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Authors

Alves, Kristin
Penny, Norgrove
Kobusingye, Olive
et al.

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Pediatric Musculoskeletal Disease in Kumi District, Uganda: A Cross-sectional Survey

Kristin Alves, MD[1,5], **Norgrove Penny, MD**[2], **Olive Kobusingye, MBChB MSc MMed MPH**[3], **Robert Olupot, MBChB MMed Surg**[4], **Jeffrey N. Katz, MD MSc**[5], and **Coleen S. Sabatini, MD MPH**[6]

[1.]Harvard Combined Orthopaedic Surgery Residency Program, Boston, MA, USA [2.]University of British Columbia, Department of Orthopaedic Surgery, Victoria, Canada [3.]Makerere University School of Public Health, Kampala, Uganda [4.]Kumi Hospital, Kumi, Uganda [5.]Brigham and Women's Hospital, Department of Orthopaedic Surgery, Boston, MA, USA [6.]University of California San Francisco Department of Orthopaedic Surgery, UCSF Benioff Children's Hospital Oakland, Oakland, CA, USA.

Introduction

In 2003, the World Health Organization (WHO) published a report highlighting the burden of musculoskeletal conditions in low resource countries. The report emphasized a need for data on prevalence and incidence of musculoskeletal conditions in order to appropriately determine healthcare priorities [1]. Subsequently, the 2010 Global Burden of Disease studies found that non-traumatic musculoskeletal disease is estimated to account for 6.8% of all disability adjusted life years (DALYs) lost with another 11% of DALYs coming from traumatic injuries [2]. A prior study has documented that a large burden of disease in low and middle-income countries (LMICs) is due to musculoskeletal disorders (14.8%) with up to 60% of the need for care being unmet [3]. The specific musculoskeletal conditions that comprise this large burden of musculoskeletal disease are not known and may differ markedly across countries and regions.

In Africa, conservative estimates are that 11% of total burden of disease and 25 million disability-adjusted life years (DALYs) (38/1,000 population) are due to surgical conditions [4]. Despite increasing awareness of the burden of surgically treated conditions, there remains a paucity of information on surgical utilization in the pediatric population, with estimates that up to 85% of children in Africa have a surgically treatable condition by age 15 [5]. Butler et al. found that 14% of Ugandan children had a surgically treatable condition, although only half of these are being addressed currently [6]. Little is known about which

Corresponding Author: Coleen S. Sabatini, MD, MPH, 747 52nd Street, OPC 1st Floor, Oakland, CA 94609, Phone: 415-514-1519, Fax: 415-476-5363, Coleen.Sabatini@ucsf.edu.

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pediatric musculoskeletal conditions are contributing to this surgical burden [7,8]. Thus, a better understanding of the distribution of specific musculoskeletal disorders in the pediatric population, including those generally treated surgically and those treated nonoperatively, would permit more informed allocation of medical and surgical resources in these countries [9].

Methods

Design:

This was a retrospective cohort study of all children seen in Kumi Hospital's musculoskeletal hospital-based and outreach clinics between January 2013 and December 2015.

Setting:

Kumi Hospital is a rural hospital located in Kumi District and serves the district's population through inpatient, outpatient and outreach services. As of 2014, Kumi District was one of 111 districts in Uganda, with a population of over 239,268 [10]. Kumi Hospital has a musculoskeletal clinic located at the hospital for outpatients with musculoskeletal problems. The hospital also runs outreach programs held in outlying villages where patients with a wide range of musculoskeletal disabilities are seen. The study was approved by the Uganda local Institutional Review Board and the Uganda National Council for Science and Technology as well as the senior author's (CSS) institution.

Sample:

The study sample included all children (age ≤18 yrs) seen in Kumi Hospital musculoskeletal clinic or Kumi District outreach clinic for disabling impairments between January 2013 and December 2015. Only children labeled as a new visit were included.

