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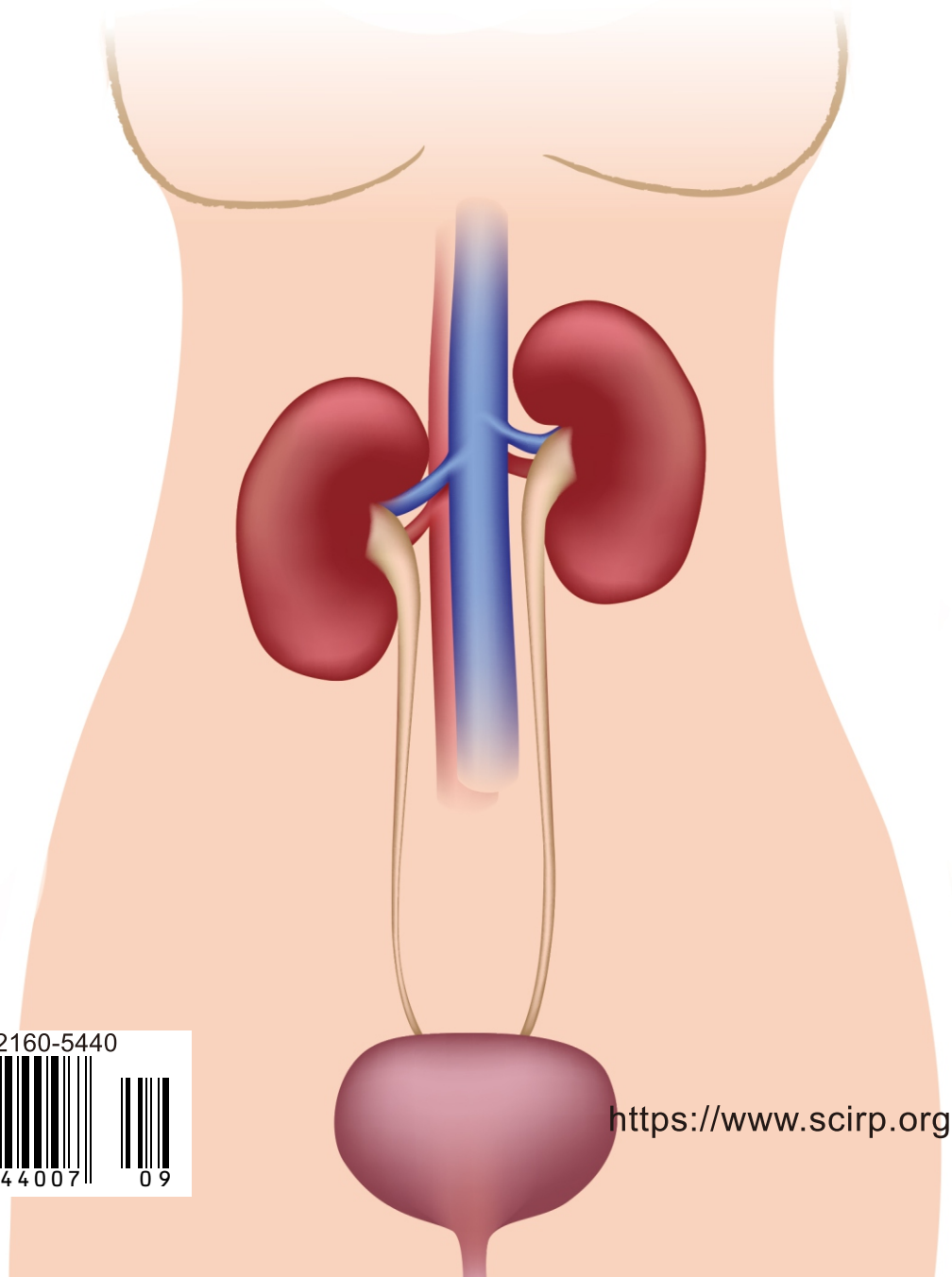

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Anderson-Hines Open Pyeloplasty in the Treatment of Pyelo-Ureteral Junction Syndrome: Results from 36 Cases

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Abstract

Goal: To evaluate the results and complications of open pyeloplasty according to Anderson-Hynestechnic. **Patients and Methods:** We conducted a retrospective study from 2000 to 2014. The study included 36 cases of opening the ureteropyelic junction operated pit syndrome according to Anderson-Hynes technique. **Results:** Lumbotomy was used in all patients. A pelvic pyelolithotomy for lithiasis was performed in two patients (5.5%) and unwinding of a lower polar pedicle in 3 cases (8.3%). The average duration of response was 119 ± 15 min. The average length of hospital stay was 11.2 ± 3 days. Patients were followed for a mean of 10 months. Thirty-five patients were asymptomatic and in one case lower back pain persisted. IVU to 6 months showed a permeable junction in 97.2% of cases. Seven patients (19.4%) had short-term complications. Ureteropelvic stenosis was the only complication in the medium and long term in one case (2.8%). The success rate of the Pyeloplasty was 97.2%. **Conclusion:** The open pyeloplasty as Anderson-Hynes remains the treatment of choice in our context SJPU with great results. The indications tend to decrease in favor of laparoscopic pyeloplasty.

