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**March 2017**

**Volume 14**

**Issue 1**

**Doctors Academy Publications**

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# WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy

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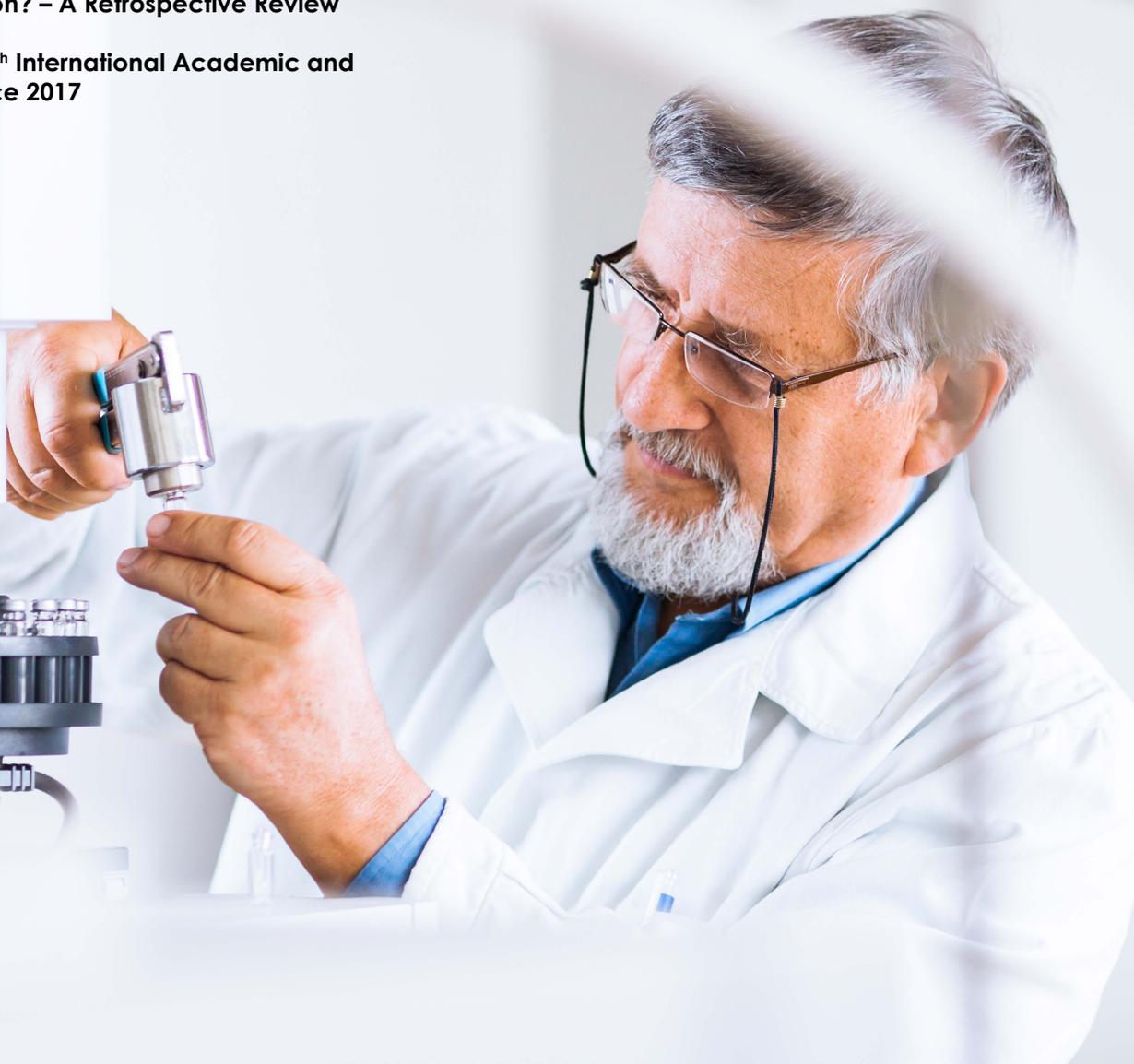
**Abstracts from the 7<sup>th</sup> International Academic and  
Research Conference 2017**

**DOCTORS ACADEMY**



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ISSN 2052-1715





## Paediatric Surgical Intervention In Sierra Leone: A Retrospective Study of 204 Patients

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*WJMER, Vol 14: Issue 1, 2017*

### Abstract

**Introduction:** There is growing evidence that childhood surgical conditions, especially injuries, are common in developing countries and that poor care results in significant numbers of deaths and cases of disability. For paediatric purposes, it appears that there are four areas where efforts should be focused. Special attention should be given to defining a cost-effective package of surgical services, improving surgical care at the community level, strengthening surgical education, and surgical care should be an essential component of child health programmes in Sierra Leone.

**Aim:** The main aim of this study was to establish the Burden of Paediatric Surgical Conditions, Types of Paediatric Surgical Procedures and determine the Postoperative Outcome in Sierra Leone.

**Method:** Visited Connaught Hospital to interview staff and review theatre logbook for the period of one year. A data collection tool was used to obtain the number, age, sex, types of paediatric surgical conditions and procedures on all patients 0 to 15 years at Connaught Hospital Operating Theatre (CHOT) from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.

**Conclusion:** Inguinal Hernia is the commonest paediatric surgical condition in Sierra Leone. The number of paediatric surgical procedures at CHOT is higher in males than females. The highest number of paediatric surgical procedures is in the youngest age-group (0 - 4 years). Common paediatric surgical conditions managed at CHOT are: Inguinal Hernia, Hydrocele, Appendicitis and Osteomyelitis. 93% success rate of paediatric surgical procedures at CHOT.

### Key Words

Paediatric Surgical Conditions; Paediatrics; Sierra Leone; Inguinal Hernia

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### Introduction

**Background:** Paediatric surgery arose in the middle of the 20<sup>th</sup> century as the surgical care of birth defects required novel techniques and methods, and became more commonly based at children's hospitals. One of the sites of this innovation was Children's Hospital of Philadelphia. Beginning in the 1940s under the surgical leadership of C. Everett Koop, newer techniques for endotracheal anaesthesia of infants allowed surgical repair of previously untreatable birth defects. By the late 1970s, the infant death rate from several major congenital malformation syndromes had been reduced to near zero.

Perhaps the most significant advance associated with the surgical care of children during the past century has been the realization that "children are not small adults". Rather, children develop distinct surgical conditions, present unique anaesthetic challenges,

and have special perioperative needs. Moreover, the consequences of paediatric surgical conditions may be lifelong since they affect children at critical times during development.

**Justification:** There is no defined essential package of paediatric surgical services based on the epidemiology of childhood surgical diseases and on the estimated need and expense of surgical care including both preventive and curative services in Sierra Leone. With regard to surgical services, the programme should define which operations are appropriate, the level of the health system at which they can be performed, and the level of training required in order to carry them out. The package might include injury prevention, routine screening of neonates for congenital anomalies, simple protocols for the management of uncomplicated paediatric surgical conditions, and criteria for referring children to secondary or tertiary facilities.

