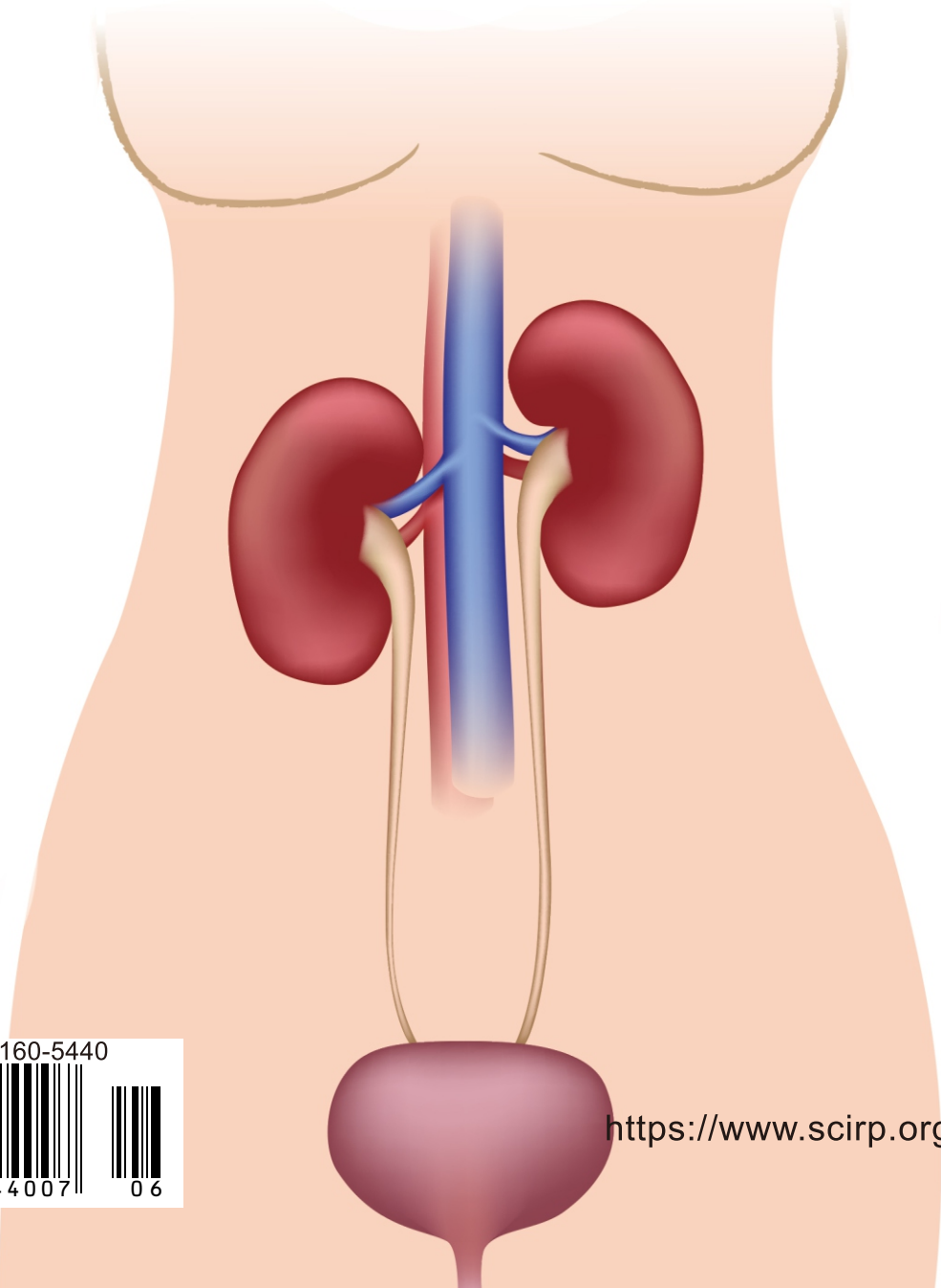


# Open Journal of Urology



ISSN: 2160-5440



<https://www.scirp.org/journal/oju>

# Journal Editorial Board

ISSN 2160-5440 (Print) ISSN 2160-5629 (Online)

<https://www.scirp.org/journal/oju>

---

## Editor-in-Chief

**Dr. Phillip Mucksavage** University of Pennsylvania, USA

## Executive Editor-in-Chief

**Dr. Robert Daniel Moore** Atlanta Center for Laparoscopic Urogynecology, USA

## Editorial Board

**Prof. Hideyuki Akaza** The University of Tokyo, Japan  
**Dr. Daniele Amparore** University of Turin, Italy  
**Dr. Hemant Kumar Bid** The Research Institute at Nationwide Children's Hospital, USA  
**Prof. Alessandro Calisti** San Camillo Hospital of Rome, Italy  
**Prof. Sung-Goo Chang** Kyung Hee University Medical Center, South Korea  
**Prof. Piergiuseppe Colombo** University of Milan, Italy  
**Dr. Xiao Gu** Le Bonheur Children's Medical Center, USA  
**Prof. Samy L Habib** The University of Texas Health Science Center at San Antonio, USA  
**Prof. Sarel Halachmi** Israel Institute of Technology, Israel  
**Prof. Kyu-Sung Lee** Sungkyunkwan University, South Korea  
**Prof. Yuanyuan Liang** University of Texas Health Science Center at San Antonio, USA  
**Dr. Bashir A. Lwaleed** Istanbul University, Turkey  
**Prof. Evangelos M. Mazaris** St. Mary's and Charing Cross Hospital, Greece  
**Dr. Chong-Xian Pan** University of California Davis Cancer Center, USA  
**Prof. Jose Enrique Robles** University of Navarra, Spain  
**Prof. Charles Joel Rosser** University of Central Florida, USA  
**Dr. Di Francesco Simona** People's University Nicolaus Copernicus, Italy  
**Dr. Scott W. Smilen** New York University, USA  
**Prof. Dingwei Ye** Fudan University Cancer Hospital, China  
**Prof. Stanley Zaslau** West Virginia University, USA

# Table of Contents

**Volume 12    Number 6**

**June 2022**

**Effect of Varicocelectomy on Gonadal Function among Patients Reporting with Sexual Dysfunction in Ghana**

Y. Adams, A. A. Afoko, N. Amidu, L. Quaye, S. B. Bani, P. P. M. Dapare, V. Afoko.....305

**Laparoscopic Varicocelectomy: Results and Outcomes in a Single Center in Cameroon**

C. Kamadjou, B. Essola, D. Eyongeta, E. Muhawenimana, A. Kameni, F. Angwafo.....331

**Transurethral Resection of Bladder Tumours: Results and Outcomes**

C. Kamadjou, J. Kuitche, A. K. Wadeu, A. Mbassi, F. Angwafo.....342

**An Analysis of MRI-Fusion Prostate Biopsy Results in PI-RADS 3 MRI Findings in a Cohort of Men in a Community Hospital Setting**

R. A. Edelstein, D. J. Berman, L. Joseph, K. Daley, M. Anamur.....357

**Comparison of Combination Treatments of Distigmine and either Mirabegron or Solifenacin for Rats with Partial Bladder Outlet Obstruction**

K. Sugaya, S. Nishijima, K. Kadekawa, K. Noguchi, K. Ashitomi, S. Matsumoto, H. Yamamoto.....366

**Management of Trauma to the External Genitalia at the Nianankoro-Fomba Hospital in Segou Mali**

S. I. Koné, A. Kassogué, B. Samaké, M. Keita, T. Traore, A. N. Coulibaly, M. A. Togo, T. B. Bagayoko, A. Bah, A. Fofana, A. Sanogo, D. Coulibaly, S. M. Doucouré, H. J. G. Berthé.....376

# Open Journal of Urology (OJU)

## Journal Information

### SUBSCRIPTIONS

The *Open Journal of Urology* (Online at Scientific Research Publishing, <https://www.scirp.org/>) is published monthly by Scientific Research Publishing, Inc., USA.

#### Subscription rates:

Print: \$79 per issue.

To subscribe, please contact Journals Subscriptions Department, E-mail: [sub@scirp.org](mailto:sub@scirp.org)

### SERVICES

#### Advertisements

Advertisement Sales Department, E-mail: [service@scirp.org](mailto:service@scirp.org)

#### Reprints (minimum quantity 100 copies)

Reprints Co-ordinator, Scientific Research Publishing, Inc., USA.

E-mail: [sub@scirp.org](mailto:sub@scirp.org)

### COPYRIGHT

#### Copyright and reuse rights for the front matter of the journal:

Copyright © 2022 by Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>

#### Copyright for individual papers of the journal:

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

#### Reuse rights for individual papers:

Note: At SCIRP authors can choose between CC BY and CC BY-NC. Please consult each paper for its reuse rights.

#### Disclaimer of liability

Statements and opinions expressed in the articles and communications are those of the individual contributors and not the statements and opinion of Scientific Research Publishing, Inc. We assume no responsibility or liability for any damage or injury to persons or property arising out of the use of any materials, instructions, methods or ideas contained herein. We expressly disclaim any implied warranties of merchantability or fitness for a particular purpose. If expert assistance is required, the services of a competent professional person should be sought.

### PRODUCTION INFORMATION

For manuscripts that have been accepted for publication, please contact:

E-mail: [aju@scirp.org](mailto:aju@scirp.org)

# Effect of Varicocelectomy on Gonadal Function among Patients Reporting with Sexual Dysfunction in Ghana

Yussif Adams<sup>1\*</sup> , Akisibadek Alekz Afoko<sup>2,3</sup>, Nafiu Amidu<sup>1</sup>, Lawrence Quaye<sup>1</sup>, Simon Bannison Bani<sup>1</sup>, Peter Paul M. Dapare<sup>1</sup>, Vivian Afoko<sup>4</sup>

<sup>1</sup>Department of Biomedical Laboratory Science, School of Allied Health Sciences, University for Development Studies, Tamale, Ghana

<sup>2</sup>Department of Surgery, School of Medicine, University for Development Studies, Tamale, Ghana

<sup>3</sup>Urology Unit, Tamale Teaching Hospital, Tamale, Ghana

<sup>4</sup>Department of Paediatric Nursing, School of Nursing and Midwifery, University for Development Studies, Tamale, Ghana

Email: \*adamsyussif@uds.edu.gh

**How to cite this paper:** Adams, Y., Afoko, A.A., Amidu, N., Quaye, L., Bani, S.B., Dapare, P.P.M. and Afoko, V. (2022) Effect of Varicocelectomy on Gonadal Function among Patients Reporting with Sexual Dysfunction in Ghana. *Open Journal of Urology*, 12, 305-330. <https://doi.org/10.4236/oju.2022.126031>

**Received:** April 24, 2022

**Accepted:** June 7, 2022

**Published:** June 10, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Background:** Long-standing varicocele is often associated with testicular hypoxia and that might worsen Leydig cell function, a significant risk factor for hypogonadism. This may affect both the secretory and endocrine functions of the testis. This study aims to determine the effect of microsurgical sub-inguinal varicocelectomy on gonadal function among men reporting sexual dysfunction in Ghana. **Methods:** This was an intervention study conducted at the Tamale Teaching Hospital from September 2017 to August 2021. A total of 103 participants were randomized into two groups; the surgery group (n = 52) and the observed group (n = 51). Venous blood samples were collected at baseline, varicocelectomy was performed for the surgery group, and no intervention was given to the other. Blood samples were subsequently collected at 12-, 24-, 36-, and 48-month intervals for assay of serum total testosterone, FSH, and LH. The data were analyzed in GraphPad Prism (v8.0) at an alpha value of 0.05. **Results:** All the participants had varicocele and were aged between 55.0 to 69.0 years old. At the baseline of the study, all participants presented with sexual dysfunction but a significant improvement ( $p < 0.001$ ) in the GRISS score, and the subscale was observed 12 months after the surgery. The mean  $\pm$  SD serum total testosterone ( $p = 0.6078$ ), FSH ( $p = 0.6522$ ) and LH ( $p = 0.2281$ ) between the groups at baseline did not vary but those in surgery group had improved values at 12-, 24-, 36- and 48-month post-surgery ( $p$ -trend  $< 0.0001$ ). The surgery group had an overall percent increase in serum total testosterone (76.3%, 194.0%, 221.0%, and 231.9%) over 12-, 24-, 36- and 48-month and significant percent reduction in both FSH ( $-14.7\%$ ,  $-29.9\%$ ,

–33.8% and –40.8%) and LH (–21.8%, –31.0%, –32.4%, and –36.4%) respectively. These gonadotropins observed annual percentages spike within the first and second year but changes were marginal from the third year onwards in the surgery group. **Conclusions:** Microsurgical sub-inguinal varicocelectomy improved gonadal function among varicocele patients reporting sexual dysfunction. It is recommended to use this choice for similar patients; however, these findings should be verified by a multi-institutional study to provide more evidence for this choice.

## Keywords

Varicocele, Sub-Inguinal Varicocelectomy, Gonadal Function, Sexual Dysfunction

---

## 1. Introduction

Varicocele is the enlargement of pampiniform venous plexus draining the testicle, with reflux of venous blood [1] [2]. It is a common problem in men who seek medical attention for fertility problems, sexual dysfunction, or complain of continuing scrotal discomfort [3].

Varicocele has been identified in 15% of healthy men [4] but the prevalence ranges from 35% to 45% among men seeking medical attention for primary infertility and 80% among patients seeking care for secondary infertility [5] [6].

Studies involving humans have reported that varicocele causes progressive time-dependent testicular damage [7] [8] [9]. Between the ages of 18 - 20 years, the testicular function is usually normal but declines progressively depending on the duration of the varicocele [10]. Some propositions have sort to explain the lethal effects of varicocele on testicular function with the most accepted postulate related to alterations in the thermal environment of the testicles. The formation of a communicating meshwork of spermatic veins leaving the testicles produces a counter-current heat-exchange mechanism to cool arterial blood [11]. However, persons confirmed with varicocele lack this mechanism, hence, causing elevated scrotal temperature.

Long-standing varicocele might worsen Leydig cell functions and is a significant risk factor for hypogonadism. Lotti *et al.* [12] in a study found that patients with severe varicocele had increased serum follicle-stimulating hormone (FSH) and luteinizing hormone (LH) with lowered testicular volume. Increased serum FSH and LH levels in infertile men diagnosed with varicocele have resulted in the hypothesis that varicocele causes Leydig cell dysfunction [13].

Clinical studies suggest that repair of the varicocele may improve gonadal function in men with varicocele [14] [15] [16]. Çayan *et al.* [16] reported that approximately 60% - 80% of men with low serum testosterone had normalized testosterone levels after varicocele repair. Li *et al.* [15] in a meta-analysis found that the mean serum testosterone level increased after varicocelectomy. None-

theless, there are conflicting reports on whether varicocele and varicocelectomy result in changes in serum FSH and LH levels or not. Some studies reported no significant changes in the levels of serum FSH and LH [17] [18], yet others noted decreased serum FSH and LH levels following varicocelectomy [13] [19].

As already known, Leydig cells function to produce testosterone but this is controlled by luteinizing hormone. FSH functions to promote the beginning of testosterone production; in the process, LH is maintained. Hence, there is cross-talk with the changes in serum testosterone, FSH, and LH. This study, therefore, aims to determine the effect of microsurgical sub-inguinal varicocelectomy on serum total testosterone, FSH, and LH levels among patients reporting sexual dysfunction in Ghana.

## **2. Methods**

### **2.1. Ethical Consideration**

This study was approved by the Ethics and Review Board of the Department of Research and Development, Tamale Teaching Hospital (No: TTH/R & D/SR/119), and has therefore been performed following the standards laid down in the 1964 Declaration of Helsinki. Informed consent was obtained from all the participants before the study. Participation in this study was voluntary, participants were kept anonymous, and information obtained remained confidential to the researchers only. Only blood samples intended for the study were drawn and information that was deemed as important to the management of the patient was communicated to the patient.

### **2.2. Study Design**

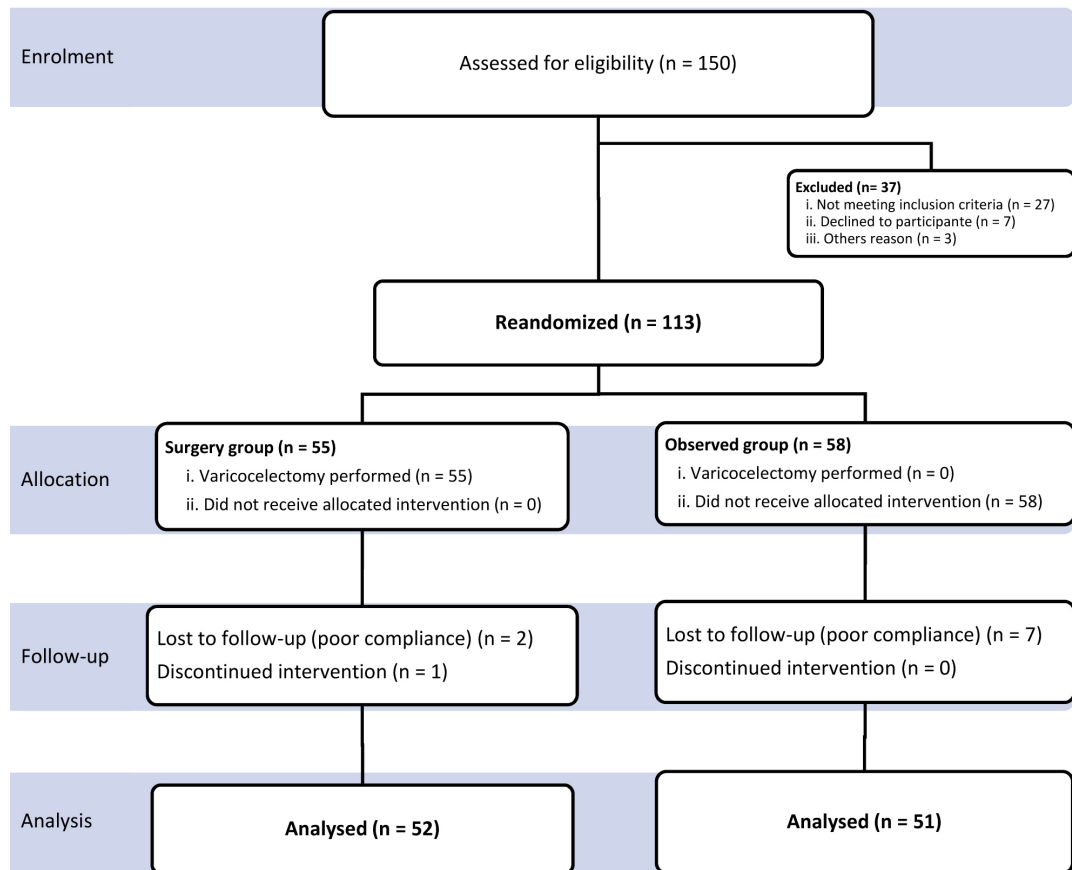
This was an intervention study design in which participants were randomized into two groups; the surgery group (n = 52) and the observed group (n = 51) (**Figure 1**). The study was conducted at Tamale Teaching Hospital in the Tamale Metropolis from September 2017 to August 2021.

### **2.3. Study Population**

Participants who were eligible for inclusion in this study were given the option of immediately undergoing microsurgical sub-inguinal varicocelectomy or being observed for 12 months with a subsequent reassessment of the management plan and possibly delayed the operation. Based on the willingness to equally accept either option, eligible participants were randomized to the surgery group and observed group. However, neither the investigator nor participants were blinded to the intervention after allocation [20].

#### **2.3.1. Inclusion Criteria**

Participants were eligible for inclusion in the study if they had fathered at least one child, and had complained of any form of sexual dysfunction including; weak sex drive, impotency, premature ejaculation, infrequency of sexual intercourse,



**Figure 1.** Flowchart diagram.

avoidance of sexual intercourse, non-communication about sex with a partner, and dissatisfaction after sexual intercourse activity [21].

All consented participants were sexually active men who had maintained a stable heterosexual relationship for at least 2 years before participating in the study. A stable heterosexual relationship was considered as one in which the man was involved and maintained sexual relations, regardless of marital status.

Selection strategies were adopted depending on the unit at the recruitment center of the Tamale Teaching Hospital. After a patient arrived at the Urology Specialist Clinic, pre-assessment checks were made according to the criteria stated above and those who did not qualify for the study were made to continue with their routine medical examinations. If a patient met the eligibility criteria, informed consent was obtained and a questionnaire was administered to be completed independently. Where participants were not able to read and write, the queries on the questionnaire were translated verbatim in the common dialect. Participants were made to see the urologist for medical examination.

### 2.3.2. Exclusion Criteria

Participants with sexual dysfunction who had not fathered a child (or children), had no sexual dysfunction complaints, excessive alcohol use (chronic alcoholics), cigarette smoking history, and incomplete/inconclusive questionnaires were ex-

cluded. Again, participants with a history of uncontrolled diabetes, uncontrolled hypertension as well as patients on long term statins, undescended testis, mumps orchitis, use of anti-androgen and/or testosterone replacement therapy, or orchiectomy were all also excluded [22].

## **2.4. Clinical Evaluation**

Each consenting participant was clinically examined by a urologist. The diagnosis was based on physical examination and was confirmed by ultrasound scan examination. All participants had a varicocele. Dubin and Amelar [23] approach was employed to detect, confirm and clinically grade varicocele. Varicocele was categorized into three (3) grades; grade I (first grade), II (second grade), and III (third grade). Grade I was confirmed if the participant had an enlarged venous plexus of spermatic tone evident only by palpation during the Valsalva manoeuvre. Enlargement of the venous plexus of spermatic tone evident only by palpation at the upright position was considered Grade II while enlargement of the venous plexus of spermatic tone evident visually was confirmed Grade III [24]. Scrotal ultrasound was used to diagnose the non-palpable enlargement of the venous plexus of the spermatic tone [25].

