Identification of the Most Common Surgical Conditions among Children and Adolescent Patients Attending Holy Innocent Children's Hospital in Mbarara in Uganda

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Abstract

Perioperative morbidity is characterized as negative health outcomes associated with a surgical treatment while perioperative mortality is any death in a child that occurs during surgical treatment within thirty days after surgery. The aim of this study was conducted in order to determine the most common surgical diseases among children and adolescent. This was a hospital based prospective study of children who is defined as any person who is less than 18 years. and who were operated on between 27th April 2022 to 7th July 2022 at Holy Innocent Children's Hospital in Mbarara in Uganda. There were 173 surgical procedures performed in Children and adolescents during our 10 weeks study period. From the study findings, Hirschsprung's disease was the commonest among those aged <1 month 1(50.0%). Phymosis was the commonest disease among those aged 1.1 to 12 months 3(15.0%) followed by Hirschsprung's disease and foreign body in airway 2(10.0%) and the least common being Imperforate anus and Aspiration pneumonia 1(5.0%). In those aged between 12.1 to 60 months, Adeno Tonsillar Hypertrophy was the commonest disease 60(62.5%) followed by foreign body in airway 6(6.3%), Hydrocele, Wilm's tumor being 4(4.2%), Phymosis 3(3.1%) and the least was Hirschsprung's disease 2(2.1%). In those aged between 60.1 to 120 months, Adeno tonsillar Hypertrophy was the most common disease 17(38.5%) followed by Wilm's tumor 3(6.8%) then Imperforate anus and foreign body in airway 2(4.6%). Between 120.1 to 180 months old, the most common disease was Adeno Tonsillar Hypertrophy 5(50.0%) with intra-abdominal mass being the least common 2(20.0%). The adeno tonsillar hypertrophy was the most common surgical disease. The age group between 12.1-60 months was most affected by surgical disease, morbidity and mortality followed by the age group between 60.1 to 120 months.

Keywords: common surgical conditions, children, adolescent

Introduction

Perioperative morbidity and mortality (M &M) are an important indicator of quality of care for the health system.[1] Perioperative mortality takes in consideration a ratio of all the causes of death before discharge in patient who underwent a surgical operation in theatre to the total number of procedures and the outcome is expressed in percentages.[2] Surgery related diseases are part of the 15 commonest causes of disability and they contribute to thirty percent of the total Disability Adjust Life Years lost in the entire world but more significant in the LMICs.[3] Globally, 5 billion people lack access to surgical care of which 1.7 billion are children and adolescents [4] and the impact is much felt among the African children. 40%-50% of African population are children and approximately 80% of them require surgical procedure.[5]

Pediatric surgery differs from adult general surgery in that it faces specific difficulties.[6] Pediatric surgical patients are still having the immature physiology.[7] Children have unique perioperative demands linked with significant perioperative morbidity and mortality, present with diverse surgical pathologies, respond to anesthetic differently, and have special perioperative needs.[8] Neonates are more affected by congenital surgical diseases while the remaining age group is more affected by the acquired surgical diseases. In our study, we shall look at the proportion of children who died amongst those who would have been operated.

In Sub-Saharan Africa, surgical care is mainly concentrated in urban referral hospitals [9] that have experienced surgeons and are well equipped than those health facilities in the rural areas.[9] As such, the pattern of surgical morbidities in children in urban areas greatly varies from the pattern in rural areas since these health facilities lack both the experienced pediatric surgeons and equipment.[10] In Uganda, surgical capacity is limited with significant unmet needs with over twenty million of the population being children with few pediatric general surgeons serving the Ugandan population which could be normally served by 200 pediatric surgeons.[11]

Methodology

Research design
This was a hospital based prospective cohort study among children and adolescent surgical patients admitted and managed at Holy Innocent Children's Hospital Mbarara.

Research site
The study was conducted in the surgical department of Holy Innocent Children's Hospital.

Study population
The study population was comprised of all children and adolescent admitted in surgical department and underwent surgery during our study period.

Inclusion criteria
All patients who are less than eighteen years while their parents or care taker gave consent who were seeking surgical treatment in Holy Innocent Children Hospital in Uganda.

Exclusion criteria
Patient's caretaker who refused to consent

Children or adolescent surgical patients who have surgical conditions that we were not able to manage at Holy Innocent Children Hospital were referred for specialist attention, better management elsewhere.

Sample size estimation

Objective one: Determining most common surgical conditions among children and adolescent patients attending Holy Innocent Children's hospital in Mbarara in Uganda.

