

# The hidden burden of Pediatric urology in Sub-Saharan Africa: an analysis of hospital admission data from three East African Health Centres

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## Abstract

Specialist facilities for children are still unavailable in some Sub-Saharan African contexts. It is the case of pediatric urology, whose recent advances are still largely unshared. Prenatal diagnosis of urinary abnormalities (CAKUT) is largely unknown. Early recognition and referral of Undescended testis (UDT), Hypospadias,

bladder exstrophy epispadias complex, ambiguous genitalia, stone disease, and tumours are uncommon in rural areas. Missed diagnosis is not uncommon and delayed management is associated with poor outcomes. We present a cross-sectional, descriptive study about the epidemiology of Pediatric urological admissions to three sub-Saharan East African Hospitals. All the urological cases between 0-18 years referred to three distinct East African Hospitals over 124 weeks were considered. Prevalence of different groups of diseases, age, and mode of presentation were reported. We found 351 cases (M/F 127/24) out of 2543 surgical referrals (13%). Seventy percent of cases were Hypospadias and UDT. Fifty percent of UDT were beyond 6, and most Hypospadias were between 4 and 7 yrs. CAKUT had a very low prevalence (4.84%), and about 50% of Wilms Tumours came too late to be resectable. In many African contexts, urology is still a tiny portion of the pediatric surgical workload compared to the 25% of European and American reports. There are also differences in the epidemiology of genitourinary conditions. A hidden burden of diseases may be presumed, remaining undiagnosed due to the shortage of specialist facilities.

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## Introduction

Genitourinary (GU) diseases are estimated to represent, in highly resourced contexts (HRC), more than 25% of the pediatric surgical workload.<sup>1</sup> Widespread use of prenatal ultrasound (US), alerting on the presence of anomalies of the kidney and urinary tract (CAKUT), consents to early management, limiting the risk of chronic kidney disease (CKD). Parental and medical awareness favors prompt referral of the most evident anomalies of genitalia with a better functional outcome. Dietary and pharmacological prevention and easy access to minimally invasive treatment reduce the burden of stone disease. Early approaches to solid tumors and combined therapies contribute to improved survival.

Most children living in some areas of Sub-Saharan Africa (SSA) are still not sharing these advances. Expert care and adequate facilities are only available in the main urban areas and the number of trained urologists still needs to be increased<sup>2</sup> to serve the large African pediatric age group, about 50% of the population. Over half of these patients live in vast rural areas undersupplied by good health services and specialist facilities. Lack of an efficient transport network, illiteracy, and poor parental awareness, even for the most evident GU abnormalities, delays or prevents seeking medical care.<sup>3</sup> The epidemiology of urological conditions referred to African Health facilities may be signifi-

cantly influenced and the actual prevalence of many health and life-threatening GU diseases may be therefore underestimated.

## Materials and Methods

### Aim

The present study is on the epidemiology of main GU conditions in children referred to three distinct East African Health Centres. The mode of presentation and the age at admission were considered for each group of diseases and compared with figures from a high-resource setting. The possible impact on management was speculated.

### Study setting

The study has been made in the following contexts: i) Gezira National Centre of Pediatric Surgery (GNCPS) of Wad Medani which is affiliated with the Gezira University in the Sudanese State of Gezira; ii) Orotta National Referral Hospital (ONRH) of Asmara, Eritrea's central public health Institution with its annex 300-bed Mekane Hiwot Pediatric Hospital; iii) Consolata Hospital Ikonda (CHI) in the Tanzania Highlands which is a charitable Institution acting as a Regional Referral Hospital for the district of Makete.

All these Hospitals have a general pediatric surgical activity on an elective and emergency basis. Institution A receives patients from urban and rural contexts; Institution B has a mainly metropolitan catchment area, while Institution C is far from the main urban areas.

### Study population

A cross-sectional, descriptive study was done on hospital records of all patients from birth to 18 years of age with a GU disease admitted for a surgical condition to the three Institutions. The study was conducted during distinct pediatric surgical outreaches within the framework of Academic International partnerships. It lasted 30 weeks (GNCPS), 42 weeks (ONRH), and 52 weeks (CHI), between 2012 and 2022.

### Data collection

Mean age at referral, demographics, prevalence, and mode of presentation were registered for each group of GU diseases: i) undescended testis (UDT); ii) hypospadias; iii) stone disease, (SD); iv) congenital anomalies of the kidney and urinary tract (CAKUT), including hydronephrosis, renal parenchymal malformation, abnormalities of migration and fusion, abnormalities of the collecting system, bladder, and urethra; v) tumors of the GU tract (GuT); vi) Bladder Extrophy Epispadias (BEEC); vii) ambiguous genitalia and disorders of sex development (AG).

Repeated admissions due to surgical failures of previous procedures were not included in the final count. Acquired disorders were not considered (*e.g.*, post-circumcision injuries, trauma).

### Data entry

The GraphPad Prism 8.4.0 (San Diego, CA, USA) Statistical Package was used for data entry and analyses of frequency distributions and percentages.