### **Scrotal Ultrasound Evaluation (SUE)**

Two phases of scrotal ultrasound scans were carried out on participants who qualified for the study; the first phase was with participants in the supine position (with penis resting on suprapubic region) and the second in an upright position. The examination was conducted with a Samsung Medison Accuvix V20 scan (Samsung Electronics, South Korea) equipped with linear, high-resolution, and high-frequency (7.5 - 14 MHz) probe keen to the study of soft body parts and with color Doppler for detecting slow flows and scanning surface of at least 5 cm [26]. To evaluate testicular malposition, blood reflux along the pampiniform plexus, or the extent of any fluid collections an ultrasound scan was done [22].

## **2.5. Data Collection**

### **2.5.1. Questionnaire Administration**

Sociodemographic data, cigarette smoking, and medical history were gathered with a structured pre-tested questionnaire. Questions on sexual response were assessed using the Golombok Rust Inventory of Sexual Satisfaction (GRISS) questionnaire which measures specific sexual behaviors, attitudes, and beliefs [21]. The GRISS questionnaire has 28 items on a single sheet and it is used for assessing the existence and severity of sexual problems in heterosexual couples or individuals who have a current heterosexual relationship. All the 28 questions were answered on a five (5) point scale from “always” through “usually”, “sometimes” and “hardly ever” to “never”. This provided overall scores for the quality of sexual functioning within a relationship. In addition, the subscale scores for infrequency, non-sensuality, dissatisfaction, non-communication, and avoidance

were obtained and presented as a profile. The total score and subscale scores were transformed using a standard nine-point scale ranging between 1 and 9, with high scores indicating greater problems. Scores of 5 or more were considered to indicate sexual dysfunction (SD). The GRISS was chosen because it is standardized, easy to administer and score, relatively unobtrusive, and substantially inexpensive [21].

### **2.5.2. Blood Pressure Measurement**

The Omron blood pressure monitor was used to measure the blood pressure of the participant. These included; systolic blood pressure (SBP), diastolic blood pressure (DBP) and pulse rate, and categorization of normotension (SBP < 140 mmHg/DBP < 90 mmHg) and hypertension (SBP > 140 mmHg/DBP > 90 mmHg) was based on WHO cut-offs as cited by Mittal and Singh [27]. The Omron blood pressure monitor uses the oscillometric method of blood pressure measurement. This means the monitor detects the blood's movement through the brachial artery and converts the movements into a digital reading (<https://www.omron.com/global/en/>).

### **2.5.3. Anthropometric Measurement**

Anthropometric measurements were done on all study participants. The Seca 213 portable Stadiometer (Seca Corp., Hamburg, Germany) was used to measure the height of the participants to the nearest 0.1 cm. To measure the height, the stadiometer was set up according to the manufacturer's instructions. Participants were asked to take off footwear including socks and measurements taken in the upright position.

The measurement of weight, calculation of BMI, and the assessment of body fat composition were done using the Omron HBF-516B Body Composition Analyzer and Electronic Scale (Omron Corp., USA). The Omron HBF-516B Body Composition Analyzer and Electronic Scale is a tetra-polar bioelectrical impedance analyzer that measures weight to the nearest 0.01 kg. It has electrodes on the surface of the scale and on a hand-held device that is attached to the scale by a retractable cord. It works by passing a painless, imperceptible electrical current (500  $\mu$ A) at a fixed frequency of 50 kHz through the body while determining resistance and reactance. Body fat and muscle mass were recorded as percentages of the total body weight at intervals of 0.1% [22].

### **2.5.4. Blood Samples Collection**

Venous blood samples (4 mls) were collected from each participant within the hours of 8:00-11:00 GMT after at least 8 hours of fast by a phlebotomist using standard venipuncture methods. A check-list was given to each consenting participant to tick the number of hours fasted to enable rescheduling those who could not meet the time.

Venous blood samples collected were dispensed into a 5 ml vacutainer containing a gel separator. Blood samples were centrifuged at 8000 rpm for 5 minutes to yield serum and cells. The serum was aliquoted and stored at  $-20^{\circ}\text{C}$  until assay.

### 2.5.5. Hormonal Measurement

Baseline male fertility hormones (total testosterone, follicle-stimulating hormone (FSH), and luteinizing hormone (LH)) were measured by electrochemiluminescence with Hitachi-Roche analyzer (Cobas 6000, Roche Diagnostics, IN, USA).

### 2.6. Interventions (Sub-Inguinal Microscopy Varicocelectomy)

Participants were counselled about their condition, and the exact nature of the problem was explained to them by a urologist. A microsurgical open sub-inguinal varicocelectomy procedure as described by Marmar *et al.* [28] was performed for the surgery group. Surgery was performed under spinal anaesthesia, using microsurgical instruments and magnification with an operating microscope KARL CAPS SOM 82, Germany. The lymphatic vessels and testicular artery were spared, and both internal and external spermatic veins ligated and divided. The spermatic fasciae were closed using PGA 3/0 running sutures. The wound was closed in layers and a subcuticular skin stitch was applied using 4/0 PGA sutures. Wound dressing was removed after 24 hours. No antibiotics were employed and the pain was managed by using 1-gram of rectal paracetamol during the period of recovery and followed by oral paracetamol 1-gram tid for the next 24 hours [22].

### 2.7. Follow-Up

Both groups were followed for 48 months (4 years) after the day of surgery (surgery group) or the day of the last baseline hormone analysis (observed group). Participants in the observed group were advised not to use any form of contraceptives during sexual intercourse, and to abstain from tobacco/cigarette smoking. Participants in the operated group were advised to abstain from any form of sexual activity until the surgical wound was properly healed. All participants were reassessed every 90 days to confirm that; the participant was not smoking, and was clinically examined to confirm the absence of genital infection, formation of hydrocele, recurrence of varicocele, and increased testicular size. Participants were asked to revisit the clinic after 6 months and 12 months. Blood samples were drawn for repeated measurement of serum total testosterone, FSH, and serum LH at follow-up months 12, 24, 36, and 48 respectively.

### 2.8. Statistical Analysis

Data were entered into Microsoft Excel version 10 (<https://www.ibm.com/cn-zh>) and exported to GraphPad Prism version 8.0 (<https://www.graphpad.com/>) for analysis. Categorical data were presented as frequency, percent, and charts, and parametric data presented as mean  $\pm$  standard deviation (SD) or mean  $\pm$  standard error of the mean (SEM). Kolmogorov-Smirnov test was performed on parametric data to check whether or not the data was normally distributed. To compare two groups, the Chi-square test was used for categorical variables, and the unpaired student t-test was used for parametric data. Variables before and

after the operation in each patient were compared using paired *t*-test. Group means were compared using one-way ANOVA followed by Newman-Keul's test as post hoc. A two-tailed *p*-value less than 0.05 was considered statistically significant.

### 3. Results

#### 3.1. Baseline General Characteristics of Study Participants

The general characteristics of the study population are summarized in **Tables 1-3**. From **Table 1**, the majority of the participants were married (83.5%), self-employed (60.2%), and were from the Mole-Dagomba tribe (62.1%). About 46.6% of the participants attained formal education and 19.4% were gainfully employed. The majority were confirmed with varicocele grade II (50.5%) with left-sided being the predominant type (94.2%) (**Table 1**).

As shown in **Table 2**, participants were aged between 55.0 and 69.0 years old. The mean  $\pm$  standard deviation (SD) BMI, body fat, muscle mass, and visceral fat were  $23.63 \pm 2.971$ ,  $17.92 \pm 7.814$ ,  $35.82 \pm 4.322$ , and  $7.434 \pm 3.467$  respectively. The systolic blood pressure (SBP) was between 96.0 and 136.0 mmHg while the diastolic blood pressure (DBP) was between 66.0 and 88.0 mmHg. Before the randomization, the mean  $\pm$  standard deviations (SD) for the total FSH, LH, and Testosterone were  $23.8 \pm 7.788$ ,  $11.85 \pm 3.751$ , and  $2.128 \pm 0.811$  respectively.

**Table 1.** General (categorical variables) characteristics of study participants.

Variable	Frequency (n = 103)	Person (%)
Married	86	83.5
Formal education	48	46.6
Consumption of alcoholic beverage	21	20.4
<b>Ethnicity</b>		
Mole-Dagomba	64	62.1
Other tribes	39	37.9
<b>Occupation status</b>		
Gainful employed	20	19.4
Self-employed	62	60.2
Unemployed	21	20.4
<b>Varicocele grade</b>		
I	16	15.6
II	52	50.5
III	35	33.9
<b>Varicocele type</b>		
Left-sided	97	94.2
Bilateral	6	5.8

Data presented as frequency and percent. Other tribes in Ethnicity included; Dagaati, Frafra, Gonja, Ashanti, Ewe, Ga, and Kassena.

**Table 2.** General (continuous variables), anthropometric characteristics, and baseline hormonal parameters of study participants.

Variable	Minimum	Mean	Std. deviation	Maximum
<b>Age (years)</b>	55.0	60.92	2.487	69.0
<b>Anthropometric measurements</b>				
Weight (kg)	60.1	69.2	15.62	158.0
Height (cm)	82.3	168.9	13.47	183.0
BMI (kg/m <sup>2</sup> )	17.9	23.63	2.971	33.0
Body fat (%)	6.9	17.92	7.814	45.8
Muscle mass (%)	22.6	35.82	4.322	44.7
Visceral fat	2.0	7.434	3.467	17.0
<b>Blood pressure</b>				
SBP (mmHg)	96.0	121.1	7.190	136.0
DBP (mmHg)	66.0	73.7	5.787	88.0
Pulse (beat/mins)	58.0	66.77	5.250	97.0
<b>Pre-operative hormones</b>				
S-Follitropin (FSH) (IU/L)	4.8	23.8	7.788	38.1
S-Lutroppin (LH) (IU/L)	2.0	11.85	3.751	25.0
Total Testosterone (nmol/L)	0.4	2.128	0.811	4.1

Data presented as mean and standard deviation (SD); Abbreviation: BMI—Body Mass Index; SBP—Systolic Blood Pressure; DBP—Diastolic Blood Pressure, FSH—Follicle Stimulating Hormone; LH—Luteinizing Hormones.

**Table 3.** General (continuous variables), age, anthropometric characteristics, and blood pressure at baseline of study participants.

Variable	Observed Group (n = 51)	Surgery Group (n = 52)	p-value
<b>Age (years)</b>	61.35 ± 2.262	60.52 ± 2.666	0.2294
<b>Anthropometry</b>			
Weight (kg)	68.43 ± 19.81	69.93 ± 10.48	0.7300
Height (cm)	166.7 ± 18.23	171.0 ± 5.831	0.2509
BMI (kg/m <sup>2</sup> )	22.76 ± 2.857	24.48 ± 2.880	0.0337
Body fat (%)	17.44 ± 8.634	18.38 ± 7.070	0.6648
Muscle mass (%)	36.21 ± 4.142	35.44 ± 4.534	0.5235
Visceral fat	6.538 ± 2.420	8.296 ± 4.103	0.0644
<b>Blood Pressures</b>			
SBP (mmHg)	121.2 ± 13.59	121.0 ± 11.23	0.9697
DBP (mmHg)	72.81 ± 4.77	71.67 ± 4.444	0.1247
Pulse (beat/min)	66.15 ± 5.12	68.22 ± 6.11	0.2986

Data presented as mean ± standard deviation (SD); quantitative variables compared using unpaired *t*-test statistics and a two-tailed p-value less than 0.05 considered statistically significant. Abbreviation: BMI—Body Mass Index; SBP—Systolic Blood Pressure; DBP—Diastolic Blood Pressure.

The eligible participants were randomized into; the observed group and the surgery group (those who had undergone varicocelectomy). At baseline, participants in the surgery group recorded significantly higher BMI ( $p = 0.0337$ ) compared with their counterparts. However, there was no significant difference between the age ( $p = 0.2294$ ), body fat ( $p = 0.6648$ ), muscle mass ( $p = 0.5235$ ) and visceral fat ( $p = 0.0644$ ) (**Table 3**).

### **3.2. Baseline Score of Sexual Dysfunctions among Participants according to Golombok Rust Inventory of Sexual Satisfaction (GRISS)**

The sexual function scores of the participants for each GRISS scale are shown in **Figure 2**. The Stanine scale depicting sexual dysfunction for the overall male score ranges from 6 - 9, impotence (5 - 9), premature ejaculation (4 - 9), non-sensuality (5 - 9), avoidance (4 - 9), dissatisfaction (4 - 9), in frequency (5 - 7), and non-communication (6 - 9) with the prevailing value for each of these scales being a score of 5 or above.

### **3.3. Subscale Score among Participants Using GRISS**

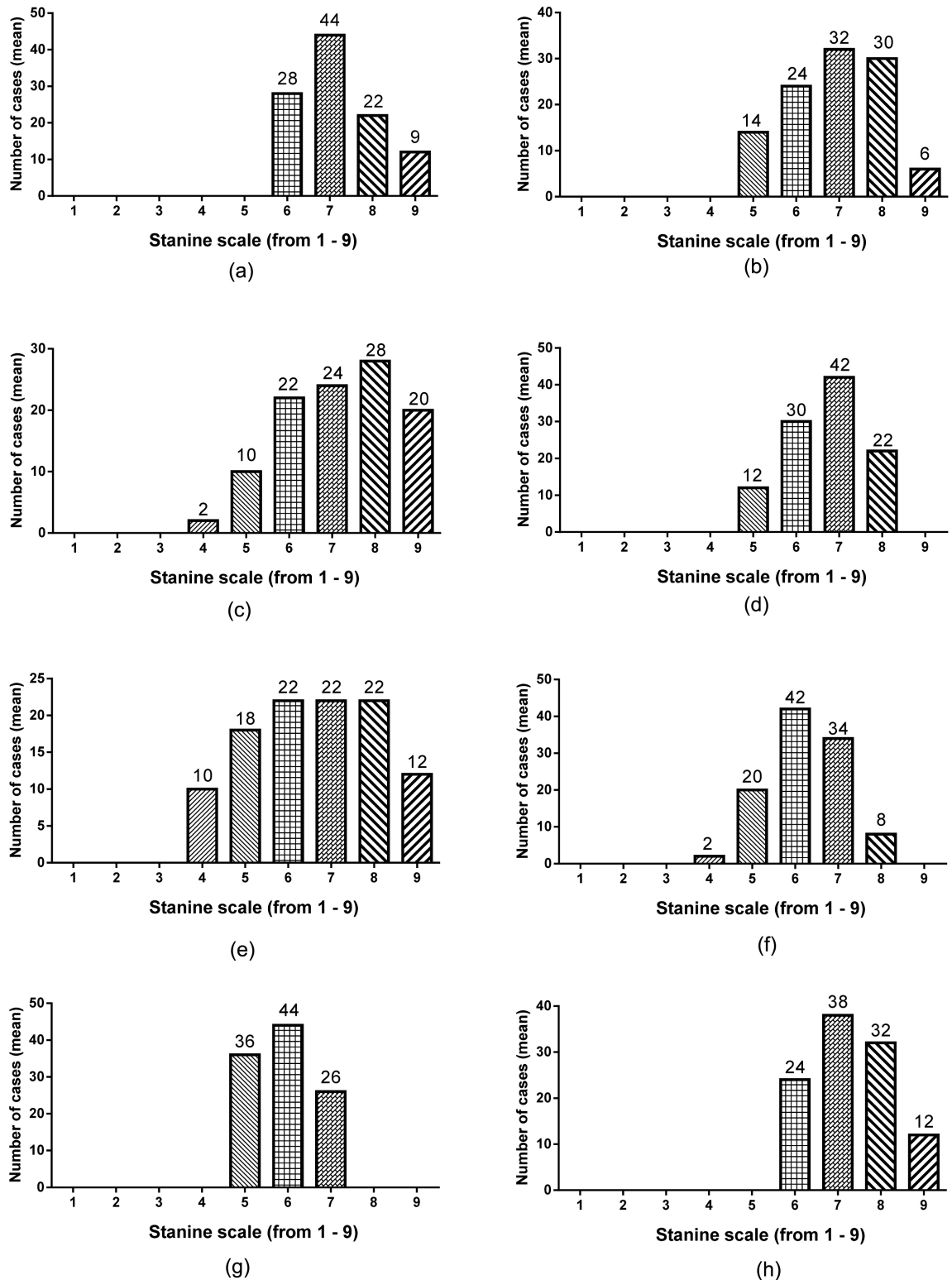
As shown in **Table 4**, all consenting participants had one or more baseline subscale scores reflecting sexual problems as the overall GRISS scale and the score for each subscale was above the upper value of 5. The distribution of the baseline subscale score for each of the groups was almost the same such that there was no significant ( $p < 0.05$ ) difference between their means.

After 12 months of follow-up, the overall male scale ( $3.259 \pm 0.9027$ ), impotence ( $3.037 \pm 1.1260$ ), premature ejaculation ( $3.481 \pm 1.2820$ ), non-sensuality ( $2.667 \pm 0.9199$ ), avoidance ( $3.148 \pm 1.4060$ ), dissatisfaction ( $2.222 \pm 0.8006$ ), infrequency ( $1.963 \pm 0.8077$ ) and non-communication ( $3.407 \pm 1.1180$ ) were significantly ( $p < 0.0001$ ) lower in the surgery group compared with the observed group (**Table 4**).

### **3.4. Distribution of Gonadal Function over 48 Months of Follow-Up among Study Participants**

The gonadal function was compared to the baseline measurement for over the 48 months follow-up in each group. From the unpaired t-test analysis, before the operation, there was no difference between the serum testosterone ( $p = 0.6078$ ), FSH ( $p = 0.6522$ ) and LH ( $p = 0.2281$ ). After 48 months of follow-up, the serum testosterone increased in 12 months ( $p < 0.0001$ ), 24 months ( $p < 0.0001$ ), 36 months ( $p < 0.0001$ ), and 48 months ( $p < 0.0001$ ) in patients whom had undergone varicocelectomy compared with the observed group whilst the levels of serum FSH and serum LH values decreased ( $p < 0.0001$ ) respectively (**Table 5** and **Figure 3(a)** and **Figure 3(b)**).

According to the paired t-test statistics showing whether the difference between gonadal hormones among each group was significant; in the surgery group, baseline serum testosterone was  $2.185 \pm 0.730$  but increased in 12 months



**Figure 2.** Score of sexual dysfunctions among participants according to Golombok Rust Inventory of Sexual Satisfaction (GRISS) questionnaire. Graphs show the number of participants (y-axis) and Stanine scale (from 1 - 9 on the x-axis) for each GRISS subscale. Normal scores range from 1 - 4 and 5 - 9 indicate the abnormal score. (a) Overall male score; (b) Impotence; (c) Premature Ejaculation; (d) Non-sensuality; (e) Avoidance; (f) Dissatisfaction; (g) Infrequency; (h) Non-communication.

**Table 4.** Subscale score among participants using GRISS.

GRISS SCALE	Observed Group (n = 51)	Surgery Group (n = 52)	p-value
<b>Baseline (Onset)</b>			
Overall male scale	7.115 ± 1.033	7.222 ± 0.891	0.6882
Impotence	6.769 ± 1.142	7.037 ± 1.126	0.3941
Premature Ejaculation	6.846 ± 1.287	7.519 ± 1.312	0.0654
Non-sensuality	6.615 ± 0.983	6.778 ± 0.892	0.5312
Avoidance	6.231 ± 1.478	6.963 ± 1.480	0.0775
Dissatisfaction	6.308 ± 0.970	6.185 ± 0.879	0.6318
Infrequency	5.846 ± 0.732	5.963 ± 0.808	0.5840
Non-communication	7.269 ± 0.919	7.333 ± 1.000	0.8092
<b>12 Months</b>			
Overall male scale	7.269 ± 0.8744	3.259 ± 0.9027	<0.0001
Impotence	7.231 ± 0.7646	3.037 ± 1.1260	<0.0001
Premature Ejaculation	7.077 ± 0.8910	3.481 ± 1.2820	<0.0001
Non-sensuality	6.692 ± 1.1580	2.667 ± 0.9199	<0.0001
Avoidance	6.500 ± 1.0680	3.148 ± 1.4060	<0.0001
Dissatisfaction	6.692 ± 1.0110	2.222 ± 0.8006	<0.0001
Infrequency	6.846 ± 0.8339	1.963 ± 0.8077	<0.0001
Non-communication	7.000 ± 0.9381	3.407 ± 1.1180	<0.0001

Data presented as mean ± standard deviation (SD); quantitative variables compared using unpaired t-test statistics and p-value < 0.05 considered statistically significant.

