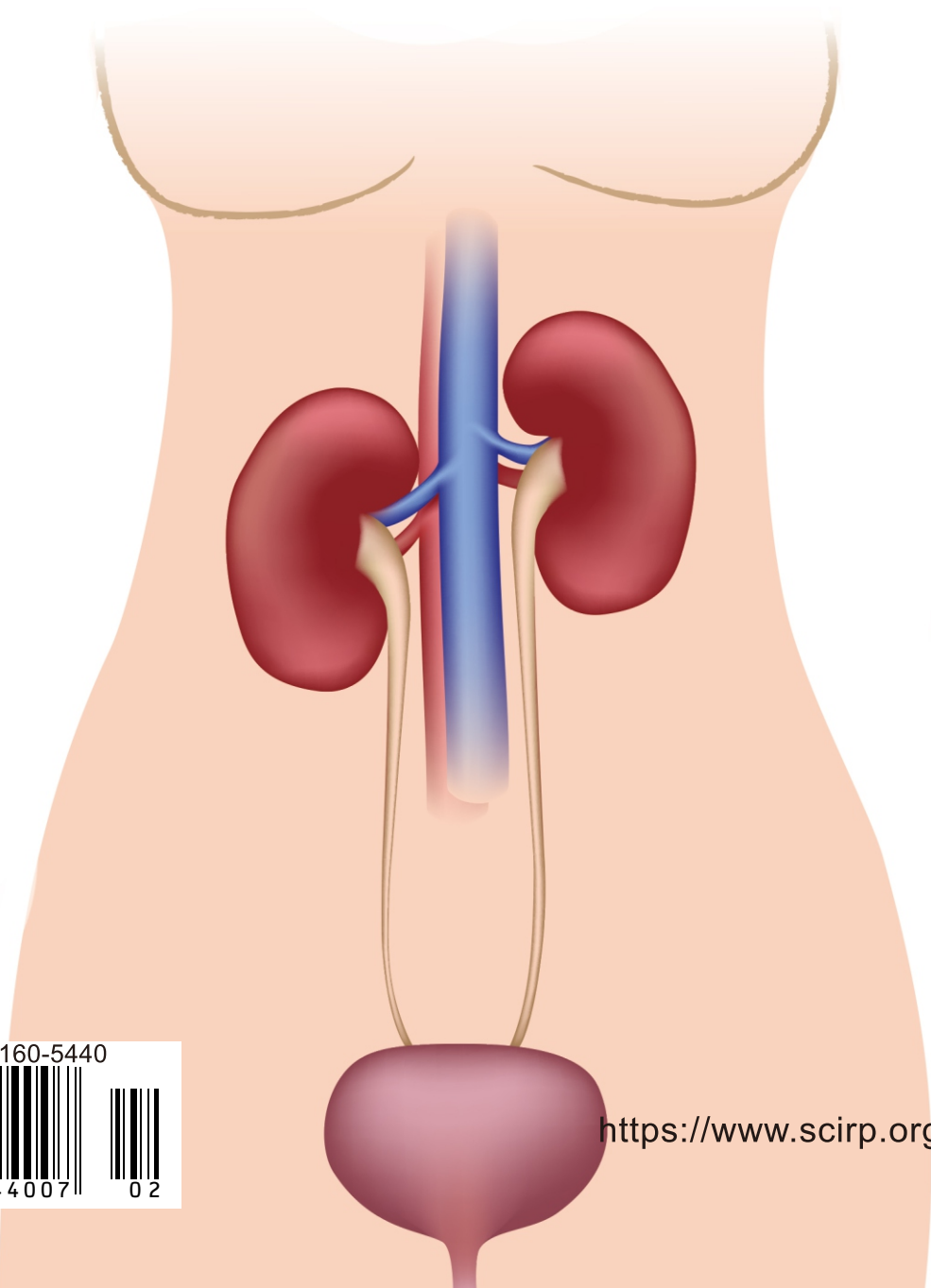


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Prediction of Acute Renal Failure in Dengue Fever Patients

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Abstract

Background: Dengue virus (DENV) infection is caused by an arboviral strain and is transmitted by the mosquito *Aedes aegypti* which is found in Sudan especially Red Sea and Kassala states in the east. The disease is known to cause renal disturbances and a thorough understanding of that will potentially help in the prediction, diagnosis and treatment of the disease. **Methods:** This study is a prospective observational cross sectional study conducted in the Eastern Sudan College of Medical Science and Technology and Port Sudan Teaching Hospital. 200 confirmed Dengue virus infected patients along with 200 healthy appearing adults (control) were enrolled for the study. Statistical analysis was carried out after the collection of patients' demographic, clinical, and investigational data including serum urea and creatinine values. Ethical approval was obtained from the ministry of health, Red Sea state and informed written consent was obtained from each participant. **Results:** The highest incidence of DENV infection was observed in individuals of the middle age group (29%). Elevated blood urea levels were detected in 10 (5%) patients while elevated creatinine levels were seen in 17 (8.5%) patients. Although fallen within reference ranges found in the literature, mean blood urea and creatinine values differed significantly between patients and controls and between different categories of the disease. Mean blood urea concentration showed a statistically significant difference between the control (22.3 mg/dl) and the test (28.4 mg/dl) (P value < 0.001). Similarly, mean serum creatinine in the control (0.70 mg/dl) differed significantly (P value < 0.001) from test (0.94 mg/dl). Clinically, fever was present in 97.5% of patients, headache in 95.5%, joints pain in 71%, lethargy in 67%, vomiting in 49%, skin rash in 40%, abdominal pain in 24% and bleeding in 17.5%. **Conclusion:** We strongly conclude that renal involvement is not uncommon in Dengue fever

and that blood urea and creatinine evaluation should be considered in the counseling of DENV infection patients. Patients need to be subjected to necessary laboratory investigations associated with acute kidney injury to decrease the rate of morbidity and mortality associated with the disease.

Keywords

Dengue Virus, Acute Kidney Injury, Hemorrhagic Fever, Shock Syndrome, Eastern Sudan

1. Introduction

Dengue fever is a mosquito borne viral infection that constitutes a major health problem in tropical and sub-tropical regions of the world. Urbanization and air travel are among the factors associated with the increased trend of infection in recent years. Over 2.5 billion people of the world's population are now at risk for Dengue. The consequence of Dengue virus (DENV) infection ranges from the asymptomatic condition (Dengue fever (DF), to more severe forms, such as Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS). Severe Dengue is characterized either by plasma leakage, fluid accumulation, respiratory distress, severe bleeding, or organ impairment. Clinical manifestations offer the earliest markers in predicting severe Dengue Disease [1].

Patients with Dengue fever are clustered into two groups: one with warning signs including abdominal pain, mucosal bleeding and hepatomegaly that warrant ICU admission and the other without those signs. Early prediction of severe Dengue infection in patients without any warning signs who may later develop severe DHF is very important to give the best supportive care since approved vaccines for immunization are yet to be commercialized. An ideal biomarker should be able to identify individuals who are at risk of developing severe Dengue infection [2]. Dengue patients show fever symptoms during peak of viraemia while DHF/DSS appears during the time when the virus has been cleared from the circulation suggesting that severe Dengue disease is most likely associated with immunopathology [2].

Dengue infection has been associated with a variety of renal disorders. Acute renal failure is a potential complication of severe Dengue infection and is typically associated with hypotension, rhabdomyolysis, or hemolysis. Acute renal failure occasionally complicates severe Dengue infection and carries a high mortality rate. Transient proteinuria has been detected in most patients with severe Dengue infection. Hematuria has been reported in a significant subset of patients with severe forms of the infection. Various types of glomerulonephritis have been reported during or shortly after Dengue infection in humans and mouse models. Meningeal proliferation and immune complex deposition are the dominant histologic features. On a rare occasion, Dengue infection is associated with systemic autoimmune disorders involving the kidneys. In the vast majority

of cases, Dengue infection and associated renal disorders are self-limited [3].

Dengue infection evolving into systemic lupus erythematosus and lupus nephritis has been reported with antibodies directed against nuclear antigens including ANA and double-stranded DNA [3].

In Sudan, Dengue fever (DF) is considered a major public health issue in the Eastern region of the country, where it has been reported since 1908 with endemicity and frequent outbreaks in the coastal and sub-coastal areas of the Red Sea and Kassala states. Dengue fever reported in the Sudanese population is associated with serious presentations including DHF and DSS with an increased rates of morbidity and mortality. Acute kidney injury (AKI) is a serious and potentially lethal complication of this disease. It is obvious that Dengue Fever is becoming a serious problem and this needs specific investigation and diagnosis to avoid complications of the disease. Approximately 2.5 billion individuals from more than 110 countries are in danger of DENV infection each year due to the lack of an efficient vaccine and a specific treatment [4]. Dengue fever is transmitted by *Aedes aegypti* with other species of *Aedes* mosquito involved [5]. There are 4 serotypes of dengue viruses known as DENV-1, DENV-2, DENV-3, and DENV-4 [6].

Renal function is routinely assessed by a profile that includes the determination of serum urea, creatinine, creatinine clearance and electrolytes. An elevated concentration of urea in the blood is called azotemia. Very high plasma urea concentration accompanied by renal failure is called uremia, or the uremic syndrome. This condition is eventually fatal if not treated by dialysis or transplantation [7]. Decreased renal function causes an increase in plasma urea concentration as a result of compromised urea excretion. Renal causes of elevated urea include acute and chronic renal failure, glomerular nephritis, tubular necrosis, and other intrinsic renal diseases. Measurement of creatinine concentration is used to determine sufficiency of kidney function and the severity of kidney damage and to monitor the progression of kidney disease. The amount of creatinine in the bloodstream is reasonably stable, although the protein content of the diet does influence the plasma concentration because of the constancy of endogenous production [8].

Acute kidney injury (AKI) is a condition where kidneys suddenly stop working properly. It can range from minor loss of kidney function to complete kidney failure. AKI normally happens as a complication of another serious illness. It is not the result of a physical blow to the kidneys, as the name might suggest. This type of kidney damage is usually seen in older people who are unwell with other conditions and the kidneys are also affected. It is essential that AKI is detected early and treated promptly. Without quick treatment, abnormal levels of salts and chemicals can build up in the body, which affects the ability of other organs to work properly. If the kidneys shut down completely, this may require temporary support from a dialysis machine, or lead to death [9] [10]. This study is designed to incorporate the prediction of acute renal injury as a routine check in approaching Dengue fever patients.

2. Methods

This was an hospital-based cross sectional descriptive study conducted at Port Sudan Teaching Hospital in the period from June 2018 to September 2021 to evaluate the involvement of acute kidney injury (where kidney suddenly stops working properly) in confirmed Dengue fever patients. Enrolled in the study are 200 diagnosed Dengue fever patients (fixed number) and other 200 healthy appearing people as a control group. Patients with a past history of renal or liver disease before diagnoses of Dengue fever and patients who have lupus erythromatosis were excluded. Ethical approval was achieved from the research committee in the ministry of health, Red Sea state and an informed written consent was obtained from each participant.

Venous blood samples were collected from each patient, one in heparinized containers, and another in plain containers then refrigerated at 2°C - 8°C till analyzed. The diagnosis of Dengue fever was established by the detection of DENV IgG/IgM antibodies by ELISA Technique.

Blood urea and creatinine were measured photometrically by the enzymatic method using the PT350 Bio system spectrophotometer and reagent kits from Biosystems Company. Data were statistically analyzed by the SPSS software and frequencies, concentrations and correlations were illustrated.

3. Results

The higher percentage of patients of DENV infection was from individuals of middle age (40 - 49 years old) representing 29% of cases (**Figure 1**).

Out of the 200 confirmed DENV positive patients included in this study, 126 (63%) were males and 74 (37%) were females along with other 200 healthy appearing adults of whom 100 (50%) were males and 100 (50%) were females as a control group, 160 (80%) were found to suffer from mild Dengue fever, 35 (17.5%) suffered from Dengue hemorrhage fever, 5 (2.5%) suffered from Dengue shock syndrome. Eight patients (4%) showed signs of acute kidney injury (1 patient with acute kidney injury the result of ANA, anti-dsDNA were significantly increased).

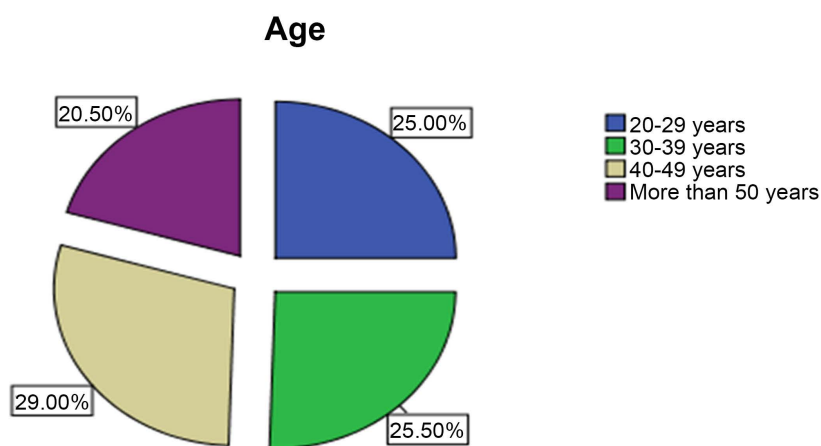


Figure 1. Age distribution (in years) in patients.

Table 1 shows a statistically significant difference between Dengue fever patients and the control group in the concentration of serum urea and creatinine.

Bio chemical findings in the different categories of Dengue virus infection showed statistically significant differences. **Table 2** illustrates the difference between Dengue fever and Dengue hemorrhagic fever.

Similarly, **Table 3** shows a significant difference in biochemical finding between Dengue fever and Dengue shock syndrome especially in urea concentration.

In contrast, **Table 4** illustrates an insignificant difference in biochemical finding between Dengue hemorrhagic fever and Dengue shock syndrome.

Insignificant differences were also seen in biochemical findings according to gender in Dengue virus infected patients in different categories of the disease in urea and creatinine concentration apart from creatinine in males and females of Dengue fever (**Tables 5-7**).

4. Discussion

Dengue fever can be presented with a variety of clinical presentations associated

Table 1. Comparison between test and control in biochemical findings.

| Parameter | Reference Range | Test (Mean \pm 1 SD) N = 200 | Control (Mean \pm 1 SD) N = 200 | P value |
|--------------------|-----------------|-----------------------------------|--------------------------------------|---------|
| Urea (mg/dl) | 15 - 50 | 28.40 \pm 25.7 | 22.30 \pm 6.30 | <0.001 |
| Creatinine (mg/dl) | Up to 1 | 0.94 \pm 0.08 | 0.70 \pm 0.15 | <0.001 |

Table 2. Comparison between DF and DHF in biochemical findings.

| Parameter | DF (Mean \pm 1 SD) N = 160 | DHF (Mean \pm 1 SD) N = 35 | P value |
|--------------------|---------------------------------|---------------------------------|---------|
| Urea (mg/dl) | 22.3 \pm 6.005 | 44.88 \pm 39.80 | 0.020 |
| Creatinine (mg/dl) | 0.75 \pm 0.18 | 1.44 \pm 1.45 | <0.001 |

Table 3. Comparison between DF and DSS in biochemical findings.

| Parameter | DF (Mean \pm 1 SD) N = 160 | DSS (Mean \pm 1 SD) N = 5 | P value |
|--------------------|---------------------------------|--------------------------------|---------|
| Urea (mg/dl) | 22.3 \pm 6.005 | 109.30 \pm 76.50 | <0.001 |
| Creatinine (mg/dl) | 0.75 \pm 0.18 | 3.54 \pm 1.10 | 0.050 |

Table 4. Comparison between DHF and DSS in biochemical findings.

| Parameter | DHF (Mean \pm 1 SD) N = 35 | DSS (Mean \pm 1 SD) N = 5 | P value |
|--------------------|---------------------------------|--------------------------------|---------|
| Urea (mg/dl) | 44.88 \pm 39.80 | 109.3 \pm 76.5 | 0.500 |
| Creatinine (mg/dl) | 1.44 \pm 1.45 | 3.54 \pm 1.10 | 0.100 |

Table 5. Comparison between dengue fever male and female patients in biochemical findings.

| Parameter | Males (Mean \pm 1 SD) N = 103 | Females (Mean \pm 1 SD) N = 57 | P value |
|--------------------|------------------------------------|-------------------------------------|---------|
| Urea (mg/dl) | 22.92 \pm 6.20 | 21.21 \pm 5.60 | 0.080 |
| Creatinine (mg/dl) | 0.77 \pm 0.19 | 0.70 \pm 0.11 | 0.040 |

Table 6. Biochemical findings in patients of dengue hemorrhagic fever based on gender.

| Parameter | Males (Mean \pm 1 SD) N = 20 | Females (Mean \pm 1 SD) N = 15 | P value |
|--------------------|-----------------------------------|-------------------------------------|---------|
| Urea (mg/dl) | 53.5 \pm 49.70 | 33.4 \pm 15.70 | 0.100 |
| Creatinine (mg/dl) | 1.70 \pm 1.85 | 1.05 \pm 0.45 | 0.200 |

Table 7. Biochemical findings in patients of dengue shock syndrome based on gender.

| Parameter | Males (Mean \pm 1 SD) N = 3 | Females (Mean \pm 1 SD) N = 2 | P value |
|--------------------|----------------------------------|------------------------------------|---------|
| Urea (mg/dl) | 156.0 \pm 52.40 | 39.25 \pm 39.24 | 0.070 |
| Creatinine (mg/dl) | 3.90 \pm 0.18 | 3.10 \pm 0.21 | 0.400 |

with unpredictable progression and outcomes. They range from asymptomatic illness to severe shocks eventually resulting in death [11]. Dengue is considered a major health threat by the World Health Organization. An increase in infection has been seen in recent years due to many factors including urbanization and air travel. Approximately over 2.5 billion people of the world's population are now at risk for Dengue [12]. The purpose why only a few DENV disease cases get worse is poorly understood but the host immune response has been considered as the major factor responsible for Dengue pathogenesis [13]. Dengue infection is associated with multiple organ dysfunction involving liver, muscles, heart, brain and kidney [14]. Dengue fever has been associated with various types of renal disorders such as proteinuria, hematuria, glomerulonephritis, and acute kidney injury [15].