### Ethical standard

The study was conducted under the 1964 Helsinki Declaration and later amendments or comparable ethical standards by local surgeons, assisted by the outreach team.

## Results

Urological cases included in the study were 351 (13.80%) (M/F:127/24), among 2543 surgical referrals to the three Hospitals (Table 1). The incidence of GU diseases among surgical referrals was significantly ( $p < 0.00001$ ) lower at CHI (7.83%) compared to ONRH and GNCPS (17.36% and 13.82%). The epidemiology of our series is reported in Table 2. It was relatively homogeneous in the three Institutions except for the SD, which was significantly under-represented ( $p = 0.01427$ ) at Hospital C.

Undescended testis (153 cases, 19.6% bilateral) was the most frequent GU observed condition (43.58%). Late referral was common, as reported in Table 3. It was after six years in more than half of cases. Admissions rate within the first year of life was higher (22%) in Hospital B (Table 3).

Hypospadias was the second among GU abnormalities (94 out of 351, 26.78%). Meatus position was 60.2% distal, 22.5% mid-shaft, and 17.3% proximal. The mean age at first referral was 4.52 yrs at Hospital A (median 3, range 1-15, SD 3.795), 5.05 yrs at Hospital B (median 4, range 1-13 SD 3.550), and 7.05 at Hospital C (median 6, range 1-16, SD 4.295). Age at referral was significantly higher ( $p < 0.5$ ) for Hospital C cases compared with figures from A and B.

SD condition was significantly under-represented at Hospital C (only 1 case, 2.00%). It was the third among GU diseases observed at Hospitals A and B, with a prevalence rate of 15.33% and 19.86%, and the mean age at referral (6.44 yrs., median 6, range 1-13, SD 7.731) was the same in both Institutions. The stone position was intravesical in 40% of the cases, pelvic calyceal in 47%, and ureteral in 13%. Stone composition analysis was sporadically available in all three Institutions.

The mean prevalence rate of CAKUT was 4.84% in the three institutions without significant differences. A prenatal diagnosis by maternal ultrasound was never recorded. Four patients out of seventeen (26.31%) had posterior urethral valves (PUV), and only two came in the first year of life. Another thirteen anomalies were occasionally diagnosed in association with a palpable abdominal mass, recurrent infections, or anorectal malformations (ARM). Mean age at referral was 7.71 years (median 6, range 1-17, SD 4.542) among four multicystic kidneys (30.07%), four pelviureteric junction obstructions (30.07%), three obstructive megaureters (23.07%) and two vesicoureteral reflux (15.38%).

Wilms Tumor was the most represented among 17 GU neoplasms. Eleven (M/F 8/3) were admitted at a mean age of 3.09 (median 3, range 1-5, SD 1.239). A nephrectomy was possible only in six (54%), due to renal-caval thrombosis or high-grade tumor extension in the others.

Fourteen cases of BEEC were admitted (M/F 10/4) with a prevalence rate of 3.96%. Only four (28.57%) were referred within the first two months of life. The others came at a mean age of 4.3 years. (median 4, range four months -10 yrs., SD 3.034).

Regarding AG, only two out of eight were seen in their first year of life. The others came at a mean age of 5.1 years (median 6, range 2-8, SD 2.409). Four cases had been raised as males and four as females.

## Discussion

Although the burden of GU anomalies (about 30% of all congenital malformations) is expected to similarly affect people from High (HRC) and Low Resources contexts (LRC),<sup>4</sup> their spectrum and mode of presentation among pediatric Hospital admissions in SSA may be surprisingly different. They resent "the three delays

**Table 1.** Study sample of 351 pediatric urological referrals.

Hospital	Weeks of survey	Surgical referrals in the period	Pediatric urological cases	%
A	30	1092	151	13.82
B	42	864	150	17.36
C	52	587	50	7.83

**Table 2.** Epidemiology of 351 pediatric urological referrals.

Hospital	Udt	%	Hypospadias	%	Stones	%	Cakut	%	Wilms tumors	%	BEEC	%	Ambiguous genitalia	%
A	64	42.38	38	25.16	30	19.86	6	3.97	4	2.64	6	3.97	3	1.98
B	67	44.66	36	24.00	23	15.33	8	5.33	5	3.33	7	4.66	4	2.66
C	22	44.00	20	40.00	1	2.00	3	6.00	2	4.00	1	2.00	1	2.00
	153	43.58	94	26.78	54	15.38	17	4.84	11	3.13	14	3.98	8	2.27

**Table 3.** Age at the referral of 153 cases of undescended testis.

Hospital	0-1 yrs	2-5 yrs	6-18 yrs
	%	%	%
A	13	37	55
B	22	38	55
C	3	37	60

framework<sup>25</sup> in seeking, reaching, and receiving care common to many diseases in this context.