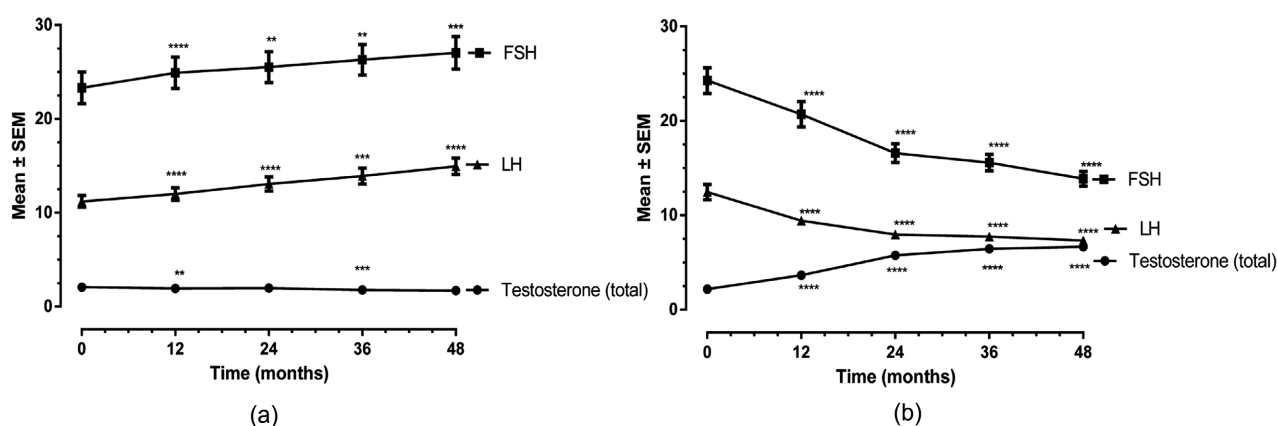
**Table 5.** The distribution of gonadal function over 48 months of follow-up among study participants.

Variable	Baseline	12 months	24 months	36 months	48 months	One-way ANOVA; p-value	p-trend
<b>FSH (IU/L)</b>							
Observed group	23.30 ± 8.642	24.91 ± 8.446****	25.52 ± 8.339**	26.31 ± 8.257**	27.03 ± 8.799***	F (4,125) = 0.7348; p = 0.5699	0.0949
Surgery group	24.28 ± 7.001	20.69 ± 6.947****	16.59 ± 5.197****	15.57 ± 4.512****	13.87 ± 4.019****	F (4,130) = 14.99; p < 0.0001	<0.0001
p-value	0.6522	0.0518	<0.0001	<0.0001	<0.0001		
<b>LH (IU/L)</b>							
Observed group	11.21 ± 3.168	12.00 ± 3.335****	13.07 ± 3.850****	13.91 ± 4.368****	14.94 ± 4.439****	F (4,125) = 3.823; p = 0.0058	0.0002

## Continued

Surgery group	12.46 ± 4.207	9.419 ± 2.410****	7.970 ± 1.668****	7.752 ± 1.313****	7.323 ± 1.452****	F (4,130) = 19.80; p < 0.0001	<0.0001
p-value	0.2281	0.0021	<0.0001	<0.0001	<0.0001		
<b>Testosterone (nmol/L)</b>							
Observed group	2.069 ± 0.899	1.931 ± 1.931**	1.977 ± 0.9052	1.773 ± 0.8488***	1.869 ± 1.333	F (4,125) = 0.3298; p = 0.8575	0.3654
Surgery group	2.185 ± 0.730	3.644 ± 1.239****	5.915 ± 2.101****	6.444 ± 2.211****	6.667 ± 2.202****	F (4,130) = 32.17; p < 0.0001	<0.0001
p-value	0.6078	<0.0001	<0.0001	<0.0001	<0.0001		

The data were presented as mean ± SD. The presence of significant differences among means of the groups was determined by one-way ANOVA followed by Newman-Keul's test as post hoc. Significantly different from baseline (Ctrl): \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001 by Newman-Keuls test.



**Figure 3.** Mean difference in the hormones for each of the groups; data presented as means ± standard error of mean. (a) For the observed group; (b) For the surgery group.

(p < 0.0001) through to 48 months (p < 0.0001) whilst serum FSH (baseline: 24.28 ± 7.001) and LH (baseline: 12.46 ± 4.207) decreased significantly (p < 0.0001) throughout the 48 months of follow-up. On the other hand, the baseline serum testosterone was 2.069 ± 0.899 but reduced in 12 months (p = 0.001) and 36 months (p < 0.0001) whilst serum FSH (baseline: 23.30 ± 8.642) and LH (baseline: 11.21 ± 3.168) continued to increase (p < 0.0001) for the 48 months of follow-up in the observed group (Table 5).

For the one-way ANOVA statistics, serum FSH increased significantly (p < 0.05) in the observed group for every 12 months of follow-up through to the 48 months, but the group means did not vary statistically (F (4,125) = 0.7348, p = 0.5699; p-trend = 0.0949). However, after 48 months of follow-up, the serum FSH values were significantly lowered and the linear trend indicated a significant reduction (F (4,130) = 14.99, p < 0.0001; p-trend < 0.001) for each year among

participants who had the surgery. The serum luteinizing hormone (LH) generally showed a significant difference between the observed group and the varicocelelectomy group. Luteinizing hormone (LH) significantly ( $F(4,125) = 3.823$ ,  $p = 0.0058$ ) increased in the observed group with the linear trend showing the rise ( $p\text{-trend} = 0.002$ ) but decreased ( $F(4,130) = 19.80$ ,  $p < 0.0001$ ) in the operated group with a lowered linear trend ( $p < 0.0001$ ). Furthermore, total testosterone increased significantly ( $F(4,130) = 32.17$ ,  $p < 0.0001$ ) in the operated group with a linear trend ( $p < 0.0001$ ) depicting the increase but was moderately decreased in the observed group although this was not statistically significant (Table 5).

### 3.5. Comparison of Overall Percentage Change in Gonadal Function over 48 Months Follow-Up

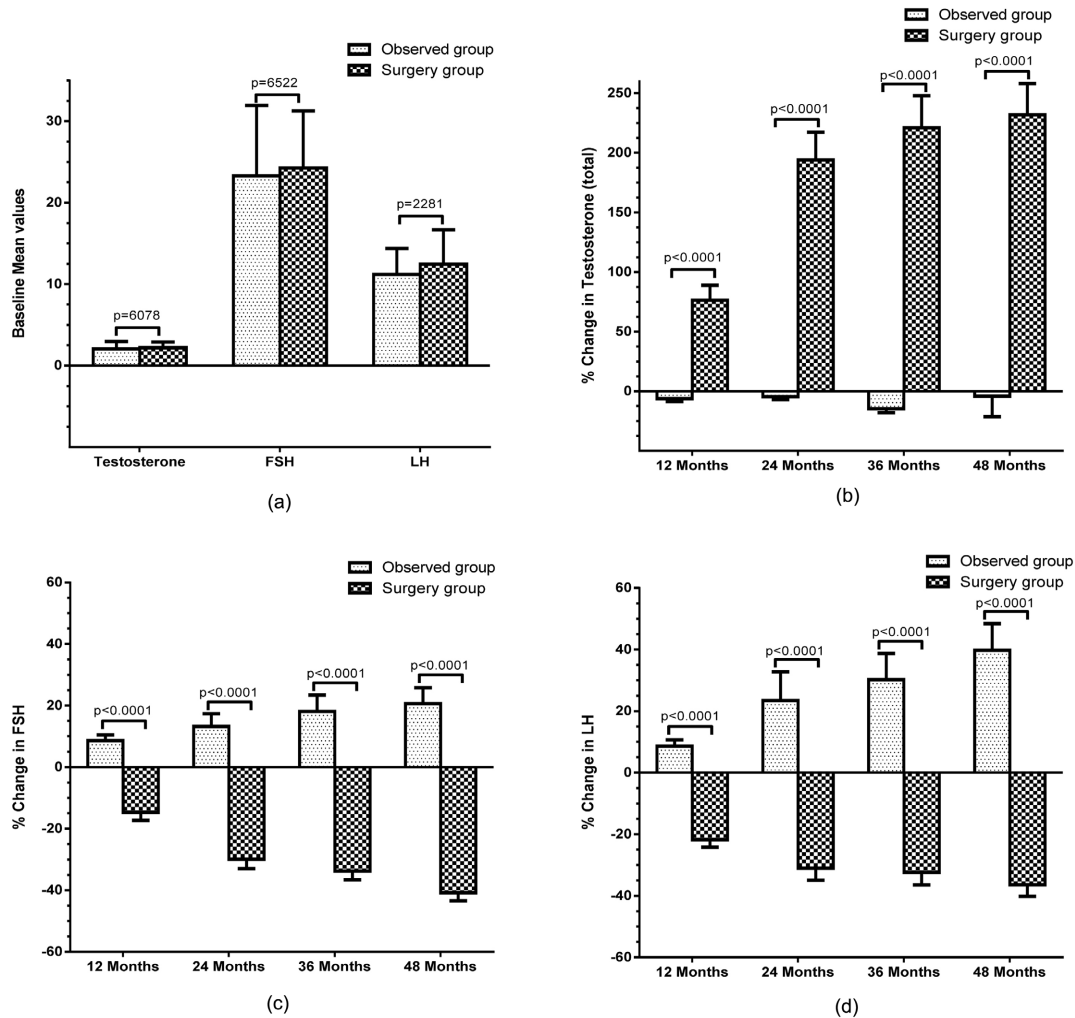
As shown in Figure 4, the baseline serum total testosterone ( $p = 6078$ ), serum FSH ( $p = 6522$ ) and LH ( $p = 6078$ ) did not vary significantly among the two groups (Figure 4(a)). However, a 76.3% increase in testosterone was observed in 12 months, 194.0% in 24 months, 221.0% in 36 months, and 231.9% increase in 48 months among participants who had surgery compared with a percentage reduction in the observed group. The percentage variations between these two groups were statistically significant (Figure 4(b)).

A significant ( $p < 0.0001$ ) reduction in FSH was observed in the surgery group over the 48 months with the percentage change of 14.7% in 12 months, 29.9% in 24 months, 33.8% in 36 months, and 40.8% in 48 months. While a steady increase in FSH in the observed group with a percentage change of 8.6%, 13.2%, 18.1%, and 20.6% in the first year, second, third, and fourth-year respectively (Figure 4(c)).

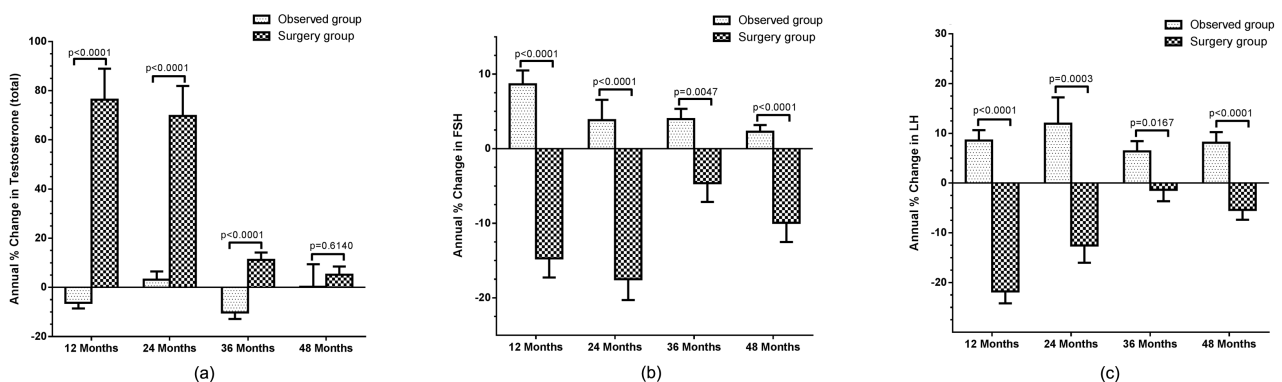
Again, LH reduced significantly ( $p < 0.0001$ ) in the surgery group with the change of 21.8% in 12 months, 31.0% in 24 months, 32.4% in 36 months, and 36.4% in 48 months. Whilst among the observed group, LH increased with a change from the baseline values of 8.6% in 12 months, 23.4% in 24 months, 30.2% in 36 months, and 39.8% in 48 months (Figure 4(d)).

### 3.6. Comparison of Annual Percentage Change in Gonadal Function over the 48 Months Follow-Up

A comparison of annual percentage change in the gonadal function between the two groups is shown in Figure 5. Among participants who had undergone varicocelelectomy, serum total testosterone increased by 76.3% in the first year from the baseline, reduced to 69.7% in the second year, and 11.2% in the third year and further to 5.2% in the fourth year. While in the observed group, a decrease of 6.3% was observed in year one, an increase to 3.1% annually from the first year, then a decrease to 10.2% in the third year and finally increase to 0.3% in the fourth year. The annual variations in percentage change were statistically significant ( $p < 0.05$ ) (Figure 5(a)).



**Figure 4.** Comparison of overall percentage change in gonadal function between the observed group and operated group over 48 months. (a) = a graph of mean values of total testosterone, FSH, and LH between the two groups; (b) = a graph % change in Testosterone; (c) = a graph % change FSH; and (d) = a graph % change in LH. Data presented as group means (SEM). Significantly different between observed group and the surgery group at: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , \*\*\*\* $p < 0.0001$ .



**Figure 5.** Comparison of annual percentage change in gonadal function between the observed group and operated group. (a) = a graph of Annual % change in Testosterone; (b) = a graph of Annual % change in FSH; (c) = a graph of Annual % change in LH respectively. Data presented as group means (SEM). Significantly different between observed group and surgery group at: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , \*\*\*\* $p < 0.0001$ .

As shown in **Figure 5(b)**, serum FSH decreased by 14.7% in the first year from the baseline, decreased further by 17.5% in the second year, an annual decrease of 4.6% in the third year, and in the fourth year, a downward increase by 9.9% in the surgery group. In the observed group, a percentage change of 8.6 was observed in year one, 3.8% in year two, 4.0% in year three, and finally to 2.3% in year four (**Figure 5(b)**).

In the surgery group, serum LH had reduced significantly by 21.8% in the first year, and a year after, changed to 12.5%, further reduced by 1.3% in the third year, and finally to 5.4% in the fourth year. Whilst in the observed group, a percentage change of 8.6% in the first year was observed, then increase to 11.9% the following year, 6.4% in the third year, and further to 8.1% in the fourth year. For each year, the percentage change was statistically significant ( $p < 0.05$ ) (**Figure 5(c)**).

In the surgery group, 5 patients recorded postoperative pain requiring strong opioids, 3 patients experienced severe pains that was not relieved by paracetamol after 24 hours, and 2 patients had postoperative erythema which was noticed on the 3rd and 4th day after the surgery (**Table 6**).

#### 4. Discussion

Erectile dysfunction is commonly reported among mature and aging men [29] [30] with an estimated prevalence of 66% among the Ghanaian populace [31] and rates varying from 12% to 71% in other parts of the world [32] [33].

All enrolled participants in this study were clinically diagnosed [23] and confirmed with varicocele [26]. Earlier studies have reported extreme rarity of isolated right-sided varicocele with reported incidence rates between 2.5% to 6.5% depending on the diagnosis [34] [35]. From the results of this study, 94.0% of the respondents by laterality of varicocele were left-sided while the rest were bilateral, which finding is in consonance with reported rarity of isolated right-sided varicocele.

Baseline analysis of the data showed that all the men had sexual dysfunction based on the GRISS scale with subscale scores above 5 [21]. We observed improved erectile function among study participants who had undergone varicocelectomy 12 months post-operation. Prior to the surgeries, pre-operative hormonal concentrations were recorded which allowed a comparative analysis to post-operative hormonal concentrations to reveal improvements in testosterone

**Table 6.** Post-surgery complications.

Postoperative complications	Frequency (n)	Percent (%)
Postoperative pain	5	9.6
Severe postoperative pain that was not relieved by paracetamol.	3	5.8
Postoperative erythema	2	3.8

concentration among the surgery group. This finding suggests that induced Leydig cell dysfunction attributed to varicocele can be reversed by varicocelectomy which is consistent with reportedly improved erectile function post varicocelectomy by Sathya Srini and Belur Veerachari [19]. The observed improvement in total testosterone levels plays an important role in the male sexual characteristics controlling the timing of the erectile process as a function of sexual desire [36].

There is still a debate on the effect of varicocele on Leydig cell function and testosterone biosynthesis. Some researchers have reported no significant effect of varicocelectomy on testosterone levels [37] [38] with fewer studies reporting significant improvement in gonadal function following varicocelectomy [17] [19] [39]. Sathya Srini and Belur Veerachari [19] reported a significant rise in serum total testosterone from  $1.77 \pm 0.18$  ng/mL pre-varicocelectomy to  $3.01 \pm 0.43$  ng/mL 12 months after surgery and this was associated with insignificant reductions in serum FSH and LH. Su *et al.* [17] also found that serum total testosterone increased post microsurgical varicocelectomy but serum LH and FSH levels did not vary.

Sakamoto and Ogawa [9] reported an association between varicocele and relative testicular hypotrophy. Patients with severe varicocele showed lower testicular volume and increased FSH levels [12] and management of the varicocele reduced this negative effect [9]. A systematic review and meta-analysis of five studies including 312 patients by Tian *et al.* [13] showed that serum FSH levels (95% CI: 0.19 - 0.77;  $p = 0.001$ ) and serum LH levels (95% CI: 0.25 - 0.91;  $p = 0.0005$ ) were higher pre-varicocelectomy compared to post-varicocelectomy. In this study, serum FSH and serum LH decreased significantly after varicocelectomy among the surgery group over the 48 months of follow-up whilst no significant changes were recorded for respondents in the observed group. The observed percent decrease in FSH and LH could be attributed to negative feedback on the hypothalamus-pituitary-gonadal axis as a result of increased serum total testosterone stemming from improvements in Leydig cell function.

Few clinical studies have reported on the effects of varicoceles on serum testosterone and sexual dysfunction. Comhaire and Vermeulen [40] reported decreased testosterone levels and erectile dysfunction in 30% of men with varicoceles and both symptoms improved after varicocelectomy. In 2011, a study conducted by Tanrikut *et al.* [41] demonstrated that men with varicocele had lower serum total testosterone levels compared with controls, and about 79% of cases post-varicocelectomy reported with normal serum total testosterone levels. Cayan *et al.* [42] found that men with varicoceles exhibit decreased free testosterone levels and increased plasma FSH levels but after microsurgical varicocelectomy, the total plasma and free testosterone levels significantly increased and FSH level decreased which findings are consistent with what is reported in this study.

In a meta-analysis of seven studies involving 712 patients to compare pre-and post-surgical serum testosterone levels, Chen *et al.* [43] found that the mean

post-operative serum testosterone concentration improved by 34.3 ng/dL compared with pre-treatment concentrations representing an increase by 105.65 ng/dL in the hypogonadal men, favoring those who had undergone varicocele repair. After the microsurgical sub-inguinal varicocelectomy, sharp increases in serum total testosterone by 76.3% in the first year and subsequent, diminishing change by 69.7% in the second year, 11.2% in the third year, and 5.2% in the fourth year. Contrary to the observations for testosterone concentration, sharp decreases in serum FSH and LH (annual percentage change) was observed post-operatively. The possible explanation may be due to the fact that within the first two years of post-varicocele repair by microsurgical sub-inguinal varicocelectomy, serum testosterone concentration increases whilst serum FSH and LH reduce significantly. From the third year, variations in the annual percent changes in gonadotropin concentration will be marginal as a result of hormonal down regulation.

The following postoperative complications were observed in the surgery group: 1) Postoperative pain requiring strong opioids 5/52 (9.6%); After the surgery, all patients received paracetamol 1000 mg tid for 24 hours with the majority not experiencing pain. However, three patients experienced severe post-operative pain that was not relieved by paracetamol. They, therefore, were given IM Pethidine 50 mg tid to control the pain. 2) Postoperative erythema 2/52 (3.8%); a mild form of surgical site infection which was noticed on postoperative days 3 and 4. Wound swab for culture and sensitivity yielded negative cultures. The wound healed spontaneously without the need for antibiotics.

A major limitation of the study was drop-outs during follow-up, especially among the observed group due to the 48 months long (4 years) duration of follow-up. We recommend the use of microsurgical sub-inguinal varicocelectomy for similar categories of patients with further studies in large sample sizes to provide significant evidence for such therapy.

## 5. Conclusion

Long-standing varicocele may cause Leydig cell damage and this may be seen by causing a further decrease in total testosterone and a concomitant rise in follicle-stimulating hormone (FSH) and luteinizing hormone (LH). This study found that serum total testosterone, FSH, and LH observed spike changes within the first and second year in the surgery group but changes were marginal from the third year onwards. Microsurgical sub-inguinal varicocelectomy improved serum total testosterone, decrease both serum FSH and LH levels, and improve sexual dysfunction in patients reporting with varicocele.

## Acknowledgements

We wish to acknowledge the staff of the Urology Unit in Tamale Teaching Hospital and the following people for their assistance: Nabia Richard and Alfred Faadenige Doglikuu.

## Authors' Contributions

This work was carried out in collaboration with all authors. Authors YA, AAA, and NA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors YA, SBB, VA, and PPMD carried out the sample collection and immunoassays. Authors YA, LQ, SBB, and PPMD managed the analysis of the study, and software and did the validation. Authors YA, AAA, PPMD, and LQ managed the literature searches. All authors read and approved the final manuscript.

## Approval of the Research Protocol

This study was approved by the Ethics and Review Board of the Department of Research and Development, Tamale Teaching Hospital (No: TTH/R & D/SR/119).

## Informed Consent

All patients provided written informed consent before the start of the study.

## Data Availability

The data that support the findings of this study are available on request.

## Conflicts of Interest

All authors declare no competing interests.