Health policy in Sierra Leone cannot reflect the surgical needs of children until there are data demonstrating that paediatric surgical conditions are a significant public health problem. There is a major need for data on the epidemiology of paediatric surgical diseases, the morbidity and mortality associated with poor surgical care, and the cost of paediatric surgical services. Support for research on these matters could perhaps be given by WHO, UNICEF, and other international agencies. Information on paediatric surgical conditions in Sierra Leone can be expected to become increasingly important as evidence-based methods are used to a greater extent in the allocation of resources. In the absence of data demonstrating that paediatric surgical conditions are a problem, it would be unreasonable to expect resources to be allocated for paediatric surgical care. In the Global Burden of Disease (GBD) study<sup>12</sup>, childhood surgical conditions were underrepresented. Of 58 major paediatric surgical diagnoses recorded at the main government referral hospital in the Gambia only 21 were included in the analysis. Of course, the GBD methodology cannot include all diagnoses but a GBD study focusing solely on the paediatric age group might offer the best prospect of resolving this matter.

The issue is not whether selected children can receive surgical care but whether children in general have access to appropriate surgical services. Only a small fraction of children in Sierra Leone have access to basic surgical care. Long distances from hospitals and prohibitive transportation costs prevent the timely treatment of paediatric surgical conditions. Travelling to a hospital may take several days, during which time the patient's condition may deteriorate, leading to increased operative risk and mortality. Disease processes are often far advanced when a patient reaches the hospital, such that there may be pathological consequences threatening survival. It is also worth noting that children are often referred after folk medicine or traditional remedies have failed.

### Burden of Childhood Conditions

**Injuries:** Injuries are the commonest surgical condition affecting African children. For children in Africa who survive the first four years of life, injury becomes the most likely cause of disability and death, a situation that remains true until the fourth decade of life<sup>6</sup>. In a recent review of injuries and noncommunicable diseases in developing countries, childhood disability-adjusted life years (DALYs) related to injuries were the highest in sub-Saharan Africa<sup>7</sup>. DALYs related to injuries were higher among males than females and among children aged 0–4 years than among those aged 5–14 years.

That injuries are a significant cause of death and

disability among African children should not be surprising, since, in most established market economies, they are the leading cause of death and disability for the age group 1–19 years. In low-income countries also, especially those that have recently become industrialized and motorized, injuries are an important health problem. Even in those countries with the lowest incomes, injuries comprise one of the leading causes of death among adults and are a major cause of disability in most age groups<sup>8–13</sup>.

In rural East Africa, injuries (40 000 episodes and 100 deaths per 100 000 of the general population annually) rank third in importance behind diarrhoea and malaria<sup>14</sup>. Mortality rates associated with injury are even higher in urban areas of Africa. For example, one community survey in an urban area of Uganda indicated that the annual mortality rate attributable to injury was 217 per 100 000<sup>13</sup>. The lifetime risk of dying from an injury in urban Uganda was 10% for both males and females and was twice as high as the risk of maternal death<sup>15</sup>. In Ghana the all-age, annual, non-fatal injury rate has been estimated at 7.6 per 100<sup>11</sup>.

Road traffic accidents, falls, burns and accidental poisoning are the commonest categories of childhood injuries. Child safety is seen as a relatively low priority, and it can be expected to remain so in the foreseeable future in the face of poorly maintained roads, large numbers of old vehicles, inadequate law enforcement, and overloaded public transport systems. Hundreds of thousands of children are permanently disabled in Africa every year as a consequence of injuries and poor trauma care.

Armed conflicts also take their toll<sup>16</sup>. During 2000, a total of 11 major wars were being fought in Africa, involving half the countries in the continent and 20% of the population. It is estimated that 120 000–200 000 child soldiers aged 5–16 years are currently participating in such conflicts. Children involved in armed conflicts sustain bullet and shrapnel wounds, as well as burns and land mine injuries, all of which require surgical care. In Africa, landmines are responsible for killing or injuring 12 000 people a year, many of them children.

Childhood injuries also place a significant burden on health services. At the main government referral hospital in Banjul, injuries accounted for almost half the paediatric surgical admissions<sup>4</sup>. In Lilongwe, Malawi, 9.7% of all paediatric admissions were related to accidents; 27% of cases were burns and scalds, and 32% were fractures, usually caused by falls<sup>17</sup>. A household survey suggested that 21% of urban children and 15% of rural children would suffer an accidental injury each year and that half of them would visit health centres. At Baragwanath

Hospital, Johannesburg, 25% of paediatric surgical admissions are related to injuries<sup>3</sup>.

**Congenital abnormalities:** Congenital abnormalities are another common and underreported paediatric surgical condition. A recent study from an urban centre in South Africa showed the incidence of congenital anomalies at birth to be 11.8 per 1000 live births<sup>18</sup>, with central nervous system, musculoskeletal, and cardiovascular anomalies being the commonest. Extrapolation from other studies conducted in developing countries indicates that the cumulative incidence of severe congenital abnormalities may affect up to 85 per 1000 children by the age of 5 years<sup>19</sup>. The impact of congenital anomalies on childhood morbidity and mortality in Africa is unknown. Neonates with surgical conditions are especially problematic, most notably in emergency settings. In Zaria, Nigeria, 38% of neonates developed postoperative complications and the overall mortality 30.5%<sup>20</sup>. Inguinal hernias, genitourinary and anorectal malformations,



**Figure 1:** Intussusception Protruding from the Anus in a 2 day old baby girl Admitted at Connaught Hospital.

meningomyeloceles, and cleft lip and palate are the commonest congenital anomalies requiring surgical repair in Africa.

**Surgical infections:** Surgical infections pose another threat to African children. Abscesses, pyomyositis, and osteomyelitis are common in tropical regions of Africa, and their increased incidence is most probably related to malnutrition or immunosuppression associated with parasitic infections. Surgical infections, particularly chronic osteomyelitis, are a significant burden on health services. At the main government referral hospital in Banjul, for example, osteomyelitis accounted for 7.8% of paediatric surgical admissions and 15.4% of total inpatient days<sup>4</sup>. The number of hospital days taken up by osteomyelitis was second only to that for burns.

#### Statement of the Problem

Despite increasing awareness of the unmet burden of surgical conditions, little information is available

on surgery in children worldwide<sup>21</sup>. It has been estimated by WHO that 85% of children in low-income countries are likely to require treatment for a surgical condition by the age of 15 years<sup>21</sup>. Many disease conditions of childhood are amenable to simple surgical intervention, but if left untreated, complications, lifelong disability or death can ensue. Uganda, a low-income country, faces considerable challenges in the provision of paediatric surgical care. Of its rapidly-growing population of 31.7 million, 49% is under 15 years of age and 88% lives in rural areas<sup>3</sup>. Uganda's population demographics, expenditure on health care and health-care outcomes are typical of low-income countries in sub-Saharan Africa. Postgraduate training opportunities for physicians are limited; only 10 trainees complete postgraduate training in surgery in the country each year.

There is only one paediatric referral hospital in Sierra Leone- Ola During Children's Hospital (ODCH), a government facility located in Freetown, Western urban area. All surgical cases at ODCH are referred to Connaught Hospital, another government facility also in Freetown, Western urban area. Connaught Hospital serves as the primary referral hospital for many other health facilities in the country. In addition to the expenditure on medication, there is the cost of transportation, feeding and accommodation which discourages many from seeking health care in the hospital. Furthermore, the Ebola Virus Disease (EVD) outbreak exposed the wide breach of Infection Prevention and Control (IPC) protocols which led to the demise of some health workers; Thus, making hospitals no go area for patients because they thought albeit erroneously that they could also die while seeking care in such facility<sup>22</sup>. This perception is gradually changing with the introduction of the Free Health Care Scheme for the under five's and the recent inclusion of paediatric surgery into this programme. Notwithstanding, there is an influx of paediatric patients who require surgical intervention.