Keywords

Hydronephrosis, Pyeloplasty, Anderson Hynes, Open Surgery

1. Introduction

The syndrome of pyelo-ureteral junction (SJPU) or hydronephrosis is the most frequent malformations of the urinary tract system. The incidence of congenital

hydronephrosis is about 5 per 100,000 births [1].

SJPU corresponds to a dilation of the pyelocalicielles cavities upstream of an obstacle situated at the level of the pyelo-ureteral junction [2]. The etiology is often congenital. It is either an aperistaltic junction segment, or aberrant vessels or a high insertion ureter [1] [3].

The standard treatment for SJPU remains open pyeloplasty according to the Anderson-Hynes technique [4]. This technique has a success rate greater than 90% [1] [3].

Nowadays, the management of SJPU is marked by the development of so-called mini-invasive techniques which are laparoscopic pyeloplasty and endopyelotomies.

In Congo, an earlier study on the diagnosis and treatment of pyelo-ureteral junction syndrome in 13 cases was published in 2004 by Bouya, *et al.* [5]. Our work proposed to study the Anderson-Hynestechnic [4] in order to evaluate the results obtained and the short, medium and long term complications.

2. Patients and Methods

2.1. Framework and Methods of Study

This was a retrospective study on the medical records of patients operated for an anomaly of the pyeloureteral junction, in the urology-andrology department of University Hospital, Brazzaville, from 2000 to 2014. Diagnostic of pyelo-ureteral junction syndrome was based on ultrasonography, urography and tomography result.

We included in the study any patient with pyelo-ureteral junction syndrome, operated by Anderson-Hynes [4] open pyeloplasty, who had a complete medical record. Operated patients whose records were incomplete were not included. We classified hydronephrosis into 4 types as proposed by CendrenMoulard and Valeyer. Type1: localized dilatation with pelvis; Type 2: dilation of the pelvis and calices, but rapid impregnation of the cavities and good thickness of the parenchyma; Type 3: Large pelvic-calyx dilation with a fuzzy and incomplete image within normal delays, very clear thinning of the cortex; Type 4: silent kidney [6]. In total, 36 files were the subject of this study.

The variables studied were: whether preoperative nephrostomy was performed, the approach used for pyeloplasty, intraoperative exploration, associated procedures, intraoperative drainage (transnephro-anastomotic or transpyelo-anastomotic drain), intraoperative incidents, duration of interventions, average duration of drains and bladder catheter, average length of hospital stay, short-term complications, medium and long-term complications, follow-up (clinical intravenous urography and tomograhy) after average of 12 months.

After the discharge of the service, the patients were reviewed at 1 month for a clinical control. During this check, the presence of residual pain and the condition of the wound was assessed. At three months, clinical and ultrasound control was performed. At 6 months, antomograhy was performed to assess the permeability of the anastomosis and ureter. Clinical and ultrasound control was per-

formed at 1 year and every year up to 3 years. The result of the surgery was considered a "success" when there was both the disappearance of clinical signs and the permeability of the ureteropulmonary anastomosis to intravenous urography, that is to say the passage of the contrast product throughout the ureter in normal time and without hydronephrosis.

2.2. Characteristics of the Population

During the study period, 36 patients met our inclusion criteria.

The average age of our patients was 29.4 years, extreme (7 and 53 years). There was male predominance in 63.9% (23 cases) with a 2/1 sex ratio. The patients came from Brazzaville in the majority of cases (32 cases) Pointe-Noire (3 cases) and Kinkala (1 case).

Clinically, the circumstances of discovery were multiple. Flank or lumbar pain was the most common form of discovery (28 cases). The other circumstances were repeated urinary tract infection (5 cases), hematuria (2 cases) and abdominal mass (1 case).

Physical examination was normal in 29 cases. He had noted a large kidney in 1 case; a sensitivity of the lumbar fossa in 6 cases.

Paraclinically, cytobacteriological examination of urine (ECBU) was performed in all patients. It had allowed isolating a germ in 6 cases. It was an *Escherichia coli* (4 cases) and *Klebsiella pneumoniae* (2 cases). These urinary tract infections had been treated by antibiotic therapy in relation to the results of the antibiogram. This examination is performed systematically in all our patients preoperatively to sterilize the urine before any intervention.

3. Results

Preoperative nephrostomy was performed in 11 patients. The surgical approach was the lombotomy in the 11th intercostal space in all cases.

Intraoperative exploration revealed pyelo-ureteral junction stenosis in all cases, peripelitis in two patients (5.5%) with pyeliclithiasis. In three patients (8.3%), there was evidence of an inferior polar vessel crossing the pyelo-ureteral junction.

Resection of the pyelo-ureteric junction, sometimes associated with remodeling of the renal pelvis, followed by pyelo-ureteral anastomosis using the Anderson Hynes technique. The pyelo-ureteral anastomosis was made by two suture contin. The suture material used was vicryl® Absorbable Yarn 4/0.

Two patients (5.5%) underwent pyelolithotomy for pyeliclithiasis associated with the treatment of pyelo-ureteral junction syndrome.

Three patients (8.3%) had an aberrant lower polar vessel decay (**Figure 1**) associated with treatment.

The drainage was transpyeloanastomotic in 56% of the cases, transurethral in 17% of the cases, and in 28% of the cases, it did not have drainage. The drainage of the renal lodge by a Redon drain was systematic in all cases (36 cases).