## References

- [1] Clavijo, R.I., Carrasquillo, R. and Ramasamy, R. (2017) Varicoceles: Prevalence and Pathogenesis in Adult Men. *Fertility and Sterility*, **108**, 364-369. <https://doi.org/10.1016/j.fertnstert.2017.06.036>
- [2] Bertolotto, M., Freeman, S., Richenberg, J., Belfield, J., Dogra, V., Huang, D.Y., et al. (2020) Ultrasound Evaluation of Varicoceles: Systematic Literature Review and Rationale of the ESUR-SPIWG Guidelines and Recommendations. *Journal of Ultrasound*, **23**, 487-507. <https://doi.org/10.1007/s40477-020-00509-z>
- [3] Paick, S. and Choi, W.S. (2019) Varicocele and Testicular Pain: A Review. *The World Journal of Men's Health*, **37**, 4-11. <https://doi.org/10.5534/wjmh.170010>
- [4] Alsaikhan, B., Alrabeeah, K., Delouya, G. and Zini, A. (2016) Epidemiology of Varicocele. *Asian Journal of Andrology*, **18**, 179-181. <https://doi.org/10.4103/1008-682X.172640>
- [5] Jarow, J.P., Coburn, M. and Sigman, M. (1996) Incidence of Varicoceles in Men with Primary and Secondary Infertility. *Urology*, **47**, 73-76. [https://doi.org/10.1016/S0090-4295\(99\)80385-9](https://doi.org/10.1016/S0090-4295(99)80385-9)
- [6] Gorelick, J.I. and Goldstein, M. (1993) Loss of Fertility in Men with Varicocele. *Fertility and Sterility*, **59**, 613-616. [https://doi.org/10.1016/S0015-0282\(16\)55809-9](https://doi.org/10.1016/S0015-0282(16)55809-9)
- [7] Lipshultz, L.I. and Corriere Jr., J.N. (1977) Progressive Testicular Atrophy in the Varicocele Patient. *The Journal of Urology*, **117**, 175-176. [https://doi.org/10.1016/S0022-5347\(17\)58387-1](https://doi.org/10.1016/S0022-5347(17)58387-1)
- [8] Russell, J. (1957) Varicocele, Age, and Fertility. *The Lancet*, **270**, 222. [https://doi.org/10.1016/S0140-6736\(57\)91599-4](https://doi.org/10.1016/S0140-6736(57)91599-4)

- [9] Sakamoto, H. and Ogawa, Y. (2009) Does a Clinical Varicocele Influence the Relationship between Testicular Volume by Ultrasound and Testicular Function in Patients with Infertility? *Fertility and Sterility*, **92**, 1632-1637. <https://doi.org/10.1016/j.fertnstert.2008.08.105>
- [10] Agarwal, A., Sharma, R., Harlev, A. and Esteves, S.C. (2016) Effect of Varicocele on Semen Characteristics According to the New 2010 World Health Organization Criteria: A Systematic Review and Meta-Analysis. *Asian Journal of Andrology*, **18**, 163-170. <https://doi.org/10.4103/1008-682X.172638>
- [11] Lü, Y.Q. and Chen, B. (2008) Progress in Researches on the Mechanism of Varicocele-Induced Male Infertility. *National Journal of Andrology*, **14**, 454-458.
- [12] Lotti, F., Corona, G., Mancini, M., Biagini, C., Colpi, G.M., Degli Innocenti, S., *et al.* (2009) The Association between Varicocele, Premature Ejaculation and Prostatitis Symptoms: Possible Mechanisms. *The Journal of Sexual Medicine*, **6**, 2878-2887. <https://doi.org/10.1111/j.1743-6109.2009.01417.x>
- [13] Tian, D., Huang, W., Yan, H., Zong, H. and Zhang, Y. (2018) Effect of Varicocelectomy on Serum FSH and LH Levels for Patients with Varicocele: A Systematic Review and Meta-Analysis. *Indian Journal of Surgery*, **80**, 233-238. <https://doi.org/10.1007/s12262-016-1571-1>
- [14] Tiseo, B.C., Esteves, S.C. and Cocuzza, M.S. (2016) Summary Evidence on the Effects of Varicocele Treatment to Improve Natural Fertility in Subfertile Men. *Asian Journal of Andrology*, **18**, 239-245. <https://doi.org/10.4103/1008-682X.172639>
- [15] Li, F., Yue, H., Yamaguchi, K., Okada, K., Matsushita, K., Ando, M., *et al.* (2012) Effect of Surgical Repair on Testosterone Production in Infertile Men with Varicocele: A Meta-Analysis. *International Journal of Urology*, **19**, 149-154. <https://doi.org/10.1111/j.1442-2042.2011.02890.x>
- [16] Çayan, S., Akbay, E., Saylam, B. and Kadioğlu, A. (2020) Effect of Varicocele and Its Treatment on Testosterone in Hypogonadal Men with Varicocele: Review of the Literature. *Balkan Medical Journal*, **37**, 121-124. <https://doi.org/10.4274/balkanmedj.galenos.2020.2020.1.85>
- [17] Su, L.M., Goldstein, M. and Schlegel, P.N. (1995) The Effect of Varicocelectomy on Serum Testosterone Levels in Infertile Men with Varicoceles. *The Journal of Urology*, **154**, 1752-1755. <https://doi.org/10.1097/00005392-199511000-00047>
- [18] Salem, H. and Mostafa, T. (2009) Preserved Testicular Artery at Varicocele Repair. *Andrologia*, **41**, 241-245. <https://doi.org/10.1111/j.1439-0272.2009.00926.x>
- [19] Sathya Srini, V. and Belur Veerachari, S. (2011) Does Varicocelectomy Improve Gonadal Function in Men with Hypogonadism and Infertility? Analysis of a Prospective Study. *International Journal of Endocrinology*, **2011**, Article ID: 916380. <https://doi.org/10.1155/2011/916380>
- [20] Abdel-Meguid, T.A., Al-Sayyad, A., Tayib, A. and Farsi, H.M. (2011) Does Varicocele Repair Improve Male Infertility? An Evidence-Based Perspective from a Randomized, Controlled Trial. *European Urology*, **59**, 455-461. <https://doi.org/10.1016/j.eururo.2010.12.008>
- [21] Rust, J. and Golombok, S. (1985) The Golombok-Rust Inventory of Sexual Satisfaction (GRISS). *British Journal of Clinical Psychology*, **24**, 63-64. <https://doi.org/10.1111/j.2044-8260.1985.tb01314.x>
- [22] Adams, Y., Afoko, A.A. and Amidu, N. (2022) Effect of Varicocelectomy on Semen Parameters of Men Seeking Infertility Treatment in Tamale, Ghana. *Open Journal of Urology*, **12**, 7-26. <https://doi.org/10.4236/oju.2022.121002>
- [23] Dubin, L. and Amelar, R.D. (1970) Varicocele Size and Results of Varicocelectomy

- in Selected Subfertile Men with Varicocele. *Fertility and Sterility*, **21**, 606-609.
- [24] WHO (1992) The Influence of Varicocele on Parameters of Fertility in a Large Group of Men Presenting to Infertility Clinics. *Fertility and Sterility*, **57**, 1289-1293. [https://doi.org/10.1016/S0015-0282\(16\)55089-4](https://doi.org/10.1016/S0015-0282(16)55089-4)
- [25] Marsman, J. and Schats, R. (1994) The Subclinical Varicocele Debate. *Human Reproduction*, **9**, 1-8. <https://doi.org/10.1093/oxfordjournals.humrep.a138294>
- [26] Hussein, A.F. (2006) The Role of Color Doppler Ultrasound in Prediction of the Outcome of Microsurgical Subinguinal Varicocelectomy. *The Journal of Urology*, **176**, 2141-2145. <https://doi.org/10.1016/j.juro.2006.07.009>
- [27] Mittal, B.V. and Singh, A.K. (2010) Hypertension in the Developing World: Challenges and Opportunities. *American Journal of Kidney Diseases*, **55**, 590-598. <https://doi.org/10.1053/j.ajkd.2009.06.044>
- [28] Marmar, J.L., DeBenedictis, T.J. and Prais, D. (1985) The Management of Varicoceles by Microdissection of the Spermatic Cord at the External Inguinal Ring. *Fertility and Sterility*, **43**, 583-588. [https://doi.org/10.1016/S0015-0282\(16\)48501-8](https://doi.org/10.1016/S0015-0282(16)48501-8)
- [29] Ayta, I., McKinlay, J. and Krane, R. (1999) The Likely Worldwide Increase in Erectile Dysfunction between 1995 and 2025 and Some Possible Policy Consequences. *BJU International*, **84**, 50-56. <https://doi.org/10.1046/j.1464-410x.1999.00142.x>
- [30] Feldman, H.A., Goldstein, I., Hatzichristou, D.G., Krane, R.J. and McKinlay, J.B. (1994) Impotence and Its Medical and Psychosocial Correlates: Results of the Massachusetts Male Aging Study. *The Journal of Urology*, **151**, 54-61. [https://doi.org/10.1016/S0022-5347\(17\)34871-1](https://doi.org/10.1016/S0022-5347(17)34871-1)
- [31] Amidu, N., Owiredu, W.K., Woode, E., Addai-Mensah, O., Gyasi-Sarpong, K. and Alhassan, A. (2010) Prevalence of Male Sexual Dysfunction among Ghanaian Population: Myth or Reality? *International Journal of Impotence Research*, **22**, 337-342. <https://doi.org/10.1038/ijir.2010.24>
- [32] Lyngdorf, P. and Hemmingsen, L. (2004) Epidemiology of Erectile Dysfunction and Its Risk Factors: A Practice-Based Study in Denmark. *International Journal of Impotence Research*, **16**, 105-111. <https://doi.org/10.1038/sj.ijir.3901184>
- [33] Braun, M., Wassmer, G., Klotz, T., Reifenrath, B., Mathers, M. and Engelmann, U. (2000) Epidemiology of Erectile Dysfunction: Results of the 'Cologne Male Survey'. *International Journal of Impotence Research*, **12**, 305-311. <https://doi.org/10.1038/sj.ijir.3900622>
- [34] Matsuda, T. (1993) Varicocelectomy. *The Japanese Journal of Urology*, **84**, 797-813. <https://doi.org/10.5980/jpnjurol1989.84.797>
- [35] Onozawa, M., Endo, F., Suetomi, T., Takeshima, H. and Akaza, H. (2002) Clinical Study of Varicocele: Statistical Analysis and the Results of Long-Term Follow-Up. *International Journal of Urology*, **9**, 455-461. <https://doi.org/10.1046/j.1442-2042.2002.00501.x>
- [36] Corona, G. and Maggi, M. (2010) The Role of Testosterone in Erectile Dysfunction. *Nature Reviews Urology*, **7**, 46-56. <https://doi.org/10.1038/nrurol.2009.235>
- [37] Segenreich, E., Shmueli, H., Singer, R. and Servadio, C. (1986) Andrological Parameters in Patients with Varicocele and Fertility Disorders Treated by High Ligation of the Left Spermatic Vein. *International Journal of Fertility*, **31**, 200-203.
- [38] Pasqualotto, F.F., Sundaram, A., Sharma, R.K., Borges Jr., E., Pasqualotto, E.B. and Agarwal, A. (2008) Semen Quality and Oxidative Stress Scores in Fertile and Infertile Patients with Varicocele. *Fertility and Sterility*, **89**, 602-607. <https://doi.org/10.1016/j.fertnstert.2007.03.057>

- [39] Hurtado de Catalfo, G.E., Ranieri-Casilla, A., Marra, F.A., De Alaniz, M.J. and Marra, C.A. (2007) Oxidative Stress Biomarkers and Hormonal Profile in Human Patients Undergoing Varicocelectomy. *International Journal of Andrology*, **30**, 519-530. <https://doi.org/10.1111/j.1365-2605.2007.00753.x>
- [40] Comhaire, F. and Vermeulen, A. (1975) Plasma Testosterone in Patients with Varicocele and Sexual Inadequacy. *The Journal of Clinical Endocrinology & Metabolism*, **40**, 824-829. <https://doi.org/10.1210/jcem-40-5-824>
- [41] Tanrikut, C., Goldstein, M., Rosoff, J.S., Lee, R.K., Nelson, C.J. and Mulhall, J.P. (2011) Varicocele as a Risk Factor for Androgen Deficiency and Effect of Repair. *BJU International*, **108**, 1480-1484. <https://doi.org/10.1111/j.1464-410X.2010.10030.x>
- [42] Cayan, S., Kadioglu, A., Orhan, I., Kandirali, E., Tefekli, A. and Tellaloglu, S. (1999) The Effect of Microsurgical Varicocelectomy on Serum Follicle Stimulating Hormone, Testosterone and Free Testosterone Levels in Infertile Men with Varicocele. *BJU International*, **84**, 1046-1049. <https://doi.org/10.1046/j.1464-410x.1999.00353.x>
- [43] Chen, X., Yang, D., Lin, G., Bao, J., Wang, J. and Tan, W. (2017) Efficacy of Varicocelectomy in the Treatment of Hypogonadism in Subfertile Males with Clinical Varicocele: A Meta-Analysis. *Andrologia*, **49**, e12778. <https://doi.org/10.1111/and.12778>

## Appendix

### QUESTIONNAIRE adopted from Adams *et al.* [22]

To be completed by each subject participating in the study

Tel.: ..... Code: .....

Please tick [] the appropriate box where applicable

#### Pre-assessment check for exclusion in the study

- 1) Are you a known hypertensive patient? [] Yes [] No
- 2) Are you a known diabetic patient? [] Yes [] No
- 3) Have you ever been diagnosed of tuberculosis? [] Yes [] No
- 4) Do you have past history of any of this; mumps orchitis, undescended testis, or orchidectomy? [] Yes [] No
- 5) Are you on/or ever been administered with anti-estrogen and/or testosterone replacement therapy? [] Yes [] No

#### Sociodemographic characteristics of study participants

- 1) Age: .....
- 2) Sex: [] male [] female
- 3) Marital status [] single [] married [] divorced [] widowed
- 4) Highest Education level [] none [] primary [] secondary [] tertiary
- 5) Occupation: [] unemployed [] trader/self-employed [] gainful employed
- 6) Ethnicity: [] Mole-Dagomba [] other ethnic

#### Lifestyle

- 7) Do you consume alcoholic beverages? [] yes [] no  
If yes to question 6, how many alcoholic beverages do you consume on an average per day? [] 1 bottle [] 2 - 3 bottles [] >3 bottles
- 8) Do you smoke cigarette? [] yes [] no  
If yes, [] 1 pack/day [] 2 pack/day [] >2 pack/day
- 9) Number of sexual partners? [] one [] two [] three [] four [] more than four

#### Anthropometric measurement

- 10) Height (cm): i.....ii.....average (i & ii).....
- 11) Weight (kg): i.....ii.....average (i & ii).....
- 12) BMI (kg/m<sup>2</sup>): i.....ii.....average (i & ii).....
- 13) body fat (%): i.....ii.....average (i & ii).....
- 14) Muscle mass (%): i.....ii.....average (i & ii).....
- 15) Visceral fat: i.....ii.....average (i & ii).....

#### Blood pressure measurement

- 16) SBP (mmHg): i.....ii.....average (i & ii).....
- 17) DBP (mmHg): i.....ii.....average (i & ii).....
- 18) Pulse (beat/minutes): i.....ii.....average (i & ii).....

#### Brief Medical history

19) How long have you and partner been trying to conceive with unprotected sexual intercourse?

Months: ..... Years: .....

- 20) Have you ever had a pregnancy with your current partner?  Yes  No  
If yes to question 10, how many pregnancies? .....  
How many did your partner successfully give birth to? .....
- 21) Have you ever had a pregnancy with another partner?  Yes  No  
If yes to question 11, how many pregnancies? .....  
How many did your partner successfully give birth to? .....
- 22) If you have children, how many are boy .....  
And how many are girls? .....
- 23) Has your current partner ever been pregnant with another partner?  Yes  
 No  
If yes to question 13,  
How many pregnancies? .....  
How many did your partner successfully give birth to? .....
- 24) Have you had any problems with erection?  Yes  No
- 25) How often do you have sex with your partner?  
per/day ..... per/week ..... per/month .....
- 26) Have you ever been treated for a sexually transmitted infection?  Yes   
No  
If yes, what infection? ..... when?.....
- 27) Did you ever have a surgery where your testes' was brought into the scrotum when you were a child?  Yes  No  
If so, did it affect your testes? ..... which sides(s)? .....
- 28) Did you ever have a surgery of your testes?  Yes  No  
If so, did it affect your testes? ..... which side(s)? .....
- Post-surgery questions (Please tick [] the appropriate box where applicable)**
- 29) Have you had any problems with erection post-surgery?  Yes  No
- 30) Have you started having sexual intercourse with your partner?  Yes   
No
- 31) How often do you have sex with your partner?  
per/day ..... per/week .....per/month .....
- 32) Do you use lubricant(s) during sexual activity?  Yes  No  
If so, what type/brand? .....
- 33) Are you currently taking any medications on a regular basis?  Yes  No  
If so, what medication? .....
- 34) Has your current partner complained of not seeing her menses (monthly period)?  Yes  No  
If so, when? .....
- 35) Is your partner pregnant?  Yes  No  
If so, when did she disclose this information to you? .....
- 36) Any other complication(s) after your surgery? .....

**MALE (GRISS-M) QUESTIONNAIRE adopted from Rust, J. and S. Gollombok [21]**

Instructions: Each question is followed by a series of possible answers:

- N—NEVER
- H—HARDLY EVER
- O—OCCASIONALLY
- U—USUALLY
- A—ALWAYS

Read each question carefully and decide which answer best describes the way things have been for you recently; then circle the corresponding letter.

**Please answer every question.**

If you are not completely sure which answer is most appropriate, circle the answer which you feel is most appropriate.

Please answer this questionnaire without discussing any of the questions with your partner. In order for us to obtain valid information it is important for you to answer each question as honestly and as accurately.

---

1	Do you have sexual intercourse more than twice a week?	N	H	O	U	A
2	Do you find it hard to tell your partner what you like and dislike about your sexual relationship?	N	H	O	U	A
3	Do you become easily sexually aroused?	N	H	O	U	A
4	Are you able to delay ejaculation during intercourse if you think you may be "coming" too quickly	N	H	O	U	A
5	Are you dissatisfied with the amount of variety in your sex life with your partner?	N	H	O	U	A
6	Do you dislike stroking and caressing your partner's genitals?	N	H	O	U	A
7	Do you become tense and anxious when your partner wants to have sex?	N	H	O	U	A
8	Do you enjoy having sexual intercourse with your partner?	N	H	O	U	A
9	Do you ask your partner what she likes and dislikes about your sexual relationship?	N	H	O	U	A
10	Do you fail to get an erection?	N	H	O	U	A
11	Do you feel there is a lack of love and affection in your sexual relationship with your partner?	N	H	O	U	A
12	Do you enjoy having your penis stroked and caressed by your partner?	N	H	O	U	A
13	Can you avoid ejaculating too quickly during intercourse?	N	H	O	U	A
14	Do you try to avoid having sex with your partner?	N	H	O	U	A
15	Do you find your sexual relationship with your partner satisfactory?	N	H	O	U	A
16	Do you get an erection during foreplay with your partner?	N	H	O	U	A
17	Are there weeks in which you don't have sex at all?	N	H	O	U	A

---

**Continued**

---

18	Do you enjoy mutual masturbation with your partner?	N	H	O	U	A
19	If you want sex with your partner, do you take the initiative?	N	H	O	U	A
20	Do you dislike being cuddled and caressed by your partner?	N	H	O	U	A
21	Do you have sexual intercourse as often as you would like?	N	H	O	U	A
22	Do you refuse to have sex with your partner?	N	H	O	U	A
23	Do you lose your erection during intercourse?	N	H	O	U	A
24	Do you ejaculate without wanting to almost as soon as your penis enters your partner's vagina?	N	H	O	U	A
25	Do you enjoy cuddling and caressing your partner's body?	N	H	O	U	A
26	Do you feel uninterested in sex?	N	H	O	U	A
27	Do you ejaculate by accident just before your penis is about to enter your partner's vagina?	N	H	O	U	A
28	Do you have feelings of disgust about what you and your partner do during lovemaking?	N	H	O	U	A

---

**Abbreviations and Acronyms**

ANOVA = Analysis Of Variance

BMI = Body Mass Index

DBP = Diastolic Blood Pressure

FSH = Follicle-Stimulating Hormone

GRISS = Golombok Rust Inventory of Sexual Satisfaction

LH = Luteinizing Hormone

RCT = Randomize Control Trials

SBP = Systolic Blood Pressure

SUE = Scrotal Ultrasound Evaluation

TTH = Tamale Teaching Hospital

WHO = World Health Organization

# Laparoscopic Varicocelectomy: Results and Outcomes in a Single Center in Cameroon

Cyril Kamadjou<sup>1,2\*</sup>, Basile Essola<sup>2</sup>, Divine Eyongeta<sup>3</sup>, Emmanuel Muhawenimana<sup>4</sup>, Annie Kameni<sup>4</sup>, Fru Angwafo<sup>5</sup>

<sup>1</sup>Medical and Surgical Center of Urology, Douala, Cameroon

<sup>2</sup>Department of Surgery and Specialties, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon

<sup>3</sup>Department of Surgery, Faculty of Health Sciences, University of Buea, Buea, Cameroon

<sup>4</sup>Kigali Teaching Hospital, Kigali, Rwanda

<sup>5</sup>Coordinator Urology Residency Program, Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon

Email: \*cyrkamadjou@yahoo.fr

**How to cite this paper:** Kamadjou, C., Essola, B., Eyongeta, D., Muhawenimana, E., Kameni, A. and Angwafo, F. (2022) Laparoscopic Varicocelectomy: Results and Outcomes in a Single Center in Cameroon. *Open Journal of Urology*, 12, 331-341.