In this study, out of the confirmed two hundred Dengue patients, eight patients (4%) had Acute Kidney Injury (AKI). Results that are similar to those of a study done by Warappa ES. *et al.* who reported that the prevalence of renal manifestation in Dengue fever patients was (9.02%) [16]. The fact that the prevalence of DF in males was higher than females in our study along with the clinical presentation that fever was detected in (97.5%) of patients, is similar to the results of a study done by Relwani P. R. *et al.* who found that fever was one of the common features associated with Dengue infection (98.66%) [17].

In our study the (mean \pm 1 SD) of serum urea levels of (22.3 \pm 6.01 mg/dl) for Dengue fever patients, (44.88 \pm 39.8 mg/dl) for Dengue hemorrhagic fever patients, and (109.3 \pm 76.5 mg/dl) for Dengue shock syndrome patients, was simi-

lar to what was seen by Guzman MG. and Halsted SB. [18] who showed increased urea levels in all categories of the disease.

Similarly, the (mean \pm 1SD) of creatinine levels in Dengue fever patients was (0.75 ± 0.18 mg/dl), in Dengue Hemorrhagic fever patients was (1.44 ± 1.45 mg/dl), and in Dengue shock syndrome was (3.5 ± 1.10 mg/dl), is agreed to the results of a study by Taurqeer H. and Amer K. [19] who reported an increase in creatinine levels in all the categories of Dengue infection.

The present study found that only one patient with acute kidney injury had increased levels of anti-dsDNA, and ANA which is similar to the findings of a study by Rajadhyaksha A. and Mehra S. in a case report [20] showing an increase in anti-dsDNA and ANA.

5. Conclusion

Renal involvement is frequent in patients with Dengue fever especially in those exhibiting complications of the disease. Routine assessment of these patients should include the determination of blood urea and creatinine as a check marker for the prediction of acute kidney injury.

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Conflicts of Interest


The authors have no conflicts of interest to disclose.

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Injectable Biological Bulking Agent to Treat Stress Urinary Incontinence in Women: A Feasibility Pilot Study

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Abstract

Background: Urinary incontinence mainly affects women regardless of age and, as it affects their quality of life, influences work, sex life and independence for activities of daily living. The treatment of stress urinary incontinence including urethral volume injection therapy can provide an intermediate option over non-surgical and surgical therapies. One of the mechanisms for stress continence depends on the effective coaptation of the urethra during the increase in intra-abdominal pressure. The bulking agents can be injected transurethral or periurethral retrogradely, using direct vision from a cystoscope. **Purpose:** To evaluate the feasibility and preliminary outcome performance of the bacterial polysaccharide gel used as biological bulking agent applied in female patients with stress urinary incontinence. **Methods:** A prospective clinical pilot study was performed, in a single institution, including female patients who were admitted to the urologic outpatient clinic with Stress Urinary Incontinence (SUI) without previous treatments and they were selected and underwent bulking agent procedure. The evaluation was performed at the time of enrollment and 6 months after treatment. The primary outcome was Quality of Life (QOL) using the ICIQ-SF Questionnaire. The amount of urine leakage measured by the 1-HOUR PAD-TEST was the second outcome. **Results:** Fifteen women (with an average age of 53 years) were submitted to the application of bacterial cellulose gel and she was analyzed. Only two patients presented unchanged incontinence. The study considered as primary outcome the improvement or disappearance of symptoms after six months of intervention. Post-intervention Quality of Life

(QOL) questionnaire indicated that all of these patients related a better quality of life (62.5%). Through the PAD-test it was possible to observe a decrease in urinary leak of 85% comparing the results pre and post-intervention (BCA—Bacterial Cellulose Application) with p-value equal to 0.000009. **Conclusions:** The results of this pilot study suggest that the use of biological bulking agent is a promising approach to treat stress urinary incontinence in female patients. **Trial registration:** Registration number and date of registration should be instated in this section.

Keywords

Bulking Agents, Urinary Incontinence, Stress, Biopolymers

1. Introduction

Urinary incontinence affects primarily women, regardless of age and by affecting quality of life, influences work, sex life and independence for various routine activities. Approximately half of these individuals suffer from stress urinary incontinence (SUI) and are directly influenced by risk factors such as obesity and diabetes [1].

Conventional treatments include a mid-urethral sling procedure that does not fit all patients or does not solve the problem of urinary incontinence [2]. For these problems, urethral expansion agents have been developed which are an alternative but still have varying clinical success rates. Many of these products have been developed in recent decades and most of them have had limited effectiveness or have problems with application such as local pain and even thromboembolism leading to death [3].

For this reason, an injectable bulking agent must be biocompatible, non-immunogenic and cause minimal fibrosis at the injected site. Several injectable bulking agents with synthetic or natural chemical composition have been developed in recent years [4]. However, injectable bulking agents such as tetrafluoroethylene (Teflon®) have been discontinued due to their high risk of particle resorption and migration to sensitive areas of the body [3]. The study and development of natural bulking agents that have positive immunogenicity factors, such as hyaluronic acid, dextranomer (Deflux®) and bovine collagen derivatives (Contigen®) have become references in the market [3] [4].

Bacterial Cellulose Gel (BC) is a highly crystalline biopolymer produced from sugarcane molasses [5]. A previous study showed that BC was not cytotoxic, genotoxic, or acutely toxic, in addition to being biocompatible and low cost [6]. In recent years, BC has been successfully used in several surgeries [7] [8] [9] [10] [11]. And for having a natural structure with easy availability and being toxicity-free, it is attracting attention in the treatment of urinary stress incontinence [12].

The BC gel was used in 2012 as an implant into rabbits' eviscerated eyes and

demonstrated that the BC was biocompatible and properly integrated into the surrounding tissues. In 2015, Lima and collaborators evaluated the biocompatibility of bacterial cellulose gel as a bulking agent in rabbit bladders. The study also demonstrated the physiological integration of BC gel application in the host tissue and resistance to the biodegradation process. These results obtained indicated that the BC gel may be an option for injectable therapy of stress urinary incontinence. [13] [14]. As the present study evaluated the use of BC gel in the treatment of stress urinary incontinence in women diagnosed with SUI.

2. Materials and Methods

Design and sample selection

A pilot study was realized from March 2019 to October 2021, female patients who were admitted to the urologic outpatient clinic with stress urinary incontinence (SUI) without previous treatments. The evaluation for the bulking agent procedure was performed at the time of enrollment and 6 months post-intervention. The sample size was calculated based on the population proportion estimation and the site sample size calculation was used.

The study followed the ethical recommendations of the National Health Council, the Helsinki Declaration and the Nuremberg Code for studies with human beings and was approved by the National Ethics in Research Committee (CONEP #1.650.992). We formally informed participants about the study and invited them to attend. All patients enrolled in the study signed an informed consent form (ICF). Exclusion criteria were: infravesical obstruction of a mechanical nature, neurogenic bladder arising from surgical treatment and patients with urethral hypermobility.

The primary outcome was quality of life (QOL) using the International Consultation on Incontinence Questionnaire in its short form (ICIQ-SF) that consists of three questions that assess the frequency, severity and impact of urinary incontinence, as well as a set of eight self-diagnosis items related to the causes or incontinence situations experienced by the patient [15]. In the test, the sum of the scores of the questions three, four and five and ranges from 0 to 21, where 0 corresponds to no UI impact on quality of life and 21 corresponds to a very severe impact of UI on the patient's quality of life.

The amount of urine leakage measured by the 1-HOUR PAD-TEST was the second outcome. This method is based on the weight gain of the pad during the test period under standard conditions. In this comparative test, the patients used the absorbent for 01 hour in the preoperative evaluation and six months after the implantation of the BC gel. The comparison of mean values was get with Wilcoxon signed-rank test (pre-post analysis). This test was considered statistically significant when P value < 0.05. The software used for analysis was SPSS Version 21.

Polysaccharide gel is an innovative product for Health Ltda which is produced from molasses biopolymer developed by POLISA's R&D and research team. The

gel was obtained by hydration of microcrystalline bacterial cellulose at a ratio of 0.8% cellulose in 99.2% water and sterilization by gamma ray [6].

The bacterial cellulose gel used for testing has a stable formulation with a concentration of 0.8% cellulose polysaccharide. The Bacterial Cellulose Application (BCA) in all patients was performed in the operating room, with patient sedated and submitted to urethrocystoscopy. The entire urethra and bladder cavity and subsequent identification of the injection site was evaluated. The material was injected at a distance of 1 cm below the vesicourethral junction with cystoscopic needle, at positions 3, 6, 9 and 12 hours, the total of 8 ml was injected into each patient. The bladder was emptied previously.

3. Results

Fifteen women were submitted to the application of bacterial cellulose gel and she was analyzed. The preliminary conditions were described in baseline characteristics (**Table 1**) and pre-intervention urodynamic data (**Table 2**).

The mean age of patients was 52.75 years, which characterizes this study population as relatively young, sexually active, and as productive workers.

After the endoscopic filling procedure, patient evolution was assessed every three months. The phases of bulking agent application were shown in different moments: (A) Aspect of the bladder neck pre-intervention. It is possible to observe

Table 1. Baseline characteristics.

| | |
|---|------------------|
| Total Sample (N*) | 15 |
| Age (years) | 40 - 68 |
| Mean (years) | 53 |
| BMI* Kg/m ² | 28.3 (21.3 - 31) |
| Obese (BMI** \geq 30 kg/m ²), n (%) | 5 |
| Family Background | 13 |
| Previous Radical Pelvic Surgery, n (%) | 4 (26.6) |

*N = Number of patients **BMI = Body Mass Index.

Table 2. Pre-intervention urodynamic data.

| VARIABLE | MEDIAN (Range) |
|--|---------------------|
| FDTV, mL | 180 (70 - 330) |
| CC, mL/s | 407 (206 - 580) |
| Q _{max} , mL/s | 24.78 (15.1 - 37.3) |
| Intravesical opening pressure, cmH ₂ O | 23.4 (9 - 66) |
| Pdet _{max} during voiding, cmH ₂ O | >60 |
| PdetQ _{max} , cmH ₂ O | 24.4 (8 - 60) |

FDTV: first desire to void; CC: cystometric capacity; Q_{max}: maximum urinary flow; Pdet_{max}; maximum detrusora.

the damage to the urethra, where the spacing allows the constant loss of fluid. (B) Image of cystoscopy needle during intervention (the endoscopic needle-injected bacterial cellulose polysaccharide filling is shown). (C) Aspect of the bladder neck post-intervention. The ultravesical space is shown to be reduced, thanks to the filling agent procedure (**Figures 1(A)-(C)**).

Although the literature presents complications such as pelvic pain and urinary retention, in our sample only urinary retention was evident in some cases post-intervention. And these were resolved with the use of intermittent catheterization, only during the hospital stay.

The study considered as primary outcome the improvement or disappearance of symptoms after six months post-intervention. Polysaccharide gel has been used in various medical and biological applications. No variation in final volume was observed after tissue injection in different experimental trials with a standardized concentration at 0.8% [16] [17].

The urine leakage has been correlated with quality of life in the pre- and post-intervention, the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) was used. Quality of life analysis was the secondary outcome. According to ICIQ-SF Questionnaire answers from the patients, there was a 62.5% improvement in the quality of life of these women (**Table 3**).

Through the results of 1-Hour PAD-Test it was possible to observe an improvement in urinary leak and, the difference in the mean values of leak was statistically significant with p-value equal to 0.000009 (**Figure 2**).

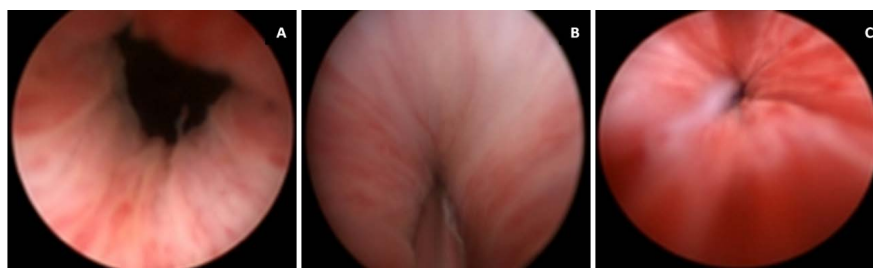


Figure 1. The phases of bulking agent application. (A) Aspect of the bladder neck pre-intervention (BCA); (B) Image of cystoscopy needle during intervention (BCA); (C) Aspect of the bladder neck post-intervention (BCA).

Table 3. ICIQ-SF score pre and post-intervention and percentage increase.

| QUESTIONS | PRÉ-INTERVENTION (BCA) | POST-INTERVENTION (BCA) | PERCENTAGE INCREASE (%) |
|---|---------------------------|----------------------------|----------------------------|
| How often do you leak urine? (0 - 5) | 4.2 | 2.9 | 31 |
| We would like to know how much urine you think leaks. How much urine do you usually leak? (0 - 6) | 4.7 | 2.6 | 43 |
| Overall, how much does leaking urine interfere your everyday live? (0 - 10) | 8.7 | 5.3 | 39 |
| All questions (0 - 21) | 17.6 | 10.8 | 62.5 |

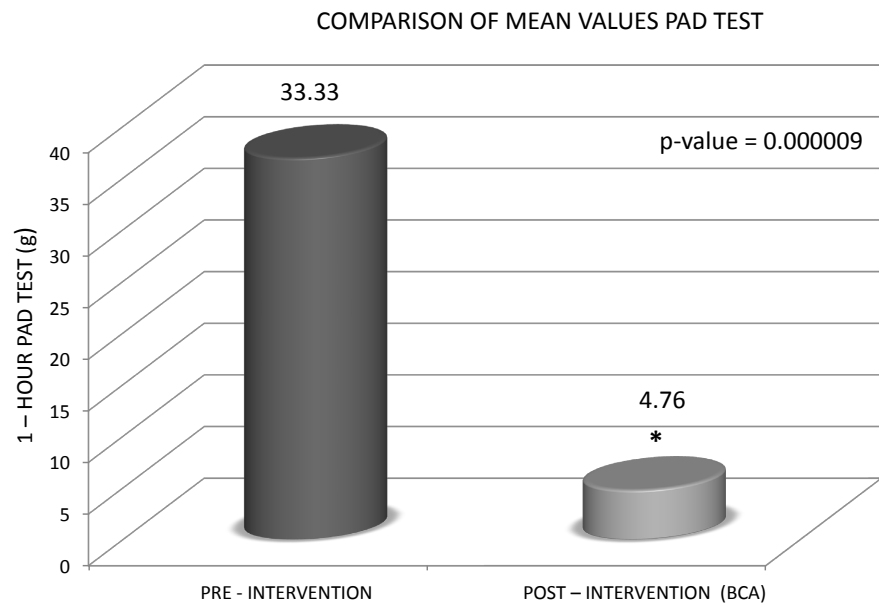


Figure 2. PAD-Test—Urinary losses pre and post-intervention (BCA).