Peroperatively, we noted as incident: a case of peritoneal breccia (2.8%) and a case (2.8%) of pleural breccia.

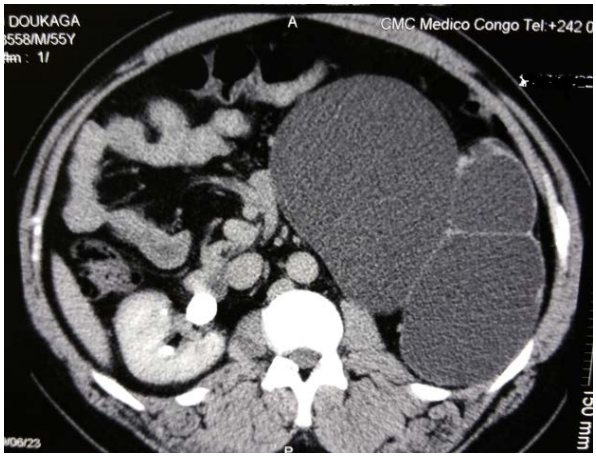

Figure 1. Left giant hydronephrosis in a 45-year-old patient.

The average duration of interventions was 119 ± 15 min, extreme (94 - 237 min). The postoperative monitoring parameters are shown in **Table 1**.

Patients were followed for an average of 12 months with extremes of 6 and 24 months.

The 35 patients (97.2%) had an improvement in symptomatology with disappearance of lumbar or flank pain and other functional signs. One patient (2.8%) had persistent low back pain.

The results of intravenous urography at 6 months of postoperative follow-up are shown in **Table 2**.

In the short term, seven patients had complications. It was a parietal suppuration in 3 cases, treated by antibiotic adapted to the isolated germ, and a urinary leakage by the operative wound in 4 cases supported by drainage of the urine.

In the medium and long term, one patient (2.8%) had pyelo-ureteral stenosis. The success rate of pyeloplasty was 97.2% (n = 35).

Renal function was explored in all patients by the determination of blood creatinine. No cases of renal failure had been revealed. The radiological assessment makes it possible to establish the diagnosis of hydroneplorosis. Ultrasound was performed in all patients. It revealed a dilatation of the renal cavities in all cases. In addition, she had diagnosed 2 cases of pyelic calculus.

Intravenous urography was performed in all patients. It allowed making the diagnosis in all cases. It is the same as for urography performed in 7 cases (**Figure 2**). The attack was unilateral in 34 cases; right in 21 cases and left in 13 cases. Urography was performed in 13 patients in our study. He confirmed the diagnosis in all these cases (**Figure 2**). Two cases of pyelic computation had been diagnosed by urography, three cases of inferior polar aberrations had been found. The syndrome of the pyelo-ureteral junction was bilateral in 2 cases. Only the symptomatic side was operated. Taking into account the classification of CENDREN MOULARD and VALAYER, pyelo-ureteral junction syndrome was type 1 (0 cases); type 2 in 14 cases (38.9%), type 3 in 21 cases (58.3%) and type 4 in 1 case (2.8%).

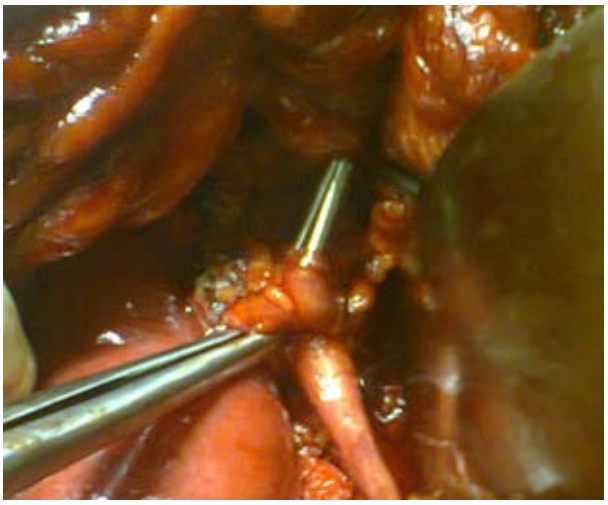

Figure 2. Intraoperative image of a polar vessel crossing the pyelo-ureteral junction.

Table 1. Result postoperative monitoring parameters.

Parameters	Average duration	Extreme
Duration hospitalization	11.2 days	7 - 30 days
Transanastomotiquedrain	11.3 days	5 - 24 days
Drain of renal lodge	12.8 days	6 - 25 days
Bladder survey	2.2 days	1 - 3 days

Table 2. Results of intravenous urography at 6 months according to the grade of hydronephrosis.

	Results of IVU at 6 months			
Grade of l'hydronéphrosis	Number of patients	Secretion within normal time	Decrease in pyelocalical dilatation	Pyeloureteral passage
I	0	0	0	0
II	14	14	14	14
III	21	21	20	20
IV	1	1	1	1

4. Discussion

Open pyeloplasty according to the Anderson-Hynes technique associates the resection of the stenosedpyelo-ureteric junction with a pyelo-ureteral anastomosis. The open surgical approach was the standard treatment for SJPU since1949, its description by Anderson-Hynes [4]. This technic had been improved by René Kuss. It makes to treat SJPU as well as associated pathologies (removal of pyelic-lithiasis, uncrossing of the inferior polar pedicle) [1] [3].