#### LITERATURE REVIEW

**Definition:** Paediatric surgery is a subspecialty of surgery that involves surgical procedures on children up to the age of 15. Paediatric age limit is higher in developed countries owing to greater availability of resources, compared to low-income countries like Sierra Leone. These surgeons cope with wide physiological differences between each of the age groups from newborns through to near-adults, as well as specific set of skills and professional attitudes for dealing with children and their families.

Where other specialties are concerned with a particular technique or area of the body, paediatric surgery is the only surgical specialty that is defined

by the patient's age rather than by a specific condition and deals with the diseases, trauma and malformations from the foetal period to teenage years.

The routine workload is very broad as paediatric surgeons deal with all conditions in this age group, though there are some conditions innate to children. Most consultants develop experience and skills across the breadth of surgery, but there is an increasing trend for consultants to develop further specific expertise in areas of special interest.

**Epidemiology:** The most important issue surrounding the surgical care of children in developing countries is the burden of surgical diseases on paediatric populations<sup>1</sup>. Epidemiological data on this subject are scarce.

The pattern of paediatric surgical diseases in sub-Saharan Africa provides an insight into this as it has the greatest disparities in health care and is the one most familiar<sup>2</sup>. Pattern of diseases and the availability of resources vary between regions of the world, but sub-Saharan Africa epitomizes many of the challenges inherent in attempting to provide surgical care for children in developing countries.

The available information suggests that surgery patients are responsible for approximately 6–12% of all paediatric admissions in sub-Saharan Africa<sup>3</sup>, although the proportion may be higher in some urban areas. At the main government referral hospital in Banjul, the Gambia, surgical patients accounted for 11.3% of paediatric admissions<sup>4</sup>. The commonest admission diagnoses were injuries, congenital anomalies, and surgical infections, accounting for almost 90% of paediatric surgical admissions. At the rural Ahmadu Bello University Teaching Hospital, Malumfashi, northern Nigeria, paediatric surgery represented 6.6% of the paediatric workload and 9.6% of all operative procedures<sup>5</sup>. The most frequent operations performed in this hospital were for congenital anomalies (40%), infections (22%), and traumas (21%).

**Consequences of Poor Surgical Care:** Inadequate surgical care for children in many developing countries has had tragic consequences. The impact on child health remains poorly defined, but it is likely that poor surgical care contributes significantly to the high disability rates in these countries. In Uganda, for example, 12% of households reported a disability related to injury<sup>15</sup>. Any of the disabilities that result from injury could either be prevented or corrected if surgical care were improved.

The most common disabilities associated with injuries relate to mismanaged burns, fractures, and

dislocations. Many of these complications result from late presentation because of poor access to surgical care.

**The Principle Subspecialties of Paediatric Surgery:** As a medical discipline that involves the care of many organs and physiological systems, paediatric surgeons perform surgery for a very wide range of conditions including:

**Neonatal Surgery** – routine antenatal ultrasound scanning means that patients are getting younger and younger. For some conditions, such as gastroschisis (a birth defect hole in the abdominal wall) and congenital diaphragmatic hernia, paediatric surgeons now provide antenatal counselling for parents in conjunction with obstetricians and specialists in foetal medicine. They plan the care of the mother and child from delivery to subsequent surgery.

**Paediatric Urology** – Few people realize that urinary tract and genital abnormalities are the third most common congenital abnormality in children, ten times more common than cleft lip or palate. Certain urological conditions, such as hypospadias, are frequently present at birth or in young people. Hypospadias, a crippling deformity of the male genitalia that prevents normal urinary and sexual function, occurs in approximately one in every 150 boys. Other urological conditions such as urinary incontinence and bladder and kidney malformations require specialized care, yet there are very few medical personnel worldwide trained in paediatric urology.

**Paediatric Oncology** – childhood cancers are different from those developed by adults. Leukaemia remains the most significant in children. Others include: Burkitt's lymphoma, Wilm's tumour, non-seminomatous germ-cell tumours (teratomas, yolk sac tumours) and non-germ-cell tumours (interstitial cell tumours) of the testis.

Other areas of surgery also have paediatric specialties of their own that require further training during the residencies and in a fellowship:

- **Paediatric Emergency Surgery** - surgery involving foetuses or embryos (overlapping with obstetric/gynaecological surgery, neonatology, and maternal- foetal medicine) for conditions where incidence of irreversible tissue damage and risk of survival are likely. These include: prolonged labour, premature rupture of membranes and late presentation to the hospital.
- **Paediatric Cardiothoracic Surgery** - surgery on the child's heart and/or lungs, including heart and/or lung transplantation.
- **Paediatric Nephrological Surgery** - surgery

on the child's kidneys and ureters, including renal (kidney) transplantation.

- **Paediatric Neurosurgery** - surgery on the child's brain, central nervous system, spinal cord, and peripheral nerves.
- **Paediatric Hepatological (liver) and Gastrointestinal (stomach and intestines) Surgery** - including liver and intestinal transplantation in children.
- **Paediatric Orthopaedic Surgery** - muscle and bone surgery in children.
- **Paediatric Plastic and Reconstructive Surgery** - such as for burns, or for congenital defects like cleft palate not involving the major organs.

#### **Common Paediatric Surgical Conditions:**

What percentage of the paediatric population in sub-Saharan Africa can be expected to require surgical care during childhood? In an attempt to answer this question, an investigation was carried out on the number of children in Banjul who sought care for surgical conditions at the main government hospital during 1997<sup>23</sup>. Surgical conditions were defined as all injuries (e.g. **fractures, lacerations, head injuries and soft tissue injuries**), correctable congenital anomalies (e.g. **inguinal hernia, clubfoot**), surgical infections (e.g. **abscesses and osteomyelitis**), and other conditions requiring surgical care. The annual presentation rate for all surgical conditions was 543 per 10 000 children aged 0–14 years. A total of 46% of children presenting with surgical conditions required surgical procedures, 68.2% of which were classified as minor. The estimated cumulative risk for all surgical conditions was 85.4% by the age of 15 years. Although based on a small paediatric population and a relatively short period of time, the data suggest that a significant proportion of children living in urban areas of sub-Saharan Africa require surgical care at some time during childhood.

- **Infantile Hypertrophic Pyloric Stenosis:** characterized by hypertrophy of the pylorus, with elongation and thickening, eventually progressing to near-complete obstruction of the gastric outlet. Occurrence of 2 to 3.5 in 1000 live births with rate varying from region to region. Affects males than females (4:1 to 6:1). Approximately 30% occur in firstborn children.
- **Hydrocele:** A hydrocele is an accumulation of peritoneal fluid in a membrane called the tunica vaginalis, which covers the front and sides of the male testes.
  1. **Primary Hydrocele** - also called idiopathic hydrocele, develops slowly and becomes large and tense. Primary hydroceles may be classified as follows:
    - a. **Vaginal Hydrocele** - This surrounds the testes in the layers of the tunica vaginalis and

does not connect with the peritoneal cavity.