4. Discussion

Despite the surgical treatment with a urethral sling is the common treatment for patients with stress urinary incontinence (SUI), urethral bulking agents have traditionally been offered as salvage procedures for recurrent this type of incontinence. However, there's a part of these patients who persist with incontinence or are not ideal candidates for surgical treatment [18].

Different bulking agents have been investigated for the treatment of SUI [19]. The parameters that distinguished an ideal bulking agent are that it should be non-immunogenic, non-migratory, non-erosive, non-inflammatory, and easily handled and stored. It should be permanent and the application should not cause pain, have long term side effects, and must provide clinical improvement [20] [21]. However, the urethral bulking agents currently being used do not fully fulfill these criteria; so, the search for the ideal agent is still ongoing which makes the results here presented with BC gel even more important. Another advantage of the present agent is its low cost and by coming from an inesgotable source in nature with makes the use very attractive.

The use of bulking agents in gel does not interfere with future procedures in the treatment of incontinence and is an extremely valid treatment in sexually active women who are planning new pregnancies or who have any comorbidity that may affect the use of anesthesia [22].

Previous studies related the application of biopolymer gel in rabbits' bladder submucosa showed that the agent did not present any inflammatory issue reaction, was well colonized by cell matrix and blood vessels indicating no body rejection of these materials [19]. In another application, the author tested the polysaccharide gel from bacterial cellulose in rats' bladder. The gel showed good stability remaining in place after implantation which characterized it as a satis-

factory bulking substance. These results allowed the testing in patients suffering from stress urinary incontinence without any improvement by previous conventional treatments [23].

Some studies have reported that the use of certain bulking agents caused some complications such as urinary retention, pain (dysuria, pain in injection site, pelvic pain) hematuria, infection in the urinary tract or vaginal injection [20]. Lower urinary tract symptoms such as incontinence, polyuria and urinary urgency have also been reported. Rare and severe complications, such as peri-urethral abscess, pseudocyst formation or granuloma of the injected material, fistula formation and erosion of the urethra or vagina, have also been reported in other studies with bulking agents [24] [25].

In our work, no major intra and post procedure complications were reported. Only two of the fifteen patients present urinary retention within 12 hours after the procedure which was overcome with the use of intermittent catheterization. No procedure related infection, painful symptoms or any of the other above-mentioned problems related to bulking agents procedures were reported.

Researchers pointed out effectiveness ranging from 50% to 70% in terms of subjective improvement which confirms the results we obtained. One study has also stated that the use of coating agents is not suitable for long term treatment of patients. Our use of polysaccharide gel from bacterial cellulose is unprecedented with patients with SUI [19]. The positive results corroborate the use and indicate the necessity of further new studies to prove the long-term effectiveness of BC gel.

The results of the improvement in the ICIQ-SF test were similar to what has been found in the literature [4]. Even though some patients reported not staying absolutely dry, all of the patients reported a marked improvement in all domains of the applied questionnaire. Improvement in quality of life is related by not having to use pads or the decrease in the number used in a way that does not have repercussions on the patient's social or professional life.

The study's difficulties were only related to the population that fit the study's inclusion criteria. There were no difficulties with the procedure because it was performed in an outpatient clinic and the material used was only a cystoscope and needle, also indicating a low cost.

Bacterial cellulose polysaccharide gel is not only an efficient but extremely economical alternative. To provide an example of this: the most commonly used bulking agent to treat stress urinary incontinence, the Dextranomer Microspheres Plus Hyaluronic Acid gel has an average price of U\$300.00 [26]. In our study, the bacterial cellulose polysaccharide gel only costs U\$10.00. Polysaccharide gel could also be used for other conditions such as vesicoureteral reflux where bulking agents are the front line of treatment. Increased demand for the substance would lower the market cost.

A multicenter prospective study conducted with forty-seven patients treated with urethral bulking agents showed 3-year results with 81% of the sample declaring themselves cured [27]. This study showed that bulking agents are an ade-

quately effective and safe option for the treatment of recurrent SUI, corroborating the findings of the present study.

Therapy with the biopolymer gel is a beneficial and valuable alternative to surgical treatment in the rather heterogeneous group of stress urinary incontinence patients. The PAD-TEST showed that the patients were not completely dry after the injections, but losses were significantly improved and there was an important repercussion on the quality of life.

5. Conclusion

The use of natural bulking agent such as bacterial polysaccharide gel has shown to be a promising alternative for treatment of stress urinary incontinence in female patients. The majority of the treatments for SUI are invasive and most of the patients persist with this disease. The use of a natural bulking agent, such as bacterial polysaccharide gel, is a valuable alternative for patients with previous uncured surgeries or other invasive treatments.

Conflicts of Interest

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

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Bipolar Transurethral Prostate Resection: A Study of 112 Cases

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Abstract

Background: With the advancement of technology, prostate resection can be performed nowadays using endoscopic techniques, which include monopolar and bipolar transurethral prostate resection. This study aimed to evaluate the results of bipolar transurethral prostate resection in a single urology center in Cameroon. **Materials and Methods:** This was a retrospective study carried out over two years (2015-2017) involving 112 patients with symptomatic prostate diseases who underwent transurethral prostate resection with the help of a bipolar Olympus generator. **Results:** The ages of the participants ranged from 44 years to 85 years, with a mean age of 64.41 ± 9.5 years. Fifty-six (50%) patients presented with only obstructive symptoms, five (4.46%) had only irritative symptoms, twenty (17.86%) presented with both obstructive and irritative symptoms, eight (7.14%) presented with macroscopic hematuria, seven (6.25%) with urinary tract infections, and sixteen (14.29%) with acute urinary retention. Digital rectal examination was unremarkable in 74 (66.07%) findings and was positive in 38 (33.93%) patients. The median prostate diameter was 70 [59 - 86.5] mm. The mean preoperative IPSS was 24.46 ± 5.68 . The mean surgery duration was 77.61 ± 23.87 minutes. The mean volume of irrigation fluid used during surgery was 24.84 ± 6.40 ml. The differences between the preoperative and postoperative mean IPSS score, maximum urine flow rate, and quality of life were statistically significant (all $P < 0.001$). Only 4 (3.57%) of the study participants experienced postoperative complications. **Conclusion:** Bipolar transurethral prostate resection is a viable alternative to open surgery or laparoscopic surgery for large prostate glands. This technique is also associated with a reduction in prostate-related morbidity.

Keywords

Bipolar Transurethral Prostate Resection, Prostatism, Quality of Life, Irrigation Fluid, Large Prostate Glands

1. Introduction

The prostate is a gland of the male reproductive system. It is located directly in front of the rectum and just below the urinary bladder. Its unique location makes it possible for the gland to be palpated during digital rectal examinations. The prostate measures approximately 3 cm × 3 cm × 5 cm and has an approximate volume of 25 ml [1]. Like every other organ, the prostate has its pathological conditions, the most common of which are benign prostatic hypertrophy, prostate cancer, and chronic prostatitis [2]. There are some symptoms that are characteristic of prostate pathologies, the most common of which are lower urinary tract symptoms (LUTS), which are mainly obstructive (voiding) symptoms and irritative (storage) symptoms. Obstructive symptoms include urinary retention, weak stream, interrupted stream, hesitancy, straining, prolonged micturition, incomplete bladder voiding, and dribbling. Irritative symptoms include frequency, urgency, urge incontinence, and nocturia [3]. Prostate pathology is also characterized by an enlargement of the prostate gland (which can be perceived during digital rectal examinations) and sexual dysfunction (which could be linked not only to the prostate diseases but to its different treatment modalities such as medical treatment, radiotherapy, and surgery) [4]. Transrectal ultrasonography is the most commonly used imaging modality for the prostate [5]. Prostate pathologies also have biological markers, the most common of which is the prostate-specific antigen (PSA) [6]. Surgical techniques for the management of patients with prostatism include transurethral resection of the prostate (TURP) and endoscopic enucleation of the prostate [7], with TURP being the gold standard and most commonly used surgical technique [8]. However, new minimally invasive surgical techniques, such as the bipolar modification of TURP (B-TURP) have been developed [2]. B-TURP has been reported to offer the theoretical advantage of providing more time to perform resection (which allows for the resection of larger prostate glands) and controlling hemostasis without compromising safety [9]. The improved hemostasis with B-TURP can be explained by the cut-and-seal effect [10]. B-TURP has also been reported to have the advantages of lesser clot retention, greater efficacy, and improvement in the transurethral resection (TUR) syndrome over monopolar TURP (M-TURP) [11]. Given the context of Cameroonian medical practice (low-resource settings and rare practice of endoscopic surgery), techniques such as B-TURP are rarely used. Hence, this study aimed to evaluate the results of B-TURP in a single urology center in Cameroon.

2. Patients and Methods

This was a retrospective study carried out from 2015 to 2017 at the *Centre me-*

dico-chirurgicale d'urologie de Douala. We consulted the clinical records of patients with symptomatic prostate pathologies who underwent transurethral prostate resection with the help of a bipolar Olympus generator. We included all patients who underwent B-TURP at our center from 2015 to 2017 and excluded those with incomplete clinical records. In the end, we recruited a total of 112 patients in this study. The data we obtained from the participants' clinical records included patients' age, histological classification (for cases of malignancy), initial clinical presentation, digital rectal examination findings, patients' initial prostate-specific antigen (PSA) levels, patients' prostate diameter on transrectal ultrasound (TRUS), initial and final international prostate symptom score (IPSS), patients' initial and final quality of life, patients' initial and final maximum urine flow rate (Qmax), indication for the surgery, surgery duration, the amount of fluid used during surgery, duration of the indwelling catheter (days), duration of postoperative complications, and postoperative complications. The digital rectal examination findings were unremarkable if there was no suspicion of prostate cancer and positive if prostate cancer was suspected upon palpation of the prostate. The IPSS score was assessed using a standardized questionnaire (IPSS questionnaire) that contains seven questions on the obstructive and irritative symptoms of prostatism, with each question scored from 0 to 5, with 0 indicating the complete absence of the symptom and 5 indicating the constant presence of the symptom (**Figure 1**). This questionnaire also contains a question on the patient's quality of life, which is scored from 0 to 6, with 0 indicating the best possible quality of life and 6 indicating the worst possible quality of life. With this questionnaire, the total score ranges from 0 to 35, with 0 - 7 being mildly symptomatic, 8 - 19 moderately symptomatic, and 20 - 35 being severely symptomatic. Surgery is usually indicated for severely symptomatic patients. Uroflowmetry was also performed in all patients before and after surgery to evaluate the Qmax. A Qmax of >15 ml/s is considered normal while a Qmax of <10 ml/s is considered abnormal [12].

Before surgery, all the patients consulted an anesthetist and did certain laboratory tests. These included a complete blood count, blood urea, serum creatinine, prothrombin time, kaolin-cephalin coagulation time, and urinalysis. This was to ensure that the patients had satisfactory blood cell counts, hemoglobin levels, kidney function indexes, and sterile urine before the surgery since a urinary tract infection of any kind is a contraindication to this mini-invasive procedure.

The patients underwent transurethral prostate resection with the help of a bipolar Olympus generator. All the interventions were carried out by the same urologist. The data collected from the patients' clinical records were entered into Microsoft Excel 2016 and then exported to Epi info 7 for statistical analysis. This study was approved by the institutional review board of the Faculty of Medicine and Pharmaceutical Sciences (FMPS) of the University of Douala and by the ethical committee of the *Centre medico-chirurgicale d'urologie* in Douala, Cameroon. The requirement for patients' informed consent was waived due to the

retrospective nature of the study. Continuous variables were presented as mean values and standard deviations for normally distributed data and as median values with interquartile ranges for data with skewed distributions. The independent samples t-test was used to compare between normally distributed continuous variables while the Mann-Whitney U test was used to compare continuous variables with skewed data distributions. The chi-square test and the Fisher exact test were used to compare categorical variables. Values of $P < 0.05$ were considered statistically significant.

3. Results

The ages of the participants ranged from 44 years to 85 years, with a mean age of 64.41 ± 9.5 years. Out of the 112 patients, 73 (65.18%) had benign prostatic hypertrophy (BPH) while 39 (34.82%) had prostate cancer. Fifty-six (50%) patients presented with only obstructive symptoms, five (4.46%) had only irritative symptoms, twenty (17.86%) presented with both obstructive and irritative symptoms, eight (7.14%) presented with macroscopic hematuria, seven (6.25%) with urinary tract infections, and sixteen (14.29%) with acute urinary retention. Digital rectal examination was unremarkable in 74 (66.07%) findings and was positive in 38 (33.93%) patients. The preoperative quality of life score was 3 in 14 (12.5%) patients, 4 in 30 (26.79%) patients, 5 in 40 (35.71%) patients, and 6 in 28 (25%) patients. The preoperative IPSS scores ranged from 12 to 35, with a mean score of 24.46 ± 5.68 . The diameters of the prostate gland ranged from 30 mm to 150 mm, with a median value of 70 [59 - 86.5] mm. A total of 37 (33.04%) had diameters of 30 - 60 mm, 52 (46.43%) had diameters of 61 - 90 mm, 20 (17.86%) had diameters of 91 - 120 mm, while 3 (2.67%) had diameters of more than 120 mm. The serum PSA levels of the participants ranged from 1.5 ng/ml to 4964 ng/ml, with a median value of 15 [7 - 58] ng/ml. Seventy-three (65.18%) of participants had serum PSA levels of 0 - 20 ng/ml, 25 (22.32%) of them had levels of 20 - 100 ng/ml, and 14 (12.5%) participants had PSA levels of more than 100 ng/ml. The preoperative Qmax ranged from 4 ml/s to 15 ml/s, with a mean value of 9.85 ± 3.03 ml/min. The preoperative QoL score ranged from 3 to 6, with a mean score of 4.73 ± 0.98 . The indication for surgery was failure of medical treatment in 61 (54.46%) participants, recurrent urinary tract infections (UTIs) in 3 (2.68%) participants, acute urinary retention in 4 (3.57%) participants, prostatic adenocarcinoma in 31 (27.68%) participants, and it was the patient's choice in 13 (11.61%) participants. The preoperative profiles of the study participants are presented in **Table 1**.

The duration of the surgery ranged from 15 minutes to 150 minutes, with a mean duration of 77.61 ± 23.87 minutes. The volume of irrigation fluid used during the surgery ranged from 15 ml to 45 ml, with a mean volume of 24.84 ± 6.40 ml. The number of days of hospitalization was 2 in 29 (25.89%) participants and 3 in 83 (74.11%) participants. The average number of days of hospitalization was 2.74 days. Twenty-nine (25.89%) patients were hospitalized for two days

International Prostate Symptom Score (I-PSS)

Patient Name: _____ Date of birth: _____ Date completed _____

| In the past month: | Not at All | Less than 1 in 5 Times | Less than Half the Time | About Half the Time | More than Half the Time | Almost Always | Your score |
|--|------------|------------------------|-------------------------|---------------------|-------------------------|---------------|------------|
| 1. Incomplete Emptying How often have you had the sensation of not emptying your bladder? | 0 | 1 | 2 | 3 | 4 | 5 | |
| 2. Frequency How often have you had to urinate less than every two hours? | 0 | 1 | 2 | 3 | 4 | 5 | |
| 3. Intermittency How often have you found you stopped and started again several times when you urinated? | 0 | 1 | 2 | 3 | 4 | 5 | |
| 4. Urgency How often have you found it difficult to postpone urination? | 0 | 1 | 2 | 3 | 4 | 5 | |
| 5. Weak Stream How often have you had a weak urinary stream? | 0 | 1 | 2 | 3 | 4 | 5 | |
| 6. Straining How often have you had to strain to start urination? | 0 | 1 | 2 | 3 | 4 | 5 | |
| | None | 1 Time | 2 Times | 3 Times | 4 Times | 5 Times | |
| 7. Nocturia How many times did you typically get up at night to urinate? | 0 | 1 | 2 | 3 | 4 | 5 | |
| Total I-PSS Score | | | | | | | |

Score: 1-7: *Mild* 8-19: *Moderate* 20-35: *Severe*

| Quality of Life Due to Urinary Symptoms | Delighted | Pleased | Mostly Satisfied | Mixed | Mostly Dissatisfied | Unhappy | Terrible |
|---|-----------|----------|------------------|----------|---------------------|----------|----------|
| If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that? | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Figure 1. The IPSS questionnaire.