Other techniques exist, Fenger's plasty, Foley's Y-V plasty which have the distinction of not removing the non-functional area, but repair the stenotic portion by increasing functional area with pyelic's flap.

Lombotomy was the first route used in all our patients. Extraperitoneal and extrapleural is the most commonly used approach in open pyeloplasty [1] [3] [5]. Diao *et al.* [7] performed lombotomy in 83.4% of cases. It has the advantage of combining a good exposure on the pyelo-ureteral junction, to allow an excellent section of the pelvis and to realize an impervious anastomosis [3]. However, it has the disadvantage of causing non-esthetic scars, causing significant postoperative pain and causing parietal weakness and evenenation [2] [8] [9]. To avoid these complications of lombotomy, other minimally invasive surgical techniques have been developed (laparoscopy, endopyelotomy) giving functional results comparable to open surgery [10] [11] [12].

In our study, two patients (5.56%) underwent pyelotithomy with pyeloplasty for pyelic computation. Bentani *et al.* [13] found a renal calculus associated with SJPU in 17.8% of cases.

We have considered the pyelo-ureteral junction syndrome as the factor favoring the occurrence of pyelic calculus. However, several authors believe that the stasis of urine alone is not enough to explain the occurrence of lithiasis: the urinary metabolic factors (hypercalciuria) of lithogenesis are necessarily associated [14]. In addition, in three patients (8.3%), there was evidence of an inferior polar vessel crossing the pyelo-ureteral junction. These patients had undergone a decrease in the inferior polar vessel associated with pyeloplasty. These results are comparable to those observed by Kirakoya *et al.* [15], who found rates of 11.4%. These vessels have been demonstrated in 30% to 70% of cases of pyelouretral junction syndrome [16]. The implementation of transpyelo-ureteral drainage associated with drainage of the renal lodge is recommended [3], but there is no consensus regarding drainage. Excretory drainage seems to be an immediate safety factor, limiting the risk of fistula and urinoma. It does not affect the long-term prognosis and the occurrence of recurrence. In our study, one case of peritoneal breccia and 1 case (2.78%) of pleural breccia were observed. The peritoneal gap had been treated peroperatively by suture. The pleural breccia had been repaired immediately. The frontal chest x-ray performed on day 1 postoperative had not revealed a pneumothorax. These incidents are also reported in the literature in similar proportions [7]. The haemorrhagic incidents have been described [16].

The mean duration of the intervention in our study was 119 ± 15 min. This operating time is comparable to those reported in the literature (90 - 120 min) [1] [3] [7]. The operative time in open surgery is generally lower than that of laparoscopic pyeloplasty. This operating time in laparoscopic pyeloplasty varies from 180 to 480 min in the literature [1]. The mastery of laparoscopic techniques by the different teams has improved the operating time. Thus Bentani *et al.* in Morocco [13] find an average operative time of 175.5 min. Soulie *et al.* [18], in France, an average time of 150 min. The average hospital stay in our study was 11.2 days with extreme 7 - 30 days. This stay is comparable to those reported in the literature: between 10 to 12 days [1] [2] [14] [16].

However, the average stay was significantly reduced by laparoscopic surgery

between 3 and 5 days [1] [13] [17] [18]. This laparoscopic pyeloplasty allows a rapid recovery of activity. In our study, seven patients had short-term complications. Diao *et al.* [7] had 20% short-term complications, including 3 cases (10%) parietal suppuration and 3 cases of urohematoma (10%). Short-term complications of pyeloplasty are usually urinary leakage in the anastomosis, urinary fistulas and urinomas [1] [3]. These complications are found both during the PCO and laparoscopically [19].

Open pyeloplasty gives very good results (disappearance of clinical signs, normalization of urographic images) with a long-term success rate of 90% to 100% [1] [3] [5]. In our series, a case of failure (pyelo-ureteral stenosis) was noted. This stenosis is due to periuretal fibrosis. Percutaneous nephrostomy was performed while waiting for pyeloplasty to be resumed. The failures most often correspond to persistent stenosis, either by insufficient resection, periuretal fibrosis, non-sloping anastomosis or neglect of a lower polar pedicle, and sometimes an error of indication (retention kidney very deficient) [3].

The results of PCO are currently comparable to those of laparoscopic pyeloplasty [13] [18] [20].

5. Conclusion

Anderson-Hynes open pyeloplasty remains the treatment of choice for SJPU in our context with excellent results. But its indications tend to decrease in favor of laparoscopic pyeloplasty, which reproduces the Anderson-Hynes technique with comparable functional results and less morbidity. Thus, the arrival of laparoscopic and endoscopic surgery in our therapeutic arsenal is necessary because it will contribute to the reduction of the length of hospitalization of patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

Ethical Clearance

This paper obtained the ethical clearance of the ethical comity of health sciences number 00000077/MRS/DGRST/CERSSA.