- b. **Congenital Hydrocele** - This is associated with a hernial sac. It connects with the peritoneal cavity.
  - c. **Infantile Hydrocele** - This extends from the testes to the deep inguinal ring. It does not connect with the peritoneal cavity.
  - d. **Hydrocele of the cord** - This lies along the cord anywhere from the deep inguinal ring to the upper scrotum. It does not connect with either the peritoneal cavity or the tunica vaginalis. A similar swelling may develop in the female and is known as a hydrocele of the canal of Nuck.
2. **Secondary Hydrocele** - tends to be small and lax, secondary to inflammation or tumour of the underlying testes, and occurs in the younger age group.
    - **Appendicitis:** an inflammation of the appendix.
    - **Acute abdomen:** an emergency that requires immediate surgical intervention. It is also called surgical abdomen. Mostly due to rupture of a viscus- appendix and peptic ulcer perforations are common, especially on late presentation to hospital.

#### **Common Elective Paediatric Surgical Procedures:**

- **Pyloromyotomy:** for correcting the narrowing of the opening between stomach and intestine (Infantile Hypertrophic Pyloric Stenosis).
- **Herniotomy:** surgical treatment of congenital inguinal (groin area) hernia in both male and female. It is done through an incision over the external inguinal ring and excision of the hernial sac at the neck. It is not necessary to open the external oblique aponeurosis as the internal and external inguinal rings are almost superimposed on each other.
- **Hydrocelectomy:** also known as hydrocele repair, is a surgical procedure performed to correct a hydrocele. There are two surgical techniques available for the Hydrocelectomy and both are performed at Connaught Hospital. They are:
  1. **Lord's technique** - Hydrocele surgery with plication of the hydrocele sac.
  2. **Jaboulay's technique** - Hydrocelectomy with excision of the hydrocele sac.
- **Orchidopexy:** Orchidopexy is a surgery to move an undescended testicle (cryptorchidism) into the scrotum and permanently fix it there. Orchidopexy also describes the surgery used to resolve testicular torsion which is a surgical emergency.
- **Mayo's repair:** Repair of umbilical (belly-button) hernia.

#### **Common Emergency Paediatric Surgical Procedures:**

- **Appendicectomy:** excision of an inflamed appendix.
- **Laparotomy:** an exploratory abdominal midline

incision for emergency surgical conditions such as acute abdomen.

## 1 METHODOLOGY

**Topic:** Paediatric Surgical Intervention in Sierra Leone.

**Aim:** To establish the Burden of Paediatric Surgical Conditions, Types of Paediatric Surgical Procedures and determine the Postoperative Outcome in Sierra Leone.

**Specific Objectives:**

1. Determine the Number of Paediatric Surgical Procedures at Connaught Hospital Operating Theatre from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.
2. Determine the Types of Paediatric Surgical Conditions at Connaught Hospital.
3. Determine the Types of Paediatric Surgical Procedures and Postoperative Outcome at Connaught Hospital Operating Theatre.
4. Determine the Age and Sex Distribution of Paediatric Surgical Patients Managed at Connaught Hospital.

**Research Questions:**

1. How many paediatric surgical procedures in a year?
2. What are the common paediatric conditions that require surgical intervention?
3. What are the common paediatric surgical procedures?
4. What paediatric surgical conditions are prevalent in a particular age group?
5. What paediatric surgical conditions are prevalent in a particular sex group?

**Study Design:** A retrospective study aimed at analysing the pattern of paediatric surgical conditions, types of paediatric surgical procedures and postoperative outcome at Connaught Hospital, Freetown, Sierra Leone.

**Study Period:** 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.

**Study Site:** Connaught Hospital, a designated centre for major paediatric surgery in Sierra Leone.

**Sampling Procedure:** Sampling was done using existing records- in Connaught Hospital Operating Theatre logbook- of all patients on whom paediatric surgical procedures were done from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.

**Sample Size:** Total number of patients 0 to 15 years who had surgery and were recorded at CHOT from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016 (204).

**Study Population** All patients 0 to 15 years on whom surgical procedures were done and recorded from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016 at the Connaught Hospital Operating Theatre.

**Selection of Study Population:** Visited

Connaught Hospital to interview staff and review theatre logbook for the period of one year. A data collection tool was used to obtain the number, age, sex, types of paediatric surgical conditions and procedures on all patients 0 to 15 years at Connaught Hospital Operating Theatre from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.

**Inclusion and Exclusion Criteria:** Included all paediatric surgical patients who had surgical procedure(s) recorded at Connaught Hospital Operating Theatre within the period of 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016.

Excluded all paediatric surgical patients who had surgical procedure(s) but have missing data.

**Ethical Consideration:** Ideally, an application for approval from Sierra Leone Ethics and Scientific Review Committee is required 3 months prior to the commencement of health related research involving participation of human subjects within Sierra Leone.

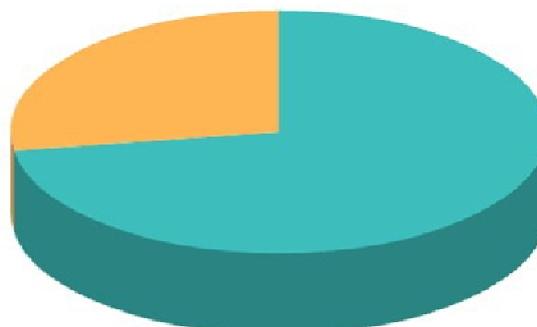
Permission to conduct this research was obtained from the Head of Department of Surgery, Connaught Hospital and the sister-in-charge, Connaught Hospital Operating Theatre. Names of patients and surgeons were not mentioned in the study to ensure anonymity. Consent from parent to take photo was obtained and face of patient was excluded for confidentiality.

**Data collection instrument/method:** Data was obtained from Connaught Hospital Operating Theatre logbook and recorded in a data collecting tool. The data collected was analysed by the use of simple descriptive statistics, summarised and represented in tables and graphs.

**Limitations:**

1. Definitive pre-/ post operative diagnoses are not stated in all cases. Atimes vague statements that do not give a proper description of the disease are used. For example, "Swelling L groin"- which could be a number of diseases (pyomyositis, inguinal hernia, fibrosarcoma or rhabdomyosarcoma) and "Lip damage"- a congenital abnormality (cleft lip) or as a result of trauma.
2. Surgical procedures are sometimes neither concise nor age-appropriate. For example, "excision of cyst" instead of "cystectomy" and "herniorrhaphy" (which includes repair of the posterior wall of the inguinal canal during an inguinal hernia repair in adults) instead of "herniotomy".
3. The precise age of paediatric surgical patients are not always represented in days (D) for neonates, months (M) for infants and years (Y) for those between ages 2 and 15 years.