Data sources and data elements:

All patient information was obtained from written logbooks. At both the hospital clinic and the outreach clinic, logbooks are used to register all patients. The logbook is completed by an orthopaedic officer or a community health worker. For each set of logbooks, only patients ages 0–18 were included for analysis. Data collected included patient's age, sex, diagnosis, and treatment recommendation. The Kumi Hospital musculoskeletal clinic logbooks included only patients seen in the clinic for musculoskeletal complaints (including pain, disability, deformity, or injury involving any extremity or the spine). The Kumi District Outreach visit logbooks included patients seen for any disabling impairment throughout Kumi District and surrounding catchment area.

Reliability of data collection:

Intraobserver reliability was assessed to ensure accuracy in data collection and data entry. KA selected 250 patients randomly and compared all variables entered into the database against the original logbook entries; 100% of the variables matched initial entry. To determine interobserver reliability, a separate reviewer repeated the data abstraction process (from written logbook to Excel) on 100 randomly selected subjects. The two observers were in agreement on 99.7% of all data abstracted.

Data management:

Once the logbook data were abstracted, patients' diagnoses and treatment recommendations were coded. Codes for diagnosis included: contractures (gluteal fibrosis (GF), quadriceps fibrosis (QF), etc.), post-injection paralysis (PIP), infections (osteomyelitis, septic arthritis, etc.), trauma (fractures and dislocations), burns, cerebral palsy, clubfoot, angular knee deformities, femoral head necrosis, Erb's palsy, keloid formation, epilepsy, malnutrition, Down syndrome, and other. Codes for treatment recommendation included: surgery (only applicable for clinic visits), referral to surgeon (only applicable for outreach visits), physical therapy, assistive devices (i.e. bracing such as an ankle foot orthoses (AFO)), further testing (i.e. radiographs, labs, etc.) and other recommendations (e.g. reassurance, medications, etc.). The accuracy of coding was verified in a process in which we examined the agreement between the diagnosis code entered into the database and the actual diagnoses listed for every 4^{th} patient entered in the database. The codes and original listed diagnosis agreed in 100% of the patients reviewed.

Statistical analysis:

Statistical analysis was conducted using SAS 9.4 (SAS, Cary, NC, USA). For the clinic population, we estimated the prevalence of a diagnosis as the ratio of the number of children with that diagnosis divided by the total number of children seen for any musculoskeletal complaint. For the outreach population, we estimated the prevalence as the number of children with a specific diagnosis divided by the total number of children seen during outreach for any medical complaint. We used descriptive statistics (mean, median) to examine the distribution of patient factors including sex and age. We documented treatment recommendations for patients and developed a coding system to analyze recommendations for each clinical setting.

Results

The three years of clinic and outreach logs yielded 4,852 total children. The majority of diagnoses could be categorized into a few conditions (Table 1, Figure 1). Overall, the large contributors of disease included contractures (29.4% (95% CI 28.1 – 30.7%)), 96% of which were gluteal fibrosis), post-injection paralysis (12.7% (95% CI 11.8 – 13.6%)), and infection (10.5% (95% CI 9.7 – 11.4%)). The prevalence of other diagnoses differed based on setting. For example, while 17% of clinic visits were for trauma cases, only 3% of outreach visits were for trauma. Conversely, while 8% of outreach visits were for cerebral palsy, only 4% of clinic visits were for cerebral palsy. Scoliosis was found to have a similar frequency in both settings with a similar rate (2/1000 overall).

Acquired conditions (including gluteal fibrosis, infections and trauma) were found in an older age cohort with median age over 8 years, while conditions that are congenital or generally identified in infancy (including cerebral palsy, clubfoot, and Erb's palsy) were found on average to present in children less than 4 years. Age at presentation to either the outreach clinic or the hospital musculoskeletal clinic was similar for most conditions except cerebral palsy and clubfoot. Both were found to be seen earlier in clinic and later in outreach. For example, cerebral palsy was seen at a median age of 4 in outreach vs 2.75 in clinic. Similarly, clubfoot was seen at median age 2.25 in outreach vs 0.42 in clinic).