Table 1. Preoperative profiles of the study participants.

| Variable | N (%) |
|-------------------------------------|------------|
| Age (years) | |
| 40 - 50 | 12 (10.71) |
| 51 - 60 | 29 (25.89) |
| 61 - 70 | 42 (37.50) |
| 71 - 80 | 25 (22.32) |
| >80 | 4 (3.57) |
| Pathology | |
| Benign prostatic hypertrophy | 73 (65.18) |
| Prostate cancer | 39 (34.82) |
| Symptoms | |
| Obstructive symptoms only | 56 (50) |
| Irritative symptoms only | 5 (4.46) |
| Obstructive and irritative symptoms | 20 (17.86) |
| Macroscopic hematuria | 8 (7.14) |
| Urinary tract infections | 7 (6.25) |
| Acute urinary retention | 16 (14.29) |
| Digital rectal examination | |
| Unremarkable | 74 (66.07) |
| Positive | 38 (33.93) |
| QoL score | |
| 3 | 14 (12.50) |
| 4 | 30 (26.79) |
| 5 | 40 (35.71) |
| 6 | 28 (25.00) |
| IPSS score | |
| 0 - 7 | 0 (00) |
| 8 - 19 | 29 (25.89) |
| 20 - 35 | 83 (74.11) |
| Prostate diameter (mm) | |
| 30 - 60 | 37 (33.04) |
| 61 - 90 | 52 (46.43) |
| 91 - 120 | 20 (17.86) |
| >120 | 14 (12.50) |
| Serum PSA level (ng/ml) | |
| 0 - 20 | 73 (65.18) |
| 21 - 100 | 25 (22.32) |
| >100 | 14 (12.50) |

Continued

| Qmax (ml/s) | |
|------------------------------------|-------------|
| <10 | 49 (43.75) |
| 10 - 15 | 63 (56.25) |
| >15 | 0 |
| Indication for surgery | |
| Treatment failure | 61 (54.46) |
| Prostatic adenocarcinoma | 31 (27.68%) |
| Choice | 13 (11.61%) |
| Acute urinary retention | 4 (3.57%) |
| Recurrent urinary tract infections | 3 (2.68%) |

while 83 (74.11%) were hospitalized for three days. The duration of the indwelling catheter ranged from 1 day to 5 days, with a mean duration of 2.60 ± 1.28 days. Most of our study participants (108, 97.30%) experienced no postoperative complications. Only 4 (3.57%) of the study participants experienced postoperative complications. Of these four, two had acute urinary retention, one had a urinary tract infection, and another one experienced multiple clot formation. All the patients with complications were managed within the next few days. In each patient with acute urinary retention, an indwelling urinary catheter was left in place for five days and removed thereafter. The patient with a urinary tract infection was treated using intravenous carbapenem for seven days during which an indwelling urinary catheter was left in place. The catheter was removed thereafter and the infection was resolved. The patient with multiple clot formation underwent surgical removal of these clots under spinal anesthesia, during which hemostasis of the bleeding vessel responsible for clot formation was performed through electrocautery. After the repeat surgery, an indwelling three-way catheter was left in place for two days. All postoperative complications were managed within a week of their occurrence. The postoperative Qmax ranged from 15 ml/s to 32 ml/s, with a mean value of 22.46 ± 4.69 ml/min. The difference between the preoperative and postoperative Qmax values was statistically significant ($P < 0.001$). The postoperative QoL score ranged from 0 to 2, with an average score of 0.56. There was a significant improvement in the quality of life ($P < 0.001$). The postoperative IPSS scores ranged from 2 to 15, with a mean value of 7.85 ± 3.10 . The difference between the preoperative and postoperative mean IPSS scores was statistically significant ($P < 0.001$). The intraoperative and postoperative features of the study participants are presented in **Table 2**.

4. Discussion

This study aimed to evaluate the results of bipolar transurethral prostate resection in a single urology center in Cameroon. We recruited a total of 112 patients with symptomatic prostate pathologies who underwent transurethral prostate

Table 2. Intraoperative and postoperative characteristics of the study participants.

| Variable | N (%) |
|---|-------------|
| Surgery duration (minutes) | |
| 0 - 60 | 36 (32.14) |
| 61 - 120 | 74 (66.07) |
| >120 | 2 (1.79) |
| Volume of fluid used (ml) | |
| 15 - 20 | 24 (21.43) |
| 21 - 30 | 75 (66.96) |
| 31 - 40 | 10 (8.93) |
| >40 | 3 (2.68) |
| Duration of hospitalization (days) | |
| 2 | 29 (25.89) |
| 3 | 83 (74.11) |
| Duration of indwelling catheter (days) | |
| 1 | 5 (4.46) |
| 2 | 83 (74.11) |
| 5 | 24 (21.43) |
| Complications | |
| None | 108 (97.30) |
| Acute urinary retention | 2 (1.79) |
| Urinary tract infection | 1 (0.89) |
| Clot formation | 1 (0.89) |
| IPSS score | |
| 0 - 7 | 57 (50.89) |
| 8 - 19 | 55 (49.11) |
| 20 - 35 | 0 (00) |
| Quality of life | |
| 0 | 52 (46.43) |
| 1 | 57 (50.89) |
| 2 | 3 (2.68) |
| Qmax (ml/s) | |
| >15 | 112 (100) |

resection with the help of a bipolar Olympus generator. The mean age of our study participants was 64.41 ± 9.5 years, which is similar to the 68.7 ± 7.1 reported by Pougla *et al.* in 2021 [13]. This similarity in the mean age can be explained by the fact that symptoms of prostatism, especially severe symptoms, usually occur in men of this age group. Obstructive symptoms were the main

presenting complaints of our study participants, which was expected since these symptoms are usually the first to occur and are more common in patients with prostatism, as was reported in the study by Liu *et al.* in 2003 [14]. The mean surgery duration was 77.61 ± 23.87 minutes, which is higher than the 55.71 ± 13.46 reported by Pougla *et al.* in 2021 [13]. This difference is probably because the prostate glands of our patients were relatively larger (median prostate diameter: 70 [59 - 86.5] mm, which corresponds to a median prostate volume of approximately 179.67 cc) than those in the study by Pougla *et al.* (they reported a mean prostate volume of 51 ± 9.85 cc in the B-TURP group), which means that we had more prostate tissue to resect than they did. Thanks to the experience we have acquired over the years, we can afford to take on such larger prostate glands during the B-TURP procedure, which comes with an increase in the surgery duration. The mean volume of irrigation fluid used during surgery was 24.84 ± 6.40 ml, which is lower than the 68.7 ml reported by Jeje *et al.* in 2021 [15]. This difference can be explained by the fact that, unlike Jeje *et al.* who carried out monopolar resection, we did not use a suprapubic trocar in our procedure. This means we did not continually recycle the fluid in the bladder during our study. Furthermore, the flow of saline into the bladder during our B-TURP procedure was intermittent and not continuous. Each time there was overt bleeding, a small amount of fluid was irrigated to clear off the blood from the surgeon's visual field and continue the procedure. Since the intraoperative blood loss during our surgical procedure was minimal, we did not need to frequently clear the surgeon's visual field using irrigation fluid, which further explains the small volume of this fluid used during our surgical procedures. The average duration of hospitalization in our study was 2.74 days, which is higher than the 32 hours reported by Mertziotis *et al.* in 2015 [16]. This difference is mainly because, in the Cameroonian context, patients are not yet used to endoscopic procedures. As such, they are skeptical about getting discharged so soon after the procedure and prefer to stay for longer in the hospital. We are positive that as the years go by and endoscopic procedures become more common in our resource-limited setting, patients will feel more comfortable going home within 24 hours of the end of mini-invasive surgical procedures. The prevalence of postoperative complications in our study was 3.57%, which is approximately double the rate reported by Sugihara *et al.* in 2012 [17]. This difference could be explained by the fact that we worked on relatively larger prostate glands, which increased the duration of our interventions. The longer duration of our interventions predisposed our patients to a higher rate of complications than is reported in the literature. The most common postoperative complication in our study was acute urinary retention, which accounted for 50% of all complications. This could be caused by incomplete resection of the prostate, blood clots that end up blocking the flow of urine, or pieces of tissue from the resected prostate that block the bladder outlet [18]. The urinary retention could also be due to underactive bladders caused by the prolonged presence of urinary catheters in the

bladder after the intervention [19]. Of the two cases of urinary retention that occurred as postoperative complications, one was caused by underactive bladder while the other was due to bladder outlet obstruction by pieces of resected prostate tissue. That notwithstanding, the complications we observed in our study were easily managed and the patients did not have to spend much time in the hospital. We observed significant improvements in the IPSS score, Qmax, and quality of life with the B-TURP technique, which is similar to the findings of Mertziotis *et al.* in 2015 [16]. This finding confirms the efficacy of B-TURP and further explains why it is currently the gold standard technique for prostate resection. However, our study had a few limitations. First, the retrospective study design means there was recall bias involved. Second, we recruited only patients that underwent B-TURP with no patients that underwent M-TURP. This means that we could not demonstrate via comparisons that B-TURP is better than M-TURP in this study. We suggest that a comparative prospective study between M-TURP and B-TURP be carried out in the future.

5. Conclusion

Endoscopic resection of the prostate is the gold standard technique for prostate resection in patients with prostatism. There are different endoscopic techniques, including monopolar resection and bipolar resection. Bipolar resection has the advantage of enabling surgeons to perform resections for much larger prostate glands since the procedure can last longer, mainly thanks to the better hemostasis and reduced occurrence of the TUR syndrome associated with this technique. The bipolar technique is also associated with a reduction in prostate-related morbidity.

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Availability of Data and Materials

The data analyzed in this study are available from the corresponding author upon reasonable request.

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Ethics Statement

Ethical approval was obtained from the institutional review board of the Faculty of Medicine and Pharmaceutical Sciences and the ethics committee of the *Centre medico-chirurgical d'urologie* in Douala, Cameroon. The requirement for informed consent was waived due to the retrospective nature of the study.

Conflicts of Interest

The authors have no conflicting interests to declare.

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Primary Prostatic Tuberculosis: A Rare Entity

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Abstract

Objectives: To clarify the clinical, histological and therapeutic features of prostatic tuberculosis. **Methods:** We conducted a single-centre retrospective descriptive study of all patients presenting with prostatic tuberculosis between January 2002 and December 2020. Patients who were lost to follow-up, could not be reached by telephone or whose records were not usable were excluded from this study. **Results:** 240 patients were treated for urogenital tuberculosis, including 13 for isolated prostatic tuberculosis. The average age of the patients was 75 years. None of our patients had a history of tuberculosis. The average of international prostate symptom score (IPSS) was 27. Lower urinary tract symptoms in the filling phase were predominant. The digital rectal examination was suspicious in only one patient. The mean preoperative PSA was 9.24 ng/ml. 46.15% of patients underwent transurethral resection of the prostate and 53.85% underwent ultrasound-guided prostate biopsy. Histological examination showed epithelioid giantocellular granuloma with isolated caseous necrosis in 61.53% of patients and associated adenomyomatous hyperplasia in 38.47% of patients. Antituberculosis treatment was given for 6 months. The average of follow up was 15 months. All patients reported an improvement in clinical signs with a mean post operative IPSS score of 17 and a normalisation of PSA levels. **Conclusion:** Isolated prostatic tuberculosis is a rare entity, it can simulate a cancer. In front of the symptoms of the lower urinary tract, the clinicians must think of it especially in the developing countries where tuberculosis still prevails in an endemic state.

Keywords

Prostatic Tuberculosis, Epithelioid Giantocellular Granuloma,

1. Introduction

Tuberculosis remains a priority public health issue for the World Health Organization (WHO). It is a real public health problem in our country and all in developing countries. Globally, no country has ever been able to eradicate TB. Urogenital tuberculosis accounts for 30% - 40% of extra-pulmonary localisations [1]. Prostate involvement is still rare and is usually diagnosed by histopathological analysis of prostate resection or biopsy specimens [2]. Few studies have been found in the literature with 5 cases as the longest series. The aim of our study was to clarify the clinical, histological and therapeutic features of isolated prostatic tuberculosis in 13 cases diagnosed and treated in our department.

2. Patients and Methods

We conducted a single-centre retrospective descriptive study of all patients with prostatic tuberculosis managed in our institution: Urology department of Rabta Hospital, Tunis, Tunisia, between January 2002 and December 2020. To be included, patients should be at least 14 years old at the time of diagnosis. Patients who were lost to follow-up, could not be reached by telephone or whose records were not usable were excluded from this study. All data were collected from the clinical records using a standardised data collection form. This included data on the history, clinical examination, routine biological examinations, necessary radiological investigations, treatment modalities as well as the evolution. The clinical and para-clinical data were entered into an Excel table (Microsoft Excel® 2008). The means used for continuous variables and the percentage for qualitative variables were determined using the calculation functions of Excel® 2008.

3. Results

Two hundred and forty patients were treated for urogenital tuberculosis, including 13 for isolated prostatic tuberculosis. The average age of the patients was 75 years (57 - 86 years). None of our patients had a history of tuberculosis. The vaccination status of our patients was considered correct in all patients. The average of IPSS was 27. Lower urinary tract symptoms were present in all patients, with a predominance of irritative signs. The digital rectal examination was suspicious in only one patient with a nodular consistency. Renal and vesicoprostatic ultrasound revealed an enlarged prostate with significant post-void residual in 61.54% of cases (Figure 1).

The mean prostate size was 52 mL (40 - 80 mL). The mean preoperative PSA was 9.24 ng/mL (0.78 - 50 ng/mL). 6 patients (46.15%) underwent transurethral resection of the prostate for failure of medical treatment of benign prostatic hypertrophy and 7 (53.85%) underwent ultrasound-guided prostate biopsy for



Figure 1. Homogeneous prostate hypertrophy with significant post-void residual.

suspected prostate cancer. The histological examination showed epithelioid gigantocellular granuloma with isolated caseous necrosis in 61.53% of patients and associated adenomyomatous hyperplasia in 38.47% of patients (**Figure 2** and **Figure 3**).

All patients tested negative for Koch's bacillus (BK) in urine and sputum. Intravenous urography (IVU), performed in all patients, found no evidence of urinary TB lesions. Antituberculosis treatment was indicated in all cases combining two major (rifampicin, isoniazid) and two minor (pyrazinamide and ethambutol) antituberculosis drugs taken once daily for 2 months, followed by a combination of two major antituberculosis drugs (rifampicin, isoniazid) for 4 months with good clinical and biological tolerance. (**Table 1** summarises all patients.)

The average follow-up time was 15 months. All patients reported improvement in lower urinary tract signs. The mean postoperative IPSS was 17. Three patients still had urinary urgency treated with anticholinergics with good clinical response. The PSA level normalized after 4 months of treatment.