**Fig. 2. Sex distribution of paediatric surgical patients managed.**

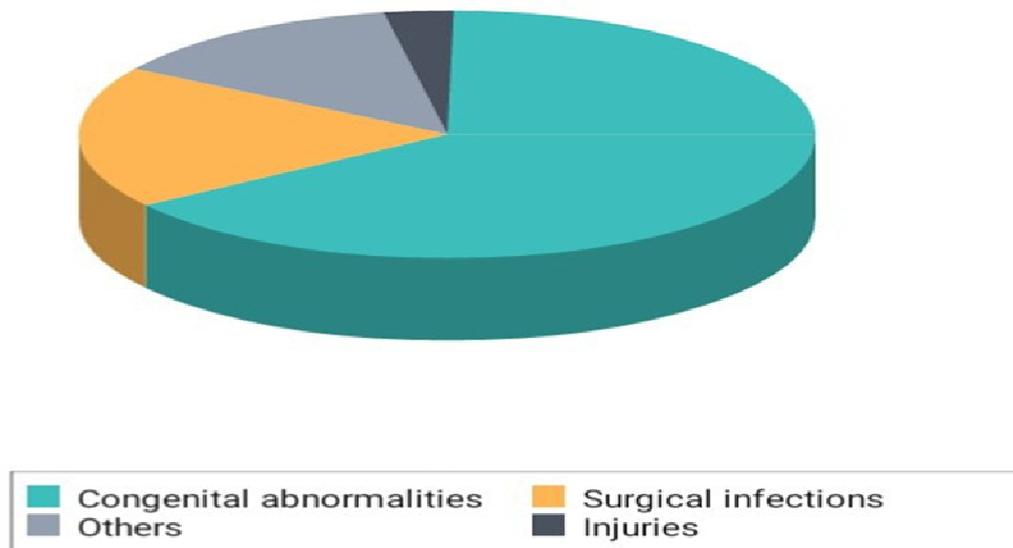


| Surgical condition     | Males | Females | Total | Percentage (%) |
|------------------------|-------|---------|-------|----------------|
| Inguinal hernia        | 75    | 10      | 85    | 41.6           |
| Hydrocele              | 18    | 0       | 18    | 8.8            |
| Appendicitis           | 5     | 8       | 13    | 6.4            |
| Acute abdomen          | 8     | 3       | 11    | 5.4            |
| Abscess                | 5     | 2       | 7     | 3.4            |
| Cryptorchidism         | 5     | 0       | 5     | 2.5            |
| Cleft lip              | 2     | 3       | 5     | 2.5            |
| Umbilical hernia       | 0     | 4       | 4     | 2.0            |
| Fracture               | 2     | 2       | 4     | 2.0            |
| Spina bifida           | 1     | 2       | 3     | 1.5            |
| Tumour                 | 3     | 0       | 3     | 1.5            |
| Mesenteric cyst        | 0     | 3       | 3     | 1.5            |
| Septic arthritis       | 2     | 0       | 2     | 1.0            |
| Lymphatic malformation | 0     | 2       | 2     | 1.0            |
| Anal malformation      | 1     | 1       | 2     | 1.0            |
| Patent urachus         | 0     | 1       | 1     | 0.5            |
| Omphalocele            | 0     | 1       | 1     | 0.5            |
| Bladder extrophy       | 0     | 1       | 1     | 0.5            |
| Cellulitis             | 1     | 0       | 1     | 0.5            |
| Haemangioma            | 1     | 0       | 1     | 0.5            |
| Pyomyositis            | 1     | 0       | 1     | 0.5            |
| Toxic colitis          | 0     | 1       | 1     | 0.5            |

|                        |            |           |            |            |
|------------------------|------------|-----------|------------|------------|
| Uncircumcised          | 1          | 0         | 1          | 0.5        |
| Phimosis               | 1          | 0         | 1          | 0.5        |
| Staphyloma             | 0          | 1         | 1          | 0.5        |
| Gangrene               | 1          | 0         | 1          | 0.5        |
| Intestinal obstruction | 1          | 0         | 1          | 0.5        |
| Hirschsprung's disease | 1          | 0         | 1          | 0.5        |
| Cholecystitis          | 0          | 1         | 1          | 0.5        |
| Splenomegaly           | 1          | 0         | 1          | 0.5        |
| Splenic rupture        | 0          | 1         | 1          | 0.5        |
| Syndactyly             | 1          | 0         | 1          | 0.5        |
| Laceration             | 1          | 0         | 1          | 0.5        |
| Stab wound             | 1          | 0         | 1          | 0.5        |
| Lipoma                 | 0          | 1         | 1          | 0.5        |
| Fibroadenoma           | 0          | 1         | 1          | 0.5        |
| Scalp cyst             | 1          | 0         | 1          | 0.5        |
| Cystic hygroma         | 0          | 1         | 1          | 0.5        |
| Occipital hygroma      | 1          | 0         | 1          | 0.5        |
| Tongue tie             | 1          | 0         | 1          | 0.5        |
| <b>Grand total</b>     | <b>148</b> | <b>56</b> | <b>204</b> | <b>100</b> |

Table 2: Types of Paediatric Surgical Conditions.

**Fig. 3. Pattern of Paediatric Surgical Conditions**



| Surgical condition     | 0 - 4 (years) | 5 - 10 (years) | 11 - 15 (years) |
|------------------------|---------------|----------------|-----------------|
| Inguinal hernia        | 67            | 11             | 7               |
| Hydrocele              | 15            | 1              | 2               |
| Appendicitis           | 0             | 3              | 10              |
| Acute abdomen          | 0             | 8              | 3               |
| Osteomyelitis          | 7             | 1              | 3               |
| Abscess                | 4             | 2              | 1               |
| Cryptorchidism         | 2             | 2              | 0               |
| Cleft lip              | 5             | 0              | 0               |
| Umbilical hernia       | 2             | 2              | 0               |
| Fracture               | 1             | 2              | 0               |
| Spina bifida           | 3             | 0              | 0               |
| Tumour                 | 1             | 0              | 2               |
| Mesenteric cyst        | 2             | 1              | 0               |
| Septic arthritis       | 2             | 0              | 0               |
| Lymphatic malformation | 2             | 0              | 0               |
| Anal malformation      | 2             | 0              | 0               |
| Patent urachus         | 1             | 0              | 0               |
| Omphalocele            | 1             | 0              | 0               |
| Bladder extrophy       | 1             | 0              | 0               |
| Cellulitis             | 0             | 0              | 1               |
| Haemangioma            | 1             | 0              | 0               |
| Pyomyositis            | 0             | 1              | 0               |
| Toxic colitis          | 0             | 0              | 1               |
| Uncircumcised          | 0             | 1              | 0               |
| Phimosis               | 1             | 0              | 0               |
| Staphyloma             | 1             | 0              | 0               |
| Gangrene               | 1             | 0              | 0               |
| Intestinal obstruction | 1             | 0              | 0               |
| Hirschsprung's disease | 1             | 0              | 0               |
| Cholecystitis          | 0             | 0              | 1               |
| Splenomegaly           | 0             | 0              | 1               |
| Splenic rupture        | 0             | 1              | 0               |
| Syndactyly             | 1             | 0              | 0               |
| Laceration             | 1             | 0              | 0               |

|                   |            |           |           |
|-------------------|------------|-----------|-----------|
| Stab wound        | 0          | 0         | 1         |
| Lipoma            | 1          | 0         | 0         |
| Fibroadenoma      | 0          | 0         | 1         |
| Scalp cyst        | 0          | 1         | 0         |
| Occipital hygroma | 1          | 0         | 0         |
| Cystic hygroma    | 1          | 0         | 0         |
| Tongue tie        | 1          | 0         | 0         |
| <b>Total</b>      | <b>130</b> | <b>37</b> | <b>34</b> |