The sample size was determined by the formula defined by Cochran[12] stated as:

$$n_0 = \frac{z^2 \times p \times q}{d^2}$$

$$n_0 = \frac{(1.96)^2 \times (0.13) \times (1 - 0.13)}{(0.05)^2}$$

$$n_0 = 173$$

For, n_0 is the estimated size of the sample,

$z =$ value for selected alpha level $= 1.96$. z value is found in a z table

$d =$ acceptable margin of error for proportion being estimated $= 0.05$

$p = is$ the estimated proportion of an attribute that is present in the population: 0.13 % our p is the most common surgical disease based on the study done by Grabski in Uganda

q=1-p=0.87

The sample size of this study was calculated using the estimated incidence of the most common surgical disease 13.2% based on the prospective study done about access to pediatric surgery delivered by general surgeons and anesthesia providers in Uganda: Results from 2 rural regional hospitals.[13]

Based on the sample size calculation formula for cohort studies[14]:

$Z_{\alpha:} =$ Standard normal variate for level of significance

$Z_{\beta} =$ Standard normal variate for power or type 2 error

m = Number of control subject per experimental subject

p1 = Probability of events in control group

p2 = Probability of events in experimental group p.[14]

$$p^* = \frac{p2 + mp1}{m + 1}$$

$$sample\ size = \frac{\left[{}^{z\alpha}\sqrt{(1 + \frac{1}{m})\, p^*\, (1 - p^*)} \quad + \quad {}^{z\beta}\sqrt{p1(1 - p1)/m} \quad + p2(1 - p2) \right]^2}{(p1 - p2)^2}$$

$$sample\ size$$
$$= \frac{\left[{}^{1.96}\sqrt{(1 + \frac{1}{1})\, 0.49\, (1 - 0.49)} \quad + \quad {}^{0.84}\sqrt{0.29(1 - 0.29)/1} \quad + 0.70(1 - 0.70) \right]^2}{(0.29 - 0.70)^2}$$

Sample size =18

Based on the prospective study done by Talabi *et al*. [15] about Perioperative mortality in children in a tertiary teaching hospital in Nigeria has found that the emergency surgical procedure is associated with higher mortality (70.6%) than elective surgical procedure (29.4%)

p1: proportion of death in children who underwent elective surgical procedure: 29.4%

p2: proportion of death in children who underwent emergency surgical procedure: 70.6%

Z_α: = 1.96

Z_β = 0.84

 m = 1

The sample size calculated using associated factors (18) was smaller than the one based on   the most common surgical disease (173). Therefore, the larger sample size (173) was used.

 Sampling techniques

Consecutive recruitment was used to select the study participants

Data analysis

Descriptive statistics was carried out and stratified by age. Continuous variables were summarized as means, standard deviation, median and Interquartile ranges. Categorical variables were summarized as percentages and frequencies.

The most Common surgical   condition was analyzed as prevalence and stratified over age.

Results

Table 1: Showing socio-demographic factors

Variable	n (%)
Sex	
Male	103(59.5)
Female	70(40.5)
Age in months	
<1	2(1.2)
1.1-12	20(11.6)
12.1 -60	96(55.5)
60.1 -120	44(25.4)
120.1-180	10(5.8)
180.1 -216	1(0.6)
Religion	
Catholic	81(46.8)
Anglican	67(38.7)
Born again	13(7.5)
Muslim	12(6.9)
Level of Education of caretakers	
None	7(4.1)
Primary	48(27.9)

Secondary	41(23.8)
Tertiary	76 (44.2)
Residence	
Rural	167(96.53)
Urban	6(3.47)

From the study findings, out of 173 operated patients, the majority of patients were males 103(59.5%), the many patients were catholic 81(46.8%), many caretakers have attained tertiary level of education 79(44.2%). The majority of patients were between 12.1-60 months 96(55.5%). The majority of patients came from rural area 167(96.53).