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Catheter-Associated Bacteria Urinary Tract Infection and Antibiotic Susceptibility Pattern in a Tertiary Hospital, in Ghana

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Abstract

Background: This study seeks to identify the prevalence of catheter associated urinary infection and the type of bacteria that are associated with this infection, as well as the antibiotic susceptibility patterns of the organisms isolated. This would guide the choice of antibiotics when there is catheter associated urinary tract infection. **Method**: From 1 November 2015-31 April 2016 a cross-sectional study was conducted among patients with urinary catheter in-situ. Urine samples collected were processed and cultured on CLED agar plates. Pure colonies of isolated organism were Gram and Biochemically characterized. A disc diffusion antibiotic susceptibility determined by Kirby-Bauer disc diffusion method was performed on each uropathogen isolated. Data obtained was cleaned, analyzed and presented. **Result:** There were 122 study subjects of which, 73 (59.8%) were males and 49 (40.2%) were females. Their median age was 42.5 (range 33 - 65) years. Significant bacterial growth was obtained in 88 (72.1%) of the urine specimen cultured of which males constituted 48 (54.5%) and females 40 (45.5%). The most prevalent uropathogens isolated were *Escherichia coli* 41 (46.6%), *Klebsiella spp.* 18 (20.6%), *Pseudomonas aeruginosa* 10 (11.4%), *Enterobacter spp.* 6 (6.8%) and *Staphylococcus aureus* 5 (5.8%). Bacterial isolates showed some susceptibility to Amikacin 73 (83.0%), Levofloxacin 34 (38.6%) and Ciprofloxacin 26 (29.5%) respectively. The uropathogens were least susceptible to Gentamicin 3 (3.4%), Ampicillin 3 (3.4%) and Cefuroxime 1 (1.1%) respectively. **Conclusion:** Catheter associated bacterial urinary tract infection (CABUTI) is prevalent at

the Tamale Teaching Hospital. Micro bacterial isolates demonstrated substantial decrease in susceptibility to antibiotics commonly used. Understanding the local antibiotic susceptibility pattern could guide the choice of antibiotics used in treating CABUTI.

Keywords

Catheter Bacteria Urinary Tract Infection

1. Introduction

Urinary catheters are passed to permit drainage of urine [1]. They may have diagnostic or therapeutic uses [2]. Globally, about two-thirds of urinary tract catheterization among adults is for therapeutic reasons in order to relief bladder outlet obstruction due to benign prostatic obstruction [3] [4] [5] [6]. The risk of bacterial Urinary Tract Infections (UTI) is dependent on the patient's susceptibility, the quality of catheter and how long catheter has been in place [7] [8].

Catheter Associated Bacteria Urinary Tract Infection (CABUTI) occurs in at least 40% of hospital-acquired infections [9]. CABUTI has been associated with substantial morbidity in acute care settings and extended care facilities at rates of 20% and 50% respectively [8]. CABUTI rates vary widely from up to 5% for single brief catheterization to 100% for indwelling catheters over a duration of 4 days [10]. Female, advanced age and the critically ill are known risk factors [11].

In clinical practice, varied microorganisms may be associated with CABUTI and these include: *Escherichia coli*, *Klebsiella spp.*, *Proteus*, *Enterococci*, *Pseudomonas*, *Enterobacter*, *Serratia and Candida* [12] [13]. Within a couple of days after insertion of catheter, bacteria may migrate to bladder from biofilms formed on the surface of indwelling catheter [14] [15]. Commonly, biofilms are initially caused by a single species of bacteria and may eventually become polymicrobial and resistant to various antimicrobial agents especially following long-term catheterization [16] [17]. Worldwide, antimicrobial resistance due to CABUTI contributes substantially to a rise in morbidity and mortality as well as high cost of health care delivery. The epidemiology remains variable and health facility dependent [18].

Understanding the local antibiotic susceptibility pattern in our setting could enable practitioners to select the appropriate medication necessary for effective treatment. Therefore, this study was carried out to determine the prevalence of CABUTI and the antimicrobial susceptibility pattern at Tamale Teaching Hospital.

2. Methods

2.1. Study Type

This is a cross-sectional study conducted among patients who had catheter in-

serted into urinary bladder from November 2015 to April 2016.

2.2. Study Site

Tamale Teaching Hospital, an 800 bed capacity tertiary hospital in Tamale, Northern Region, Ghana.

2.3. Patients' Recruitment and Specimen Collection

From November 2015 to April 2016, a cross sectional study was undertaken at the urology clinic of the Tamale Teaching Hospital of Ghana. The eligibility criteria included patients who had catheter in situ and who consented to be part of the study. We excluded, immunosuppressed patients, non-catheterized patients, those who had confirmed UTI just preceding this study, those taking antibiotic prophylaxis prior to catheterization and those who declined consent.

Eligible patients who consented to be part of the study were assigned unique Identification (Id) numbers. Data was recorded on a well-designed sheet. Data fields included: age, sex, address marital status and indication for catheterization.

A spigot was placed at tip of catheter and opened when the patient experienced the sensation to void, associated with a suprapubic mass, which was indicative of a full bladder. The spigot was then removed to allow about 10 - 20 ml of urine to flow through and drop off. This was to ensure clean urine was obtained devoid of contamination. Urine collection was done under aseptic conditions into a sterile, dry, leak-proof container. About 2 - 5 ml was collected from the tip of catheter. The containers were labeled with the patient's identification number, age, sex, date and the time of collection. The urine specimen was transported together with the data collection form and delivered to the bacteriology laboratory for culture, biochemical tests, isolation and antibiotic susceptibility tests.

