

Research article

# Pattern of Pediatric Musculoskeletal Surgical Admissions to a Tertiary Hospital in a Low-Income Country: A Retrospective Review of Medical Records

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## Abstract

**Background:** Pediatric musculoskeletal surgical conditions pose a major public health challenge in Ethiopia, similar to other low-middle income countries. There is a dearth of information about a pattern of pediatric musculoskeletal surgical diseases. Understanding the burden of these disorders in children will inform capacity building efforts, resource allocation and training. This study aimed to assess the pattern and magnitude of pediatric orthopedic surgical disorders among patients admitted to Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia. **Methods:** Clinical records that included the admission and discharge registry data were retrospectively reviewed for pediatric orthopedic patients (0- 15 years) admitted at TASH between September 2017 and August 2021. Data recorded were age, sex, diagnosis, treatment and discharge recommendations. **Results:** A total of 726 children were admitted to the pediatric orthopedic unit during the study period. Of these 482 (66.4%) were male and 244 (33.6%) were female. The most common diagnoses were trauma (n=278, 38.3%), infection (n=161, 22.2%), musculoskeletal tumors (n=95, 13.0%), and congenital anomalies (n=78, 11.0.3%). **Conclusions:** Findings demonstrate a wide spectrum and pattern of pediatric orthopedic conditions that require surgical admission at TASH. As the largest national specialized teaching and tertiary referral center in the country, these findings give insight into different types of musculoskeletal surgical disorders in children. This highlights the need to increase the capacity to care for specific musculoskeletal conditions in the pediatric population of Ethiopia.

## Keywords

Pediatric Musculoskeletal Conditions, Surgical Admission, Ethiopia, Children, Surgery, Musculoskeletal

## 1. Introduction

Musculoskeletal disorders are common causes of severe long-term morbidity affecting hundreds of millions of people around the world and create enormous economic and social impacts on individuals, society, and on health systems [1]. These disorders encompass a wide range of musculoskeletal pathologies from traumatic injury to congenital anomalies,

developmental conditions, musculoskeletal infection, tumors, and neuromuscular disorders as well as inflammatory joint disease [2]. According to the Global Burden of Disease, musculoskeletal disorders are the biggest contributor to years lived with disability worldwide, with more than 90% of disability-adjusted life years lost occurring in low- and mid-

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dle-income countries (LMICs) [3]. Despite the well understood lifelong consequences, little is known about the burden and pattern of musculoskeletal conditions in these countries [4, 5]. Existing surveys in LMICs have revealed that a significant proportion of the populations with musculoskeletal disorders lack access to basic surgical care [6-9].

Moreover, disparities exist in available data for pediatric musculoskeletal disorders. Despite pediatric musculoskeletal disorders being common worldwide, most information describes the burden of the condition in adults, with little emphasis on pediatric populations presenting with musculoskeletal pathologies [10-12]. The vast majority of children with musculoskeletal disorders are in LMIC, given the high number of births and children representing up to 50% of the population and untreated conditions can result in long-term disability which can strain health system further [11, 13, 14]. The children's orthopedic surgery service is a relatively newly emerging surgical sub-specialty in most of the sub-Sahara region and there is a scarcity of reports on the prevalence of pediatric musculoskeletal disorders that require surgical care [15]. Population-based survey studies in sub-Saharan countries show that a large number of children experience musculoskeletal disorders and most lack access to safe, affordable, and timely surgical care [14, 16-21].

Ethiopia is the second most populated country in Africa where half of the population is under 16 years of age and more than 80% of the total population lives in rural areas without access to tertiary-level surgical care. Many children with musculoskeletal disorders do not receive the surgical care they need due to inadequate infrastructure, service delivery systems, trained personnel, and poor awareness among the general population [22].

There is limited literature about pediatric orthopedic surgical conditions affecting children in Ethiopia despite the high pediatric population. To date, no published data exist on the pattern of surgical admissions for children with musculoskeletal disorders despite a long history of providing pediatric orthopedic surgical services in Tikur Anbessa Specialized Hospital (TASH). The few available data focus mainly on adult orthopedics and general pediatric surgery, with little emphasis on children's orthopedic surgical disorders [23-25]. Whilst, studies on specific pathology have been reported, such as clubfoot and fractures, these do not reflect a diversity of the pediatric orthopedic surgical burden [26, 27].