Table 2: showing most Common surgical disease among children and adolescents

	Age group in months						
	<1 (n=2)	1.1-12 (n=20)	12.1 -60 (n=96)	60.1 - 120 (n=44)	120.1-180 (n=10)	180.1 -216 (n=1)	
Disease,							n(%)
ATH	0(0.0)	1(5.0)	60(62.5)	17(38.6)	5(50.0)	0(0.0)	83(47.98)
Hirschsprung's disease	1(50.0)	2(10.0)	1(1.04)	0(0.0)	0(0.0)	0(0.0)	4(2.31)
Imperforate anus	0(0.0)	1(5.0)	2(2.1)	2(4.6)	0(0.0)	0(0.0)	5(2.89)
Intra-abdominal mass	0(0.0)	0(0.0)	3(3.1)	0(0.0)	2(20.0)	0(0.0)	5(2.89)
Foreign body in air-way	0 (0.0)	2(10.0)	6(6.3)	2(4.6)	0(0.0)	0(0.0)	10(5.78)
Phimosis	0(0.0)	3(15.0)	3(3.1)	0(0.0)	0(0.0)	0(0.0)	6(3.47)
Hydrocele	0(0.0)	0(0.0)	4(4.2)	0(0.0)	0(0.0)	0(0.0)	4(2.31)
Wilm's tumor	0(0.0)	0(0.0)	4(4.2)	3(6.8)	0(0.0)	0(0.0)	7(4.05)
Others	1(50.0)	11(55.0)	13(13.46)	20(45.4)	3(30.0)	1(100.)	49(28.32)

The above table is showing that the age group<1 month was most affected by Hirschsprung's disease 1(50.0%); the age group between 1.1-12 months was most affected by phymosis 3(15.0%);

the age group between 12.1-60 months was most affected by adeno tonsilar hypertrophy 60(62.5%); the age group between 60.1-120 was most affected by adeno tonsilar hypertrophy 17(38.5%); the age group between 120.1-180 months was most affected by adenotonsilar hypertrophy 5(50%). However, there was no common surgical disease among those aged between 180.1-216 months.

Discussion

Neonates are most affected by congenital diseases while the rest of the pediatric age groups are affected by acquired surgical diseases[16] our study is similar to the study done by Botchway where neonates were most affected by the congenital surgical (100%) diseases than others. In the study done in Nigeria, in neonates: Necrotising enterocolitis9(60%) was the most common followed by anterior abdominal wall defect 3(20) and intestinal atresia3(20%) ; in infants intussusception was the most common surgical disease ; in children > 1 year typhoid intestinal perforation was the most common 11(50%) followed by ruptured appendix 8 (36.4%) ,Wilms tumor 2(9.1%),intussusception1(4.5%).[17] In Nigeria, they have found that the surgical disease can vary according to the region. The findings of the research done in Nigeria are different from our findings. In our study, only 1 (1.04) patient who was older than one year had Hirschsprung's disease.

In The study done in South Africa, patients< 1 month were affected by necrotizing enterocolitis and divided colostomy 60(3.5%), patients who were between 1 month to 12 months were affected by inguinal hernias; patients who were between 12 months to 60 months were affected by gastric diseases they underwent diagnosis and therapeutic gastroscopy, from 60 to 120 months, they have appendicitis.[18]

In Uganda, 2,071 children (or 60%) had surgery while they were being admitted. Neonatal patients made up 26% of admissions, and infants under 1year olds made up 50%. Only 28% of patients were beyond the age of three. The most frequent diagnostic (32%) was congenital anomalies, which included Hirschprungs, anorectal malformations, intestinal atresia, omphalocele, and gastroschisis. Hernias (10.2%), tumors (8.1%), and intussusception (8.1%) were the next most prevalent diagnoses (6.6 percent).[19]

Conclusion

The results showed a remarkable decrease in the number of perioperative mortalities over time that may be due to better monitoring and patient care. Children who are in the age group between 12 months to 60 months and children who are between 60 and 120 months were most affected by surgical disease, Hirschsprung's disease was common in neonate while, phimosis were common in infant (1.1-12 months) Adenotonsilar hypertrophy were most common in age group of 12.1- 60; Adenotonsilar hypertrophy was also most common in the age group of 60. 1- 120; Adenotonsilar hypertrophy was most common in the age group of 120.1-180. there was no common disease in those aged between 180 to 216 months, the age group of 12.1-60 months and from 60.1 -120 was most affected by the perioperative morbidity and mortality.