Using a sterile calibrated wire loop and under aseptic conditions, about 0.01 ml of urine was inoculated onto a prepared agar plate of Cystine Lactose Electrolyte Deficient (CLED). The plate was incubated under aerobic conditions at 37˚C for 24 hours and observed for bacteria growth. Significant growth of $>10^5$ bacteria/ml of catheter urine was interpreted as a colony of bacteria with a viable count [19]. Bacteria colonies were identified using colony growth characteristics and Gram staining as well as standard biochemical testing procedures which included indole, urea, triple sugar Iron (TSI), motility and citrate tests were all carried out in accordance with Monica Chessbrough [20].

An emulsification was made in bijou bottle containing 5 ml peptone water with the pure colonies, until the turbidity was equal to the 0.5 McFarland standards. An approximately 200 µl/loopful of the suspension was dispensed to the center of 25 ml Muller-Hinton culture plate and seeded carefully with the sterile swab stick in three directions to obtain even growth on the Muller-Hinton agar surface, allowing the moisture to be absorbed for at least 15minutes. Using the disc diffusion method of antimicrobial susceptibility test, the urine antibiotics multi-discs (manufactured by Axiom Laboratories, India) were applied firmly to

the surface of the Mueller-Hinton agar plate. The antibiotics multidisc comprised of Ampicillin (AMP, 20 mcg), Ceftizoxime (CL, 30 mcg), Ciprofloxacin (CP, mcg), Amikacin (AMK, 30 mcg), Cotrimoxazole (BA, 25 mcg), Cephalexin (PR, 30 mcg), Tetracycline (TE, 30 mcg), Levofloxacin (LE, 5 mcg), Ofloxacin (OF, 5 mcg), Norfloxacin (NX, 10 mcg), Chloramphenicol (CH, 30 mcg), Sparfloxacin (SC, 5 mcg), Gentamicin (GEN, 30 mcg), Ceftriaxone (CTR, 30 mcg), Cefuroxime (30 mcg).

The set-up was incubated aerobically at 37˚C for 18 - 24 hrs, after which it was inspected for bacteria growth and growth inhibition. The diameter of the zone of growth inhibition around each antimicrobial agent was measured and compared with the NCCLS interpretive table, NCCLS, 1997 to determine bacterial sensitivity or resistance to each of the antimicrobial agents used [21]. Standard commercial bacteria strains comprising of *Staphylococcus aureus* NCTC 6571, *Escherichia coli* NCTC 10418 and *Pseudomonas aeruginosa* NCTC 10662 were used as control.

Data was entered into Microsoft excel spreadsheet windows 7 and checked for data entry errors. Data analysis was carried out using IBM SPSS version 21 statistical package. Associations between variables were determined with level of significance set at $p < 0.05$.

3. Results

One hundred and twenty-two patients participated in the study. There were 73 (59.8%) males and 49 (40.2%) females. The median age was 42.5 (range 33 - 65) years. There were 37 (30.3%) participants in the modal age group 51 - 60 years (Table 1). The highest number of bacterial isolates 22 (25.0%) out of the 88 positive culture results were in age group 31 - 40 years. Frequency of urine culture isolates and age were not statistically significant ($p = 0.35$) (Table 2).

Significant bacterial growth was obtained in 88 (72.1%) of the urine sample cultured, of which males constituted 48 (54.5%) and females 40 (45.5%). This was not statistically significant ($p = 0.06$). The relationship between sensitivity

Table 1. The socio-demographic characteristics of patients with catheter (n = 122).

Age Group	Gender N = 122	
	Female Frequency (%)	Male Frequency (%)
≤20	1 (0.8)	2 (1.6)
21 - 30	8 (6.5)	7 (5.7)
31 - 40	8 (6.5)	2 (1.6)
41 - 50	10 (8.2)	12 (9.8)
51 - 60	18 (14.8)	19 (15.6)
61 - 70	2 (1.6)	9 (7.4)
71 - 80	2 (1.6)	15 (12.3)
81 - 90	0	6 (4.9)
91 - 100	0	1 (0.8)
	49 (40.2)	73 (59.8)

Table 2. Urine culture results among various age groups.

Age Group	Urine Culture	χ^2 (df)	P-value
	Frequency (%) N = 88		
≤20	2 (2.3)	8.94 (8)	0.35
21 - 30	9 (10.2)		
31 - 40	22 (25.0)		
41 - 50	17 (19.3)		
51 - 60	11 (12.5)		
61 - 70	8 (9.1)		
71 - 80	12 (13.6)		
81 - 90	6 (6.8)		
91 - 100	1 (1.1)		

df: degrees of freedom.

pattern of bacteria to antibiotics and sex category of the patient was not significant (p = 0.06).

Thirteen different organisms were identified from 88 (72.1%) culture positives of which 81 (92.1%) were Gram-negative bacteria, 6 (6.8%) Gram-positive bacteria and in 1 (1.1%) case of *Candida albicans* was isolated. The predominant bacteria isolates were *Escherichia* (*E.*) *coli* 41 (46.6%), *Klebsiella spp*. 18 (20.6%), *Pseudomonas spp*. 10 (11.4%), Enterobacter 6 (6.8%) and *Staphylococcus aureus* 5 (5.8%). Other organisms isolated 8 (8.8%) include: *Citrobacterdiversus*, *morgani*, *Enterococcus spp*., *Klebsiellaoxytoca*, *Streptococcus spp*., *Proteus mirabilis* and *Candida albicans* (Table 3).