**Table 4:** Types of Paediatric Surgical Procedures.

| Surgical procedure           | Males      | Females   | Total      | Percentage (%) |
|------------------------------|------------|-----------|------------|----------------|
| Herniotomy                   | 59         | 9         | 68         | 33.3           |
| Herniorrhaphy                | 16         | 1         | 17         | 8.3            |
| Hydrocelectomy               | 18         | 0         | 18         | 8.8            |
| Appendectomy                 | 5          | 9         | 14         | 6.9            |
| Laparotomy                   | 11         | 4         | 15         | 7.4            |
| Aspiration                   | 1          | 0         | 1          | 0.5            |
| I & D                        | 6          | 4         | 10         | 4.9            |
| Sequestrectomy               | 4          | 4         | 8          | 3.9            |
| Arthrolysis                  | 2          | 0         | 2          | 1.0            |
| Orchidopexy                  | 2          | 0         | 2          | 1.0            |
| Orchidectomy                 | 1          | 0         | 1          | 0.5            |
| Circumcision                 | 2          | 0         | 2          | 1.0            |
| Lip reconstruction           | 1          | 2         | 3          | 1.5            |
| Cheiloplasty                 | 1          | 1         | 2          | 1.0            |
| Mayo's repair                | 0          | 4         | 4          | 2.0            |
| Wound ligation               | 2          | 0         | 2          | 1.0            |
| Closed reduction and P.O. P. | 2          | 0         | 2          | 1.0            |
| O. R. I. F.                  | 0          | 1         | 1          | 0.5            |
| Hand reconstruction          | 1          | 0         | 1          | 0.5            |
| Amputation                   | 1          | 0         | 1          | 0.5            |
| Skin grafting                | 1          | 0         | 1          | 0.5            |
| Closure                      | 2          | 4         | 6          | 3.0            |
| Evisceration                 | 0          | 1         | 1          | 0.5            |
| Extirpation                  | 1          | 1         | 2          | 1.0            |
| Release                      | 2          | 0         | 2          | 1.0            |
| Cystectomy                   | 1          | 3         | 4          | 2.0            |
| Splenectomy                  | 0          | 1         | 1          | 0.5            |
| Retrograde cholecystectomy   | 0          | 1         | 1          | 0.5            |
| Total colectomy              | 0          | 1         | 1          | 0.5            |
| Colostomy                    | 1          | 1         | 2          | 1.0            |
| Sclerotherapy                | 0          | 3         | 3          | 1.5            |
| Biopsy                       | 5          | 1         | 6          | 3.0            |
| <b>Grand total</b>           | <b>148</b> | <b>56</b> | <b>204</b> | <b>100</b>     |

\*I & D - Incision and drainage. \*P. O. P. - Plaster of Paris. \*O. R. I. F. - Open Reduction and Internal Fixation.

**Table 5:** Sex Distribution of Paediatric Surgical Patients in Different Age- groups.

| Age group          | Males      | Females   | Total      | Percentage (%) |
|--------------------|------------|-----------|------------|----------------|
| 0 – 4 years        | 97         | 33        | 130        | <b>63.7</b>    |
| 5 – 10 years       | 29         | 8         | 37         | <b>18.2</b>    |
| 11 – 15 years      | 22         | 13        | 34         | <b>18.1</b>    |
| <b>Grand total</b> | <b>148</b> | <b>56</b> | <b>204</b> | <b>100</b>     |

\* % males: 72.5.

\* %females: 27.5.

\* % 0 - 4 males: 65.5.

\* % 0 - 4 females: 58.9.

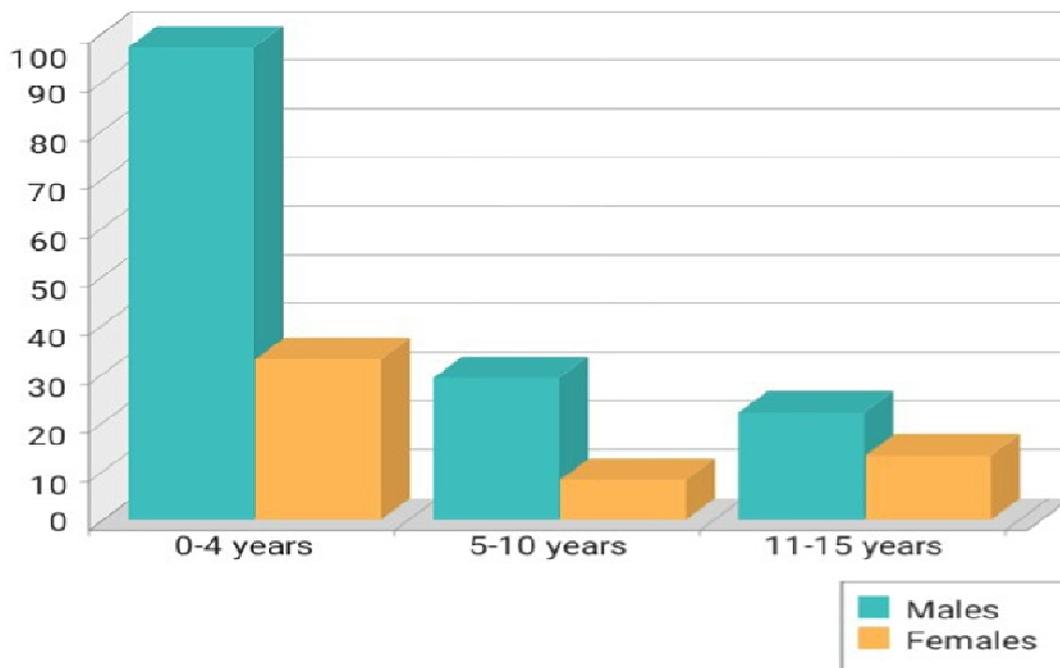
\* % 5 - 10 males: 19.5.

\* % 5 - 10 females: 17.5.

\* % 11 - 15 males: 15.0.

\* % 11 - 15 females: 23.6.

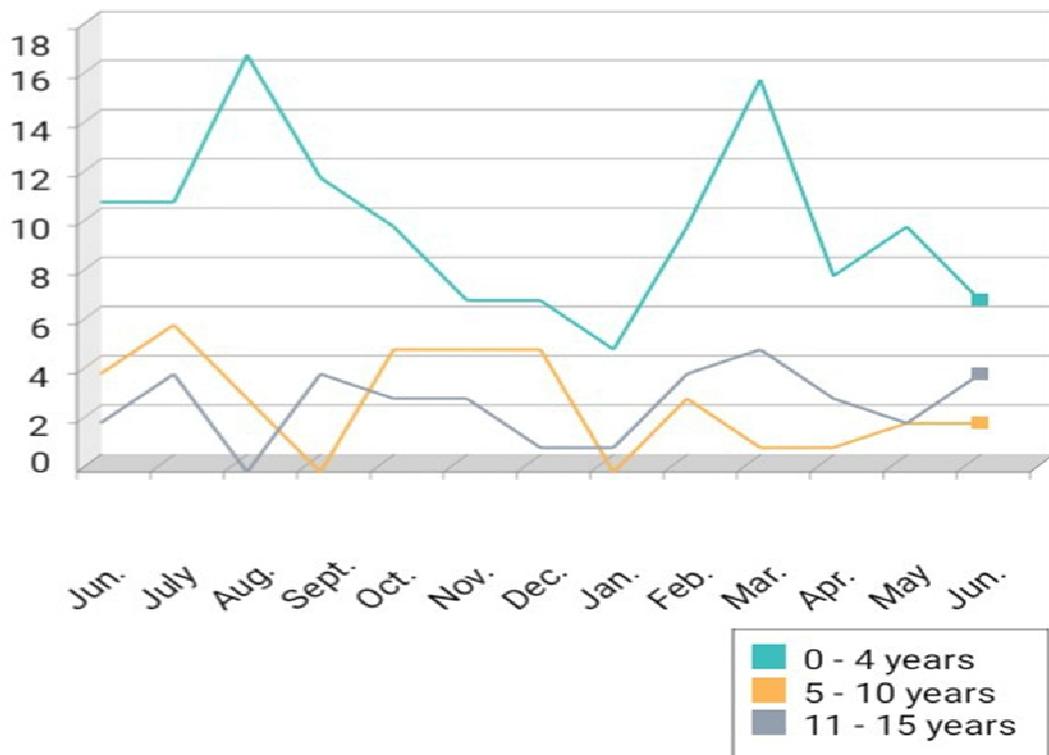
**Fig. 4. Sex Distribution of Paediatric Surgical Patients in Different Age-groups**