4. Discussion

Urogenital tuberculosis accounts for 10% - 14% of all extra-pulmonary localisations of tuberculosis [3]. Isolated prostate tuberculosis is still rare. It was first described in 1882 by Jasmin [4]. The incidence of isolated prostatic localization has been estimated at 6.6% [3]. Primary prostatic involvement remains exceptional, particularly in immunocompetent subjects [5], and is often discovered incidentally following trans-urethral resection of the prostate or following prostate biopsies [6]. The routes of transmission are downward following an upper urinary tract infection, the haematogenous route, the lymphatic route and more rarely following endo-vesical instillation of Bacillus Calmette-Guerin or by sexual transmission [7]. Clinically, patients are often asymptomatic or present with a non-specific symptomatology consisting of urinary disorders during the filling or emptying phase. However, persistent haemospermia should alert the clinician [8]. In advanced cases, destruction of the prostatic parenchyma leads to a reduction

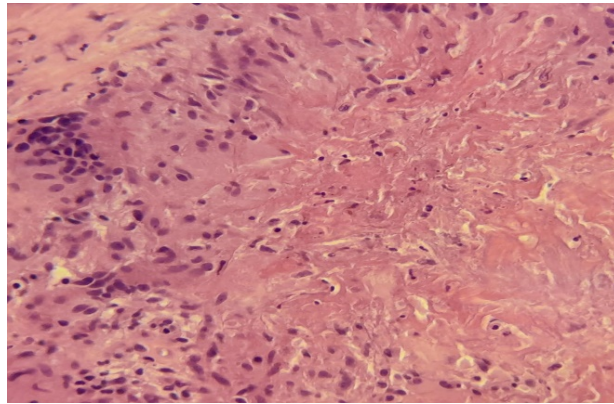


Figure 2. Epithelioid and giantcellular granuloma centred by caseous necrosis. (HE ×40).

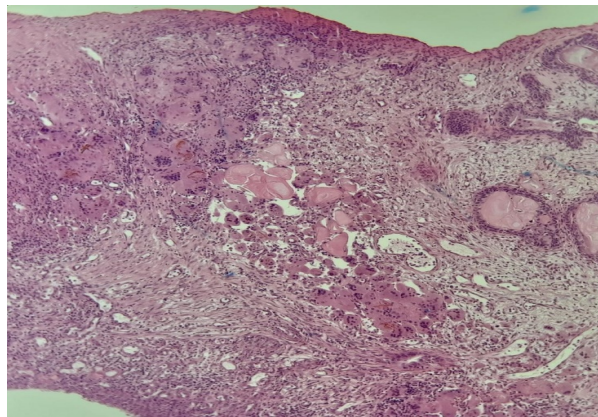


Figure 3. Granulomatous inflammatory changes in the prostatic parenchyma (HE ×10).

Table 1. Summary of all patients.

| patients | Age | History of pulmonary TB | Clinical feature | IPSS | Digital rectal examination | Serum PSA | Urine for AFB stain, and urine culture for TB | Renal and vesicoprostatic ultrasonography with RPM | Chest x-ray/IVU | Histopathological examination | Treatment anti TB and follow up |
|----------|-----|-------------------------|---|------|---|-----------|---|--|-----------------|-------------------------------|---------------------------------|
| 1 | 77 | No | LUTS with predominantly irritative voiding symptoms | 26 | Enlarged prostate | 7.36 | Negative | only prostatic hypertrophy 450 cc | NAD | PTB + BPH | Combined form Recovered |
| 2 | 57 | No | LUTS with predominantly irritative voiding symptoms | 32 | Enlarged prostate | 10.26 | negative | only prostatic hypertrophy 250 cc | NAD | PTB | Combined form Recovered |
| 3 | 73 | No | Irritative voiding symptoms and dysuria | 30 | Enlarged prostate and elastic consistency | 2.26 | negative | only prostatic hypertrophy 50 cc | NAD | PTB | Combined form Recovered |
| 4 | 86 | No | Irritative voiding symptoms and dysuria | 25 | Enlarged prostate | 11.73 | negative | only prostatic hypertrophy 160 cc | NAD | PTB | Combined form Recovered |
| 5 | 77 | No | LUTS with predominantly irritative voiding symptoms | 30 | Enlarged prostate and elastic consistency | 10 | negative | only prostatic hypertrophy 200 cc | NAD | PTB | Combined form Recovered |

Continued

| | | | | | | | | | | | |
|----|----|----|---|----|---|------|----------|---|-----|-----------|----------------------------|
| 6 | 68 | No | Irritative voiding symptoms and dysuria | 29 | Enlarged prostate An elastic consistency | 12 | negative | only prostatic hypertrophy 150 cc | NAD | PTB | Combined form Recovered |
| 7 | 80 | No | LUTS with predominantly irritative voiding symptoms | 26 | Enlarged prostate | 2.36 | Negative | only prostatic hypertrophy 360 cc | NAD | PTB + BPH | Combined form Recovered |
| 8 | 77 | No | Irritative voiding symptoms and dysuria | 30 | Enlarged prostate | 1.39 | Negative | only prostatic hypertrophy 50 cc | NAD | PTB | Combined form Recovered |
| 9 | 78 | No | LUTS with predominantly irritative voiding symptoms | 28 | Enlarged Prostate with nodular consistency | 50 | Negative | Hypoechoic nodule calcification 210 cc | NAD | PTB | Combined form Recovered |
| 10 | 69 | no | LUTS with predominantly irritative voiding symptoms | 26 | Enlarged prostate | 0.78 | negative | only prostatic hypertrophy 30 cc | NAD | PTB + BPH | Combined form Recovered |
| 11 | 83 | no | Irritative voiding symptoms and dysuria | 24 | Enlarged prostate | 8 | Negative | Prostatic hypertrophy 50 cc | NAD | PTB + BPH | Combined form Recovered |
| 12 | 67 | No | Luts with dysuria and irritative symptoms | 26 | Enlarged prostate | 2 | Negative | Prostatic hypertrophy 150 cc | NAD | PTB + BPH | Combined form Recovered |
| 13 | 83 | | LUTS with predominantly irritative voiding symptoms | 22 | Enlarge prostate | 2 | negative | Prostatic hypertrophy 60 cc | NAD | PTB | Combined Form Recovered |

PSA: Prostate-specific antigen, AFB: Acid-fast bacilli, PTB: Prostatic Tuberculosis, LUTS: Lower urinary tract symptom, ATT: Antituberculosis treatment, NAD: Not associated with disease, IPSS: international prostate symptom score, RPM: post void residue, BPH: Benign Prostatic Hypertrophy.

in semen volume [9]. Perineal fistulisation may also be observed. On rectal examination the prostate is often firm or nodular [9]. The search for BK in urine and sputum with Ziehl-Neelsen staining can help in the diagnosis but their contribution remains low with a sensitivity of 52.7% [10]. Several molecular biology techniques on urine, based on PCR, are available with excellent sensitivity (95.59%) and specificity (98.12%), depending on the bacillary richness of the sample and the presence of amplification inhibitors (present in about 10% of samples) [10]. Diagnosis is confirmed by pathological examination of the resection shavings or prostate biopsy specimens. The lesion found is epithelioid and gigantocellular granuloma with or without central breakage necrosis. These lesions are not confined to the periductal area as can be seen in non-specific granulomatous prostatitis [7]. Endorectal ultrasound can show hypoechoic lesions or calcifications mainly in the peripheral part of the gland [10]. Computer tomography scan can also show these lesions more specifically. Magnetic resonance imaging is also helpful in the diagnosis, showing nodular or diffuse lesions mainly in the peripheral zone [11]. The first-line treatment is medical, identical to that for pulmonary tuberculosis. It consists of an initial four-drug regimen of

isoniazid (4 - 5 mg/kg/d), rifampicin (10 mg/kg/d), ethambutol (15 - 20 mg/kg/d) and pyrazinamide (20 - 25 mg/kg/d) for two months, followed by dual therapy with rifampicin and isoniazid for four months [12]. Surgical treatment is only indicated for cases that do not respond to well-managed medical treatment [13]. It consists of removal of the lesions, with or without endoscopic or open drainage. Medical treatment usually results in a favourable outcome. Our study being retrospective and only based on the clinical records of the patients could taint the added value of the study.

5. Conclusion

Isolated prostatic tuberculosis is rare. It may simulate prostate cancer or be associated with benign prostatic hypertrophy. Histological examination is essential for diagnostic confirmation. The simple and classic anti-tuberculosis treatment is very effective. More than the treatment, it is the early diagnosis of the infection that remains to be improved. Clinicians must have a high index of suspicion of tuberculosis, in particular in patients with lower urinary tract symptoms from endemic zones.

Consent

Written informed consent was obtained from the patients for publication of this series and accompanying images.

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None.

Author Contribution for-Profit Sectors

All authors have contributed to this work and have read and approved the final version of the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Fracture of the Penis: About a Case of Delay in Management at the Nianankoro Fomba Hospital in Segou-Mali

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Abstract

Introduction: Fracture of the penis is a rare uro-andrological emergency defined as the rupture of the tunica albuginea of the erect penis most often during sexual intercourse. Surgical exploration and repair of the albuginea breach as soon as possible are the standard treatment. However, in our African context, early diagnosis and management are negatively influenced by the delay in consultation due to modesty. Our objective was to describe the clinical and therapeutic aspects of the fracture of the penis seen late in the African context and to compare it with the literature review. **Presentation of the case:** Our aim was to report our experience in the management of late-onset fracture of the penis, after more than 48 hours of evolution, by reporting the observation of a 54-year-old patient, who had a false coitus, treated in the urology department of the Nianankoro Fomba Hospital. The physical examination revealed a deformation of the penis following the formation of a large hematoma with a characteristic eggplant appearance. Therapeutically, a suture of the albuginea was performed with simple follow-up. **Conclusion:** This case study shows a delay in the management of this emergency due to the reluctance of the patient to be consulted as soon as possible for reasons of modesty. A delayed emergency surgical management was the only therapeutic alternative and the coronal incision with degloving was the only way to ap-

proach the voluminous hematoma related to the delay in management.

Keywords

Penis, Fracture, Corpora Cavernosa, Albuginea, Nianankoro Fomba Hospital

1. Introduction

Fracture of the penis is a rare uro-andrological emergency defined as the rupture of the tunica albuginea of the erect penis most often during sexual intercourse.

The main cause is the coital faux pas, where the erect penis strikes the pubic symphysis or the partner's perineum [1]. The diagnosis of a fracture of the penis is based on a typical clinical presentation associating a rapid detumescence of the penis, the formation of a hematoma, a cracking sound and a deformation of the penis. Urethral involvement must be systematically sought during the clinical examination in search of macroscopic or microscopic hematuria or acute retention of urine. In case of diagnostic doubt or before performing an elective approach, imaging should be performed, with penile MRI or ultrasound as the first option.

Surgical exploration and repair of the albuginea breach as soon as possible are the reference treatment with possibly an elective approach for trained operators in the case of a clearly localized fracture line. The coronal incision with degloving is the reference approach allowing a complete exploration with an associated lesion assessment despite the more important postoperative complications. The surgical treatment consists of evacuating the hematoma, performing hemostasis, trimming and suturing the tear of the albuginea. A lesion of the urethra should be sought and sutured if present [1]. The management of a fracture of the penis must be done as a matter of urgency; however, in Mali, modesty has a negative impact on the arrival of certain patients in health facilities.

Our aim was to report our experience in the management of a fracture of the penis after more than 48 hours of evolution by reporting the observation of a patient treated in the urology department of the Nianankoro Fomba Hospital. Our objective was to describe the clinical and therapeutic aspects of the fracture of the penis in the African environment and to compare it with the literature review.

2. Observation

We report a case of fracture of the penis after 48 hours of evolution in a 54-year-old patient. The patient, married, polygamous and father of 6 children, was referred from a referral health center that had received him 48 hours after the accident. Upon admission to the hospital the next day, the interrogation revealed the notion of sexual intercourse.

The patient would have made a false step of coitus with reception of the penis

in erection on the pubis of the spouse, he would have heard a cracking followed by the immediate loss of the erection with installation of a sharp pain and a swelling of the genitals for which he took an anti inflammatory without success. No particular history was found in the patient.

I On physical examination a Peno scrotal edema was found with characteristic appearance of eggplant penis (**Figure 1**).

The Rolling Sign was negative.

A Doppler ultrasound of the corpora cavernosa showed on a longitudinal section, an irregularity of the left corpora cavernosa at the median level of the penis, a spongy body on both sides of the urethra of homogeneous structure (**Figure 2**).

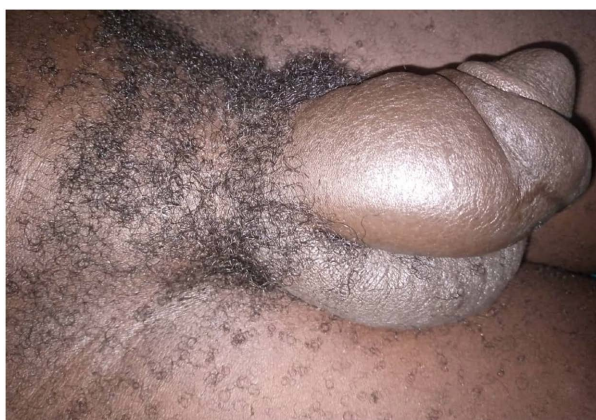


Figure 1. Appearance of the eggplant penis.

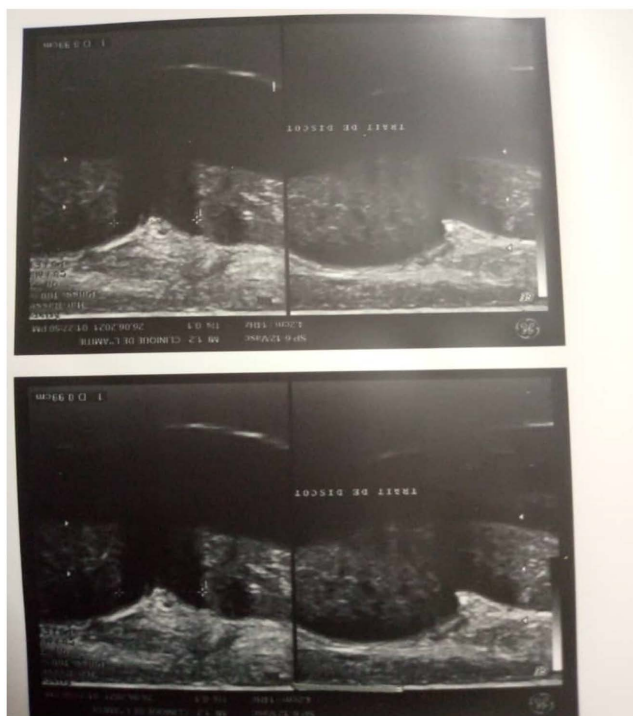


Figure 2. Ultrasound result.

The blood count (CBC) came back normal.

The coagulability test was normal.

The patient was grouped B+ (positive).

Therapeutic management was surgical. However, certain prerequisites were taken into account, such as the use of an ice bladder, a lightly compressive bandage, antibiotic prophylaxis and ketoprofen-based anti-inflammatory treatment.

For the surgical treatment, the patient was placed in dorsal decubitus position under locoregional anesthesia (spinal anesthesia).

We proceeded to a coronal incision, to a degloving to the root of the penis (**Figure 3**).

Exploration revealed a **haematoma** which was evacuated by a longitudinal incision of Buck's fascia, exposing a **breach of** the albuginea of the left corpora cavernosa measuring 20 mm, the urethra was found to be free of lesions (**Figure 4, Figure 5**).

The procedures performed were evacuation of the hematoma, lavage with saline and suturing of the albuginea in separate stitches with 3/0 vicryl (**Figure 6, Figure 7**).

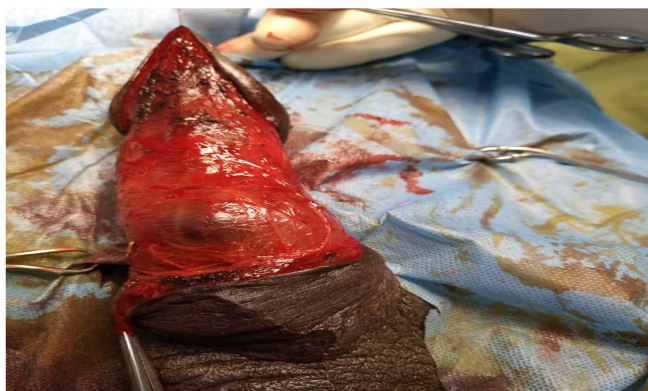


Figure 3. Operative view of the removal of the penis.