Assessing the epidemiology of pediatric orthopedic surgical admissions will provide insight into the spectrum of pathologies and their burden. This will be useful for long-term health care planning, appropriate resource allocation, providing appropriate care, and developing sub-specialty training programs and research. Therefore, the purpose of the study was to describe the pattern and extent of pediatric orthopedics surgical patients admitted to TASH.

## 2. Patient and Methods

We reviewed patient records for pediatric orthopedic patients (0-15 years of age) admitted to the TASH, department of orthopedic surgery, pediatric orthopedic surgery unit between September 2017 and August 2021.

TASH is a multi-departmental and multi-disciplinary tertiary teaching University Hospital located in the capital city of the country, Addis Ababa. It is the main public hospital giving service to children with musculoskeletal pathologies and receives referrals from all over the country for complex pediatric orthopedic conditions.

The pediatric orthopedic unit is under the Department of Orthopedic Surgery and was established as an independent unit in 2013. It has a ward with 30 beds that is run by one fellowship-trained pediatric orthopedic surgeon and three consultant general orthopedic surgeons.

The data were retrieved from the hospital's computerized admission and discharge registry to identify all pediatric orthopedic surgical conditions and performed procedures. Additionally, the OR logbook, patient documentation chart and digital x-ray findings were used to confirm the reliability of the data, and validate the data. The following data were extracted: demographic data, primary diagnosis, and surgical procedures. For the purpose of this study, the specific orthopedic surgical pathologies are classified into the following categories: congenital, developmental, infection, trauma, neuromuscular, tumor, and miscellaneous. All information was obtained and curated with a customized data collection form. Patients were excluded if incomplete data and patients with non-orthopedic cases. Two study investigators (SE & BB) independently reviewed the data collection forms to verify the accuracy of the data. Descriptive data analysis was undertaken using SPSS version 22. Continuous variables were expressed as a range (SD). Categorical variables were expressed as number (%).

Ethical consideration: Ethical approval for the study was obtained from the departmental ethics committee.

## 3. Results

There were a total of 782 patients admitted to the unit out of which 726 patients were included in the study and 56 were excluded due to incomplete data and children with non-orthopedic conditions during the study period. Among these 482 (66.4%) were male and 244 (33.6%) were female. The age ranged from 0 to 15 years with a mean age of 7.5 years (SD 4.1). The diagnosis of pathologies was grouped into seven major categories (Figure 1). The most common diagnostic categories were trauma (n= 278, 38.2%), infection (n=161, 22.1%) and musculoskeletal neoplasm (n=95, 13.0%).

The most prevalent fracture that required surgical treatment was a displaced supracondylar fracture of the humerus (Gartland 3) (n=77, 38%) followed by femur shaft fracture (n=74, 27%) and forearm fracture (n=25, 9%) (Table 1).

Osteomyelitis was the leading cause of admission within musculoskeletal infections ( $n = 75$ , 47%), followed by joint infection ( $n = 47$ , 29%) and cellulitis/pyomyositis ( $n=29$ , 18%). Almost all children with osteomyelitis presented in the chronic stage of the disease requiring radical surgical procedures aimed to eradicate infection and/or salvage damaged osseous and articular structures.

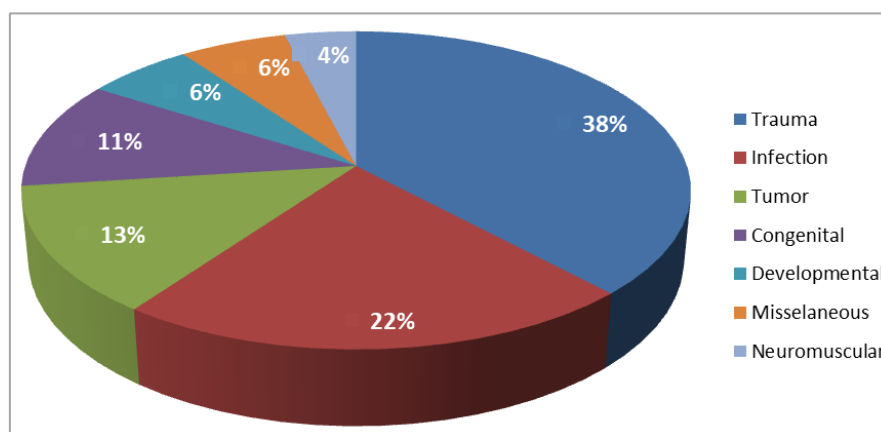
The majority of cases of musculoskeletal tumor were malignant tumors with delayed presentation ( $n= 95$ , 13%). A large number of these cases have visited traditional care like herbal medicine and bone setter treatment prior to admission.