In evaluating the common conditions seen, the distribution of treatment recommendations varied widely (Table 2). For GF and MSK infections, patients seen on outreach were largely referred to a surgeon (87% for GF and 61% for MSK infections). Similarly, when seen in the hospital clinic the GF and MSK infection patients often received a recommendation for surgical release by the consultants (93% for GF, 58% for MSK infections). Cerebral palsy on the other hand generally received non-operative treatment recommendations in both settings. In contrast, while clubfoot and trauma patients seen on outreach were referred to a surgeon (50% and 61%), those seen in the hospital clinic rarely actually required surgical management (6% and 20%) and often underwent casting, bracing or other form of non-operative treatment.

Discussion

This retrospective review of all pediatric patients seen over a three-year period in a northeastern Ugandan musculoskeletal clinic and comprehensive community-based rehabilitation outreach program highlights the burden of specific pediatric musculoskeletal disorders in this region. Over 50% of patients seen were diagnosed with contractures, post-injection paralysis or infection. These conditions are either seen nearly exclusively in resource-limited settings or are seen in greater proportion in resource-limited settings than in resource rich settings. The prevalence of other diagnoses differed based on setting, with trauma and clubfoot being more likely to be brought to the hospital clinic and cerebral palsy and Down syndrome more likely to be seen on outreach visits. Such data on distribution of specific conditions and condition-specific referral for surgery and nonoperative therapy will permit health officials to make more informed decisions about appropriate management of health resources in these settings. In addition, determining the prevalence of disease such as scoliosis allows for the determination of cost-effectiveness of screening programs in low-resources settings [11].

Of note, conditions caused by suspected iatrogenic injection injuries (GF, QF and PIP) account for over 30% of hospital clinic visits for musculoskeletal conditions and 40% of outreach visits for any medical complaint in this northeastern region of Uganda. Prior studies in Uganda, as well as other higher resource countries, have highlighted the concern for injection injury related conditions [12–15]. In 2004, post-injection paralysis was seen in 10% of patients seen in a Kumi, Uganda Community Based Rehabilitation (CBR) Project and 8% of pediatric operations in Kumi Hospital (N. Penny, personal communication, June 13, 2017). This study confirms that PIP continues to be an important cause of MSK disability in children. Osteomyelitis also remains a large problem in Uganda. In 2004, osteomyelitis was found in 6% of patients in the CBR project in Kumi, Uganda and 19% of pediatric operative cases were for osteomyelitis in Kumi Hospital. In 2009, 10% of patients had osteomyelitis in a cross-sectional study with 80% of the cases being under 20 years of age [16]. Chronic osteomyelitis is a rare disease among pediatric populations in high income countries, but as demonstrated in our study, chronic osteomyelitis remains a large burden on healthcare services in Uganda for the pediatric population and a significant burden on families and communities.

In many LMICs including Uganda, there can be deficiencies in care for musculoskeletal diseases including osteomyelitis at all tiers of the health care system due to limited availability of infrastructure, supplies, and human capacity to deliver orthopaedic surgical care [17,18]. In Uganda, there are 0.1 surgeons per 100,000 people compared to 250 surgeons per 100,000 in the US [6]. Furthermore, only 47 of these surgeons are orthopaedic surgeons for a country of over 41 million people. Nearly half of Ugandans are under 15 years old, with over 80% living in a rural setting [19,20]. Mission or NGO hospitals and surgeons were estimated to provide the majority of pediatric operations (55–80%) in south-western Uganda [21]. Even with NGO and mission driven aid, the surgical rate for children in Uganda was found to be just 3% of the rate documented in England, highlighting the vast unmet need in pediatric surgical care [21].