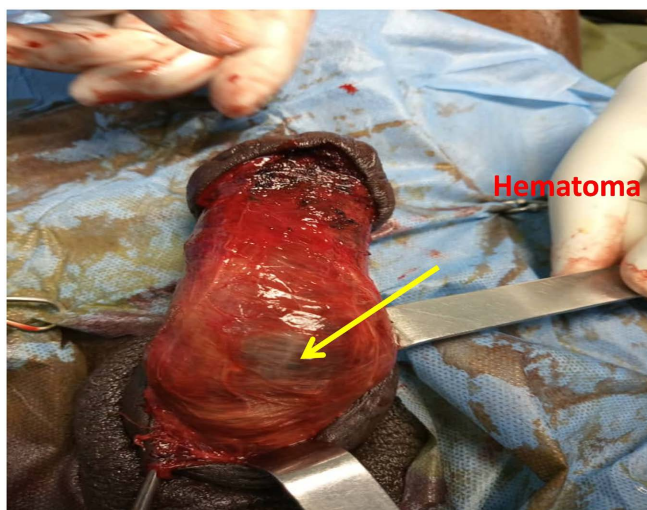


Figure 4. Surgical view of the hematoma.

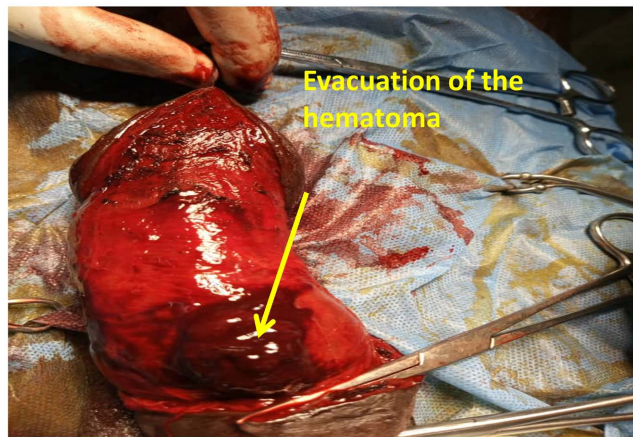


Figure 5. Surgical view of the evacuation of the hematoma.

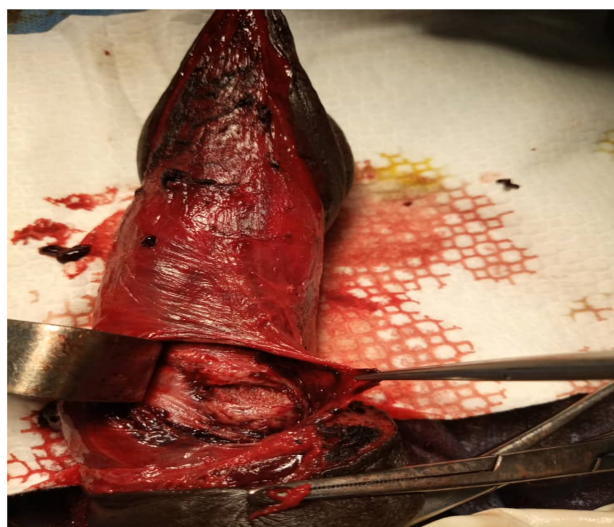


Figure 6. Surgical view of the breach of the albuginea of the corpus cavernosum.

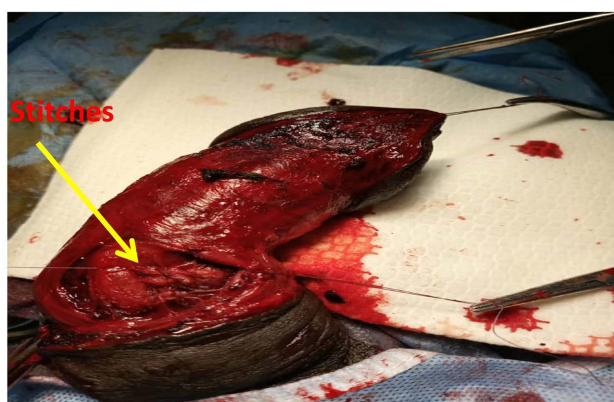


Figure 7. Suture of the albuginea breach of the corpus cavernosum.

We then performed an overjet suture of Buck's fascia with 3/0 Vicryl and a coronal suture in separate points with 2/0 Vicryl. The immediate postoperative course was simple (**Figure 8**).

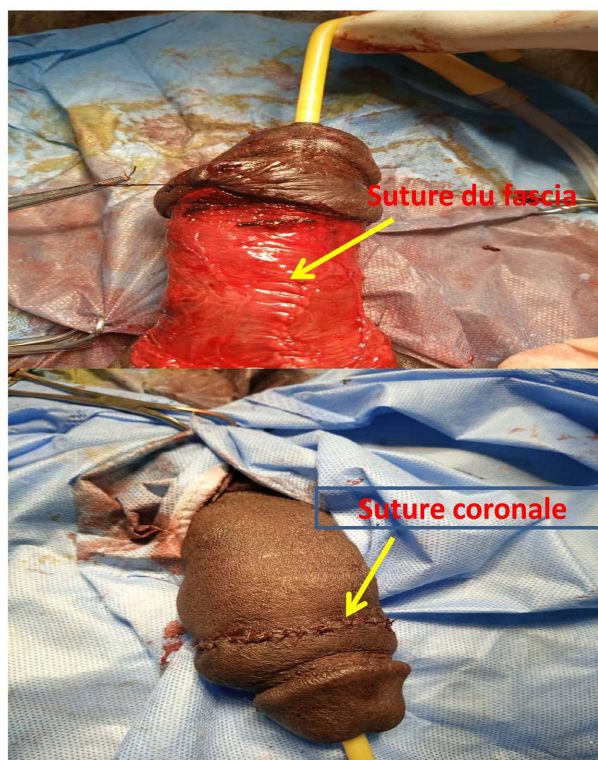


Figure 8. Surgical view of closure (Buck's fascia suture and coronal suture).

An anti-androgenic treatment (androcur) was instituted for one month in order to avoid the physiological nocturnal erection before healing as well as an analgesic and anti-inflammatory treatment (**Figure 9**).

The patient was seen again three months after the operation, without any particular sign and with a preserved erection (**Figure 10**).

3. Discussion

3.1. Hospital Frequency

The extreme rarity of this accident in our context, which is evidenced by the reporting of only one case in 9 years (from October 2013 to September 2021) is probably related to the under-reporting of cases. For reasons of modesty, a certain number of patients tend to want to conceal the accident and therefore do not come to the care structures.

They generally resort to traditional therapies. Socio-cultural aspects in the African environment make everything related to sex a taboo subject. This is a limiting factor for care. Previous studies have noted the negative interference of this modesty leading to an underestimation of the hospital frequency of fracture of the penis [2] [3] [4]. In 66 years, Eke et al in a review of the literature counted 1331 cases reported by 183 publications worldwide [5].

Age: Our patient, 54 years old, is relatively older than those reported in several previous studies. One of the series reported a mean age of the patients estimated at 38.3 years with extremes of 30 and 43 years [3].



Figure 9. Postoperative result on day 9.

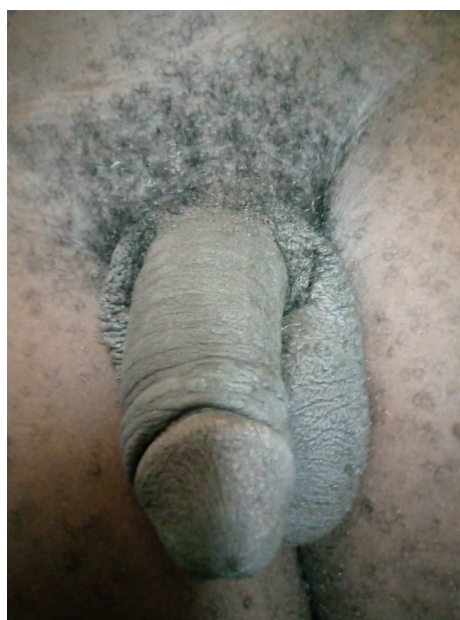


Figure 10. View of the penis at 30 days post-op.

The pathology is recognized as a condition that affects mainly young and sexually active adults [2] [4] [6].

3.2. Etiology or Mechanism

In our patient it was a coitus faux pas. This is the most frequent cause in the western literature [7] [8] as well as in previous studies in Mali and in the sub-region. However, in the Middle East, coital malpractice is second only to untimely manipulation of the erect penis during masturbatory maneuvers, turning over in bed during sleep, or straightening up and concealing a morning erection in a promiscuous context [9] [10].

3.3. Management

The delay in management, which was more than 48 hours in our patient, was relatively long given the urgent nature of the case. This delay in requesting a consultation was related to modesty in our patient. A relatively long average de-

lay of 74 hours has been reported in a previous series. According to the authors, this delay in management was related to the reluctance of patients to consult for this reason, which is generally difficult to mention in Africa because of the modesty of the population [2] [3].

In our case, the diagnosis was made on the basis of clinical findings, although a Doppler ultrasound of the penis was performed to evaluate the lesion before surgery. The diagnosis was made after sexual intercourse with an audible cracking sound when the erect penis was accidentally landed on the partner's pubic bone, and significant edema of the penis with the characteristic appearance of an eggplant penis. In the literature the diagnosis of the fracture of the penis is clinical [11] [12] [13] [14]. Ultrasound and magnetic resonance imaging (MRI) are often used but are not essential [15] [16].

The management of our patient was surgical in accordance with the trend in the literature, the conservative treatment being more and more abandoned because of its complications. A coronal incision was made with degloving of the penis and suturing of the albuginea breach in our patient. The postoperative course was simple in our patient. This type of incision allows for better exploration and a complete lesion assessment. In addition, the scar is more aesthetically pleasing, unlike longitudinal lateral incisions opposite a corpus cavernosum, allowing an elective approach to the fracture site.

In our case, an elective approach was not possible, despite the proximal location of the fracture site, because of a large hematoma of the penis in our patient. A coronal incision with degloving was necessary in our patient because of the hematoma, which had become large due to the delay in management. In the literature, an elective approach is possible when the fracture zone is proximal and clearly identified clinically or radiologically; it is not feasible in cases of large hematoma. An incision opposite this area allows for elective repair without the need to undress the entire penis, thus shortening the operating time and making it simpler for teams not used to degrafting.

Moreover, studies have shown a lower morbidity in terms of infection, abscesses and skin necrosis in small series (10% to 24% of complications) [17]. The literature as a whole agrees on the need for emergency treatment as soon as possible, ideally within 24 hours, to avoid serious functional repercussions. Delayed surgical treatment is also recommended in cases of delayed consultation (even beyond 48 hours), according to the same surgical principles but with a higher risk of pseudoaneurysmal hematoma and postoperative complications [8].

In front of the physiological erections in our patient postoperatively, we had to use an inhibitory treatment however some authors did not advocate an erection inhibiting treatment considered unnecessary [1].

4. Conclusion

The fracture of the penis is an emergency, however in our context the modesty

impacts negatively the delay of surgical management imposing then the surgery in emergency deferred, the conservative treatment being less and less proposed nowadays [1].

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Conflicts of Interest

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

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Penile Fracture—Report on Three Cases from Cape Coast, Ghana

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Abstract

Introduction: Penile fracture is a urological emergency that occurs when the penis in an erect state suffers a blunt trauma resulting in a rupture of the tunica albuginea of either one or both corpora cavernosa. It is often caused by vigorous sexual intercourse, hence the incidence of penile fracture is under-reported. We therefore present our experience of the clinical presentation and surgical management of penile fracture. **Presentation of Cases:** We report three cases of penile fracture and all were diagnosed based on their clinical presentation and examination findings. The patients include two middle aged men and one young man, all with history of hearing a popping sound and experiencing sudden onset pain with detumescence of the penis. No radiological investigations were carried out. An emergency surgical repair was done for all patients. **Discussion:** All the patients had no urethral injury on presentation and underwent immediate surgical repair. The erectile and voiding function of each patient was preserved. **Conclusion:** The management of penile fracture involves early diagnosis and immediate surgical repair. Early intervention is necessary to preserve penile function.

Keywords

Penile Fracture. Tunica Albuginea. Corpora Cavernosa, Tunical Injury

1. Introduction

Penile fracture is a urological emergency that occurs when the penis in an erect state suffers a blunt trauma resulting in a rupture of the tunica albuginea of either one or both corpora cavernosa. It is usually caused by vigorous sexual intercourse when the penis strikes the pubic symphysis or perineum [1]. Other causes of penile fracture include rolling over onto an erect penis, masturbation, falling out of bed onto an erect penis and forceful flexion of the penis to achieve

detumescence [2].

The incidence of penile fracture is under-reported mainly because it is often of a sexual cause and the associated shyness patients feel narrating the occurrence [3]. Penile fracture is mainly a clinical diagnosis based on its peculiar history and examination findings. Patients usually describe a snapping, popping or crackling sound heard followed by a mild-severe pain and sudden detumescence of the erect penis. On examination, the penile shaft is angulated. Haematoma usually forms in the Buck's fascia and is observed as a swelling with ecchymosis along the shaft of the penis. Blood observed at the urethral meatus may indicate a urethral injury [4].

In some circumstances where history and examination findings are inconclusive or a urethral injury is suspected, imaging modalities such as ultrasonography and colour doppler, MRI, cavernography, retrograde urethrography and angiography are employed [5]. The management of penile fracture is mainly surgical. Conservative management has been associated with many complications, hence it has fallen out of favour [6].

The objective of this study is to present our experience with the clinical presentation and surgical management of penile fracture. From 2018 to 2021, three patients were admitted to the urology unit of the Cape Coast Teaching Hospital on account of penile fracture. All the patients were diagnosed clinically based on their history and examination findings. History was taken with enquiry of the duration since the time of injury, cause of injury and symptoms experienced after injury. No imaging investigation was carried out. Surgical repair was done for each patient on the same day of presentation. All patients were placed under spinal anesthesia. A distal degloving subcoronal circumferential incision was made to explore both corpora and urethra. Haematoma was identified under the Buck's fascia. After incision and drainage of the haematoma, the tunical tear was identified. The affected corpora was toileted and the edges of the tunica refreshed. The laceration was sutured in interrupted fashion, with absorbable or non-absorbable suture and the suture knots buried. Gitte's test was done to confirm full closure of defect.

All patients were given prophylactic antibiotics. All patients were also counselled on abstinence from sexual activity for a minimum of 6 weeks to allow for complete healing of the wound. Patients were followed up for a minimum of 3 months (range between 3 months - 3 years) and assessment of their erectile and voiding function was done.

2. Presentation of Cases

2.1. Case 1

A 54-year-old man with no known medical condition, presented to the emergency room with a history of a sudden onset penile pain and swelling of about 6 hours duration. The patient reported to have heard a pop sound associated with a sudden detumescence of the penis after falling on an erect penis. The patient

had no haematuria or voiding difficulty. On physical examination, the penile shaft was deformed and swollen with ecchymosis. No blood was seen at the penile meatus. The patient was clinically diagnosed with penile fracture. No imaging test was done. An emergency surgery was performed for the patient. At surgery, haematoma in Buck's fascia was identified and evacuated. A unilateral tunical tear measuring 1 cm was identified at the penoscrotal junction and repaired using an absorbable suture. No urethral injury was identified. The patient had an uncomplicated post-operative period and was discharged on post-operative day 7. No complications of voiding difficulty or erectile dysfunction were identified during the 3 years of follow-up with an uneventful recovery. Based on the International Index of Erectile Function (IIEF) score, the patient had a total of 28 out of 30 in the area of erectile function. This indicates no erectile dysfunction.

2.2. Case 2

A 60-year-old man with no known medical condition, presented to the emergency room with a history of penile swelling and pain of 12 hours duration. The patient was having sexual intercourse when he heard a pop sound associated with sudden pain and detumescence of the penis. There was no haematuria or voiding difficulty. On physical examination, the penis was angulated and swollen with ecchymosis. No blood was seen at the penile meatus. Penile fracture was diagnosed based on clinical presentation. No radiological investigations were done as no urethral injury was suspected from the history and examination. An emergency exploration and repair of tunical rupture was done. Intra-op findings included haematoma confined to the Buck's fascia and a unilateral tunical rupture located at the distal one-third of the penile shaft which measured about 1cm. No urethral injury was identified. Tunical rupture was successfully repaired using an absorbable suture. The patient had an uncomplicated post-operative period and was discharged on post-operative day 3. After 10 months of follow-up after surgery with an uneventful recovery, the patient had no voiding or erectile dysfunction. His IIEF score in the domain of erectile function was 28, indicating no erectile dysfunction.