Congenital anomalies were the fourth most common condition with 78 cases (11.0%). Of these, clubfoot was the most common diagnosis that required admission for surgical treatment. Clubfoot constituted 69.2% ( $n=54$ ) of congenital anomalies.

Miscellaneous cases are conditions that could not fall within the categories previously outlined. There were a total of 54 cases (6.1%). These include osteogenesis imperfect, rickets, dysplasia, hemophilic arthropathy, hardware removal, contracture and acquired deformities.

Developmental orthopedic disorders in children constituted 40 (5.5%) admissions which included angular deformity of the limbs, developmental dysplasia of the hip, coxa vara, and Perthes disease.

There were a fewer number of neuromuscular cases 29 (4.1%). Of these, cerebral palsy was the leading cause of admission followed by residual brachial plexus palsy and arthrogryposis. A very few number of cases ( $n = 10$ , 1.2%) were in another form of neuromuscular conditions such as myelomeningocele, peripheral neuropathy and post-injection neuropathy.



**Figure 1.** Pattern of pediatric orthopedic surgical admission in TASH, Ethiopia.

**Table 1.** Distribution of pediatric orthopedics surgical conditions.

Category	Diagnosis	Number of cases	Percentage (%)
Trauma		278	38.2
	Humeral fracture	7	2.5
	Clavicle fracture	1	0.3
	Supracondylar fracture	77	28
	Condylar fracture	10	3.5
	Montegia fracture-dislocation	3	1.0
	Forearm fracture	25	9
	Distal radial physeal injury	3	1.0
	Hand fracture	2	0.7
	Chronic elbow dislocation	7	2.5
	Pelvic fracture	7	2.5
	Chronic traumatic hip dislocation	2	0.7
	Femur neck fracture	12	4.3

Category	Diagnosis	Number of cases	Percentage (%)
	Femur fracture	74	27
	Tibio-fibular fracture	23	8.2
	Foot fracture	3	1.0
	Soft tissue injury	4	1.4
	Traumatic amputation	5	2
	Polytrauma	13	5
		161	22.1
	Osteomyelitis	75	47
	Septic arthritis	47	29
	Tbc hip arthritis	4	2.5
Infection	Pyomyocitis/ Abscess	29	18
	Surgical site infection	6	4
Tumor		95	13
	Benign	22	23
	Malignant	73	79
Congenital		78	11
	Clubfoot	54	69
	Polydactyl	4	5
	Trigger finger	2	2.5
	Macroductyly	3	4
	Congenital tibial pseudoarthrosis	4	5
	Congenital synostosis of forearm	2	2.5
	Club hand	2	2.5
	Congenital Vertical Talus	3	4
	Torticollis	1	1.2
	Congenital elbow contracture	1	1.2
	Fibula hemimeliac	1	1.2
	Congenital posteromedial bowing of tibia	1	1.2
		45	6.1
Miscellaneous	Acquired deformity	14	31
	Hardware in-situ	10	22
	Contractures	7	15.5
	Dysplasia	3	7
	others	11	24
Developmental		40	5.5
	DDH	5	12.5
	Coxa vara	2	5
	Perthe's disease	3	7.5
	Angular deformities of knee	19	47.5

Category	Diagnosis	Number of cases	Percentage (%)
Neuromuscular	Madlung	2	5
	Hallux valgus	2	5
	Others	7	17.5
		29	4.1
	Cerebral palsy	10	34
	Erbs palsy	7	24
	Arthrogryposis	2	7
	Peripheral neuropathy	8	27
	Melomeningocele	2	7
Total		726	100%

## 4. Discussion

The pattern and burden of pediatric orthopedic surgical conditions within the general population in Ethiopia has yet to be measured and the results of this study showed a wide spectrum of children's musculoskeletal surgical disorders presenting to a national referral hospital. These findings can be considered reasonably representative of orthopedic surgical conditions that affect the pediatric population in Ethiopia, taking into account that Tikur Anbessa Specialized Hospital is the biggest tertiary referral hospital in the country from all over the region. The majority of patients fall into four major diagnostic categories: trauma, surgical infections, tumor and congenital anomalies respectively. These four diagnostic categories accounted for almost 85% of pediatric orthopedic surgical admissions.