All isolates demonstrated sensitivity to Amikacin. *Pseudomonas aeroginosa* demonstrated the least sensitivity to Amikacin (70%) while *Enterobacter spp*. and *Staphylococcus aureus* were the most sensitive (100%). Gentamycin and cefuroxime showed the least sensitivity pattern; as they were sensitive to only one isolate each of *Escherichia coli*. The remaining drugs on the antibiotics multidisc showed variable sensitivity pattern (Table 4).

Among the isolates, the best sensitivity pattern to majority of the antimicrobials was observed for *Escherichia coli*. *Escherichia coli* isolates demonstrated sensitivity to Amikacin 35 (85.4%), Levofloxacin 17 (41.5%) and Ciprofloxacin 16 (39%) in descending order. None of the isolates was susceptible to Ampicillin. *Klebsiella spp*. 15 (83.3%) exhibited sensitivity to Amikacin but resistant to Ampicillin, Gentamicin, Cefuroxime and Cephalexin (Table 4).

Generally, the best susceptibility of bacteria isolates to antibiotics was observed in the following antimicrobials: Amikacin 73 (83.0%), Levofloxacin 34 (38.6%), Ciprofloxacin 26 (29.5%), Ceftizoxime 23 (26.1%), Orfloxacin 22 (25.0%) and Chloramphinicol 21 (23.9%) respectively in descending order. Overall, decreased susceptibility of bacteria to antibiotics was observed with Sparfloxacin 13 (14.8%), Cephalexin 8 (9.1%), Norfloxacin 7 (8.0%), Cotrimoxazole 7 (8.0%), Gentamicin 3 (3.4%), Ampicillin 3 (3.4%) and Cefuroxime 1 (1.1%), respectively (Table 5).

Table 3. Pattern of uropathogens isolated.

Organisms	Number of Samples of uropathogens isolated (N = 88) Frequency (%)
Escherichia coli	41 (46.6)
Klebsiella spp.	18 (20.6)
Pseudomonas aeruginosa	10 (11.4)
Enterobacter spp.	7 (8.0)
Staphylococcus aureus	5 (5.8)
Citrobacter diversus	1 (1.1)
Morganella morgani	1 (1.1)
Proteus vulgaris	1 (1.1)
Klebsiella oxytoca	1 (1.1)
Streptococcus spp.	1 (1.1)
Proteus mirabilis	1 (1.1)
Candida albicans	1 (1.1)
Total	**88 (100)**

Table 4. Antimicrobial susceptibility patterns to most common bacterial isolates.

Antibiotic Sensitivity	Bacteria Isolates									
	E. coli (n = 41)		*Klebsiella spp.* (n = 18)		*Pseudomonas aeroginosa* (n = 10)		*Enterobacter spp.* (n = 4)		*Staphylococcus aureus* (n = 5)	
	N	%N	N	%N	N	%N	N	%N	N	%N
Ampicillin	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0
Ceftizoxime	16	39.0	4	22.2	2	20.0	1	25.0	0	0.0
Ciprofloxacin	16	39.0	4	22.2	4	40.0	1	25.0	1	20.0
Amikacin	35	85.4	15	83.3	7	70.0	4	100	5	100
Cotrimoxazole	3	7.3	1	5.6	1	10.0	1	25.0	1	20.0
Cephalexin	7	17.1	0	0.0	0	0.0	0	0.0	1	20.0
Ofloxacin	13	31.7	5	27.8	2	20.0	0	0.0	2	40.0
Norfloxacin	3	7.3	3	16.7	0	0.0	1	25.0	0	0.0
Chloramphenicol	10	24.4	5	27.8	4	40.0	1	25.0	0	0.0
Sparfloxacin	8	19.5	3	16.7	1	10.0	0	0.0	1	20.0
Gentamicin	1	2.4	0	0.0	0	0.0	0	0.0	0	0.0
Cefuroxime	1	2.4	0	0.0	0	0.0	0	0.0	0	0.0
Levofloxacin	17	41.5	7	38.9	4	40.0	2	50.0	3	60.0

Table 5. Overall susceptibility of uropathogens.

Antibiotics	Sensitivity of Isolate N = 88	
	Frequency	(%)
Amikacin	73	(83.0)
Levofloxacin	34	(38.6)
Ciprofloxacin	26	(29.5)
Ceftizoxime	23	(26.1)
Ofloxacin	22	(25.0)
Chloramphenicol	21	(23.9)
Sparfloxacin	13	(14.8)
Cephalexin	8	(9.1)
Norfloxacin	7	(8.0)
Cotrimoxazole	7	(8.0)
Gentamicin	3	(3.4)
Ampicillin	3	(3.4)
Cefuroxime	1	(1.1)

4. Discussion

The prevalence of CABUTI and antimicrobial susceptibility patterns among patients may vary from one setting to the other. In the United Kingdom, Wazait and associate found catheter associated urinary tract infection to be 35.5%. Koshariya and colleagues reported the prevalence of CABUTI in India to be 27% [22]. In Nigeria, Taiwo *et al.* reported the prevalence of CABUTI of 13.3% and 98.8% when bladder catheter was *in situ* at less than 7 days or more than 7 days respectively [23]. In this study, the prevalence of CABUTI was 72.1%. This could be due to contamination of urine by bowel flora or catheters were passed without adherence to strict aseptic protocols. Also, this high prevalence may be due to prolonged catheterization as the duration of catheterization prior to sample collection was not established by this study. Among females, the prevalence of CABUTI was 45.5%. There exist anatomical variations, between female and male urethra and meatus. The female urethra is short and has a meatus closer to the anal opening. This poses a risk for females to contract CABUTI.

