final manuscript: ALL; Accountability of the work: ALL

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