| Month          | 0 - 4 (years) | 5 - 10 (years) | 11 - 15 (years) |
|----------------|---------------|----------------|-----------------|
| June 2015      | 11            | 4              | 2               |
| July 2015      | 11            | 6              | 4               |
| August 2015    | 17            | 3              | 0               |
| September 2015 | 12            | 0              | 4               |
| October 2015   | 10            | 5              | 3               |
| November 2015  | 7             | 5              | 3               |
| December 2015  | 7             | 5              | 1               |
| January 2016   | 5             | 0              | 1               |
| February 2016  | 10            | 3              | 4               |
| March 2016     | 16            | 1              | 5               |
| April 2016     | 8             | 1              | 3               |
| May 2016       | 10            | 2              | 2               |
| June 2016      | 7             | 2              | 4               |
| <b>Total</b>   | <b>130</b>    | <b>37</b>      | <b>34</b>       |

*Table 6: Monthly Distribution of Paediatric Surgical Patients in Different Age- groups*

**Fig. 5. Trend of paediatric surgical procedures.**



| Surgical procedure         | Number     | Alive      | Dead      |
|----------------------------|------------|------------|-----------|
| Herniotomy                 | 69         | 67         | 2         |
| Herniorrhaphy              | 17         | 17         | 0         |
| Hydrocelectomy             | 18         | 18         | 0         |
| Appendicectomy             | 14         | 12         | 2         |
| Laparotomy                 | 14         | 7          | 7         |
| Aspiration                 | 1          | 1          | 0         |
| I & D                      | 10         | 10         | 0         |
| Sequestrectomy             | 8          | 8          | 0         |
| Arthrolysis                | 2          | 2          | 0         |
| Orchidopexy                | 2          | 2          | 0         |
| Orchidectomy               | 1          | 1          | 0         |
| Circumcision               | 2          | 2          | 0         |
| Lip                        | 3          | 3          | 0         |
| Cheiloplasty               | 2          | 2          | 0         |
| Mayo's repair              | 4          | 4          | 0         |
| Wound ligation             | 2          | 2          | 0         |
| Closed reduction and P.    | 2          | 2          | 0         |
| O. R. I. F.                | 1          | 1          | 0         |
| Hand                       | 1          | 1          | 0         |
| Amputation                 | 1          | 1          | 0         |
| Skin grafting              | 1          | 1          | 0         |
| Closure                    | 6          | 6          | 0         |
| Evisceration               | 1          | 1          | 0         |
| Extirpation                | 2          | 2          | 0         |
| Release                    | 2          | 2          | 0         |
| Cystectomy                 | 4          | 4          | 0         |
| Splenectomy                | 1          | 0          | 1         |
| Retrograde cholecystectomy | 1          | 0          | 1         |
| Total colectomy            | 1          | 0          | 1         |
| Colostomy                  | 2          | 2          | 0         |
| Sclerotherapy              | 3          | 3          | 0         |
| Biopsy                     | 6          | 6          | 0         |
| <b>Total</b>               | <b>204</b> | <b>190</b> | <b>14</b> |

*Table 7: Postoperative Outcome of Paediatric Surgical Procedures*

| Procedure      | Number   | Alive    | Dead     |
|----------------|----------|----------|----------|
| Laparotomy     | 2        | 1        | 1        |
| Laparotomy     | 1        | 1        | 0        |
| Release        | 2        | 2        | 0        |
| Drainage       | 2        | 2        | 0        |
| Stump revision | 1        | 1        | 0        |
| <b>Total</b>   | <b>8</b> | <b>7</b> | <b>1</b> |

**Table 8:** Surgical Procedures for Postoperative Complications

During this study period, a total of 204 patients were managed for various paediatric surgical conditions: Congenital abnormalities 133 (65. 3%) - 106 (79. 7%) males and 27 (20. 3%) females; Surgical infections 38 (18. 6%) – 20 (52. 6%) males and 18 (47.4) females; Injuries 6 (2. 9%) – 4 (66. 7%) males and 2 (33. 3%) females and; Others 27 (13. 2%). An average of 17 patients were managed on a monthly basis- 12. 3 males and 4. 7 females. The highest number of paediatric surgical procedures (22) was seen in March 2016 and the lowest (6) in January 2016. The highest number of paediatric surgical procedures was in age group 0 - 4 years (63. 7%) and the lowest in age group 11 - 15 years (18. 1%). There were no surgical procedures on female patients in November 2015 and January 2016.

## DISCUSSION

This study was designed to analyse the types of paediatric surgical conditions, procedures and postoperative outcome from 1<sup>st</sup> June, 2015 to 30<sup>th</sup> June, 2016 at the Connaught Hospital Operating Theatre (CHOT) in Freetown, Sierra Leone.

In contrast to previous study which stated that "Injuries are the commonest surgical condition affecting African children.", congenital abnormalities are the commonest paediatric surgical condition in Sierra Leone. Hence, paediatric surgical conditions in Sierra Leone are predominantly diseases. Inguinal hernia (41. 6%) was the commonest congenital abnormality in both males and females. Right-sided inguinal hernia (48) was the most frequently occurring variety. In males, this is probably due to the late descent of the testis on that side with resulting increased abnormalities. The rest were left-sided and bilateral. Other paediatric surgical conditions in Sierra Leone managed at CHOT include: Congenital abnormalities- Hydrocele (8. 8%), Cryptorchidism (2. 5%), Cleft lip (2. 5%), Umbilical hernia (2%) and Spina bifida (15%); Surgical

infections- Appendicitis (6. 4%), Osteomyelitis (5. 4%) and Abscess (3. 4%); Injuries- Fracture (2%).

Paediatric surgical diseases prevalent in males include: Inguinal hernia, Hydrocele, Acute abdomen, Cryptorchidism, Abscess, Tumour, Hirschsprung's disease, Haemangioma, and Septic arthritis. While those prevalent in females include: Appendicitis, Umbilical hernia, Messenteric cyst, Lymphatic malformation, Staphyloma, Patent Urachus and Fibroadenoma.

In the 0 - 4 years age-group, prevalent paediatric surgical diseases were: Inguinal hernia, Hydrocele, Cleft lip, Spina bifida, Lymphatic malformation, Anal malformation, Haemangioma, Hirschsprung's disease, Intestinal obstruction, Patent urachus, Omphalocele, Bladder extrophy, Phimosis, Septic arthritis and Syndactyly. For 5 - 10 years age-group: Acute abdomen, Pyomyositis, Splenic rupture and Scalp cyst; and 10 - 15 years age-group: Appendicitis, Fibroadenoma, Splenomegaly, Cholecystitis, Toxic colitis and Cellulitis.

