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Research Article

Epidemiological, Diagnostic and Therapeutic Aspects of Lower Congenital Urinary Tract Anomalies at Albert Royer Children's Hospital

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Abstract

Introduction: Lower Congenital Urinary Tract Anomalies (LCUTA) group together congenital anomalies of the bladder, urethra, and lower urinary tract. This study describes their epidemiological, diagnostic, and therapeutic aspects at the Albert Royer National Children's Hospital Center (CHNEAR) in Dakar.

Patients and methods: A retrospective study from January 2020 to December 2023 in the pediatric surgery department, including children aged 0 to 15 years hospitalized for suspected or confirmed LCUTA (148 files).

Results: The number of cases increased sharply, from 4 in 2020 to 73 in 2023. The 1-month to 2-year age group was the most represented (33.1%). Males dominated (95%, sex-ratio 4.2). Only 37.2% of mothers had attended prenatal consultations and 24.3% a prenatal ultrasound, which was almost always normal. Antenatal diagnosis was therefore rare. Consanguinity was frequent, especially at the 2nd degree. The main reason for consultation was an external genital malformation (63.5%). Hypospadias was the most frequent LCUTA (80.5%), followed by posterior urethral valves (12.5%). The most common associated anomalies were umbilical hernias (39.5%) and cryptorchidism (26.3%). Renal ultrasound showed anomalies in 60% of cases, mainly ureterohydronephrosis. Duplay's technique dominated for hypospadias surgery (86.7%). The average delay for surgical management was 490 days. Two deaths (1.4%) were recorded.

Conclusion: LCUTAs constitute a public health problem. Prenatal monitoring and diagnosis are insufficient, postnatal diagnosis is often late, which threatens renal function, and mortality remains concerning.

Keywords: Lower congenital urinary tract anomalies; Hypospadias; Posterior urethral valves; Child; Senegal

Introduction

Congenital anomalies of the kidney and urinary tract (CAKUT) are a set of both morphological and functional anomalies related to a disorder of embryonic development of the kidneys and excretory pathways [1].

Congenital anomalies of the lower urinary tract (CALUT) group together malformations present at birth affecting the bladder, urethra, and others. They are part of the Congenital Anomalies of The Kidney and Urinary Tract (CAKUT), but specifically target the lower portion of the urinary system [2].

We proposed to conduct a retrospective study on the epidemiological, diagnostic, and therapeutic aspects of LCUTA from January 2020 to December 2023 in the Pediatric Surgery Department of the Albert Royer National Children's Hospital Center (CHNEAR) [3].

Patients and Methods

We included in this study all children presenting with lower congenital urinary tract anomalies aged between birth and 15 years, having a clinical presentation suspecting and/or confirming a lower congenital urinary tract anomaly, hospitalized during the period mentioned between January 1, 2020 and December 31, 2023 in the Pediatric Surgery Department of CHNEAR.

We collected one hundred and forty-eight (148) files meeting the inclusion criteria.

Our work was based on a retrospective study running from January 1, 2020 to December 31, 2023, representing a three-year period.

Files were studied using a questionnaire including various parameters:

- Sociodemographic data: Age, sex, term of birth, demographic origin, provenance.
- Maternal information and history: Mother's age, gravidity, parity, abortion, pathological pregnancy, consanguinity,

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medical conditions.

- Pregnancy history: Number of Prenatal Consultations (PNC), pregnancy workup, serology, number of ultrasounds, antenatal diagnosis.
- Neonatal history: Fetal distress, prematurity, neonatal asphyxia, neonatal infection.
- Delivery: Route, reason if upper, place of delivery.
- Provenance, reason for transfer, and mode of admission.
- Clinical and paraclinical data: Reasons for consultation, clinical findings, biology, imaging, malformative workup.
- Diagnosis.
- Type of intervention.
- Patient outcome and mortality.

Results

Frequency of LCUTA

A total of 148 cases of Lower Congenital Urinary Tract Anomalies (LCUTA) were collected between 2020 and 2023. Annual trends show a marked increase in the number of cases: 4 cases in 2020 (2.7%), 36 in 2021 (24.3%), 35 in 2022 (23.6%), and 73 in 2023 (49.3%) (Table 1).