<https://doi.org/10.4236/oju.2022.126032>

**Received:** January 16, 2022

**Accepted:** June 11, 2022

**Published:** June 14, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Background and Objective:** The optimal treatment for varicocele is still controversial. Although there are many treatment methods, none can be considered as the best therapeutic option. We present our initial laparoscopic varicocelectomy experience by describing the clinical aspects and evaluating the outcomes of this surgical procedure at the *Centre medico-chirurgical d'urologie* in Douala, Cameroon. **Materials and Methods:** This was a retrospective study carried out between January 2015 and December 2019 on 35 patients with symptomatic varicoceles who were treated for either testicular pain or infertility. All surgical procedures were performed via laparoscopy, with ligation of the spermatic vein using a hemlock clip in the retroperitoneal space. The patients were followed up for three months after surgery, and data were collected and analyzed to obtain results. **Results:** The study participants were aged 16 - 55 years, with a mean age of  $36.11 \pm 8.45$  years. Infertility was the main presenting complaint. In 65.7% of cases, varicoceles were bilateral with testicular atrophy occurring in 26 patients (74.28%). The surgery duration ranged from 14 minutes to 60 minutes, with an average duration of 34.8 minutes. There was no case of conversion to open surgery. No major complications were observed and all patients were discharged the day after surgery. Three months after surgery, all patients stopped experiencing pain and semen parameters improved in 71.42% of the study participants, with 42.82% of them impregnating their partners. **Conclusion:** Laparoscopic varicocelectomy is efficient, less time-consuming, with minimal postoperative complications. It can be performed easily in the outpatient department.

---

## Keywords

Varicocele, Laparoscopic Varicocelectomy, Testicular Pain, Male Infertility

---

### 1. Introduction

The testes, which are the male gonads, are a set of oval-shaped organs located in the scrotum. They are suspended in the scrotum by spermatic cords, which are cord-like structures that run from the deep inguinal ring down to each testicle. The spermatic cord is made up of the vas deferens, the testicular artery, the artery of the ductus deferens, the cremasteric artery, the pampiniform plexus, the genital branch of the genitofemoral nerve, sympathetic and parasympathetic nerves, and lymphatic vessels. Venous drainage of the testis is done via the pampiniform plexus, which is primarily drained by the testicular and external pudendal veins [1]. Varicocele is a vascular abnormality of the testicular venous drainage system. It is better defined as an abnormal venous dilatation and/or tortuosity of the pampiniform plexus in the scrotum. It represents the most common cause of primary and secondary infertility in men [2]. Varicocele more commonly occurs in the left (in 78% - 93% of cases) since the left testicular vein is usually 8 - 10 cm longer than its right counterpart [3]. This condition, which is a major cause of infertility in men, is present in 19% - 41% of infertile men [4]. It is found in 15% of the general population [5], 35% of men with primary infertility, and 81% of men with secondary infertility [6]. In fact, this condition is often diagnosed during routine workup for male infertility. There are no confirmed risk factors for this condition; however, Kumanov *et al.* reported that the incidence of varicocele in adolescents was associated with certain somatometric parameters, some of which predisposed patients to varicocele (height, penile length, and penile circumference) and others that protected them against varicocele (weight and BMI) [7]. The etiology of varicocele is said to be multifactorial. The anatomic differences in venous drainage between the left and right internal spermatic vein (accounting for the predominance of left-sided varicocele), and the incompetence of venous valves resulting in reflux of venous blood and increased hydrostatic pressure are the most quoted theories for varicocele development [8]. Physical exertion during puberty may lead to the development of varicocele whereas physical exertion at a later age can aggravate the condition but does not modify the prevalence of varicocele [9]. Clinically, a varicocele can be identified via an increase in the size of the affected testis and a palpable dilatation in the pampiniform plexus of the affected testis with or without the help of the Valsalva maneuver [10]. Varicoceles could also present with a dull, aching, or throbbing pain in the testicle, scrotum, or groin; rarely, it can be acute, sharp, or stabbing [11]. Imaging modalities for the diagnosis of varicocele include ultrasound, which is the most widely used imaging modality [12], and retrograde spermatic venography, which is considered the gold standard for diagnosis [13].

Treatment options for varicoceles include open varicocelectomy performed at various anatomical levels, laparoscopic varicocelectomy (which has been proven to be a safe and effective treatment for varicoceles), robotic surgery (which was introduced recently as an alternative surgical option for varicocelectomy), and microsurgical varicocelectomy (which has gained increasing popularity among experts in male reproductive medicine as the treatment of choice for varicocele because of its superior surgical outcomes [14]). Laparoscopic varicocelectomy has been widely used to treat varicoceles, and this technique has been reported to be associated with a low incidence of persistent or recurrent hydrocele [15]. Despite its numerous advantages, this procedure is not yet common practice in Africa. In 2020, Gbenou *et al.* reported that laparoscopic treatment was done as part of a training mission for pediatric surgeons through a European Non-governmental organization in two university hospitals in Africa [16]. With time, many surgeons and urologists are getting trained in laparoscopic surgery, and laparoscopic procedures are becoming common in this part of the globe. In this paper, we present our initial laparoscopic varicocelectomy by describing the clinical aspects of varicoceles (with a special focus on varicocele-associated pain and the effect of varicoceles on sperm quality) and evaluating the outcomes of this surgical procedure at the *Centre medico-chirurgicale d'urologie* in Douala, Cameroon.

## 2. Materials and Methods

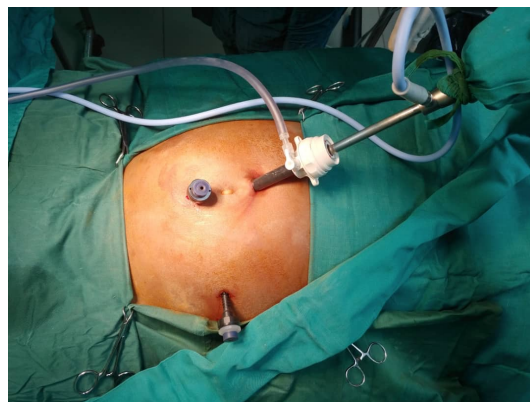
This was a retrospective study carried out at the *Centre medico-chirurgicale d'urologie* in Douala, Cameroon. The clinical records of 35 male patients who were managed at our center between January 2015 and December 2019 were consulted for data collection. We included patients who were diagnosed with varicocele and underwent laparoscopic varicocelectomy and excluded patients with incomplete clinical records. The data collected from the patients' clinical records include patients' ages, professions, initial clinical presentation (testicular pain or infertility), laterality (left, right, or bilateral), testicular volume, method of diagnosis of varicoceles, varicocele grade, results of semen analyses, surgery duration, postoperative hospitalization, and postoperative complications. In this study, varicoceles were graded using the Dubin and Amelar varicocele grading system as shown in **Figure 1**.

Laparoscopic varicocelectomy was performed under general anesthesia in all cases, with the patients in the supine position. In each case, three trocars were used: a 10-mm trocar for the camera that was inserted two finger-breadths above the umbilicus and two 5-mm trocars for monopolar pairs of scissors and forceps on the upper left iliac fossa and just above the umbilicus. The peritoneum was inflated with carbon dioxide using a Veress needle at a pressure of 15 mmHg, after which the patient was placed in the Trendelenburg position to expose the internal inguinal ring and the varicocele complex. Thereafter, the posterior parietal peritoneum was incised using a pair of monopolar scissors, which was fol-

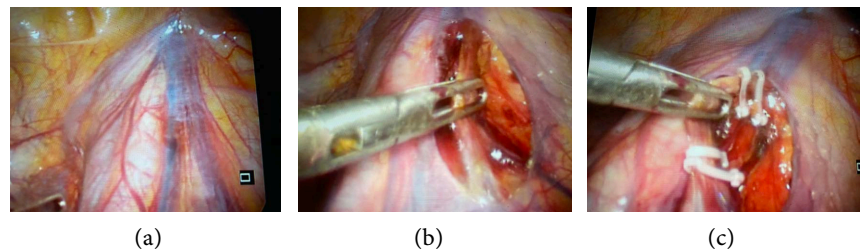
lowed by a dissection of the varicocele with preservation of the spermatic artery. Finally, we applied four 5-mm Hemlock clips without sectioning the vessels. The visual analog scale (VAS) was used to assess the pain felt by the patients during the laparoscopic procedure. This is a horizontal scale graduated from 0 to 10 that is used for the subjective assessment of pain intensity, with 0 representing no pain and 10 representing the highest possible intensity of pain. After the procedure, we monitored all the patients and checked for adverse effects. The outcome of the intervention was assessed after one month for patients whose presenting complaint was testicular pain (via the visual analog scale) and after three months for patients who consulted for primary infertility (via semen analysis) (**Figure 2** and **Figure 3**).

Grade 1	Varicocele only palpable during or after Valsalva maneuver on physical exam
Grade 2	Varicocele palpable on routine physical exam without the need for Valsalva maneuver
Grade 3	Varicocele visible to the eye and palpable on physical exam

**Figure 1.** Dubin and Amelar varicocele grading system.



**Figure 2.** Positions of the trocars during laparoscopic varicolectomy.



**Figure 3.** Laparoscopic view of the different stages of the procedure: (a): Varicocele complex before dissection; (b): Dissection of the varicocele complex; (c): Hemlock clips on varicocele complex.

This study was approved by the institutional review board of the Faculty of Medicine and Pharmaceutical sciences and the ethics committee of the *Centre medico-chirurgicale d'urologie*, Douala, Cameroon. The requirement for patients' informed consent was waived due to the retrospective nature of the study. The data collected from patients' clinical records were entered into Microsoft Excel 2016 and exported to Epi info 7 for analysis. Continuous data were presented using the mean value and standard deviation for normally distributed variables and as median values with interquartile ranges for variables with skewed data distributions. Values of  $p < 0.05$  were considered statistically significant.

### 3. Results

The ages of the 35 study participants ranged from 16 years to 55 years, with a mean value of  $36.11 \pm 8.45$  years. The most represented age group was the 31 - 40 years age group with 19 (54.29%) participants. Their heights ranged from 170 cm to 191 cm, with a mean value of  $178.6 \pm 4.92$  cm. Their body weights ranged from 63 kg to 121 kg, with a mean value of  $87.49 \pm 13.47$  kg. The BMIs of the participants ranged from 21.72 to 37.34, with a mean value of  $27.34 \pm 3.73$  kg/m<sup>2</sup>. The presenting complaint was testicular pain in 14 (40.0%) participants and infertility in 21 (60.0%) participants. The varicocele was located to the left in 12 (34.29%) patients and was bilateral in 23 (65.71%) cases; thus, a total of 58 testes were affected. Of these 58 affected testes, 2 (3.45%) had grade 1 varicocele, 37 (63.79%) had grade 2 varicocele, and 19 (32.76%) had grade 3 varicocele. In 9 (25.71%) participants, the two testes had varicoceles of different grades. The testes were normal in size in 12 (34.29%) patients while 23 (65.71%) patients had testicular atrophy. Out of the 23 patients with testicular atrophy, 11 (47.83%) had left testicular atrophy, 4 (17.39%) had right testicular atrophy, and 8 (34.78%) had bilateral testicular atrophy. Semen analyses were carried out before and after the intervention. The pre-intervention analyses revealed that 14 (40%) participants had normal semen, 8 (22.86%) participants had azoospermia, 9 (25.71%) participants had oligoasthenoteratozoospermia, 3 (8.57%) participants had oligospermia, while 1 (2.86%) had oligoasthenozoospermia (Table 1).

The duration of the intervention ranged from 14 minutes to 60 minutes, with a median duration of 37 [27 - 44] minutes. The intervention had no complications in 33 (94.29%) patients; however, one patient (2.86%) ended up with a left hydrocele and another one (2.86%) ended up with a right hydrocele. All the patients felt only mild pain during the laparoscopic procedure, with the VAS score being 1/10 in 33 (94.29%) participants and 2/10 in 2 (5.71%) participants. All the participants were hospitalized for 24 hours after the intervention. Regarding the outcome of the intervention, all the patients whose presenting complaint was testicular pain experienced a complete resolution of the pain (VAS score of 0). For the 21 patients who consulted for infertility, there was an improvement in semen analysis findings in 15 (71.43%) of them, with 9 (42.86%) of them impregnating their spouses by the end of the 3-month follow-up period. However,

**Table 1.** Demographic and clinical characteristics of the study participants.

VARIABLE	FREQUENCY
<b>Age</b>	
10 - 20	1 (2.86%)
21 - 30	6 (17.14%)
31 - 40	19 (54.29%)
41 - 50	7 (20%)
51 - 60	2 (5.71%)
<b>BMI</b>	
18 - 24.9 (Normal)	10 (28.57)
25 - 29.9 (Overweight)	17 (48.57)
>30 (Obesity)	8 (22.86%)
<b>Presenting Complaint</b>	
Testicular pain	14 (40%)
Infertility	21 (60%)
<b>Laterality</b>	
Left (unilateral)	12 (34.29%)
Bilateral	23 (65.71%)
<b>Grade of Varicocele (n = 58)</b>	
Grade 1	2 (3.45%)
Grade 2	37 (63.79%)
Grade 3	19 (32.76%)
<b>Testicular appearance</b>	
Normal	12 (34.29%)
Atrophy	23 (65.71%)
<b>Pre-intervention semen analysis</b>	
Normal semen	14 (40%)
Azoospermia	8 (22.86%)
Oligoasthenoteratozoospermia	9 (25.71%)
Oligoasthenozoospermia	1 (2.86%)

two out of these nine pregnancies occurred via medically assisted reproduction (Table 2).

#### 4. Discussion

This retrospective study aimed to present our initial laparoscopic varicocelectomy experience by describing the clinical aspects and evaluating the outcomes of

**Table 2.** Details and outcomes of the laparoscopic procedure.

VARIABLE	FREQUENCY
<b>Surgery duration (minutes)</b>	
≤20	5 (14.29%)
21 - 40	18 (51.42%)
>40	12 (34.29%)
<b>Hospitalization duration (hours)</b>	
24	35 (100%)
<b>Complications</b>	
No	33 (94.29%)
Yes	2 (5.71%)
<b>VAS score for pain during procedure</b>	
1	33 (94.29%)
2	2 (5.71%)
<b>Postoperative semen analysis</b>	
Normal	20 (57.14%)
Azoospermia	5 (14.29%)
Oligoasthenozoospermia	3 (8.57%)
Oligoasthenoteratozoospermia	9 (25.71%)
Oligospermia	3 (8.57%)
Oligoteratozoospermia	1 (2.86%)
<b>Outcomes of patients with infertility (n = 21)</b>	
Improvement in sperm quality	15 (71.43%)
Pregnancy	9 (42.86%)
<b>Outcomes of patients with testicular pain (n = 14)</b>	
Complete resolution of pain	14 (100%)

this surgical procedure at the *Centre medico-chirurgicale d'urologie* in Douala, Cameroon. The mean age of our study participants was  $36.11 \pm 8.45$  years, which is different from the  $25.97 \pm 5.7$  years reported by Hosseini *et al.* in 2020. This difference could be due to the fact that carried out a comparison of three different surgical techniques whereas we studied only one technique [17]. This mean age is similar to the  $36.3 \pm 7.6$  years reported by ElBardisi *et al.* in Qatar in 2017 [18]. The mean BMI of our study participants was  $27.34 \pm 3.73$  years, which is similar to the  $21.66 \pm 3.21$  kg/m<sup>2</sup> reported by Bae *et al.* in 2014 [19]. In our study, varicoceles were unilateral in 12 (34.29%) patients and bilateral in 23 (65.71%) patients, which is different from the 46.43% and 53.57% reported for unilateral and bilateral varicoceles, respectively, reported by Besiroglu *et al.* in

2019 [20]. This difference is probably due to the fact that Besiroglu *et al.* recruited 224 participants in their study while we had only 35 participants in ours. Yigal *et al.* reported that 80.7% of the varicoceles they found in their prospective study were bilateral ones [21], which is in line with our findings and further attests to the fact that varicoceles are essentially bilateral. The most common grade of varicocele we found in our study was grade 2, which was encountered in 37 (63.79%) participants. ElBardisi *et al.* [18] and Besiroglu *et al.* [20] also identified grade 2 as the most common grade in their respective studies. This is probably because grade 1 varicoceles are subclinical and can only be palpated when the Valsalva maneuver is performed. As such, patients may not realize that it is a problem until it has progressed to at least stage 2 when it can be palpated without this maneuver. In our context, many patients do not see it as a problem even when it has progressed to grade 2 and only get to realize it when they are investigating their infertility, as can be seen in our study where 60% of cases were diagnosed when the patients had infertility as their presenting complaint. Guo *et al.* reported that up to 30% of all men that were consulted for infertility had varicoceles [22], while Valentino *et al.* reported that 40% of males with infertility had varicoceles [23]. This highlights the fact that the condition is, indeed, a major public health problem and that early diagnosis and management are of paramount importance. Twenty-three (65.71%) of our study participants had testicular atrophy, which is a finding that has long been associated with varicocele [24]. This finding attests to the fact that the condition is usually not diagnosed early enough in our context and more work needs to be done to ensure early diagnosis and treatment. The median duration of laparoscopic varicocelectomy in our study was 37 [27 - 44] minutes. This is a bit longer than the mean surgery duration reported by Söylemez *et al.* in 2012, which was  $35.8 \pm 9.5$  minutes [25]. In a comparative study, Shamsa *et al.* reported that the mean operative times were  $30.0 \pm 5.5$  minutes for laparoscopies,  $27.0 \pm 3.5$  minutes for open varicocelectomies under general anesthesia, and  $38.0 \pm 1.8$  minutes for open varicocelectomies under local anesthesia [26]. Our mean surgery duration is probably higher because this was our initial experience and we were operating on patients who were generally diagnosed late. In our study, no complication was reported after laparoscopic varicocelectomy in 33 (94.29%) participants, while 2 (5.71%) participants reported hydrocele as a postoperative complication. This finding is similar to those of a study by Franco in 2004, who reported that this procedure is usually associated with minimal postoperative complications, with hydrocele being the main one [27]. Generally, laparoscopic varicocelectomy is an intervention that is usually not associated with a high rate of postoperative complications. All the patients in our study were hospitalized for just 24 hours, which is in line with the report by Chen in 2016 that says all patients that underwent this procedure were discharged on the same day [28].

There was a complete postoperative resolution of testicular pain in all the participants of our study who presented with that symptom. This is in line with the findings of Maghraby in 2002, who reported complete postoperative pain resolu-

tion in 84.5% of his study participants [29]. Kachrilas *et al.* also reported a significant improvement in the VAS scores of 87.5% of their study participants after laparoscopic varicocelectomy in 2014 [30]. In this study, we recorded an improvement in semen quality in 15 (71.43%) participants, with 9 (42.86%) participants impregnating their spouses by the end of the follow-up period. Similar results were reported by Chen in 2016, in which 80% of study participants experienced improvements in sperm quality and 45% of their wives got pregnant [28]. In 2001, Tulloch also reported an improvement in semen quality in 86.67% of his study participants after varicocelectomy [31]. This indicates that a well-performed varicocelectomy goes a long way to resolve the problem of male infertility.

However, our study had a few limitations. First, the retrospective study design we used meant that there was some recall bias. Also, the spouses of the patients who consulted for infertility were not investigated, which means that we could not say for sure if the men were indeed the partners with the infertility issue in such couples. Furthermore, in such resource-limited settings as ours, laparoscopic procedures are costly and cannot be afforded by the vast majority of the population, which explains why our study sample was small.

## 5. Conclusion

Laparoscopic varicocelectomy is an efficient, mini-invasive, comfortable, and brief surgical procedure that is capable of addressing the two main issues associated with varicoceles, which are testicular pain and infertility. This technique also has the advantages of being almost painless, being associated with minimal postoperative complications, and requiring no more than 24 hours of postoperative hospitalization.

## Acknowledgements

The authors thank Health Search Association for their contribution to this work.

## Conflicts of Interest

The authors have no conflicting interests to declare.

## References

- [1] Wishahi, M.M. (1991) Anatomy of the Venous Drainage of the Human Testis: Testicular Vein Cast, Microdissection and Radiographic Demonstration. A New Anatomical Concept. *European Urology*, **20**, 154-160.  
<https://doi.org/10.1159/000471687>
- [2] Cho, C.L., Esteves, S. and Agarwal, A. (2016) Novel Insights into the Pathophysiology of Varicocele and Its Association with Reactive Oxygen Species and Sperm DNA Fragmentation. *Asian Journal of Andrology*, **18**, 186-193.  
<https://doi.org/10.4103/1008-682X.170441>
- [3] Kantartzi, P.D., Goulis, C.D., Goulis, G.D. and Papadimas, I. (2007) Male Infertility and Varicocele: Myths and Reality. *Hippokratia*, **11**, 99-104.