2.3. Case 3

A 31-year-old man with no known medical condition, presented to the emergency room with a history of pain and swelling of about 9 hours duration. Patient reports of having sexual intercourse in reverse coital position when he heard a pop sound and sudden onset pain with detumescence of the penis. On physical examination, the penile shaft was angulated and swollen as shown in **Figure 1** but no ecchymosis was observed due to dark pigmented skin colour. The patient reported blood was seen from the penile meatus but had no difficulty voiding. Penile fracture was clinically diagnosed and the patient was sent to the theatre for emergency exploration and repair of tunical injury. Intra-operative findings included a haematoma confined in Buck's fascia and a 1.5 cm tear in the tunica which was identified as shown in **Figure 2** and repaired using a

non-absorbable suture (**Figure 3**). No laceration of the corpus spongiosum was observed. A urethral catheter was therefore inserted as a conservative management of the urethral injury. The contralateral cavernosum was explored but no tunical injury was identified. The patient had an uncomplicated post-operative period as shown in **Figure 4** and was discharged 2 days after surgery. He had 3 months

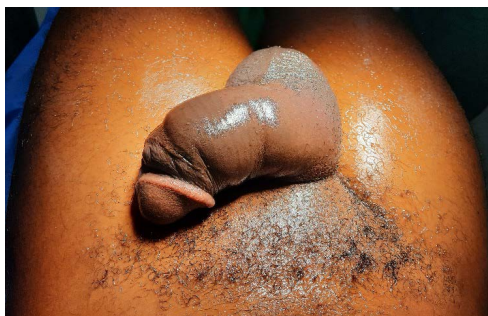


Figure 1. Swollen and deformed penile shaft (Picture by Dr Ofori).



Figure 2. Tunica albuginea tear identified (Picture by Dr Ofori).



Figure 3. Tunical tear sutured (Picture by Dr Ofori).



Figure 4. Skin incision sutured (Picture by Dr Ofori).

of follow-up with an uneventful recovery. No voiding or erectile dysfunction has been reported so far. Patient's IIEF score in the area of erectile function was 27 indicating no erectile dysfunction.

3. Discussion

In modern literature of medicine, the first published case of penile fracture was the article *der fractura penis* (German) of 1924 by Malis and Zur. Nonetheless, the earliest documentation of penile fractures dates back to a report by an Arabian physician over 10 decades ago [7].

Penile fracture is presumed to be a rare urological emergency but the true prevalence of the condition cannot be accurately ascertained in the clinical setting due to under-reporting of cases. As a result of socio-cultural perceptions surrounding the sexually related cause of the event, many feel embarrassed to report [8]. According to a study by Atat *et al.*, penile fracture occurred within the age range of 12 - 82 years and most of the patients were in their 4th decade of life [9] [10]. In this study, the three patients were in their 6th, 7th and 4th decades respectively.

Penile fractures are associated with blunt trauma to an erect penis leading to a tear in the tunica albuginea of either one or both cavernosa bodies. The tear is usually unilateral, transverse and at the proximal end of the penis [11]. During an erection, the tunica albuginea is susceptible to tear as a result of a decrease in its thickness from 2 mm in a flaccid state to 0.25 - 0.5 mm in an erect state. Beyond a threshold intra-corporeal pressure of 1500 mmHg, the tunica loses its tensile strength leading to a rupture [12]. Blood extravasates from the deep artery of the cavernosa body into the Buck's fascia forming a haematoma. In the event where the Buck's fascia ruptures, extravasated blood collects in the Dartos fascia and may spread along its fascial plane into the lower abdominal wall where it is continuous with the Scarpa's fascia. Blood may spread into the scrotum within the Dartos fascia or the perineum where it is continuous with the

Colles' fascia [13]. If the leaked blood is confined in the Colles' fascia, a "butterfly sign" may be seen [14]. From this study, haematoma was confined to the Buck's fascia in all three patients.

According to a meta-analysis done by Takir *et al.*, 46% of cases of penile fracture were caused by sexual intercourse; making up the majority of cases. Forced flexion accounted for 21% of cases, followed by masturbation, 18% [1]. Out of the three cases reported in this study, two were caused by sexual intercourse. Although the reverse coitus position is widely known to be more likely to cause a penile fracture, it was insignificant ($p = 0.59$) in the meta analysis of 5 different studies by Takir *et al.* [1]. One out of the three patients in this series had penile fracture in the reverse coitus position. In some countries in the Middle East such as Iran, forced flexion is practiced more often, and is known as "Taqaandan." According to a study by Zargooshi, 76% of males who practiced it suffered a penile fracture raising the prevalence of penile fracture within the region [15].

Penile fracture is usually diagnosed clinically because of its unique clinical presentation. Patients report of hearing a popping, cracking or snapping sound associated with sudden onset pain which may be mild, moderate or severe depending on the severity of the injury [6]. On physical examination, the penile shaft is seen to be swollen with ecchymosis. This presentation is called the "aubergine sign." The shaft of the penis is usually deformed in a direction opposite the site of injury. A "rolling sign" is also seen which is a discrete and fixed haematoma which is palpable as the skin is rolled over [4]. From our study, all the patients were diagnosed clinically using history and physical examination. They all attested to hearing a snapping sound associated with some pain and sudden detumescence. On examination, the penile shaft was swollen and ecchymosed. This observation is similar to results found by Amer *et al.*, that showed that majority of patients presented with penile swelling and ecchymosis (45% and 33% respectively) [1]. In one patient, no ecchymosis was observed which was due to the darkened skin colour. The penis was angulated with its curvature away from the site of injury in all three patients.

A clinical diagnosis was made from the history and clinical examination which unequivocally suggested a penile fracture. For this reason, no further radiological investigations were conducted for the patients. Some studies indicated preference for radiological investigations prior to surgery to aid in localizing tear [16]. With the need for immediate surgical intervention, many others are of the viewpoint that such investigations are time-consuming with delays leading to poor-outcomes [8] and such imaging tests are only relevant when a urethral injury is likely or the clinical presentation is not clear hence the need for confirmation [3] [17].

Current management of penile fractures is surgery [5] [18] [19]. In the past, conservative management of penile fractures was the practice. Elastic bandages, cold compresses, antibiotics, anti-inflammatory agents, anticoagulants, fibrinolytics, erection suppression drugs like anti-androgens and estrogen analogues were used [20]. This practice was associated with high rates of complications of

29% - 53% [21]. In 1936, Fetter and Gartmen first described the surgical repair of penile fracture. However, it gained popularity in the 1980's when several studies showed that surgical repair was associated with less complications [22]. A study by Muentener *et al.* revealed that immediate surgical intervention had a better outcome with 92% success rate as compared to 59% for conservative management [23]. Studies by Amer *et al.*, Gamal *et al.* and Zarin *et al.* also confirmed that surgical repair was superior to conservative management with less than 10% complication rate [1] [19] [24] [25]. Early surgical repair aims at relieving symptoms, preventing erectile dysfunction, ensuring normal voiding, reducing hospital stay while minimizing complications associated with delayed treatment such as permanent penile deformity and fibrosis [4].

In this study, all patients had an immediate surgical repair done. This mainly involved the identification and evacuation of haematoma, debridement and the repair of tunical laceration. The procedure was done under spinal anaesthesia. The surgical repair can also be done under general anaesthesia and even local anaesthesia [6] [8]. For all the patients in this study, a sub-coronal degloving incision was made to locate the haematoma and site of fracture. Many types of incisions have been described by different authors including longitudinal incision over the suspected haematoma, midline peno-scrotal incision over median raphe, para-penile incision, inguino-scrotal incision and infra-pubic incision [21] [26]. Nonetheless, the sub-coronal degloving approach offers the best cosmesis and provides an excellent exposure of both corpora cavernosa and the corpus spongiosum for easy identification and repair of tunical fracture and urethral injury [13] [27]. A distal circumferential sub-coronal incision is made and the skin degloved proximally to the penoscrotal junction. The corpora cavernosa are explored for identification and evacuation of haematoma. Bleeding vessels are ligated. The tunical laceration is identified and a local cavernosal debridement is done to remove dead tissue present [28]. In a series by Nawas *et al.*, the orientation of the tear in the tunica albuginea in many cases is transverse and ventrally or laterally positioned at the proximal end of the penile shaft. That notwithstanding, the fracture can occur anywhere along the tunica [4]. Following toiletting of the cavernosa, the tunical edges are freshened and sutured with either continuous or interrupted sutures. Absorbable or non-absorbable sutures can be used to close the tunical defect. Opinions are divided on the best choice as some argue that the use of non-absorbable sutures are associated with stitch granulomas, painful and palpable knots as well as stitch sinuses [29]. Proponents of the use of non-absorbable sutures in tunical defect closure believe it holds together the tunical edges in place for a long time preventing breakdown and recurrence of defect when intracorporeal pressure increases [27]. Absorbable sutures (vicryl) were used for repair of tunical defect in the first two patients in this series whilst a non-absorbable suture (prolene) was used in the third patient. After the tunical defect is sutured, the Gittes test (intracorporeal saline injection) is done to cause an artificial erection to help the surgeon identify any obscure tears that have not been sutured as well as assess the curvature of the penis in an erect state

[30].

Urethral injury is sometimes associated with penile fractures and usually occurs at the same level of tunical injury [17]. When a urethral injury is suspected, the use of retrograde urethrogram is relevant to confirm and localize the urethral injury [8]. Management of urethral injury is usually by urethral stenting or an end-to-end anastomosis [13]. However, in mild injuries where voiding is achieved spontaneously, a urethral catheter is passed and kept in situ for 2 - 3 weeks to allow for the healing of the urethra. The reason urethroplasty may not be employed in this setting is to avoid a possible complication of stricture formation from the surgery [27]. In Case 3, despite the presence of blood at penile meatus, no laceration of the corpus spongiosum was observed which suggested that a rupture of the urethral wall was less likely. Hence, the blood seen at the meatus may have been due to a contusion in urethral mucosa. A urethral catheter was therefore inserted as a form of conservative management of the urethral injury.

Non-operative management accounts for most complications associated with penile fractures [31]. Such complications include erectile dysfunction, urethrocarvenous fistula, fibrosis with permanent penile deformity, painful erection, strictures, pulsative haematoma and penile necrosis [32] [33]. This is markedly reduced by early surgical repair. The repair of penile fractures is not devoid of possible complications. With the use of a degloving distal subcoronal circumferential incision, complications that may occur include transient penile oedema, neurovascular injury, abscess formation, subcoronal skin necrosis and infection [34].

A differential diagnosis for penile fracture is a pseudo penile fracture that occurs as a result of rupture to the dorsal artery or vein of the penis [35]. This may pose a diagnostic challenge as clinical presentation mimics a true penile fracture. The patient however does not hear the classic snap sound but experiences the sudden detumescence of the penis as seen in true penile fracture. That notwithstanding, the ultimate step in diagnosing a pseudo penile fracture is surgery where a rupture of either the superficial dorsal vein, deep dorsal vein, dorsal artery or a non-specific dartos bleed of the penis is identified with intact tunica albugenia and corpora cavernosa bodies. The ruptured vessels are then ligated at both ends to secure haemostasis [36] [37].

Patient should be advised to avoid sexual intercourse for 6 - 8 weeks to allow for complete healing of the fracture. Follow-up is relevant to identify post-operative complications.

4. Conclusion

Penile fracture is a urological emergency. Knowledge of the clinical presentation is necessary for rapid diagnosis and immediate intervention. Radiological investigations are not relevant except a urethral injury is suspected. Immediate surgical repair of fracture is recommended for managing penile fracture as it is associated with low rates of complications and the restoration of both erectile and

voiding function of the penis.

Consent

All the patients provided written informed consent for the publication of this case series and the accompanying images.

Ethical Approval

Written informed consent was obtained from the patients for publication of this case series and the accompanying images.

Permission was also granted by the Health Monitoring and Evaluation and Research department of the Cape Coast Teaching Hospital for this study.

Conflicts of Interest

Authors have declared that no competing interests exist.

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Epidemiological Profile of Patients Suffering from Urolithiasis in African Urological Environments from 2016 to 2020

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Abstract

Introduction: Urolithiasis is a very common pathology in the world. Its epidemiological profile varies from one region to another. In Africa in general and in the Congo in particular, it seems to be unknown. **Objective:** To determine the sociodemographic, diagnostic, therapeutic and evolutionary paraclinical parameters of 167 adult patients with urolithiasis. **Patients and Methods:** Cross-sectional, descriptive, retrospective study conducted in the urology department of Brazzaville University Hospital over a period of five years. We studied sociodemographic, therapeutic and evolutive. **Results:** During the study period 167 patients were treated for urolithiasis out of 2236 patients, a hospital frequency of 7.46%. The sex ratio M/F was 1.49. The average age of the patients was 42.05 years. They were overweight and/or obese in 53% of cases. Workers accounted for 46.53% of cases, with a low socio-economic level (42.5%) and a lower level of education (68.31%). There was a high percentage of complications, dominated by hydronephrosis (66.33%) and urinary tract infection (59.4%). The treatment was surgical in the majority of cases or 74.8%. Thirty-three patients had a lithiasis recurrence, a frequency of 19.7%. **Conclusion:** Urolithiasis is common. Being overweight is the most found risk factor. Lithiasis recurrence affects nearly one in five patients.

Keywords

Urolithiasis, Epidemiology, Brazzaville

1. Introduction

Urolithiasis (UL) is an ancient and widespread pathology in the world [1]. While

the epidemiological profile and its etiological factors continue to increase [2], its occurrence depends on the health conditions, dietary habits and standard of living of the populations [1].

The prevalence of UL differs from region to region. Indeed, it is 7% to 13% in North America, 5% to 9% in Europe and 1% to 5% in Asia [3]. However, in Africa, its prevalence is little known due to a low attendance of hospital structures and the absence of a study extended to the population [4]. However, several indicators tend to show its increase due to global climate change, increasing socio-economic status, westernization of diet and lifestyle [5].

While several studies in Congo have been conducted in particular on open-air surgery in urolithiasis [6], UL of children [7] and lithiasis of the upper urinary tract [8], however none of them has been devoted to the epidemiological profile of UL. It is in this perspective that we proposed to carry out this study with the objective of describing the epidemiological profile of UL in the urology department of the CHUB.

2. Patients and Methods

We carried out a descriptive study with retrospective collection from January 2016 to December 2020, five years in the urology and andrology department of the Brazzaville University Hospital.

Our sample consisted of all patients who had been treated for UL during this period and meeting the inclusion criteria; that is, all patients treated and having at least one imaging examination confirming the diagnosis.

We excluded all patients who were not treated, those whose information was missing from the operating and/or hospitalization records or those without imaging.

The parameters studied were: Socio-demographic *i.e.* age, sex, body mass index (Classified as follows: Normal: BMI < 25 kg/m²; overweight: 25 - 30 kg/m², Obesity: >30 kg/m²), level of education, socio-professional status, place of origin, socio-economic level, Clinical (functional signs related to UL or associated with UL: pain, urination disorders, hematuria, digestive disorder, fever, Previous history and treatments (Hypertension, diabetes, urinary tract infection, other pathologies, family history of UL, physical signs: lumbar sensitivity, bladder globe, pain in the ureteral points, large kidney), paraclinical (ECBU, biological assessment: serum creatinine, azotemia, serum calcium, Urinary Tract Ultrasound, radiography of the urinary tree without preparation (AUSP), A computerized tomography (CT) urogram and intravenous urography (IVU). therapeutic (type of treatment: open surgery, pharmacological treatment, endoscopic treatment), progressive (Uretero-hydronephrosis, urinary tract infection, AORF, pyonephrosis). In the minor, it is the socio-economic level of the parents that has been taken into account, to do this we have used the British classification of economic status taking into account the prestige of the profession [9]. There are thus three categories namely:

- Category 1: with a high socio-economic level, consisting of groups I (management employees and senior managers) and II (management employees and lower managers);
- Category 2: average socio-economic level, consisting of groups III (intermediate employees), IV (small employers and self-employed workers) and V (lower employees in supervision, crafts and similar trades);
- Category 3: low or low socio-economic level, consisting of groups VI (employees in semi-routine jobs) VII employees in routine jobs) and VIII (never worked or long-term unemployed).

For the retired subject, it is the profession exercised the longest that has been considered.