Sociodemographic data

Age: The 1-month to 2-year age group was the most represented (49 cases, or 33.1%), followed by the 2-to-5-year group (42 cases, or 28.4%). New-borns represented 23.0% of cases (34 cases) and children aged 5 to 15 years represented 15.5% (23 cases) (Table 2).

Sex: The male sex was largely predominant, with a sex-ratio of 4.2.

Table 1: Distribution of LCUTA cases by year.

Year	Number	Percentage
2020	4	2.70%
2021	36	24.30%
2022	35	23.60%
2023	73	49.40%
Total	148	100

Table 2: Distribution of patients by age at consultation.

Age Group	Number of Cases	Percentage
Newborns	34	23.00%
1 month – 2 years	49	33.10%
2 – 5 years	42	28.40%
5 – 15 years	23	15.50%
Total	148	100

Maternal and family history

Maternal age: The 18-to-25 age group was the most represented, with 80 mothers (55.2%), followed by mothers over 25 years with 50 cases (34.5%).

Obstetric history: Seventy-two mothers were multigravida and 74 multiparous. Four histories of abortion and three histories of death (1.0%) were found.

Prenatal consultations: Fifty-five mothers had Performed Prenatal Consultations (PNC), of whom 70.9% had more than four PNCs during pregnancy.

Prenatal ultrasounds: Prenatal ultrasound was reported and performed in only 36 mothers (24.3%). Of these 36 examinations, 29 (80.6%) were reported as normal. Ultrasound anomalies represented 19.4% of examinations, with each anomaly found in only a single case (2.8%).

Term of birth and consanguinity: The term of pregnancy was specified in only 11 cases, including six full-term births (4.1% of the total headcount). Consanguinity was most frequent at the 2nd degree (17 cases) and least frequent at the 1st degree (2 cases).

LCUTA in the family: A large majority of patients (143 cases, or 96.6%) reported no similar family history, compared to 5 cases (3.4%) who declared similar cases in their surroundings.

Clinical and paraclinical data

Reasons for consultation: The most frequent reason for consultation was external genital malformation (94 cases), followed by voiding disorders (21 cases). A lower congenital urinary tract anomaly was clinically detectable in 112 patients and not detectable in 36 patients.

General condition: General condition was good in 134 patients (90.5%).

Urinary tract examination:

Micturition: Examination of micturition was performed in 126 cases. It was normal in 112 cases (75.7%); dysuria was noted in 9 cases (6.1%) (Table 3).

Table 3: Distribution of patients according to micturition examination results.

Micturition Examination	Number	Percentage
Normal	112	75.70%
Dysuria	9	6.10%
Dribbling micturition	3	2.00%
Pyuria	1	0.70%
Overflow incontinence	1	0.70%
Not explored	22	14.90%

Other examination elements: Lumbar fossa examination found lumbar contact in 0.7% of cases and was normal otherwise. Bladder examination was normal in 95.9% of cases; anomalies were detected in 4.1% of cases. Scrotal examination was normal in 90.5% of cases, with a left retractile testis in 2.7% of cases.

Examination of other systems: Cardiac level: tachycardia and an intense systolic murmur were noted.

Biological examinations: Blood tests, reported in 8 patients, highlighted a biological inflammatory/infectious syndrome in 4 cases and anemia in 4 cases.

A Urine Cytobacteriological Examination (UCBE) was performed in 22 patients: 5 were positive and 17 sterile. Isolated germs were Escherichia coli in 2 cases (40%), Klebsiella pneumoniae, Pseudomonas aeruginosa, and Proteus mirabilis in 1 case each (20%).

Renal function was explored in 20 patients: urea-creatinine in 13 cases (65%) and blood ionogram in 7 cases (35%). Hyponatremia was found in 2 cases (10%).

Urinary tract ultrasound: Out of a total of 45 patients, ultrasound was performed in 33 (73.3%) and not performed in 12 (26.7%). It reported anomalies in 27 patients (60%), dominated by ureterohydronephrosis (40%) and ureteropyelocaliceal dilation (15.6%) (Table 4).

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Table 4: Distribution of patients according to urinary tract ultrasound results.