4.1. CABUTI Uropathogens Identification

Urine culture test has been used over decades for diagnosing patients who have UTI. The identification of CABUTI uropathogens and the antibiotic susceptibility patterns enable practitioners select the appropriate antibiotics for treatment. *Escherichia coli*, the leading uropathogen in urine cultures and other *Enterobacteriaceae*, account for approximately 75% of all uropathogens [24] [25] [26]. Included in the top five uropathogens were *Escherichia coli* 30.5%, *Klebsiella*

pneumoniae 30.5%, *Pseudomonas aeruginosa* 16.6% and *Candida spp*. 16.6% as reported by Kazi and colleaques [27]. This present study revealed that *Escherichia coli* 46.6%, *Klebsiella spp*. 20.6%, *Pseudomonas spp*. 11.4%, *Enterobacter* 6.8% and *Staphylococcus aureus* 5.8% respectively were the most prevalent CABUTI uropathogens at the Tamale Teaching Hospital. The least prevalent CABUTI uropathogens were *Citrobacter diversus*, *Morganella morgani*, *Enterococcus spp*., *Klebsiellao xytoca*, *Streptococcus spp*., *Proteus mirabilis* and *Candida albicans each constituting* 1 (1.1%). These organisms are mainly endogenous bowel flora. Thus, poor personal hygiene or non-adherence to aseptic technique during catheterization could account for the higher prevalence of these organisms in the urine of our study participants. It has been established that CABUTI is one of the health care associated infections that may be contracted through contact with contaminated equipment or solutions and from other patients or hospital staff [23] [28] [29].

4.2. Uropathogen Antibiotics Susceptibility

Antibiotic use by patients prior to presentation of urine samples could significantly alter microbial yield and consequently prediction of infection rates because they suppress the endogenous bacteria flora [30] [31]. Multiple studies have demonstrated resistance to a host of antibiotics including ampicillin, chloramphenicol, cotrimoxazole, gentamicin, cefuroxime [30] [32] [33]. This phenomenon of drug resistance differs from one place to another. Though there is antimicrobial resistance to a large extend, some studies show there were susceptibility of uropathogens to some antibiotics. In Ghana, Gyansa-Lutterodt and associates found high susceptibility of uropathogens to Nitrofuantoin and Gentamicin at the Police Hospital, while Gyasi-Sarpong et al reported susceptibility of uropathogens to ciprofloxacin, nalidixic acid, cefuroxime, ceftriaxone and cefotaxime at the Komfo Anokye Teaching Hospital [30] [32]. In order of decreasing susceptibility, we report that Amikacin 83.0%, Levofloxacin 38.6% and Ciprofloxacin 29.5% were the antibiotics found to be most suitable in treatment of urinary tract infection at the Tamale Teaching Hospital. The existence of substantial resistance of bacterial isolates to antibiotics is therefore implied. This might be as a result of indiscriminate usage of these antibiotics resulting in resistance among the bacterial isolates. The bacterial isolates showed least susceptibility to Cefuroxime 1.1%, Ampicillin 3.4% and Gentamicin 3.4% in order of increasing susceptibility. Other antibiotics with least sensitivity were Co-trimoxazole 8.0%, Norfloxacin 8.0%, Cephalexin 9.1%, Sparfloxacin 14.8%, Chloramphenicol 23.9% and Ofloxacin 25.0% in order of increasing susceptibility. It is important for practicing clinicians to appraise their knowledge on the local antibiotics' susceptibility patterns so as to effectively treat CABUTI.

This study had some limitations. Firstly, the duration of catheterization preceding sample collection for urine culture and sensitivity was not established. Secondly, the participants were not grouped into either catheter associated bac-

teriuria (asymptomatic) and catheter associated urinary tract infection (symptomatic). For catheter associated bacteriuria (asymptomatic), no treatment is usually needed. This is an important point to consider in determining antibiotic susceptibility and recommending treatment.

5. Conclusion

Catheter-associated bacterial urinary tract infection is prevalent at the Tamale Teaching Hospital. Micro bacterial isolates demonstrated substantial decrease in susceptibility to antibiotics commonly used. Understanding the local antibiotic susceptibility pattern could guide the choice of antibiotics used in treating catheter-associated bacterial urinary tract infection.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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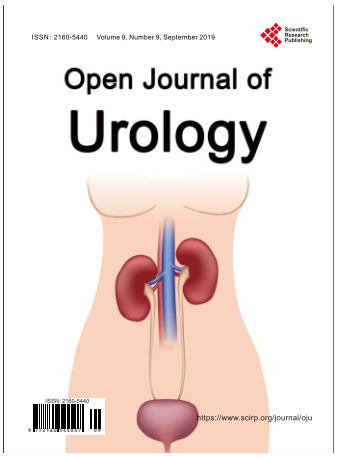

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