- [4] Naughton, C.K., Nangia, A.K. and Agarwal, A. (2001) Pathophysiology of Varicoceles in Male Infertility. *Human Reproduction Update*, **7**, 473-481. <https://doi.org/10.1093/humupd/7.5.473>
- [5] Clarke, B.G. (1966) Incidence of Varicocele in Normal Men and among Men of Different Ages. *JAMA*, **198**, 1121-1122. <https://doi.org/10.1001/jama.1966.03110230137039>
- [6] Gorelick, J.I. and Goldstein, M. (1993) Loss of Fertility in Men with Varicocele. *Fertility and Sterility*, **59**, 613-616. [https://doi.org/10.1016/S0015-0282\(16\)55809-9](https://doi.org/10.1016/S0015-0282(16)55809-9)
- [7] Kumanov, P., Robeva, R.N. and Tomova, A. (2008) Adolescent Varicocele: Who Is at Risk? *Pediatrics*, **121**, e53-e57. <https://doi.org/10.1542/peds.2007-0340>
- [8] Braedel, H.U., Steffens, J., Ziegler, M., Polsky, M.S. and Platt, M.L. (1994) A Possible Ontogenic Etiology for Idiopathic Left Varicocele. *The Journal of Urology*, **151**, 62-66. [https://doi.org/10.1016/S0022-5347\(17\)34872-3](https://doi.org/10.1016/S0022-5347(17)34872-3)
- [9] Scaramuzza, A., Tavana, R. and Marchi, A. (1996) Varicoceles in Young Soccer Players. *The Lancet*, **348**, 1180-1181. [https://doi.org/10.1016/S0140-6736\(05\)65325-1](https://doi.org/10.1016/S0140-6736(05)65325-1)
- [10] Belay, R.E., Huang, G.O., Shen, J.K.C. and Ko, E.Y.K. (2016) Diagnosis of Clinical and Subclinical Varicocele: How Has It Evolved? *Asian Journal of Andrology*, **18**, 182-185. <https://doi.org/10.4103/1008-682X.169991>
- [11] Paick, S. and Choi, W.S. (2019) Varicocele and Testicular Pain: A Review. *The World Journal of Men's Health*, **37**, 4-11. <https://doi.org/10.5534/wjmh.170010>
- [12] Sakamoto, H., Saito, K., Oohta, M., Inoue, K., Ogawa, Y. and Yoshida, H. (2007) Testicular Volume Measurement: Comparison of Ultrasonography, Orchidometry, and Water Displacement. *Urology*, **69**, 152-157. <https://doi.org/10.1016/j.urology.2006.09.012>
- [13] Ahlberg, N.E., Bartley, O., Chidekel, N. and Fritjofsson, A. (1966) Phlebography in Varicocele Scroti. *Acta Radiologica: Diagnosis (Stockh)*, **4**, 517-528. <https://doi.org/10.1177/028418516600400506>
- [14] Chan, P. (2011) Management Options of Varicoceles. *Indian Journal of Urology*, **271**, 65-73. <https://doi.org/10.4103/0970-1591.78431>
- [15] Rizkala, E., Fishman, A., Gitlin, J., Zelkovic, P. and Franco, I. (2013) Long Term Outcomes of Lymphatic Sparing Laparoscopic Varicocelectomy. *Journal of Pediatric Urology*, **9**, 458-463. <https://doi.org/10.1016/j.jpuro.2012.12.009>
- [16] Seraphin, G.A., Armand, F.M., Komlatsè, A.N.G., Serge, M.C. and José, U.T. (2019) Laparoscopic Treatment of Varicocele within Adolescents in Two African Countries. *African Journal of Paediatric Surgery*, **16**, 6-9. [https://doi.org/10.4103/ajps.AJPS\\_28\\_16](https://doi.org/10.4103/ajps.AJPS_28_16)
- [17] Hosseini, K., Nejatifar, M. and Kabir, A. (2018) Comparison of the Efficacy and Safety of Palomo, Ivanissevich and Laparoscopic Varicocelectomy in Iranian Infertile Men with Palpable Varicocele. *International Journal of Fertility and Sterility*, **12**, 81-87.
- [18] ElBardisi, H., Arafa, M., Rengan, A.K., Durairajanayagam, D., AlSaid, S.S., Khalafalla, K., et al. (2017) Varicocele among Infertile Men in Qatar. *Andrologia*, **49**, e12637. <https://doi.org/10.1111/and.12637>
- [19] Bae, K., Shin, H.S., Jung, H.J., Kang, S.H., Jin, B.S. and Park, J.S. (2014) Adolescent Varicocele: Are Somatometric Parameters a Cause? *Korean Journal of Urology*, **55**, 533-535. <https://doi.org/10.4111/kju.2014.55.8.533>
- [20] Besiroglu, H., Otunctemur, A., Dursun, M. and Ozbek, E. (2019) The Prevalence and Severity of Varicocele in Adult Population over the Age of Forty Years Old: A

- Cross-Sectional Study. *The Aging Male*, **22**, 207-213.  
<https://doi.org/10.1080/13685538.2018.1465913>
- [21] Gat, Y., Bachar, G.N., Zukerman, Z., Belenky, A. and Gornish, M. (2004) Varicocele: A Bilateral Disease. *Fertility and Sterility*, **81**, 424-429.  
<https://doi.org/10.1016/j.fertnstert.2003.08.010>
- [22] Guo, S., Sun, Z. and Li, W. (2012) New Insights about the Early Diagnosis of Fertility Impairment in Varicoceles: The DNA Repair Gene Example. *Medical Hypotheses*, **78**, 536-538. <https://doi.org/10.1016/j.mehy.2012.01.029>
- [23] Valentino, M., Bertolotto, M., Derchi, L. and Pavlica, P. (2014) Children and Adults Varicocele: Diagnostic Issues and Therapeutical Strategies. *Journal of Ultrasound*, **17**, 185-193. <https://doi.org/10.1007/s40477-014-0088-3>
- [24] Lipshultz, L.I. and Corriere, J.N. (1977) Progressive Testicular Atrophy in the Varicocele Patient. *The Journal of Urology*, **117**, 175-176.  
[https://doi.org/10.1016/S0022-5347\(17\)58387-1](https://doi.org/10.1016/S0022-5347(17)58387-1)
- [25] Söylemez, H., Penbegül, N., Atar, M., Bozkurt, Y., Sancaktutar, A.A. and Altunoluk, B. (2012) Comparison of Laparoscopic and Microscopic Subinguinal Varicocelectomy in Terms of Postoperative Scrotal Pain. *JSLs*, **16**, 212-217.  
<https://doi.org/10.4293/108680812X13427982376220>
- [26] Shamsa, A., Mohammadi, L., Abolbashari, M., Shakeri, M.T. and Shamsa, S. (2009) Comparison of Open and Laparoscopic Varicocelectomies in Terms of Operative Time, Sperm Parameters, and Complications. *Urology Journal*, **6**, 170-175.
- [27] Franco, I. (2004) Laparoscopic Varicocelectomy in the Adolescent Male. *Current Urology Reports*, **5**, 132-136. <https://doi.org/10.1007/s11934-004-0026-6>
- [28] Chen, C. (2016) Laparoscopic Varicocelectomy: My Personal Experience of 4000 Cases. *International Surgery*, **101**, 2-6.  
<https://doi.org/10.9738/INTSURG-D-15-00327.1>
- [29] Maghrab, H.A. (2002) Laparoscopic Varicocelectomy for Painful Varicoceles: Merits and Outcomes. *Journal of Endourology*, **16**, 107-110.  
<https://doi.org/10.1089/089277902753619627>
- [30] Kachrilas, S., Popov, E., Bourdoumis, A., Akhter, W., El Howairis, M., Aghaways, I., et al. (2014) Laparoscopic Varicocelectomy in the Management of Chronic Scrotal Pain. *JSLs*, **18**, e2014.00302. <https://doi.org/10.4293/JSLs.2014.00302>
- [31] Tulloch, W.S. (1955) Varicocele in Subfertility: Results of Treatment. *The Journal of Urology*, **166**, 2032-2033. [https://doi.org/10.1016/S0022-5347\(05\)65499-7](https://doi.org/10.1016/S0022-5347(05)65499-7)

# Transurethral Resection of Bladder Tumours: Results and Outcomes

Cyril Kamadjou<sup>1,2\*</sup>, Jerry Kuitche<sup>1</sup>, Annie Kameni Wadeu<sup>1</sup>, Achille Mbassi<sup>3</sup>, Fru Angwafo<sup>4</sup>

<sup>1</sup>Medical and Surgical Center of Urology, Douala, Cameroon

<sup>2</sup>Department of Surgery and Specialties, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon

<sup>3</sup>Medical Technology Institute, University of Yaoundé 1, Yaoundé, Cameroon

<sup>4</sup>Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon

Email: \*cyrkamadjou@yahoo.fr

**How to cite this paper:** Kamadjou, C., Kuitche, J., Wadeu, A.K., Mbassi, A. and Angwafo, F. (2022) Transurethral Resection of Bladder Tumours: Results and Outcomes. *Open Journal of Urology*, 12, 342-356. <https://doi.org/10.4236/oju.2022.126033>

**Received:** January 22, 2022

**Accepted:** June 11, 2022

**Published:** June 14, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Aim:** This study aimed to determine the demographic, clinical, paraclinical, therapeutic, and evolutive characteristics of patients with bladder tumors who underwent transurethral resection of bladder tumors (TURBT) at a urology center in Douala, Cameroon. **Patients and Methods:** This was a retrospective study carried out from 2015 to 2019 on 32 patients with bladder tumors that were managed at the *Centre medico-chirurgical d'urologie* in Douala, Cameroon. The relevant data were obtained from patients' clinical records. **Results:** A total of 32 patients (25 men and 7 women) aged 29 - 75 years were included in this study. The mean age of the study participants was  $58.63 \pm 11.00$  years. Among our study participants, there were 10 smokers (31.25%). Eight (25%) of them had occupational exposure while 2 (6.25%) had residential exposure to bladder cancer. Thirty (93.75%) presented with hematuria, 2 (6.25%) presented with recurrent urinary tract infections, and 1 (3.13%) presented with acute urinary colic. Nineteen (59.38%) of them were anemic, with 4 (12.5%) requiring blood transfusions. Twenty-seven (84.38%) of them had pedunculated tumors while 5 (15.62%) had sessile tumors. The tumor diameters ranged from 1 cm to 5 cm, with a mean diameter of  $2.75 \pm 1.22$  cm. Complete resection was performed in 27 (84.38%) participants while partial resection was performed in 5 (15.62%) patients. The early single instillation of intravesical chemotherapy with mitomycin was performed in 8 (25%) patients. Only one (3.13%) patient had a postoperative complication, and seven (21.88%) patients experienced tumor recurrence and underwent a second TURBT. Two (6.25%) of the 32 patients died and 30 (93.75%) survived. **Conclusion:** TURBT is the gold standard method of managing bladder tumors. This procedure is at the same time diagnostic and therapeutic for tumors that do not invade the walls of the urinary bladder.

---

## Keywords

Macroscopic Hematuria, Bladder Tumor, Transurethral Resection, Mitomycin

---

## 1. Introduction

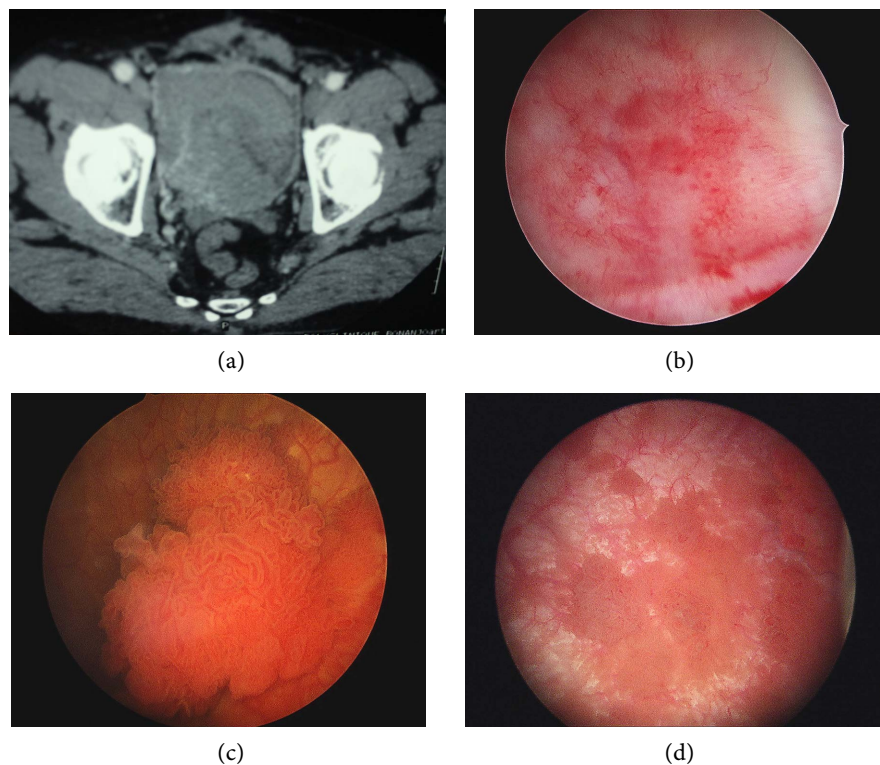
The bladder is a hollow muscular pelvic organ that stores urine briefly before its expulsion from the body. Like many organs in the body, the bladder is the seat of cancerous processes in the body. Bladder cancer is among the top ten most common cancer types in the world, with approximately 550,000 new cases annually [1]. The prevalence of this pathology in men is four times that among women [2]. Smoking (tobacco) has been identified as the main risk factor for bladder cancer [3]. Other risk factors include aromatic amines [4], polyaromatic hydrocarbons [5], and schistosomiasis (bilharziasis) [6]. In the majority of cases, painless, macroscopic hematuria is the typical initial symptom of bladder carcinoma [7]. However, patients with this condition could also present with irritative symptoms [8]. In patients with the usual signs, symptoms, and risk factors, laboratory tests such as urine cytology and imaging tests are performed [9]. Emergent technologies in the diagnostics and therapy of superficial bladder carcinoma, including fluorescence cystoscopy, can reduce recurrence and progression rates [10]. Cystoscopy is the principal means of diagnosis and surveillance of bladder tumors. It enables experts to classify bladder cancer into muscle-invasive bladder cancer (MIBC) and non-muscle-invasive bladder cancer (NMIBC) [11]. Open surgery (radical cystectomy) has been known to be the treatment of choice for bladder cancer [12]. However, with advancements in technology, laparoscopic radical cystectomy has been shown to be associated with a lower morbidity rate than cystectomy by open surgery. It has also been proven to be associated with a more rapid resumption of oral fluid and solid intake as well as a return to normal bowel function and shorter hospital stay [13]. Transurethral resection of bladder tumors (TURBT) is the standard surgical procedure for non-muscle invasive bladder cancer. This technique enables the surgeon to not only properly visualize but also resect all visible tumors, resect part of the apparently normal mucosa surrounding the tumor, resect the muscle layer at the base of the tumor till normal muscle fibers become visible, perform a biopsy of the apparently normal urothelium and prostatic urethra, and verify that there are no traces of cancerous tissue after the procedure [14]. Thus, the procedure is not only diagnostic but also therapeutic. However, in spite of the numerous advantages of this technique, it is still not a common practice in resource-limited settings such as ours. Hence, our study aims to determine the demographic, clinical, paraclinical, therapeutic, and evolutive characteristics of patients with bladder tumors managed via endoscopic resection at a urology center in Douala, Cameroon.

## 2. Patients and Methods

This was a retrospective study carried out from 2015 to 2019 on 32 patients with bladder tumors that were managed at the *Centre medico-chirurgical d'urologie* in Douala, Cameroon. The relevant data were obtained from patients' clinical records. We included all patients who were diagnosed with bladder tumors and underwent TURBT and excluded all patients with incomplete clinical records.

The diagnosis was made in all patients via cystoscopy and abdominal computerized tomography, while the nature, grade, and degree of infiltration were determined via endoscopic biopsy and histopathology. The computed tomography images and endoscopic views of the bladder tumors are presented in **Figures 1(a)-(d)**.

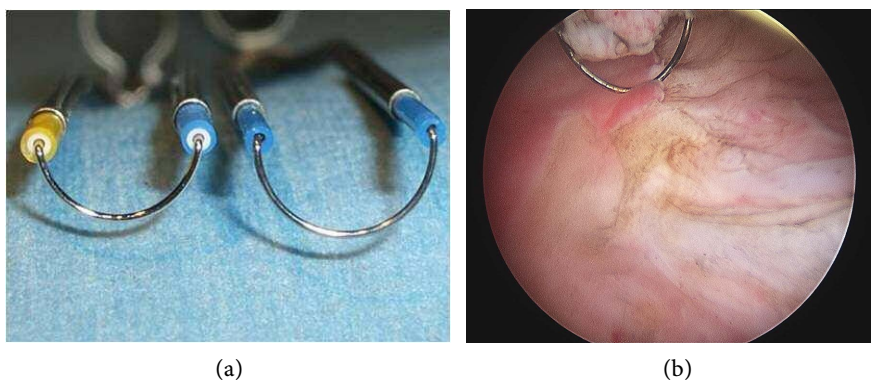
Urinalysis was also performed for all the participants of this study to ensure that they had no urinary tract infection (UTI) before going in for the mini-invasive procedure. We included all patients with bladder tumors who underwent TURBT within the study period at the *Centre medico-chirurgicale d'urologie* in Douala and had all the required information in their clinical records. The data collected from the patients' files included age, sex, tobacco consumption (measured in pack-years), environmental exposure to bladder cancer (residence in areas with lakes from where schistosomiasis could be contracted), occupational exposure to bladder cancer (professions such as painting, tiling, welding, and



**Figure 1.** Imaging of bladder tumors. (a): computed tomography image of bladder tumor; (b): Endoscopic view of carcinoma-in-situ ( $\times 50$  magnification); (c): Endoscopic view of a pedunculated tumor ( $\times 50$  magnification); (d): Endoscopic view of a sessile tumor ( $\times 50$  magnification).

motor mechanics that come with a high exposure to aromatic amines), recurrent urinary tract infections (together with the culprit pathogens), acute nephritic colic (due to the obstruction of the renal pelvis by tumors), hemoglobin level, transfusion, the location of the tumors, the type of tumor (pedunculated or sessile), the presence of single or multiple tumors, the histological nature of the tumors, the diameters of the tumors, the type of TURBT (partial or complete resection), the type of anesthesia used (spinal anesthesia or general anesthesia), surgery duration, and the early single instillation of intravesical chemotherapy with mitomycin (SIIC, an intravesical therapy that is given to reduce the rate of relapse for intermediate tumors and the rate of progression for high-risk tumors). In some of our patients, mitomycin was started early in the postoperative period, within two hours of the end of the surgical intervention. This drug was given at the highest possible dose (40 mg) in the first 24 hours after the TURBT procedure. As required, the pH of the patients' urine was rendered alkaline before using this drug. While using this drug, we bore in mind its contraindications, including macroscopic hematuria and bladder perforation. We also collected data on tumor histology after TURBT, supplementary TURBT for those who underwent partial resection the first time, duration of postoperative hospitalization, postoperative complications, recurrence (and time-lapse from diagnosis to recurrence), and patient outcome (death or life). In this study, we defined anemia as a hemoglobin level of less than 12 g/dL in women and less than 13 g/dL in men [15] (Figure 2).

These data were entered into Microsoft excel 2007 and exported to Epi Info 7 for analysis. Continuous data were presented using the mean value and standard deviation for variables with normally distributed data and the median and interquartile range for variables with skewed data distributions. Categorical data were presented as frequencies and percentages. This study was approved by the institutional review board of the Faculty of Medicine and Pharmaceutical Sciences of the University of Douala 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 study design.



**Figure 2.** Endoscopic bladder tumor resection. (a): Resection loops; (b): Endoscopic view during resection ( $\times 50$  magnification).

### 3. Results

In this study, we recruited 32 participants, 25 (78.13%) males and 7 (21.87%) females aged 30 - 75 years with a mean age of  $58.63 \pm 11.00$  years. Of the 32 patients, there were 10 smokers (31.25%) whose ages at onset of smoking ranged from 16 years to 30 years, with a mean value of  $20.30 \pm 4.64$  years. The tobacco consumption of these smokers ranged from 7 - 58 pack-years, with a median value of 24 [10 - 30] pack-years. Eight (25%) of our participants had professional exposure while two (6.25%) had residential exposure to bladder cancer since they lived around lakes from which they contracted schistosomiasis. The demographic and social characteristics of the study participants are presented in **Table 1**.

**Table 1.** Demographic and social profiles of the study participants.

Variable	Frequency (%)
<b>Age (years)</b>	
30 - 40	2 (6.25)
41 - 50	6 (18.75)
51 - 60	8 (25.00)
61 - 70	12 (37.5)
>70	4 (12.5)
<b>Sex</b>	
Male	25 (78.13)
Female	7 (21.87)
<b>Smoking</b>	
Yes	10 (31.25)
No	22 (68.75)
<b>Age at onset of smoking</b>	
$\geq 20$	5 (50)
<20	5 (50)
<b>Tobacco consumption (Pack-years)</b>	
$\geq 25$	5 (50)
<25	5 (50)
<b>Professional exposure</b>	
Yes	8 (25.00)
No	24 (75.00)
<b>Residential exposure</b>	
Yes	2 (6.25)
No	30 (93.75)

Of the 32 patients we recruited, 30 (93.75%) had hematuria, two (6.25%) had recurrent urinary tract infections, and one (3.13%) had acute nephritic colic. The hemoglobin levels of our study participants ranged from 5.5 g/dL to 15 g/dL, with a mean level of  $11.31 \pm 3.40$  g/dL. Nineteen (59.38%) of our participants were anemic while 13 (40.62%) were not anemic. Four patients (12.5%) had severe anemia and needed blood transfusions of between two and four pints of blood, depending on the severity of the anemia. Urinalysis was performed in three (9.38%) of our study participants, and the identified germ was *E. coli* in two (66.67%) patients and *Pseudomonas aeruginosa* in one (33.33%) patient. Ultrasonography was carried out in 8 (25%) of our study participants while anteroposterior computerized tomography scanning and cystoscopy were performed in all 32 patients. Two (6.25%) of our study participants had bilharziasis that occurred as a result of residential exposure. The clinical and paraclinical profiles of our study participants are presented in **Table 2**.