References

1. Cima RR, Lackore KA, Nehring SA, Cassivi SD, Donohue JH, Deschamps C, VanSuch M, Naessens JM. How best to measure surgical quality? Comparison of the Agency for Healthcare Research and Quality Patient Safety Indicators (AHRQ-PSI) and the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) postoperative adverse events at a single institution. Surgery. 2011;150(5):943-949.
2. Ariyaratnam R, Palmqvist CL, Hider P, Laing GL, Stupart D, Wilson L, Clarke DL, Hagander L, Watters DA, Gruen RL. Toward a standard approach to measurement and reporting of perioperative mortality rate as a global indicator for surgery. Surgery. 2015;158(1):17-26.
3. Bickler SW, Weiser TG, Kassebaum N, Higashi H, Chang DC, Barendregt JJ, Noormahomed EV, Vos T. Global burden of surgical conditions. Disease control priorities, 2015; 1:19-40.
4. Mullapudi B, Grabski D, Ameh E, Ozgediz D, Thangarajah H, Kling K, Alkire B, Meara JG, Bickler S. Estimates of number of children and adolescents without access to surgical care. Bulletin of the World Health Organization. 2019;97(4):254.
5. Grimes CE, Law RS, Borgstein ES, Mkandawire NC, Lavy CB. Systematic review of met and unmet need of surgical disease in rural sub-Saharan Africa. World journal of surgery. 2012;36(1):8-23.
6. Ferrari A, Bisogno G, De Salvo GL, Indolfi P, Perilongo G, Cecchetto G, Italian Study on Rare Tumours in Paediatric Age (TREP. The challenge of very rare tumours in childhood: the Italian TREP project. European journal of cancer. 2007;43(4):654-9.
7. Brownstein JN. Fundamental Principles of Pediatric Physiology and Anatomy. Pediatric Dentistry. 2019:88-96.
8. De Graaff JC, Johansen MF, Hensgens M, Engelhardt T. Best practice & research clinical anesthesiology: safety and quality in perioperative anesthesia care. Update on safety in pediatric anesthesia. Best Practice & Research Clinical Anaesthesiology. 2021;35(1):27-39.
9. Ifeanyichi M, Broekhuizen H, Cheelo M, Juma A, Mwapasa G, Borgstein E, Kachimba J, Gajewski J, Brugha R, Pittalis C, Bijlmakers L. Surgical ambulance referrals in sub-Saharan Africa–Financial costs and coping strategies at district hospitals in Tanzania, Malawi and Zambia. BMC Health Services Research. 2021; 21:1-3.
10. Concepcion T, Mohamed M, Dahir S, Ismail EA, Poenaru D, Rice HE, Smith ER. Prevalence of pediatric surgical conditions across Somaliland. JAMA network open. 2019;2(1): e186857-.
11. Badrinath R, Kakembo N, Kisa P, Langer M, Ozgediz D, Sekabira J. Outcomes and unmet need for neonatal surgery in a resource-limited environment: estimates of global health disparities from Kampala, Uganda. Journal of pediatric surgery. 2014;49(12):1825-1830.
12. Bartlett J, Kotrlik J, Higgins C. Determing appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, 2001; *19*(1): 43–50. https://www.opalco.com/wp-content/uploads/2014/10/Reading-Sample-Size1.pdf
13. Grabski DF, Ajiko M, Kayima P, Ruzgar N, Nyeko D, Fitzgerald TN, Langer M, Cheung

M, Cigliano B, D'Agostino S, Baird R, Duffy D, Tumukunde J, Nabukenya M, Ogwang M, Kisa P, Sekabira J, Kakembo N, Ozgediz D. Access to pediatric surgery delivered by general surgeons and anesthesia providers in Uganda: Results from 2 rural regional hospitals. *Surgery (United States)*, 2021; *170*(5), 1397–1404. https://doi.org/10.1016/j.surg.2021.05.007

14. Charan J, Biswas T. *Review Article How to Calculate Sample Size for Different Study Designs in Medical Research,* 2013*; 35*(2). https://doi.org/10.4103/0253-7176.116232

15. Talabi AO, Ojo OO, Aaron OI, Sowande OA, Faponle FA, Adejuyigbe O, Oi A. *Perioperative mortality in children in a tertiary teaching hospital in Nigeria : a prospective study.* 2021; 1–9. https://doi.org/10.1136/wjps-2020-000237

16. Amin R, Knezevich M, Lingongo M, Szabo A, Yin Z, Oldham KT, Calkins CM, Sato TT, Arca MJ. Long-term quality of life in neonatal surgical disease. Annals of surgery. 2018;268(3):497-505.

17. Emeke C. 2021. Perioperative mortality of pediatric surgical patients in a developing country : Incidence and Etiology. 2021; *5*, 1–5.

18. Botchway MT, Kruger D, Manful CA, Grieve A.The scope of operative general paediatric surgical diseases in South Africa—the Chris Hani Baragwanath experience. *Annals of Pediatric Surgery*, 2020; 16(1). https://doi.org/10.1186/s43159-020-00052-w

19. Cheung M, Kakembo N, Healy J, Nakanwagi AM, Sekabira J, Ozgediz D. Burden of Pediatric Surgical Conditions in Uganda: Epidemiology and Mortality from a Prospective Database at a Tertiary Care Center. *Journal of the American College of Surgeons*, 2017; 225(4), S98–S99. https://doi.org/10.1016/j.jamcollsurg.2017.07.216