Trauma and infection were responsible for the largest number of admissions, and these findings align with studies conducted in other sub-Saharan countries (Nigeria, Tanzania, and Gambia) [28-30]. However, reports from Zambia [31] revealed that congenital anomalies were the leading cause of admission followed by trauma and tumors. Spiegel et. al. in Nepal (32) found that congenital anomalies were the second common cause of admission after injuries.

Available evidence, along with these findings, underscore the major public health challenge posed by injuries worldwide [2, 14, 33]. The most common traumatic fracture was a supracondylar fracture of the humerus, followed by fracture of the femur and forearm. A similar pattern was reported in a previous study in our setting [26]. Additionally, a study from Kenya revealed that fractures of the distal metaphysis of the humerus were prevalent, which is consistent with our findings [34].

Musculoskeletal surgical infections were the second most common diagnostic category requiring surgical admission.

Comparable findings have been reported in many countries in the region [28, 29, 31]. Studies conducted in Gambia [30] and Burundi [35] found orthopedic surgical infection was a common cause of admission, and chronic osteomyelitis was the most prevalent surgical infection, consistent with our findings that highlight the burden of chronic osteomyelitis on the pediatric population. Based on this findings it is very imperative emphasize the need of health education, awareness creation among the general population and health professionals the importance of early medical-surgical management of musculoskeletal infections in children.

It is important to note that a considerable number of children with musculoskeletal tumors presented in the late stage of the disease, posing challenges for surgical management. Among musculoskeletal tumors, malignancies outnumbered benign cases and this finding align with reports from Zambia [31] and Gambia [30] where tumors were also common surgical conditions. In contrast, a study in Nigeria (28) revealed that tumors were the least cause of surgical admission. Our findings are likely due to our hospital being the only referral center for musculoskeletal tumors in the country. Currently, TASH is the only hospital providing reconstructive, radiation and chemotherapy services in Ethiopia.

The pattern of congenital anomalies in this study was similar to that reported from other LMICs and demonstrates that congenital orthopedic disorders are significant causes of disability [15, 28, 31, 32]. Among congenital anomalies, talipes equinovarus deformity (clubfoot) was the most common diagnosis that required surgical admission in this study. Interestingly, all surgical interventions for clubfoot were less extensive soft tissue procedures to treat recurrence or residual deformity after the introduction of Ponseti treatment [27].

Clubfoot is the most common musculoskeletal congenital anomaly worldwide [36]. In Ethiopia, it is estimated that about 4,000- 5,000 infants are born with clubfoot each year. TASH primarily treats clubfoot using the conservative method (Ponseti method) since its adoption in 2005 [27]. Prior to this,

the most common procedure for children with clubfoot was a radical posteromedial release [37]. We have successfully treated older patients with clubfoot with the Ponseti treatment principle combined with limited surgical intervention, thereby avoiding traditional extensive surgical correction. However, significant numbers of older children and adolescents still present with untreated clubfoot deformity in Ethiopia [38, 39]. Currently the clubfoot services have been expanded all over the regions establishing more than sixty clubfoot clinics. The expansion of the services at early age will definitely help to decrease the number of neglected clubfoot cases and avoids the need for extensive surgical intervention.

This study is limited by its retrospective method and several considerations should be taken into account when interpreting the findings. The data were collected from the only specialized government institution where children with orthopedics problems are referred and receive optimal treatment options. While all necessary information was carefully recorded, the study's reliance on data from a single facility limits its generalizability to the entire population of Ethiopia. Moreover, the retrospective nature of the study introduces inherent biases and limitations, such as incomplete or missing data, variations in data collection practices over time, and the inability to control for confounding variables. Additionally, the study's reliance on medical records may lead to inaccuracies or inconsistencies in reporting, as documentation practices can vary among healthcare providers. Furthermore, as a hospital-based study, it may not capture cases that were managed in other healthcare settings or those that did not seek medical attention. This could potentially underestimate the true prevalence and burden of pediatric orthopedic conditions in the broader population. Nevertheless, the study meticulously collected data from multiple sources to enhance the reliability and validity of the findings. The specialized setting also ensured access to specialized care and expertise, leading to accurate diagnoses and optimal treatment options for the study population.