Data entry and processing was carried out using Epi-info software version 7.2.2.6 and data analysis was carried out on SPSS 22 statistical software. The various tables and graphs were generated using the Microsoft Office Excel 2016 software.

For quantitative variables, we calculated means and standard deviations.

3. Results

During the study period, there were 167 hospitalized UL cases out of a total enrolment of 2236 patients, a frequency of 7.46%.

The annual distribution of patients with UL is shown in **Figure 1**.

The median age of our patients was 41 years and the mean age was 42.05 ± 18.40 years with extremes of 6 and 96 years. This average age was 46.12 ± 18.27 years for men and 35.93 ± 16.61 years for women, the age group from 30 to 50 years constituted 39.60% of cases.

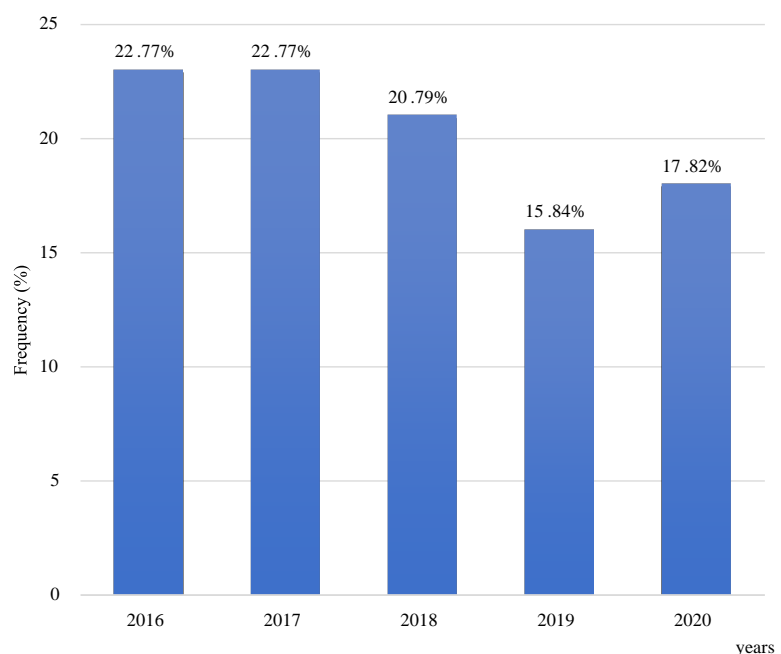


Figure 1. Recruitment of UL by year.

There were 67 women (40%) and 100 men (60%).

The sex ratio M/F was 1.49, varying by the age group (**Figure 2**).

In the male population, the frequency of UL gradually increased to a peak between the age of 40 and 49 (**Figure 3**).

Our population had 120 patients or 71.86% with a level of education at least at the secondary level and 47 patients or 28.14% were at most at the primary level.

One hundred and fifty-nine patients or 95.2% came from the urban area.

Workers made up a workforce of 78 (46.7%) patients, students, retirees and the unemployed made up a workforce of 31 (18.6%), 15 (9%) and 43 (25.7%) patients respectively.

Our population consisted of 19 miners. Of all adult urolithiasis patients, 86 patients (51.5%) were single and 62 patients (37.1%) were married or common law.

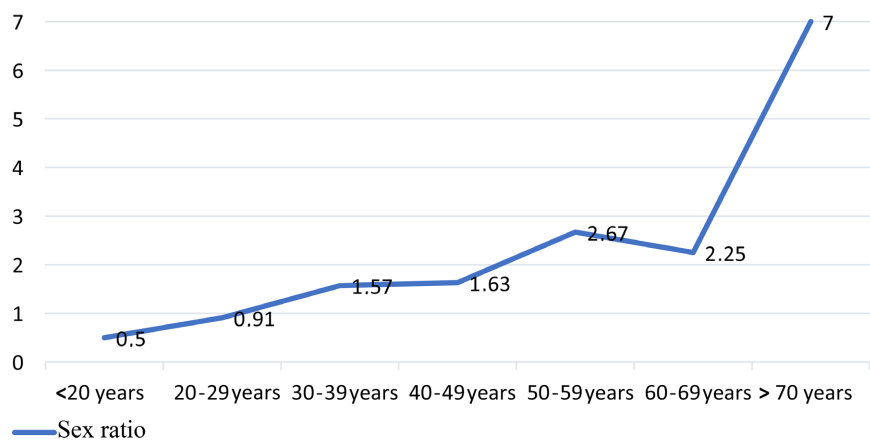


Figure 2. Change in sex ratio with age group.

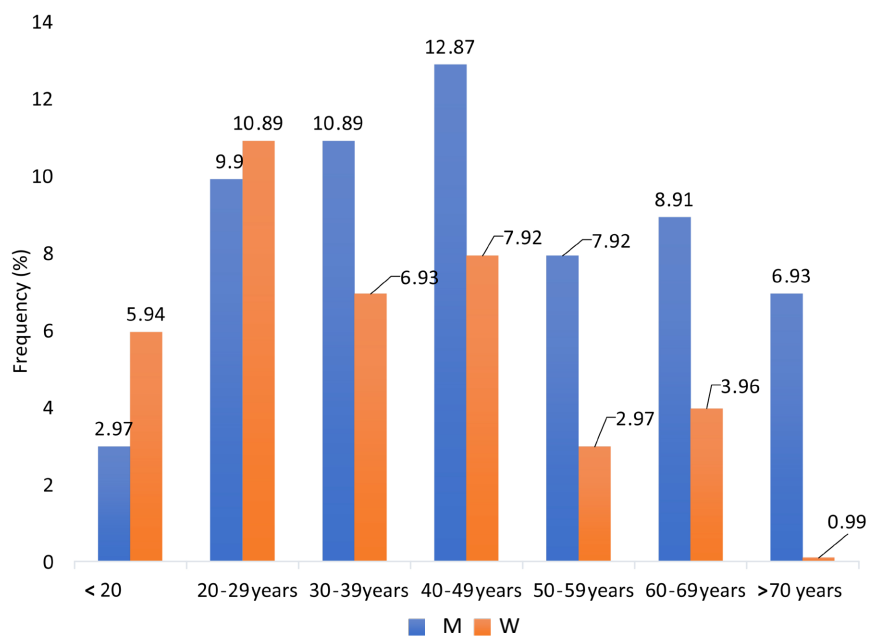


Figure 3. The age and sex distribution.

Our study population consisted of 42.5% of patients with a low socioeconomic level, 41.3% of patients with a medium level and 16.2% of a high level. In terms of the history, hypertension and diabetes were found in 33 (19.8%) and 25 (15%) patients, respectively, repeated urinary tract infections in twelve (7.2%) patients.

The main symptom was pain regardless of its location. It was renal colic in 117 patients (70%), hypogastric pain in 24 patients (14.4%), a lumbar fossa pain in fifteen patients (9%), and an iliac fossa pain in 2 patients (1.2%). Urination disorders were also found; pollakiuria in 46 patients or 27.5%, dysuria in 40 (24%) patients, urination burns in 27 (16.2%) patients, haematuria in 24 (14.4%) of patients and acute urine retention in 18 (10.8%) patients. When these signs were accompanied, fever was present in 48 patients or 28.7%, nausea and vomiting in 45 patients (27%). During the physical examination, a sensitivity of the lumbar fossa was found in 99 patients or 59.3%. Upper, middle and lower ureteral point pain was found in 17 patients (10.2%), fifteen patients (9%) and eight patients (4.9%) respectively. Twenty eight patients (16.8%) had a bladder globe; 25 patients (15%) had an abdominal and/or lumbar scar, and fifteen patients (9%) had a large kidney.

Urinary Tract without Preparation (AUSP) was performed in 134 patients and demonstrated UL in 111 patients or 79%. The Urinary Tract Ultrasound was performed in all patients and showed UL in 150 patients, or 90.10%. Single patients, were noted in 68 patients, or 40.7%. The computerized tomography (CT) urogram was used in 101 patients and found UL in all patients while IVU was performed in 66 patients and diagnosed all patients with UL. The frequencies of patients with two stones and at least three stones were 27.5% and 31.7% respectively (46 and 53 patients). The average number of calculations was 2.1. UL of the upper urinary tract, by far the most represented, was found in 127 patients or 76% of all UL.

Cystolithotomy was the most performed intervention with 25 cases or 20% of all patients treated with open surgery, then pyelolithotomy with 31 patients or 24.8%, the then nephrolithotomy and the ureterotomy with respectively 25 patients (20%) and 15 patients (12%) and finally nephrectomy with 11 patients or 8.8%. Note that 18 cases (14.4%) were subjected to double surgery, depending on the location of the LU and the state of the renal parenchymal. After surgery, 5% of patients presented with a residual stone. There was a high percentage of complications, dominated by hydronephrosis (66.33%) and urinary tract infection (59.4%). Thirty-three patients (19.7%) had at least one recurrence.

4. Discussion

The prevalence of UL has been steadily increasing around the world over the past two decades; but it remains highly variable depending on the geographical location due to multiple factors specific to each culture and race [3].

Romero *et al.* reported a national prevalence increasing from 3.8% between 1976-1980 to 5.2% between 1988-1994 in the United States [10]; Then Scales *et*

al. increased this prevalence to 10.6% among men and 7.1% among women [11]. Several studies would tend to show in various non-industrialized countries, a gradual evolution of the epidemiological profile of lithiasis patients towards that observed in Western Europe and the United States [12].

This increase is also seen in this study. We obtained a hospital frequency of 7.46% compared to the previous study conducted by Odzébé *et al.* which reported a frequency of 7.30% [6] a slight increase of about 0.16%. Some results in the literature were consistent with ours. Notably Zeng *et al.* in China [13], Kumari *et al.* in India [14], Kaboré *et al.* in Burkina Faso [4] reported a prevalence of 6.4%, 7.6% and 12.52% respectively. These results can be justified on one hand by the fact that, as in our case, they are countries with a hot and humid climate. Indeed, some studies have proven the correlation between seasonal fluctuations in urinary excretion of calcium and oxalate and the number of hours of monthly sunshine and the occurrence of lithiasic episodes [15]. High temperatures increase insensitivity to sweating, which can lead to more concentrated urine; this event then promotes urinary crystallization and therefore the formation of UL [16].

On the other hand, the majority of our study population came from urban areas where the trend is towards the westernization of eating habits as reported by Loumingou *et al.* [17].

On the other hand, Mobima *et al.* in the Central African Republic reported a prevalence of 3.07% [18]. These results show a lower prevalence than ours and could be explained by the fact that it was a multicentric study because these patients came from different departments of the city for the realization of an ultrasound in their center.

The highest prevalence was reported by Ahmad *et al.* in Saudi Arabia at 19.1% [19].

The prevalence and incidence of UL varies enormously by age, with a low frequency in childhood and then rises to peaks between the 4th and 6th decade of life [3].

The average age of our patients was 42.05 ± 18.40 years, with extremes of 6 and 96 years. Ten years before our study, Odzébé *et al.* in Congo had reported an average age of 52.13 years [6]. We have thus noted the current precocity of the occurrence of lithiasis in our population. This was similar to recent data in the literature presenting urolithiasis disease as a condition of young adults [20]. These results were similar to those reported in the African literature. Ze Ondo *et al.* in Senegal [21], Mobima *et al.* in the Central African Republic [19] and Omi-sanjo *et al.* in Nigeria [22] reported an average age close to ours, *i.e.* 42.7 years, 40 years and 40.4 years respectively. In the study surgical Management of Urolithiasis of the Upper Tract—Current Trend of Endourology in Africa bringing together several sub-Saharan countries including Congo, Cassell III *et al.* reported an overall average age of 39.1 years [20]. Kaboré *et al.* reported the lowest average age in sub-Saharan Africa in 35 years [4].

Socio-economic improvement, especially among the youngest strata, could be explanations for this result. This could also be explained by the fact that developing countries, particularly in Africa, have a predominantly young population with a median age often below twenty, unlike Western countries where there was aging population [23]. Ketabchi *et al.* in Iran reported the lowest average age in the literature in 25.8 years [24].

In our study, of the 167 patients in our study population, there were 67 women (40%) and 100 men (60%) for a sex ratio M/F of 1.49. The previous study conducted by Odzébé *et al.* at CHUB reported a sex ratio of 3.25 [6]; compared to ours there is a significant drop in the sex ratio demonstrating that the female subject is increasingly affected by lithiasis disease as reported by Abbassene *et al.* [25]. Some African authors have found a sex ratio comparable to ours, including Kaboré *et al.* in Burkina [3], Habbani *et al.* in Morocco [26].

The same is true elsewhere in the world. Lieske *et al.* in the United States [27] and Kaulanjan in the French West Indies [28] observed a sex ratio close to ours, *i.e.* 1.32 and 1.61 respectively.

All these results prove that men are mostly affected by UL than women. The influence of certain sex hormones on certain lithogenic risk factors could be the cause. Indeed, androgens seem to increase unlike estrogens which decrease the urinary excretion of calcium and oxalate, hence the formation of calcium oxalate crystals [29]. However, these results are not fixed. Indeed, we were able to observe a variation in the sex ratio according to age with a tendency to feminization at the beginning of life and then a gradual increase after 20 years until achieving a first peak between 50 - 59 years and a second beyond 70 years when the population was almost exclusively male. Some results in the literature were along the same lines as ours.

Castiglione *et al.* in Belgium reported a sex ratio of 2.25; with a tendency of sex equalization before 15 years and then a significant increase after this age, before falling in geriatric subjects [30]. The trend towards the equalization of numbers in the 2 sexes or even a feminization of UL in the population under 20 years of age could be explained by the fact that on the one hand the UL is much earlier in the female subject [31]; The jump in the sex ratio in the geriatric population would be due to the presence at these ages of mainly prostate obstacles which are an important cause of lithiasis very often affecting the lower urinary tract as reported in the literature [6]. The role of profession and educational attainment in lithiasis disease remains controversial in the literature. Our study found a proportion of 28% of patients with a lower level of education on all lithiasis patients. Possible explanations for this may include differences in diets but also the fact that subjects with a low level of education often perform more physical occupations and are therefore at risk of dehydration [32].

The proportion of patients with the socio-professional status of worker in our study was the highest at 46.7%. Recent studies have shown that LU is much less found in manual workers than in groups with sedentary occupations [29].

Low socio-economic level was associated with a high proportion of lithiasis patients.

If several authors in different parts of the globe find similar results [21], yet no explanation could be provided in particular on the biochemical and metabolic process by which psychosocial stress would become a factor responsible for the formation of urolithiasis [30]. On the other hand, Yasui *et al.* found a higher frequency of lithiasis patients in more affluent populations [33]. It has been found that they are at an increased risk of having chronic metabolic diseases through high calorie intake [32].

In our study the majority of stones were located in the upper urinary tract or 80% against 20% in the bladder. Classically, UL in developing countries was of a preferential anatomical localization in the lower urinary tract, especially at the bladder level [34]. In recent years, this localization is more common in the upper urinary tract in the literature [35].

In industrialized countries, an open surgery has become exceptional or almost non-existent given the very favorable results of the minimally invasive means of an endoscopic surgery and Extracorporeal Shock Wave Lithotripsy (ESWL). Currently, surgical indications are reserved only for complex stones after the failure of Percutaneous Nephrolithotomy (PCNL) or laparoscopy [36] [37].

The treatment was surgical in 74.8% of cases and pharmacological in 25.2%. This would be explained by an insufficiency of the technical platform and probably the significant presence of the complex shape (the coralliform and bladder stones of a large size).

As this study is retrospective, the absence of some information did not allow looking for risk factors for urolithiasis. The same applies to the morpho-constitutional analysis of urolithiasis. However, it nevertheless provides an idea of the profile of the patient suffering from urolithiasis.

5. Conclusion

UL is a major public health problem due to its increasing prevalence. It mainly affects young adults. As in other sub-Saharan African countries, the lithogenic risk in Congo is associated with the male sex and being overweight. It is seen especially in the working population and those of a high socio-economic level. Lithiasis recurrence affects nearly one in five patients.

Conflicts of Interest

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

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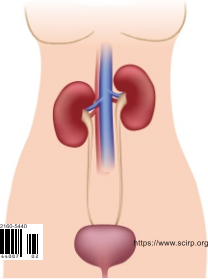
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