Ultrasound Result	Number	Percentage
Ureterohydronephrosis	18	40.00%
Bilatérale (Bilateral)	10	
Gauche (Left)	8	
With trabeculated bladder	5	
With cystitis	1	
With post-void residual	2	
Ureteropyelocaliceal dilation	7	15.60%
Hydronephrosis	1	2.20%
Vesicoureteral reflux	1	2.20%
Normal	6	13.30%
Not performed	12	26.70%

Voiding Cystourethrogram (VCUG): Among the 11 examinations performed, the most frequent anomalies were grade IV bilateral vesicoureteral reflux, posterior urethral valves associated with a trabeculated bladder, and dilated bladder with posterior urethral dilation, each representing 18.2% of cases. Normal examinations also represented 18.2% (Table 5).

Table 5: Distribution of patients according to VCUG results.

Result	Number	Percentage
Grade IV bilateral vesicoureteral reflux	2	18.20%
Posterior urethral valves + trabeculated bladder + significant post-void residual	2	18.20%
Dilated bladder + posterior urethral dilation	2	18.20%
Normal	2	18.20%
Severe stenosis of the membranous urethra	1	9.10%
Diverticular bladder + short and severe urethral stenosis	1	9.10%
Bilateral pyelocaliceal dilation + diverticulum	1	9.10%

Uro-CT scan: Among the 4 cases of bilateral ureterohydronephrosis, the absence of obstruction was found in 50% of cases. A mute right kidney and right-predominant dilation were each observed in 25% of cases.

Polymalformative workup:

- Abdomino-pelvic ultrasound: Performed in 21 patients and highlighted anomalies, notably ureterohydronephrosis in 6 cases and urachus fistula in 11.5% of cases.
- Transfontanellar Ultrasound (TFU): Performed in 4 patients, normal in all cases.
- Echocardiography: Performed in 4 patients, normal in three cases and showed persistence of the arterial duct with a patent foramen ovale in one case.
- Spine radiography: Performed in 4 patients, without particularity.

Diagnosis

Isolated LCUTA: Among isolated LCUTA, hypospadias was the most frequent (102 cases, or 80.5%), followed by posterior urethral valves (PUV) with 16 cases (12.5%). Other anomalies were much rarer (Table 6). Anatomical types of hypospadias: Out of 122 cases of hypospadias, the balanopreputial form was the most frequent (26.2%), followed by the balanic form (18.8%). Penile forms also represented a significant proportion, notably the posterior penile form (13.9%) (Table 7).

Syndromic forms: associated anomalies: Umbilical hernias were the most frequent associated anomalies (15 cases, or 39.5%), followed by cryptorchidism, all localizations combined (10 cases, or 26.3%) (Table 8).

Table 6: Distribution of isolated LCUTA.

Isolated LCUTA	Number	Percentage
Hypospadias	102	75.50%
PUV	16	9.50%
Epispadias	3	2.20%
Urachus fistula	2	1.60%
Meatal stenosis	2	1.60%
Bladder exstrophy	1	0.80%
Urachus cyst	1	0.80%
Others	20	13.00%

Table 7: Distribution of hypospadias according to anatomical type.

Hypospadias Type	Number of Cases	Percentage
Balanopreputial	32	26.30%
Balanic	23	18.80%
Posterior penile	17	13.90%
Middle penile	16	13.10%
Anterior penile	14	11.50%
Unspecified type	20	16.40%

Surgical management

Management delay: In the 33 patients for whom it was specified, the delay for surgical management ranged from 1 day to 3,293 days (approximately 9 years), with an average of 490 days (1.34 years).

Surgical techniques for hypospadias: Duplay's technique was largely predominant (13 cases, or 86.7%), ahead of Bracka and Mathieu techniques (1 case each, or 6.7%) (Table 9).

Table 8: Distribution of anomalies associated with LCUTA.