## 5. Conclusions

The study revealed a wide spectrum of pediatric orthopedic conditions that require surgical management, posing a significant public health challenge in Ethiopia. Urgent action is needed to raise awareness and implement early intervention strategies. Expanding access to basic pediatric orthopedic services is crucial to reduce the need for complex surgical procedures and costly referrals. Advocating for nationwide expansion of pediatric surgical services is necessary to address the unmet surgical demand and ensure timely care for all children in Ethiopia.

## Abbreviations

TASH      Tikur Anbessa Specialized Hospital

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## Author Contributions

**Bahiru Bezabhi:** Conceptualization, Resources, Visualization

**Samirawit Esayas:** Data curation, Methodology, software, and Investigation

**Birhanu Ayana:** Supervision. Validation, Writing- Reviewing and Editing

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## Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

## Conflicts of Interest

The author declares no conflicts of interest.

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## Biography



**Birhanu Ayana** is a consultant pediatric orthopedic surgeon at TASH, Associate professor of orthopedic surgery, Addis Ababa University, department of orthopedic and trauma surgery. He completed his pediatric orthopedic surgery fellowship from Christian medical college (CMC) Vellore, India, and his ortho-

pedic surgery residency in Addis Ababa University, Addis Ababa, Ethiopia. He has also observership fellowship training in Sickkids hospital, Toronto, Canada and Iowa university Hospital, Ponseti clubfoot center, USA. Dr. Ayana has significant contribution for the development of Ethiopian Clubfoot program. He has participated in Africa Clubfoot training manual project development as an Advisory group as well as faculty. In addition; he has authored and co-authored multiple publications on international and local journals. He currently serves as the pediatric orthopedic unit head at the department orthopedic surgery and medical Director of Ethiopian clubfoot Program (Hope walks Ethiopia).



**Samrawit Esayas** is an Assistant Professor of Orthopedic Surgery and Traumatology. She completed her medical degree from Tikur Anbessa Specialized Hospital (TASH), College of Health Sciences (CHS), Addis Ababa University (AAU) in 2015 and finished her specialty training in Orthopedics and Traumatology from the same institution in 2021. She is also a fellow of College of Surgeons of East, Central and Southern Africa (COSECSA) by examination in 2022. She has participated in many research projects at Tikur Anbessa Hospital Orthopedics department. She currently works as a general orthopedic surgeon in the Pediatric Unit of Orthopedics department at TASH and as a lecturer for orthopedic residents and undergraduate students. In addition, she is a coordinator of 4th year residents and also participates in organizing trainings and Ethiopian Orthopedic Society meetings.



**Bahiru Bezabhi** is a consultant orthopedic surgeon and assistant professor of orthopedic surgery at Addis Ababa University, department of orthopedic surgery, Tikur Anbessa Specialized Hospital. He obtained his medical degree in 1986 from Instituto Superior de Ciencias Medicas de Santiago de Cuba, CUBA. He completed his orthopedic surgery specialty from the same institution in 1990. Dr Bahiru is a fellow of College of Surgeons of East, Central and Southern Africa (COSECSA). Dr. Bahiru has many years' experience practice in general orthopedic surgery and pediatric orthopedics surgery internationally and locally. In addition to clinical practice and academic activity Dr. Bahiru has served as Medical Director of Tikur Anbessa Specialized Hospital, Head, department of orthopedic surgery and President of Ethiopian Society of Orthopaedics and Traumatology. He has published articles in local and international journals. Currently, he is a Vice President of Ethiopian Paralympic Committee and Board Member of Ethiopian Medical Association.

## Research Field

**Birhanu Ayana:** Pediatric musculoskeletal infection, Pediatric orthopedic trauma, Congenital musculoskeletal anomalies, Cerebral palsy, Orthopedic birth injury, Developmental hip disorders, Pediatric orthopedics service in resource limited setting

**Samirawit Esayas:** Lower extremity fracture in children, Elbow injury in pediatric, Developmental hip dysplasia of the hip, Delayed presenting clubfoot management outcome, Traditional bone setters associated disability in children, Pediatric musculoskeletal infections

**Bahiru bezabhi:** Osteomyelitis in pediatrics, Pediatric orthopedic trauma, Congenital musculoskeletal anomalies, Long bone fracture in children, Delayed presenting pediatric orthopedic conditions