Twenty-seven (84.38%) participants had pedunculated tumors while 5 (15.62%) had sessile tumors. Twenty-four patients (75%) had single tumors while 8 (25%) had multiple tumors. The diameters of the tumors ranged from 1 cm to 5 cm with a mean diameter of  $2.75 \pm 1.22$  cm. The tumors were urothelial carcinoma in 30 (93.75%) patients and epidermoid carcinoma in 2 (6.25%) patients. Carcinoma in-situ (CIS) was identified in 3 (9.38%) of our study participants. The tumors were located at the lateral surfaces of the bladder in 11 (34.38%) cases, between the bladder's neck and the prostatic urethra in 6 (18.75%) cases, at the anterior part of the bladder's neck in 6 (18.75%) cases, between the dome of the bladder and the left lateral surface in 4 (12.5%) cases, between the left lateral surface and the anterior part of the bladder in 3 (9.23%) cases, between the right meatus and right lateral surface in one (3.13%) case, and between the left meatus and the urinary pelvis in one (3.13%) case. The tumor characteristics are presented in **Table 3**.

All patients in our study underwent transurethral resection of the bladder. Twenty-seven (84.38%) patients underwent complete resection while 5 (15.62%) underwent partial resection. Spinal anesthesia was used in 26 (81.25%) participants while general anesthesia was used in 6 (18.75%) participants. Early single instillation of intravesical chemotherapy with mitomycin (SIIC) was performed in 8 (25%) patients. The duration of the surgical procedure ranged from 20 minutes to 75 minutes, with a mean value of  $47.90 \pm 14.80$  minutes. Of the five patients who initially underwent partial TURBT, two (40%) underwent supplementary TURBT. Only one patient (3.13%) developed a postoperative complication, which was a sub-peritoneal bladder perforation. This complication was managed by placing an indwelling urinary catheter for 10 days, after which the patient returned to his normal life. The duration of hospitalization ranged from 1 day to 5 days, with a median duration of 3 [2 - 3.5] days. In 7 (21.88%) of the 32 patients, the tumors recurred. The time-lapse till recurrence ranged from 133 days to 337 days, with a median value of 272 [156 - 292] days. The procedure was repeated in all patients who experienced recurrence. Two (6.25%) of the 32

**Table 2.** Clinical and paraclinical profiles of our study participants.

Variable	Frequency (%)
<b>Clinical presentation</b>	
Hematuria	30 (93.75)
Recurrent UTI	2 (6.25)
Acute nephritic colic	1 (3.13)
<b>Anemia</b>	
Yes	19 (59.38)
No	13 (40.62)
<b>Transfusion (severe anemia)</b>	
Yes	4 (12.5)
No	28 (87.5)
<b>Urinalysis</b>	
Yes	3 (9.38)
No	29 (90.62)
<b>Pathogens identified during urinalysis</b>	
<i>E. coli</i>	2 (66.67)
<i>Pseudomonas aeruginosa</i>	1 (33.33)
<b>Bilharziasis</b>	
Yes	2 (6.25)
No	30 (93.75)
<b>Ultrasonography</b>	
Yes	8 (25.00)
No	24 (75.00)
<b>Computed tomography</b>	
Yes	32 (100)
<b>Cystoscopy</b>	
Yes	32 (100)

**Table 3.** Characteristics of the tumors.

Variable	Frequency (%)
<b>Type</b>	
Pedunculated	27 (84.38)
Recurrent UTI	5 (15.62)
<b>Histology</b>	
Urothelial carcinoma	30 (93.75)
Epidermoid carcinoma	2 (6.25)

## Continued

<b>Single/Multiple</b>	
Single	24 (75.00)
Multiple	8 (25.00)
<b>Tumor diameter (cm)</b>	
1	4 (12.5)
2	12 (37.5)
3	8 (25.00)
4	4 (12.5)
5	4 (12.5)
<b>Carcinoma in-situ</b>	
Yes	3 (9.38)
No	29 (90.62)
<b>Tumor location</b>	
Left/Right lateral surface	11 (34.38)
Bladder neck–prostatic urethra	6 (18.75)
Anterior bladder neck	6 (18.75)
Dome–left lateral surface	4 (12.5)
Anterior bladder neck–left lateral surface	3 (9.23)
Right meatus–right lateral surface	1 (3.13)
Left meatus–urinary pelvis	1 (3.13)

patients died after surgery, one due to pulmonary embolism and the other due to peritoneal carcinomatosis. The follow-up durations of our study participants ranged from 149 days to 1422 days, with an average duration of 561.47 days. Details of the surgical interventions and outcomes of the patients are presented in **Table 4**.

After the first surgical intervention, a biopsy with histopathology was carried out. Of the 32 patients, two (6.25%) each had tumors of grades T1G1, T1G3, T2G3, and TaG1. Eight (25%) patients had tumors of grade TaG2, six (18.75%) had tumors of grade T1G2, four (12.5%) had tumors of grade TaG3, three (9.38%) had tumors of grade T2G2, while one (3.13%) each had tumors of grades T2G1, T1G1 + CIS, and T1G3 + CIS. Of the five patients who initially underwent partial TURBT, two (40%) underwent supplementary TURBT, after which a second biopsy with histopathology revealed that both patients had tumors of grade T2G2. The seven patients who experienced recurrence underwent a repeat TURBT procedure, which was also accompanied by biopsies with histopathology. Of these seven, two (28.57%) had tumors of grade T1G2 while each (14.29%) of the remaining five had tumors of grades T1G2 + CIS, TaG2, T2G3 + CIS, T1G3, and T2G3. The tumor grades after the first and second TURBT procedures are presented in **Table 5**.

**Table 4.** Characteristics of surgical interventions and ensuing histopathology.

Variable	Frequency (%)
<b>Type of resection</b>	
Complete resection	27 (84.38)
Partial resection	5 (15.62)
<b>Supplementary resection</b>	
Yes	2 (40.00)
No	3 (60.00)
<b>Type of anesthesia</b>	
Spinal	26 (81.25)
General	6 (18.75)
<b>SIIC</b>	
Yes	8 (25.00)
No	24 (75.00)
<b>Duration of procedure (minutes)</b>	
20 - 30	6 (18.75)
31 - 40	6 (18.75)
41 - 50	5 (15.62)
51 - 60	10 (31.25)
61 - 70	4 (12.50)
>70	1 (3.13)
<b>Postoperative complication</b>	
Yes	1 (3.13)
No	31 (96.87)
<b>Duration of hospitalization (Days)</b>	
1	2 (6.25)
2	11 (34.38)
3	11 (34.38)
4	6 (18.75)
5	2 (6.25)
<b>Recurrence</b>	
Yes	7 (21.88)
No	25 (78.12)
<b>Time-lapse till recurrence (Days)</b>	
≤200	3 (42.86)
>200	4 (57.14)

## Continued

Survival	
Yes	30 (93.75)
No	6 (6.25)
Follow-up duration (days)	
≤500	16 (50)
501 - 1000	12 (37.50)
>1000	4 (12.50)

**Table 5.** Tumor grades after first, supplementary, and repeat TURBT procedures.

Grade	Frequency (%)
<b>First TURBT</b>	
TaG2	8 (25.00)
TaG3	4 (12.50)
T1G2	6 (18.75)
T2G2	3 (9.38)
T1G1	2 (6.25)
T1G3	2 (6.25)
T2G3	2 (6.25)
TaG1	2 (6.25)
T1G1 + CIS	1 (3.13)
T1G3 + CIS	1 (3.13)
T2G1	1 (3.13)
<b>Supplementary TURBT</b>	
T2G2	2 (100.00)
<b>Repeat TURBT</b>	
T1G2	2 (28.57)
T1G3 + CIS	1 (14.29)
T1G3	1 (14.29)
T2G3	1 (14.29)
T2G3 + CIS	1 (14.29)
TaG2	1 (14.29)

**4. Discussion**

In this study, we aimed to determine the demographic, clinical, paraclinical, therapeutic, and evolutive characteristics of patients with bladder tumors who underwent TURBT at a urology center in Douala, Cameroon. We included 32

patients with a mean age of  $58.63 \pm 11.00$  years, which is similar to the 62 years reported by Uchida *et al.* [16]. This is only to be expected since bladder cancer is predominantly a disease of the elderly, with 90% of diagnoses made in those over 55 years [17]. Males constituted 78.13% of our study population, which is in line with the fact that they have a threefold to a fourfold higher risk of bladder cancer as compared to females [18]. This is logical as men are more exposed to the major risk factors for the condition, which include smoking and chemicals (occupational exposure to rubber, textiles, paint, and aromatic amines). Smokers accounted for 31.25% of our study population, which was expected since smoking is the primary risk factor for bladder cancer [19]. Twenty-five percent of our study participants had professional exposure to aromatic amines while 6.25% had residential exposure to schistosomiasis. These findings are in line with those of Pira *et al.* who found that professional exposure to aromatic amines predisposes to bladder cancer [20] and Zaghloul *et al.* who identified bilharziasis as a risk factor for bladder cancer in 2020 [21]. Hematuria was identified in 93.75% of our study participants, with 59.38% of them being anemic. These findings are in line with those of Abt *et al.* who identified hematuria as a common and severe symptom of the pathology [22] and Joynson *et al.* who reported that 52% of their study participants were anemic [23]. Bladder cancer has hematuria as its major symptom; also, like many other types of cancer, it has anemia as one of its long-term complications. In our study, pedunculated tumors accounted for 84.38% of all tumors. This finding is in line with those of a study by Ishikawa *et al.* in which pedunculated tumors outnumbered sessile tumors by a ratio of more than 2:1 [24]. Urothelial carcinoma represented 93.75% of all tumors in our study, which is in line with the findings of Tanaka and Sonpavde who reported that urothelial carcinoma accounts for more than 90% of cases of bladder cancer [25]. The mean tumor diameter in our study was  $2.75 \pm 1.22$  cm, which is similar to the findings of Kaynar *et al.* who reported an overall mean diameter of  $2.85 \pm 1.30$  cm (the mean diameter of the NMIBC group was  $2.1 \pm 1.09$  cm while that of the MIBC group  $3.6 \pm 1.5$  cm). Complete tumor resection was carried out in 84.38% of our study participants, which is higher than the 67% reported by Pak *et al.* in 2021 [26]. This difference could be accounted for by the fact that Pak *et al.* carried out complete TURBT prior to neoadjuvant chemotherapy whereas resection was the only treatment option in our study. They also had a larger study sample (93 patients) than we did. In our study, only two of the five patients who initially underwent partial resection went in for supplementary resection. This was because the histopathology results after partial resection revealed T2 tumors in three of the five patients; as such, these patients had to undergo radical cystectomy instead of a supplementary resection. Spinal anesthesia was used in 81.25% of our study participants, which is a higher proportion than the 64.04% reported by Cesur *et al.* in 2008 [27]. This difference could be explained by the fact that some patients who initially underwent epidural anesthesia in their study were converted to general anesthesia. The mean surgery time in our study was  $47.90 \pm 14.80$  minutes, which is similar to the median time of 40 mi-

nutes reported by Fukuhara *et al.* in 2017 [28].

The rate of postoperative complications in our study was 3.13%, which is lower than the 5.8% reported by Matulewicz *et al.* in 2015 [29]. This difference is mainly due to the fact that their study included 10,599 cases of TURBT while ours included just 32, which means it was more likely for them to encounter more postoperative complications. Moreover, mini-invasive procedures such as TURBT are usually associated with such low rates of postoperative complications as are reported in the above studies. The recurrence rate after TURBT in our study was 21.88%, which is similar to the 19.5% reported by Bangash *et al.* in 2020 [30]. The high rate of recurrence in our study was probably because, in the majority of our patients, the tumors were located at more than one spot, which corroborates the findings of Fradet *et al.* who reported that recurrence is more likely to occur in patients with tumors at multiple locations [31]. In our study, two patients (6.25%) died after the intervention. This is higher than the 0.1% mortality reported by Bansal *et al.* in 2016 [32]. This difference can be explained by the fact that the patients in their study were diagnosed at an earlier stage than those in ours, which improved their prognosis. Moreover, of the two deaths we recorded, one was due to pulmonary embolism and the other due to peritoneal carcinomatosis, and both of these lethal complications could be associated with the late diagnosis of the condition in these patients. Also, Bansal *et al.* studied only the complications that occurred within a month after TURBT, whereas our average follow-up duration was 561.47 days. Given that our minimum follow-up duration was 149 days, it is possible that the postoperative mortality rate would have been 0% if our follow-up duration was 30 days. Regarding the histological classification of tumors, 71.88% of tumors in our study were of grade G1 - G2, which is similar to the 65% reported by Bousted *et al.* in 2014 [33]. This further confirms the fact that most cases of bladder cancer are NMIBC.

However, our study had certain limitations. First, the retrospective study design we used comes with recall bias. Secondly, our study sample was small compared to those of other similar studies in the literature. Third, some of our findings, such as the duration of postoperative hospitalization and the postoperative mortality rate were skewed by the behaviors and tendencies of patients in our context. Firstly, these patients are usually hesitant to return home less than three days after mini-invasive surgical procedures for fear of the unknown. Secondly, the diagnosis of bladder cancer in our context is usually done at a relatively advanced stage since patients tend to consult specialists only after exhausting all other options such as traditional medicine. More studies with larger samples and different study designs should be carried out in the future to further investigate our findings.

## 5. Conclusion

TURBT is the gold standard method of managing bladder tumors. It is a rapid and efficient procedure that is associated with a short postoperative hospitaliza-

tion and minimal postoperative complications. This procedure is at the same time diagnostic and therapeutic for tumors that do not invade the walls of the urinary bladder. The use of this technique should be encouraged even in resource-limited settings such as ours for optimal surgical outcomes.

### Acknowledgements

The authors thank Health Search Association for critically reviewing the manuscript.

### Availability of Data and Materials

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

### 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.

### References

- [1] Richters, A., Aben, K.K.H. and Kiemeny, L.A.L.M. (2020) The Global Burden of Urinary Bladder Cancer: An Update. *World Journal of Urology*, **38**, 1895-1904. <https://doi.org/10.1007/s00345-019-02984-4>
- [2] Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A. and Jemal, A. (2018) Global Cancer Statistics 2018: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA: A Cancer Journal for Clinicians*, **68**, 394-424. <https://doi.org/10.3322/caac.21492>
- [3] Janković, S. and Radosavljević V. (2007) Risk Factors for Bladder Cancer. *Tumori Journal*, **93**, 4-12. <https://doi.org/10.1177/030089160709300102>
- [4] Farling, K.B. (2017) Bladder Cancer: Risk Factors, Diagnosis, and Management. *The Nurse Practitioner*, **42**, 26-33. <https://doi.org/10.1097/01.NPR.0000512251.61454.5c>
- [5] Burger, M., Catto, J.W.F., Dalbagni, G., Grossman, H.B., Herr, H., Karakiewicz, P., et al. (2013) Epidemiology and Risk Factors of Urothelial Bladder Cancer. *European Urology*, **63**, 234-241. <https://doi.org/10.1016/j.eururo.2012.07.033>
- [6] Jalloh, M., Cassell, A., Diallo, T., Gaye, O., Ndoye, M., Mbodji, M.M., et al. (2020) Is Schistosomiasis a Risk Factor for Bladder Cancer? Evidence-Based Facts. *Journal of Tropical Medicine*, **2020**, Article ID: 8270810. <https://doi.org/10.1155/2020/8270810>
- [7] Shephard, E.A., Stapley, S., Neal, R.D., Rose, P., Walter, F.M. and Hamilton, W.T. (2012) Clinical Features of Bladder Cancer in Primary Care. *British Journal of General Practice*, **62**, e598-e604. <https://doi.org/10.3399/bjgp12X654560>
- [8] DeGeorge, K.C., Holt, H.R. and Hodges, S.C. (2017) Bladder Cancer: Diagnosis and Treatment. *American Family Physician*, **96**, 507-514.

- [9] Williamson, S.R., Montironi, R., Lopez-Beltran, A., MacLennan, G.T., Davidson, D.D. and Cheng, L. (2010) Diagnosis, Evaluation and Treatment of Carcinoma *in Situ* of the Urinary Bladder: The State of the Art. *Critical Reviews in Oncology/Hematology*, **76**, 112-126. <https://doi.org/10.1016/j.critrevonc.2010.01.005>
- [10] Ohlmann, C.H. and Stöckle, M. (2010) Diagnostic Work-Up and Treatment of Bladder Cancer: Current Developments. *Der Urologe*, **49**, 172-177. <https://doi.org/10.1007/s00120-010-2377-6>
- [11] Cicione, A., Cantiello, F. and Damiano, R. (2013) Cystoscopy in Non-Muscle-Invasive Bladder Cancer: When and How (Rigid or Flexible). *Urologia Journal*, **80**, 11-15. <https://doi.org/10.5301/RU.2013.10858>
- [12] Kiss, B., Burkhard, F.C. and Thalmann, G.N. (2016) Open Radical Cystectomy: Still the Gold Standard for Muscle Invasive Bladder Cancer. *World Journal of Urology*, **34**, 33-39. <https://doi.org/10.1007/s00345-015-1729-7>
- [13] Guillotreau, J., Gamé, X., Mouzin, M., Doumerc, N., Mallet, R., Sallusto, F., et al. (2009) Radical Cystectomy for Bladder Cancer: Morbidity of Laparoscopic versus Open Surgery. *Journal of Urology*, **181**, 554-559. <https://doi.org/10.1016/j.juro.2008.10.011>
- [14] Furuse, H. and Ozono, S. (2010) Transurethral Resection of the Bladder Tumour (TURBT) for Non-Muscle Invasive Bladder Cancer: Basic Skills. *International Journal of Urology*, **17**, 698-699. <https://doi.org/10.1111/j.1442-2042.2010.02556.x>
- [15] Cappellini, M.D. and Motta, I. (2015) Anemia in Clinical Practice-Definition and Classification: Does Hemoglobin Change With Aging? *Seminars in Hematology*, **52**, 261-269. <https://doi.org/10.1053/j.seminhematol.2015.07.006>
- [16] Uchida, T., Ao, T., Ikeda, S., Yokoyama, E., Kadowaki, K., Shoji, K., et al. (1990) Clinical Statistics of the Bladder Tumor—Transurethral Resection Cases. *Hinyokika Kyo*, **36**, 1033-1038.
- [17] Saginala, K., Barsouk, A., Aluru, J.S., Rawla, P., Padala, S.A. and Barsouk, A. (2020) Epidemiology of Bladder Cancer. *Medical Sciences*, **8**, Article No. 15. <https://doi.org/10.3390/medsci8010015>
- [18] Mancini, M., Righetto, M. and Baggio, G. (2020) Spotlight on Gender-Specific Disparities in Bladder Cancer. *Urologia Journal*, **87**, 103-114. <https://doi.org/10.1177/0391560319887327>
- [19] Brennan, P., Bogillot, O., Cordier, S., Greiser, E., Schill, W., Vineis, P., et al. (2000) Cigarette Smoking and Bladder Cancer in Men: A Pooled Analysis of 11 Case-Control Studies. *International Journal of Cancer*, **86**, 289-294. [https://doi.org/10.1002/\(SICI\)1097-0215\(20000415\)86:2%3C289::AID-IJC21%3E3.0.CO;2-M](https://doi.org/10.1002/(SICI)1097-0215(20000415)86:2%3C289::AID-IJC21%3E3.0.CO;2-M)
- [20] Pira, E., Piolatto, G., Negri, E., Romano, C., Boffetta, P., Lipworth, L., et al. (2010) Bladder Cancer Mortality of Workers Exposed to Aromatic Amines: A 58-Year Follow-Up. *Journal of the National Cancer Institute*, **102**, 1096-1099. <https://doi.org/10.1093/jnci/djq214>
- [21] Zaghoul, M.S., Zaghoul, T.M., Bishr, M.K. and Baumann, B.C. (2020) Urinary Schistosomiasis and the Associated Bladder Cancer: Update. *Journal of the Egyptian National Cancer Institute*, **32**, Article No. 44. <https://doi.org/10.1186/s43046-020-00055-z>
- [22] Abt, D., Bywater, M., Engeler, D.S. and Schmid, H.P. (2013) Therapeutic Options for Intractable Hematuria in Advanced Bladder Cancer. *International Journal of Urology*, **20**, 651-660. <https://doi.org/10.1111/iju.12113>
- [23] Joynson, C.P., Sundar, S., Symonds, P. (2006) Anaemia Is Associated with Poor