The World Health Organization (WHO) established the Global Initiative for Emergency and Surgical Care which has led to increasing awareness of the role of surgical care in improving the health of individuals and thus the economic productivity of countries [22,23]. In order to determine what resources are necessary to invest in to improve surgical care, quantitative assessments of the burden of disease in the population are necessary. Prior studies have estimated surgical needs relying on the current procedures performed or survey data of population [4,24]. However, our data utilized a large sample size of nearly 5,000 patients to determine the unique distribution of pediatric musculoskeletal disease. We estimate that 50% of conditions with recommendations for surgical intervention could be prevented with policy changes and education regarding injection practices and early care for traumatic injuries, clubfoot, and musculoskeletal infection. The rural populations in areas like Kumi District have insufficient access to care exacerbating musculoskeletal conditions. For example, a fracture that would normally require a simple reduction can become an acquired deformity requiring surgical management if not treated soon after injury and result in disabling impairment. Clubfoot was found to have a delayed presentation when seen in outreach versus clinic, (median age 2.25 vs 0.42 for outreach versus clinic respectively) with an increase in surgical management recommended for the neglected cohort compared to the children seen early (50% versus 6%). In a prior systematic review, the average age of presentation for clubfoot for high income countries was less than 2 months [25]. Earlier detection and treatment of clubfoot is one example of how it is possible to decrease the surgical need and costs to the country if there was improved education on congenital conditions, advocacy and access to treatment centers for the population.

Our study must be interpreted in the context of methodologic limitations including retrospective data collection with the absence of desired details such as GMFCS grading on cerebral palsy patients and inclusion of only one region in Uganda. However, this study clearly demonstrates that a large proportion of pediatric patients seen for medical care are suffering from musculoskeletal disabilities and strongly suggests that future research is necessary to determine the scope of the problem in Uganda and throughout Africa. Limited awareness and a paucity of publications regarding the population's needs can contribute to a lack of prioritization for the care of pediatric musculoskeletal conditions. Future studies should examine epidemiology of pediatric musculoskeletal disease seen in further rural and urban areas of Uganda to establish the true burden that needs to be addressed. Many LMIC countries like Uganda have a large population of children who will soon need to make up the workforce. Prevention of disability in this population such that they are able to work is vastly important for the economic future of these countries.

Conclusion

Acknowledging and understanding the drivers of current health care utilization, as this study has presented, are fundamental in planning where to focus capacity-building efforts. Meeting the needs for safe surgical and nonoperative care of the pediatric population in Uganda is complex with few resources, limited orthopaedic surgical training positions, and no pediatric orthopaedic fellowships. Expansion of in-country subspecialty training, collaboration with NGO/mission trip physicians, and potentially task-shifting with a focus on addressing the burden of disease once determined will be necessary future steps.