Paediatric surgeons are sometimes faced with multiple surgical diseases. The most common was Congenital hydrocele (6) which is associated with a hernial sac. There was a patient with Bladder extrophy, Omphalocele and Epispadias. One patient presented with Cryptorchidism and Inguinal hernia. Another had Appendicitis and a cystic tube. Paediatric surgical education should be broadly based. It should cover traumas, infections, malignancies and the common surgical diseases encountered in Sierra Leone.

Dexterity is mandatory as certain paediatric diseases were managed using different surgical procedures. Cryptorchidism was corrected using Orchiectomy, Orchidopexy, Herniorrhaphy or

Perineal contracture release. Cleft lip was repaired by Lip reconstruction or Cheiloplasty. Osteomyelitis was managed by Incision & Drainage, Sequestrectomy or Arthrolysis.

Herniotomy was the most frequently done paediatric surgical procedure at CHOT. The highest number was in the under-fives. This is attributable to inguinal hernia being the commonest paediatric surgical disease (41.6%) with 78.8% inguinal hernia patients in the 0 - 4 age group. This may be due to the introduction of the Free Health Care Scheme which entitles children under five years to free health services, including surgical care. Common paediatric surgical procedures at CHOT include: Herniotomy 69 (33.8%); Hydrocelectomy 18 (8.8%); Herniorrhaphy 17 (8.3%);

Appendicectomy 14 (6.9%); Laparotomy 14 (6.9%) and; Incision and Drainage 10 (4.9%). Certain surgical procedures were done for different surgical diseases.

Laparotomy for Acute abdomen which is caused by the highest number of surgical diseases- Ruptured appendix, Intra-abdominal haematoma, Ruptured typhoid, Multiple intra-abdominal cysts and Burst abdomen. Herniorrhaphy for both Inguinal hernia and Cryptorchidism. Sclerotherapy for Lymphatic malformation and Cystic hygroma. Closure for Spina bifida and Bladder extrophy. Release for Tongue tie and Syndactyly. Also, several surgical procedures were done for a single disease.

Herniotomy and Hydrocelectomy for Congenital hernia. Laparotomy, Appendicectomy and Herniotomy were done on a patient with Obstructed Right Inguinoscrotal Hernia. A patient with Cryptorchidism and Inguinal hernia had Orchidopexy, Herniotomy and Circumcision. 2 patients with Mesenteric cyst in the jejunum had Cystectomy and End-to-end jejunal anastomosis.

The number of paediatric surgical patients on whom Herniorrhaphy- which is inappropriate for paediatric age- was done is 17. A major problem with paediatric surgical care in Sierra Leone is that there is a general lack of knowledge on the care of children with surgical conditions. Special attention should therefore be paid to paediatric surgical education. Knowledge in this area should be increased at all levels. In this respect, village health workers should also be included, even though they might only occasionally care for children with surgical problems. There is also a clear need to train additional paediatric surgeons. Specialists in paediatric surgery are needed to manage the more difficult cases, to set practice standards, and to educate other health care providers.

The number of patients that were alive after surgery was 190 (93%). While the intentions behind sending children to developed countries for specialized surgical care are laudable, it should be noted that the funds spent on caring for a single patient in this way could easily cover the cost of several weeks of surgical teaching in Sierra Leone. Teaching visits can be of immense value to local staff and can ultimately improve the care of large numbers of patients. Moreover, visiting specialists often learn much about the realities of practising surgery in environments with limited resources.

## CONCLUSION

The surgical care of children in Sierra Leone can be improved notwithstanding the serious socioeconomic problems that the people experience. Progress can only occur, however, if poor surgical care is recognized as a significant public health problem and if communities become aware that good surgical care can improve their children's health.

The available information suggests that the best way to facilitate an improvement in the surgical care of children in Sierra Leone is to consider surgical problems within the realm of child health. If a child with pneumonia can be treated properly at a health centre in rural Sierra Leone, it should also be possible to give proper care to a child with a fracture. Both pneumonia and fracture are child health problems, and both deserve proper care.

## RECOMMENDATIONS

### Defining a cost-effective package of paediatric surgical care

The definition of surgical conditions as child health problems does not mean that there should be separate surgical services for children, nor does it imply that paediatric surgeons should care for all children with surgical problems. It does mean, however, that an agency should be given the task of improving surgical care and that the persons with the greatest interest in child health and development should be involved in the necessary research, education, and planning. Unless children with surgical problems have an advocate, surgical care is likely to remain forgotten among other health priorities.

### Improving surgical care at the community level

Although most paediatric surgery is performed at a higher level, these services should be made available to communities. The vast majority of paediatric surgical problems, *i.e.* traumas, uncomplicated congenital anomalies and surgical infections, could

be managed at primary or secondary care levels. If general practitioners or general surgeons received a degree of additional training they could probably do most of this work. In a rural hospital in Nigeria, 95% of operations were considered simple enough to be performed by general duty doctors if they had experience in general surgery<sup>5</sup>. The question arises as to whether the present system of surgical specialization is a principal cause of the decline of surgery. Rather than training paediatric surgeons, the solution for Sierra Leone may be to re-establish general surgery to deal with the operative management of common paediatric surgical conditions<sup>25,26</sup>. The provision of basic paediatric surgical care at the primary and secondary levels requires training material to be published on the subject. The inclusion of a chapter on surgical care in the planned WHO child health pocket book is a major step forward in this respect. A paediatric surgery manual for the district hospital level would be ideal.

#### Strengthening paediatric surgical education

Paediatric surgical education could be strengthened through the work of donor organisations. Developing countries have, through various agencies, organisations, and surgical colleges, established surgical development programmes, which could teach technical skills and patient management to primary practitioners, medical students, general doctors, and professional nurses. Sierra Leone should be no exception. Transferring surgical knowledge to these groups is important because fully trained paediatric surgeons will not be available to most children in the foreseeable future in developing countries. International cooperation involves needs assessment, the establishment of appropriate local and regional training, and teaching programmes, the donation of equipment, the use of surgical journals and textbooks, assistance in research, and the provision of fellowships for young surgeons. There is also an important role for visiting surgical specialists, but in this connection it is desirable to place emphasis on transferring surgical knowledge and encouraging the development of local doctors rather than on treating patients.

#### Integration of surgical care into child health programmes

The details of how surgical care should be integrated into child health programmes, and its exact role, remain to be determined. Whatever its role, however, it should be evidence-based, cost-effective and work towards benefiting the largest possible number of children. Research into these matters is crucial. It is needed in order to arrive at a better definition of the burden of childhood surgical

conditions, to determine the best clinical practices, and to design and test prevention strategies.

The available information suggests that the improved management of congenital abnormalities should be the first priority for paediatric surgery in Sierra Leone.

#### Improve the quality of records for research purposes

Surgical admission book should be provided in the paediatric ward to determine the number of surgical admissions and the number who actually have surgical intervention.

Definitive pre-/ post operative diagnoses should be clearly stated, rather than vague statements that do not give a proper description of the disease. Surgical procedures should be concise and age-appropriate.

The age of paediatric surgical patients should be precise. Use days (D) for neonates, months (M) for infants and years (Y) for those between ages 2 and 15 year

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**World Journal of Medical Education and Research**

An Official Publication of the Education and Research Division of Doctors Academy

ISBN 978-93-80573-62-5



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