Most evident external abnormalities, like urethral meatus malposition and testicular volume or position, are still the most common pediatric urological conditions in African Hospitals.<sup>6,7</sup> According to an African study, 80.3% of the patients with UDT were not discovered or treated before 60 months, and only 42.6% had normal intraoperative appearances of their testes.<sup>8</sup> In another study, only 11% of patients with UDT had orchidopexy performed before two years.<sup>9</sup> Therefore, scheduling elective surgeries for undescended testes within 6–12 months of age is a goal still far to be achieved in many areas. Inadequate examination of the newborn at birth by attendants and missing parental health education and awareness may explain it.<sup>10</sup> Institutions A and C, with a large rural catchment area, also resented difficult access to care facilities due to poverty and distance.

In a study from Nigeria, the prevalence of Hypospadias is reported to be 1.1% of primary school boys.<sup>11</sup> In LRC, the management of Hypospadias is still evolving.<sup>12</sup> Lack of knowledge about its care, missing recognition, and high incidence of circumcision by the attending nurses and community health assistants, mainly in the extra-urban contest, together with reduced or delayed access to specialist facilities due to poverty, deny children the advantages of an early and most favorable repair.<sup>13</sup> Surgery of UDT and Hypospadias represent the most significant volume of elective procedures in HRC or LRC.<sup>14</sup> As from our survey, the main difference between the two contests was in the age of patients at referral. Hypospadias cases in our survey were also referred later than in HRC (up to 7.05 yrs. in Hospital C). However, although optimal management is recommended between 6–12 months of age for surgical and psychological reasons,<sup>15</sup> a mean age of around three years or later for Hypospadias

surgery is not uncommon in SSA, and anaesthesiologic reasons may justify it beyond social and economic constraints.<sup>16</sup>

Hot climate, poor nutrition, and familiarity<sup>17–19</sup> make SD occur in 15% of African children under 15 compared to the 1–5% involved in HRC. A delayed presentation was also common for SD in our series due to uneasy access to care and low awareness.<sup>20</sup> SD accounts for up to 30% of urological admissions, but unavailable stone composition analysis makes prevention often impossible.<sup>19–23</sup>

CAKUT is rather underrepresented in Sub-Saharan Africa, with a prevalence quoted between 0.3–1.78% among pediatric Hospital admissions, mainly due to sepsis, abdominal pain, or voiding symptoms. The mean age is 4.7 years, and 45% of these children have an already elevated creatinine.<sup>6,7,24–32</sup> The low number of CAKUT cases in the present study confirms these figures. It represents the most impressive touchstone in comparing the status of pediatric urology in LRC compared to HRC, where CAKUT accounts for 20%–30% of congenital malformations with a prevalence in live and stillborn infants of 0.3 to 1.6 per 1000. Prenatal ultrasound, which made them the most frequently found group of congenital anomalies in HRC,<sup>32</sup> is scarcely diffused in most African countries. The chronic kidney disease (CKD) burden from missed diagnosis of CAKUT or delayed access to care is a significant public health threat in Africa.<sup>33</sup> In a report including data from Hospital B of our study,<sup>34</sup> only 4% of 530 patients with Hydronephrosis were children, 40% presented a renal impairment, and 23% had a CKD.

Although Wilms Tumor is the most represented GU neoplasm in SSA, with the highest incidence worldwide (11 cases per million),<sup>35</sup> none in our series was seen before one year of age and in Stage I. About half of the neoplasm was unresectable on admission. Although needed in all operated cases, adjuvant therapy was only affordable for some. In SSA, late referral, economic constraints, and

limited access to care and follow-up still make the survival of Wilms Tumor at five years an exception.<sup>36-38</sup>

BEEC in rural SSA areas is frequently referred late to medical attention, sometimes in adult life. Only a limited number of cases of BEEC in our series were referred within the first two months of life (28.57%) to consent primary closure in a tertiary center,<sup>39</sup> when available, and the only option left for late referrals is removing the bladder plate and confectioning a continent urinary diversion.<sup>40</sup>

Traditional birth attendants dealing with about 80% of births in most parts of SSA are not trained to recognize AG, which is sometimes associated with a disturbance of sex differentiation (DSD).<sup>41</sup> This explains the sporadic referrals in our series, although the expected incidence is around 1.7% of all live births.<sup>42</sup> Sociocultural factors strongly limit medical and surgical management and gender reassignment.<sup>43,44</sup>

## Conclusions

Our survey offers a landscape of pediatric urology in some SSA areas with poor social conditions, low awareness, and lack of adequate coverage of medical facilities.<sup>45</sup> These exclude many children from early access to specialist diagnosis and care. Epidemiology of hospital admissions is significantly affected, and the risk for many life/health-threatening diseases to remain hidden or to be managed in adult life when irreversible functional damage is already established is high. Therefore, more efforts are needed to increase medical and parental awareness, empower a pediatric surgical-urological workforce in SSA, and achieve more straightforward access to specialist care for the pediatric age group, even in remote areas.<sup>46</sup> International academic partnerships and surgical outreaches can contribute to training and coaching local health providers and promote better medical and social awareness of GU diseases in children.

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