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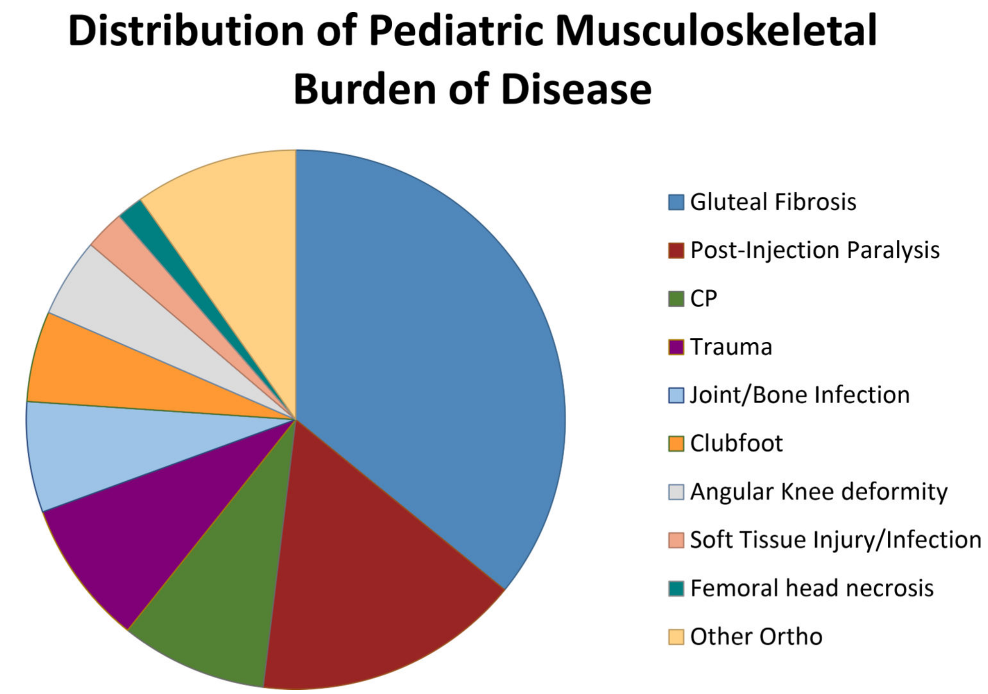

Fig 1.
Distribution of musculoskeletal conditions among pediatric population in Kumi District, Uganda

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Fig 2.

Gluteal fibrosis patient. a Skin dimpling in a gluteal fibrosis patient Photo credit: John Ekure, MBBS, MMed; b-c. Depiction of obligate external rotation and abduction contracture in gluteal fibrosis patient Photo credit: Coleen Sabatini, MD, MPH

Fig 3.

Post-injection paralysis patient Photo credit: Norgrove Penny, MD

Fig 4a-b.
Lower extremity osteomyelitis patients Photo credit: Coleen Sabatini, MD, MPH

Fig 5.
Bilateral clubfoot deformity Photo credit: Norgrove Penny, MD

Fig 6.
Windswept knee deformity Photo credit: Coleen Sabatini, MD, MPH

Table 1.

Pediatric Musculoskeletal Burden of Disease in Kumi, District in Uganda

	ALL PATIENTS (%) (4,852 TOTAL)	OUTREACH (%) (3,339 TOTAL)	CLINIC (%) (1,513 TOTAL)	MEDIAN AGE (YEARS)
CONTRACTURES	**1426 (29.4)**	**1142 (34.2)**	**284 (18.8)**	**10**
GLUTEAL FIBROSIS	1372 (28.3)	1114 (33.4)	258 (17.1)	10
QUADRICEPS FIBROSIS	46 (1.0)	23 (0.7)	23 (1.5)	6
OTHER	8 (0.2)	5 (0.1)	3 (0.2)	3.25
POST-INJECTION PARALYSIS	**614 (12.7)**	**283 (8.5)**	**331 (21.9)**	**5**
INFECTION	**511 (10.5)**	**309 (9.3)**	**202 (13.4)**	**9**
JOINT/BONE	254 (5.2)	85 (2.5)	169 (11.2)	11
SOFT TISSUE	91 (1.9)	59 (1.8)	32 (2.1)	7
FUNGAL	55 (1.1)	54 (1.6)	1 (0.1)	11
UTI	40 (0.8)	40 (1.2)	0	8
Other	71 (1.5)	71 (2.1)	0	8
TRAUMA	**333 (6.9)**	**82 (2.4)**	**251 (16.6)**	**8**
FRACTURE	256 (5.3)	29 (0.9)	227 (15.0)	9
DISLOCATION	20 (0.4)	7 (0.2)	13 (0.8)	10
BURNS	57 (1.2)	46 (1.4)	11 (0.7)	5
CEREBRAL PALSY	**336 (6.9)**	**278 (8.3)**	**58 (3.8)**	**4**
CLUBFOOT	**208 (4.3)**	**72 (2.2)**	**136 (9.0)**	**1**
ANGULAR KNEE DEFORMITY	**181 (3.7)**	**101 (3.0)**	**80 (5.3)**	**4**
FEMORAL HEAD NECROSIS	**61 (1.3)**	**25 (0.7)**	**36 (2.4)**	**10**
MALNUTRITION	**43 (0.9)**	**43 (1.3)**	**0**	**3**
DOWN'S SYNDROME	**29 (0.6)**	**28 (0.8)**	**1 (0.1)**	**3.5**
KELOID	**12 (0.3)**	**12 (0.4)**	**0**	**6.5**
ERB'S PALSY	**10 (0.2)**	**3 (0.1)**	**7 (0.5)**	**0.25**
SCOLIOSIS	**8 (0.2)**	**4 (0.1)**	**4 (0.3)**	**14.5**
OTHER	**1094 (22.5)**	**964 (28.9)**	**130 (8.6)**	**7**