Associated Anomaly	Laterality	Number / Percentage
Umbilical hernia	-	15 (39.5%)
Cryptorchidism	Bilateral	4 (10.5%)
Cryptorchidism	Right	3 (7.9%)
Cryptorchidism	Left	3 (7.9%)
Hydrocele	Bilateral	3 (7.9%)
Inguinoscrotal hernia	Right	1 (2.6%)
Inguinoscrotal hernia	Left	1 (2.6%)
Inguinal hernia	Right	1 (2.6%)
Retractile testis	Right	1 (2.6%)
Clubfoot (Talipes equinovarus)	Bilateral	1 (2.6%)
Glans amputation	-	1 (2.6%)
Symbrachydactyly of 2nd and 3rd fingers	-	1 (2.6%)
Painful pronation	-	1 (2.6%)
Choledochal cyst	-	1 (2.6%)
Gynecomastia	-	1 (2.6%)

Table 9: Distribution of patients according to hypospadias surgical technique.

Technique	Number	Percentage
Duplay	13	0.867
Bracka	1	0.067
Mathieu	1	0.066

Mortality

Two deaths (1.4%) were recorded. Causes were severe sepsis and cardiorespiratory arrest; one death occurred intraoperatively and the other postoperatively.

Discussion

Our series of 148 cases collected over 4 years (approx. 37 cases/year) shows a higher frequency than those from Mali (approx. 13/

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year), Senegal (approx. 23/year), and the Netherlands (approx. 27/year). It remains lower than high hospital recruitment series in Morocco (60/year) and Taiwan (approx. 111/year), likely reflecting the covered population size and referral system organization. Male predominance (sex-ratio 4.2) agrees with African data (Mali: 7.62; Senegal: 4.4), whereas Ukraine reports a balanced sex-ratio [4,5].

The average age at diagnosis (2.9 years) is comparable to that of Senegalese series, but significantly higher than that of European and American countries, where systematic neonatal screening allows early diagnosis. Antenatal diagnosis was made in only 2.8% of cases, compared to 5.6 to 27.7% in other African series and 85% in Canada, whereas 71.4% of mothers had completed more than 4 prenatal consultations. This gap is explained by low socio-economic status, unavailability of ultrasound in remote areas, and lack of training for certain operators. Among described risk factors, gestational diabetes and consanguinity are frequently reported in literature [6-8].

Clinically, external genital malformation was the main reason for consultation (81.7%), ahead of voiding disorders (18.3%). UCBE, performed in 22 patients, was positive in 5 cases, with Escherichia coli in 40% of cases, a result close to Senegalese series, but lower than the 70% reported in Mali and Morocco. This difference is likely due to small sample size and local antibiotic prescription practices. Impaired renal function was observed in 2 of the 13 patients explored. Yet malformative uropathies are implicated in 30 to 50% of end-stage renal failures in children, underlining the importance of early diagnosis, especially in countries where access to dialysis and transplantation is limited [9-12].

Urinary tract ultrasound, a first-line examination, was performed in 73.3% of included patients and showed ureterohydronephrosis in 40% of cases, in agreement with literature (33% to 67%). Voiding cystourethrogram (7.43% of cases) revealed anomalies in 18.2% of explored cases (posterior urethral valves, vesicoureteral reflux), and uro-CT scan (2.7%) was very sparingly used compared to 39% reported elsewhere. This limited use of imaging is explained by technical and organizational constraints, as well as the invasive and irradiating nature of these examinations [13-16].

Hypospadias largely dominated lower congenital urinary tract anomalies (69.4%), followed by posterior urethral valves (10.9%), in accordance with Senegalese, Malian, and Moroccan series, whose discrepancies stem from sample sizes and inclusion criteria [17-20]. In 29.9% of cases, these malformations were part of a polymalformative syndrome, dominated by parietal anomalies (umbilical hernia, cryptorchidism) [21-23]. Two deaths were recorded (severe sepsis, cardiorespiratory arrest).

In short, diagnostic delay and poor antenatal screening are the main difficulties in managing malformative uropathies in our context, with a real risk of progression to chronic renal failure.

Conclusion

Lower congenital urinary tract anomalies represent a true public health problem. Consanguinity is frequent and seems to play a role in the onset of these conditions. Prenatal monitoring of pregnant women remains low. The performance of prenatal ultrasounds is insufficient and the results obtained are often of limited quality. Antenatal diagnosis of malformations is infrequent. More than half of cases present a diagnostic delay after birth, which constitutes an unfavorable predictive factor for renal function. The mortality rate among these patients remains concerning.

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