Table 2.

Distribution of Treatment Recommendation

	NO (%)	SURGERY	REFERRAL TO SURGEON	ASSISTIVE DEVICE	PHYSICAL THERAPY	FURTHER TESTING	OTHER
OUTREACH PATIENTS	**3339**						
GLUTEAL FIBROSIS	1114 (33.3)	n/a	970 (87%)	0	133 (12%)	0	11 (1%)
POST-INJECTION PARALYSIS	283 (8.5)	n/a	92 (33%)	109 (39%)	55 (19%)	3 (1%)	24 (8%)
TRAUMA	82 (2.5)	n/a	50 (61%)	1 (1%)	10 (12%)	6 (7%)	15 (18%)
CLUBFOOT	72 (2.2)	n/a	36 (50%)	3 (4%)	32 (44%)	1 (1%)	0
CEREBRAL PALSY	278 (8.3)	n/a	45 (16%)	102 (37%)	66 (24%)	2 (1%)	63 (23%)
JOINT/BONE INFECTION	85 (2.5)	n/a	52 (61%)	0	1 (1%)	21 (25%)	11 (13%)
FEMORAL HEAD NECROSIS	25 (0.7)	n/a	12 (48%)	3 (12%)	0	10 (40%)	0
ANGULAR KNEE DEFORMITY	101 (3.0)	n/a	61 (60%)	7 (7%)	1 (1%)	9 (9%)	23 (23%)
SOFT TISSUE INJURY	59 (1.8)	n/a	30 (51%)	1 (2%)	4 (7%)	1 (2%)	23 (39%)
CLINIC PATIENTS	**1513**						
GLUTEAL FIBROSIS	258 (17.1)	239 (93%)	n/a	0	14 (5%)	3 (1%)	2 (1%)
POST-INJECTION PARALYSIS	331 (21.9)	44 (13%)	n/a	151 (46%)	118 (36%)	2 (1%)	16 (5%)
TRAUMA	251 (16.6)	50 (20%)	n/a	24 (10%)	136 (54%)	15 (6%)	26 (10%)
CLUBFOOT	136 (9.0)	8 (6%)	n/a	27 (20%)	93 (45%)	2 (1%)	6 (4%)
CEREBRAL PALSY	58 (3.8)	3 (5%)	n/a	20 (34%)	29 (50%)	2 (3%)	4 (7%)
JOINT/BONE INFECTION	169 (11.2)	98 (58%)	n/a	1 (1%)	6 (4%)	32 (19%)	32 (19%)
FEMORAL HEAD NECROSIS	36 (2.4)	4 (11%)	n/a	3 (8%)	2 (6%)	19 (53%)	8 (22%)
ANGULAR KNEE DEFORMITY	80 (5.3)	37 (46%)	n/a	2 (3%)	7 (9%)	21 (26%)	13 (16%)
SOFT TISSUE INJURY	32 (2.1)	6 (19%)	n/a	3 (9%)	7 (22%)	1 (3%)	15 (47%)