- Overall Survival but Not with Inferior Local Control in Patients with Muscle Invasive Bladder Carcinoma Treated by Radical External Beam Radiotherapy. A Retrospective Study. *Clinical Oncology*, **18**, 728-734.  
<https://doi.org/10.1016/j.clon.2006.09.001>
- [24] Ishikawa, O., Ohhigashi, H., Imaoka, S., Nakaizumi, A., Kitamura, T., Sasaki, Y., *et al.* (1989) The Difference in Malignancy between Pedunculated and Sessile Polypoid Lesions of the Gallbladder. *American Journal of Gastroenterology*, **84**, 1386-1390.
- [25] Tanaka, M.F. and Sonpavde, G. (2011) Diagnosis and Management of Urothelial Carcinoma of the Bladder. *Postgraduate Medicine*, **123**, 43-55.  
<https://doi.org/10.3810/pgm.2011.05.2283>
- [26] Pak, J.S., Haas, C.R., Anderson, C.B., DeCastro, G.J., Benson, M.C. and McKiernan, J.M. (2021) Survival and Oncologic Outcomes of Complete Transurethral Resection of Bladder Tumor Prior to Neoadjuvant Chemotherapy for Muscle-Invasive Bladder Cancer. *Urologic Oncology*, **39**, 787.e9-787.e15.  
<https://doi.org/10.1016/j.urolonc.2021.03.025>
- [27] Cesur, M., Erdem, A.F., Alici, H.A., Yapanoglu, T., Yuksek, M.S. and Aksoy, Y. (2008) The Role of Succinylcholine in the Prevention of the Obturator Nerve Reflex during Transurethral Resection of Bladder Tumors. *Saudi Medical Journal*, **29**, 668-671.
- [28] Fukuhara, H., Kakizaki, H., Kaneko, H., Yamanobe, T., Nakayama, S., Horie, S., *et al.* (2017) Safety and Efficacy of Continuous Administration of Antithrombotic Drugs during Transurethral Resection of Bladder Tumors. *Nihon Hinyokika Gakkai Zasshi*, **108**, 17-23. <https://doi.org/10.5980/jpnjurol.108.17>
- [29] Matulewicz, R.S., Sharma, V., McGuire, B.B., Oberlin, D.T., Perry, K.T. and Nadler, R.B. (2015) The Effect of Surgical Duration of Transurethral Resection of Bladder Tumors on Postoperative Complications: An Analysis of ACS NSQIP Data. *Urologic Oncology*, **33**, 338.e19-338.e24. <https://doi.org/10.1016/j.urolonc.2015.05.011>
- [30] Bangash, M., Ather, M.H., Khan, N., Mohammad, S. and Uddin, Z. (2020) Comparison of Recurrence Rate between “EN BLOC” Resection Of Bladder Tumour and Conventional Technique for Non-Muscle Invasive Bladder Cancer. *Journal of Ayub Medical College Abbottabad*, **32**, 435-440.
- [31] Fradet, V., Mauermann, J., Kassouf, W., Rendon, R., Jacobsen, N., Fairey, A., *et al.* (2014) Risk Factors for Bladder Cancer Recurrence after Nephroureterectomy for Upper Tract Urothelial Tumors: Results from the Canadian Upper Tract Collaboration. *Urologic Oncology*, **32**, 839-845. <https://doi.org/10.1016/j.urolonc.2014.04.006>
- [32] Bansal, A., Sankhwar, S., Goel, A., Kumar, M., Purkait, B. and Aeron, R. (2016) Grading of Complications of Transurethral Resection of Bladder Tumor Using Clavien-Dindo Classification System. *Indian Journal of Urology*, **32**, 232-237.  
<https://doi.org/10.4103/0970-1591.185104>
- [33] Boustead, G.B., Fowler, S., Swamy, R., Kocklebergh, R. and Hounscome, L. (2014) Section of Oncology, BAUS. Stage, Grade and Pathological Characteristics of Bladder Cancer in the UK: British Association of Urological Surgeons (BAUS) Urological Tumour Registry. *BJU International*, **113**, 924-930.  
<https://doi.org/10.1111/bju.12468>

# An Analysis of MRI-Fusion Prostate Biopsy Results in PI-RADS 3 MRI Findings in a Cohort of Men in a Community Hospital Setting

Robert A. Edelstein<sup>1,2</sup>, David J. Berman<sup>1</sup>, Lija Joseph<sup>3,4</sup>, Kristopher Daley<sup>5</sup>, Murat Anamur<sup>6</sup>

<sup>1</sup>Departments of Urology (RAE, DB), Lowell General Hospital, Lowell, MA, USA

<sup>2</sup>Department of Urology, Tufts University School of Medicine, Boston, MA, USA

<sup>3</sup>Pathology (LJ), Lowell General Hospital, Lowell, MA, USA

<sup>4</sup>Department of Pathology, Boston University, Boston, MA, USA

<sup>5</sup>Radiology (KD), Lowell General Hospital, Lowell, MA, USA

<sup>6</sup>Medical Oncology (MA), Lowell General Hospital, Lowell, MA, USA

Email: rob.edelstein@gmail.com

**How to cite this paper:** Edelstein, R.A., Berman, D.J., Joseph, L., Daley, K. and Anamur, M. (2022) An Analysis of MRI-Fusion Prostate Biopsy Results in PI-RADS 3 MRI Findings in a Cohort of Men in a Community Hospital Setting. *Open Journal of Urology*, 12, 357-365.

<https://doi.org/10.4236/oju.2022.126034>

**Received:** May 5, 2022

**Accepted:** June 11, 2022

**Published:** June 14, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Introduction:** With the advent of multiparametric MRI (mpMRI), clinicians added an important tool for helping to decide whether a man should undergo a prostate biopsy. The MRI PI-RADS system stratifies the risk of finding cancer on prostate biopsy. PI-RADS 3 lesions often prove to be a diagnostic challenge, and many men are advised not to proceed with a biopsy based on this finding. The goal of our paper was to evaluate the likelihood of finding cancer of clinical significance in this group. **Methods:** A retrospective 4-year data and quality analysis was performed of 312 evaluable men undergoing prostate MRI. Of the subset with scores of PI-RADS 3 who underwent biopsy (N = 32), 100 percent were biopsied using an MRI-guided fusion technique, greatly raising the likelihood that the MRI lesion was, in fact, the area sampled. **Results:** A total of 34% of the men with PI-RADS 3 lesions were found to have Grade Group  $\geq 1$ , with 15.6 % demonstrating Grade Group  $\geq 2$ . In the men with cancer, we analyzed and report the relationship to age, ethnicity, PSA density, and the presence or absence of cribriform findings. **Conclusions:** We found that many men with PI-RADS 3 findings on multiparametric MRI do, in fact, have clinically significant prostate cancer. We suggest that many factors (such as rate of rise of PSA over time, family history, and rectal examination findings) be considered in addition to the MRI PI-RADS score to advise whether or not to proceed with a biopsy of the prostate. Our findings, from a single, large, community hospital with a diverse ethnic makeup, parallel the findings of large trials done at academic centers of excellence. This de-

monstrates that comparable diagnostic mpMRI/biopsy quality may be found in the community setting.

## Keywords

MeSH Headings: Prostate, Neoplasms, Diagnosis, Magnetic Resonance Imaging

---

## 1. Introduction

Urologists face a difficult challenge in deciding who should undergo a biopsy to evaluate for prostate cancer. Multiple strategies have evolved to help decide when a biopsy of the prostate should be performed. These must be balanced against the risks of a biopsy including sepsis, cost, the possibility of false positive or negative results, and discomfort. As MRI has become more frequently used as a diagnostic adjunct, our group decided to examine more closely the characteristics of patients who underwent a prostate biopsy with mpMRI findings of PI-RADS 3. Management of this intermediate risk group has proved challenging to many clinicians.

MRI has become an important adjunct in the decision-making process. Advances including 3 Tesla magnets and improved software have increased the sensitivity and specificity of locating likely sites of prostate cancer. The first version of the Prostate Imaging-Reporting and Data System (PI-RADS v1) was published in 2012. Further refinements have improved accuracy and decreased inter-observer variation since. These advances have helped increase the likelihood of tumor detection and staging [1]. The specific definition of the various PI-RADS findings are as follows:

PI-RADS 1: Clinically significant disease is highly unlikely to be present;

PI-RADS 2: Clinically significant disease is unlikely to be present;

PI-RADS 3: Clinically significant Cancer is equivocal (intermediate risk);

PI-RADS 4: Clinically significant cancer is likely to be present;

PI-RADS 5: Clinically significant cancer is highly likely to be present.

The mpMRI can be used to help target a suspicious MRI lesion, maximizing the likelihood of the biopsy obtaining tissue from the area of interest [2] [3] [4].

## 2. Materials and Methods

Exempt status was granted on August 2, 2021, by the Clinical Research Review Committee of Lowell General Hospital [5]. After de-identification, a retrospective analysis was performed of all MRI-fusion guided biopsies performed between October 16, 2017, and November 15, 2021, numbering 320 in total. Patients were excluded unless the maximal PI-RADS score was 3 or higher, and appropriate follow-up information and demographic data were complete. A total of 312 evaluable patients were ultimately included. Data were obtained regarding

age, ethnicity, pre-biopsy serum PSA level (ng/ml), maximum PI-RADS score obtained on a multiparametric MRI, and calculated PSA density (PSAD) expressed as ng/ml/cc), and the final pathology results. PSA was determined using a Qualigen Therapeutics FastPack PSA system (Qualigen, Carlsbad, CA). If the initial PSA at the time of referral came from another institution, it was generally repeated using the Qualigen system for consistency. A decision to proceed with an mpMRI, and/or ultimately to an MRI-guided prostate fusion biopsy, was made by the patient and their Urologist after a discussion of the risks and benefits. All Urologists were in the same single specialty department at the hospital. Many patients with a PI-RADS 3 finding ultimately elected to not undergo biopsy. This report focuses only on the patients who were biopsied.

MpMRI studies were performed on a Siemens Magnetom Skyra (3 Tesla) device (Siemens USA, Washington DC), utilizing multiplanar T2W sequences with diffusion-weighted imaging and dynamic contrast-enhanced sequences prior to and following the intravenous administration of Dotarem without the use of an endorectal coil. All studies were read by Radiologists with subspecialty training in abdominal imaging. If the decision was made to proceed with an MRI-guided fusion biopsy, three-dimensional segmentation of the prostate gland with mapping of any prostatic lesions was performed on a separate workstation. All prostate fusion biopsies were performed in a trans-rectal fashion using an ARTEMIS 3D Semi-Robotic Prostate Fusion Biopsy System (InnoMedicus, Ltd, Switzerland) under either general anesthesia or deep sedation by an experienced Urologist. All specimens were reviewed by several Pathologists. Pathologic findings included Gleason score, presence, or absence of perineural invasion, concurrent prostatitis, atypical small acinar cell proliferation and presence or absence of Gleason 4 pattern cribriform morphology (which suggests a poorer prognosis). As the description of cribriform pathology was developed during the study period, our Pathologists re-reviewed all the PI-RADS 3 patients whose biopsies contained Gleason 4 areas for the presence or absence of cribriform change, allowing a more contemporary comparison between studies obtained early in the observation period to later specimens.

### 3. Results

A total of 312 evaluable patients were identified with PI-RADS scores of 3, 4 or 5, (32 patients with PI-RADS 3, 197 with PI-RADS 4 and 83 with PI-RADS 5). Only maximal PI-RADS score were used for analysis. If prostate cancer was identified, the highest Gleason score was reported. Many patients had a component of benign hyperplasia (BPH) in the transitional zone (not separately reported). Significant BPH is recognized as a possible factor accounting for a higher PSA score, as is the presence of prostatitis. In **Figure 1**, the overall characteristics of the entire study group are summarized. Note the associated trend towards higher average PSA values, higher age, higher PSA density and higher likelihood of identifying cancer as the maximal PI-RADS scores increase.

We then further analyzed the specific subgroup of patients with a maximal MRI finding of PI-RADS 3 as shown in **Figure 2** and **Figure 3**.

A total of 34% of the patients with PI-RADS 3 were found to have prostate cancer  $\geq$  Gleason score 3 + 3) with 15.6% demonstrating Grade Group 2 (Gleason grade 3 + 4) or higher on MRI-guided fusion biopsy. Patients having a prior diagnosis of prostate cancer in the past on active surveillance and not found to have cancer currently (n = 2) were excluded. Twelve out of the 32 patients had new findings of cancer: one patient demonstrated Gleason 4 + 4 adenocarcinoma, two patients demonstrated Gleason 4 + 3 adenocarcinoma, two patients demonstrated Gleason 3 + 4 adenocarcinoma, and seven patients demonstrated Gleason 3 + 3 adenocarcinoma (one in active surveillance). Of patients who eventually underwent surgical treatment, concordance of the final pathology with the preoperative biopsy results was high, although one patient with initial Gleason 3 + 3 was upgraded to Gleason 3 + 4. Six patients identified with cancer

Maximal PI-RADS Score	Average PSA (ng/ml)	Average Age (years)	PSAD*	Percent Cancer Identified
3 (n = 32)	8.16	64.6	0.167	34%
4 (n = 199)	9.55	66.8	0.30	68%
5 (n = 73)	9.74	78.6	0.55	89%

\* PSAD = PSA/volume of prostate, expressed as ng/ml/cc

**Figure 1.** Overall characteristics of study group.

PSA	AGE	PI-RADS VERSION	RACE	FAMILY HISTORY?	PRIOR BIOPSY?	PSAD	IN AS?	+Bx MATCHES MRI?	BIOPSY PATHOLOGY
9	75	2.0	White	Yes (prostate)	Yes (negative)	0.15	N/A	N/A	Prostatitis
9.8	68	2.0	Hispanic	No	Yes (negative)	0.18	N/A	N/A	Prostatitis
12	74	2.0	Asian	No	Yes (negative)	0.17	N/A	N/A	prostatitis
8.7	65	2.0	White	No	Yes (Prostate Cancer)	0.36	Yes	Yes	Extensive Gleason 3 + 3, + PNI
12.6	66	2.0	White	Yes (prostate)	Yes (ASAP)	0.13	Yes	Yes	Gleason 3 + 3, - (PNI) ASAP
5.0	69	2.0	White	No	Yes (negative)	0.14	N/A	N/A	High Grade PIN, prostatitis
13.6	56	2.0	Asian	No	No	0.32	N/A	Yes	ASAP ("worrisome" for Cancer)
6.7	69	2.1	Hispanic	Yes (female breast)	Yes (negative)	0.17	N/A	Yes	Gleason 4 + 3, - PNI, prostatitis
20.8	67	2.1	White	Yes (prostate)	Yes (negative)	0.29	N/A	N/A	ASAP, High Grade PIN
11.9	62	2.1	White	No	Yes (negative)	0.2	N/A	NO	Gleason 3 + 4, - PNI, ASAP
13.8	62	2.1	White	Yes (female breast)	No	0.25	N/A	A/S	prostatitis
9.7	67	2.1	White	No	Yes (negative)	0.11	N/A	N/A	ASAP
7.6	60	2.1	Hispanic	Yes (prostate)	Yes (negative)	0.1	N/A	Yes	Gleason 4 + 3, - PNI, High grade PIN
2.5	63	2.1	White	Yes (prostate)	No	0.06	N/A	Yes	Gleason 3 + 3, - PNI, prostatitis
8.7	73	2.1	White	No	No	0.16	N/A	N/A	prostatitis
6.9	61	2.1	Asian	No	No	0.19	N/A	N/A	prostatitis
3.5	65	2.1	White	No	Yes (prostate cancer)	0.15	Yes	N/A	New biopsy: ASAP only
5.1	62	2.1	Hispanic	No	Yes (negative)	0.8	N/A	NO	Gleason 3 + 4, - PNI, prostatitis
13.5	76	2.1	White	No	Yes (negative)	0.13	N/A	N/A	prostatitis
4.4	62	2.1	White	No	No	0.09	N/A	N/A	prostatitis
5.7	67	2.1	White	No	No	0.09	N/A	N/A	prostatitis
5.7	60	2.1	Hispanic	No	No	0.08	N/A	N/A	High Grade PIN
20.2	76	2.1	Asian	No	Yes (negative)	0.24	N/A	N/A	prostatitis
5.1	71	2.1	White	No	No	0.08	N/A	Yes	Gleason 3 + 3, - PNI, ASAP
5.0	63	2.1	White	No	Yes (negative)	0.1	N/A	N/A	ASAP
0.86	54	2.1	White	Yes (female uterine)	No	0.02	N/A	N/A	Benign
2.9	37	2.1	White	No	No	0.16	N/A	N/A	Benign
6.2	54	2.1	White	No	No	0.11	N/A	N/A	prostatitis
6.8	63	2.1	White	Yes (female breast)	Yes (prostate cancer)	0.09	Yes	Yes	Gleason 3 + 3, - PNI, prostatitis
6.8	67	2.1	White	No	No	0.11	N/A	N/A	prostatitis
5.0	57	2.1	White	Yes (prostate)	No	0.08	N/A	Yes	Gleason 3 + 3, - PNI, prostatitis
10.6	75	2.1	White	No	No	0.06	N/A	Yes	Gleason 4 + 4, - PNI, cribriform pattern, prostatitis

PSAD=PSA/prostate volume (ng/ml/cc), PNI = perineural invasion, PIN=prostatic intraepithelial neoplasia, ASAP=atypical small acinar cell proliferation, AS=active surveillance

**Figure 2.** Characteristics of maximum score PI-RADS 3 patients.

Age	PSA	Family History	PSAD*	MRI fusion Bx Pathology	Additional Pathology Comments	Treatment
63	6.8	Yes (female breast)	0.09	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
71	5.1	No	0.08	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
57	5.0	Yes	0.08	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
62	5.1	No	0.8	Adenocarcinoma	Gleason 3 + 4, - Cribriform pattern	Radiation Therapy
65	8.7	No	0.36	Adenocarcinoma	Extensive Gleason 3 + 3, + perineural invasion, upgraded to 3 + 4 on	radical prostatectomy
66	12.6	Yes	0.13	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
69	6.7	Yes (female breast)	0.17	Adenocarcinoma	Gleason 4 + 3, - cribriform pattern	Radiation Therapy
65	3.5	No	0.15	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
60	7.6	Yes	0.1	Adenocarcinoma	Gleason 4 + 3 (60% 4), + cribriform pattern, + perineural invasion	Radical Prostatectomy
75	10.6	Yes	0.08	Adenocarcinoma	Gleason 4 + 4	Active Surveillance
63	11.9	No	0.2	Adenocarcinoma	Gleason 3 + 3	Active Surveillance
62	11.9	No	0.2	Adenocarcinoma	Gleason 3 + 4, -perineural invasion, ASAP	Radiation Therapy

\* PSAD = PSA/volume of prostate, expressed in ng/ml/cc,

ASAP = Atypical Small Acinar Cell Proliferation

**Figure 3.** Management decision as of 2022 for PI-RADS 3 Patients with cancer.

had concurrent findings of prostatitis (see **Figure 2**), yet their average PSA was lower than the group, suggesting that this alone did not prompt the biopsy. Patients with cancer in the PI-RADS 3 group had a lower PSAD average than those without cancer (0.137 (ng/ml/cc) vs 0.21). Four of the twelve cancer patients had a family history of prostate cancer, whereas an additional two patients had a family history of female breast cancer. Gleason 4 with cribriform morphology was not initially reported during the early years of this study but was included in the results after pathologic re-review, as it generally conveys a poorer prognosis [6]. As regards treatment, as of this writing in 2022 six patients are in active surveillance protocols, three elected to be treated with external beam radiation therapy, and three proceeded with robotic assisted laparoscopic prostatectomy. As seen in **Figure 2**, we noted a high correlation with positive biopsy findings in the areas identified as PI-RADS 3 (10 of 12).

#### 4. Discussion

This project demonstrates our experience in a large community hospital with the management of patients with a maximal mpMRI PI-RADS score of 3. This is a common finding on MRI, and often presents a challenge for the treating physician and patient as to whether to proceed with a biopsy. Although our sample size is relatively small, we believe that this is the result of progressive stratification during the workup process for PSA elevation using mpMRI. Our group of 7 Urologists in a single large community hospital required 4 years to find 32 cases of PI-RADS 3 patients that were biopsied. In many communities based on prior studies, the finding of a PI-RADS 3 result typically reduces the likelihood of the offer of a biopsy. We believe that this study had to be done in a retrospective fa-

shion. We did not feel that it would be ethical to perform a prospective study where a group of men with PI-RADS 3 would receive a biopsy and then be compared to a group that did not. As expected, there appeared to be a significant likelihood of finding cancer in patients with mpMRI PI-RADS 4 or 5, and almost no patients were reported as PI-RADS 1 or 2. We noted a positive correlation of an increased pre-biopsy average PSA of patients with a finding of cancer. Of the remaining far smaller group that were found to have PI-RADS 3, and elected to proceed with biopsy, we identified a 34% chance of finding any prostate cancer in this group, with 5 of the 12 biopsies containing elements of Gleason grade 4 (Grade Group 2 or higher) (including one with Gleason pattern 4 cribriform morphology). Radiologists occasionally report a “predicted PSA” on mpMRI reports, based on the measured volume of the prostate, assuming that larger glands will likely produce more PSA. (A PSA density (PSAD = PSA/prostate volume) of 0.12 ng/ml/cc is used to predict the expected PSA score). PSAD has been studied as an independent predictor of the likelihood of finding cancer on biopsy, with higher values conferring a higher chance of cancer [7] [8] [9]. We noted the average PSAD in PI-RADS categories 3, 4 and 5 were higher than the “predicted” PSA, confirming this association. Increasing age also predicted a higher chance of finding cancer.

In the interpretation of prostate MRI, the possibility of inter-observer variation between Radiologists must also be considered. A recent meta-analysis attempted to address this issue, finding good inter-observer agreement in interpretation of PI-RADS scores of 4 or 5, as compared to lesser, but still generally acceptable agreement in the interpretation of PI-RADS 3 [10]. We noted a strong correlation of positive cancer findings in PI-RADS 3 lesions, suggesting that our experience parallels that of centers of excellence.

The racial composition of our cohort paralleled the surrounding towns. An ethnic estimation of the overall geographic study area consists of 54.3% White (non-Hispanic), 25.6% Asian, and 18.1% Hispanic. Black or African Americans make up a relatively small percentage. In our PI-RADS 3 group, there were 23 White patients (72%, of whom 9 had cancer), 5 Hispanic men (16%, of whom 3 had cancer), and 4 Asian men, of whom none had cancer. No Black men in the entire study group had a PI-RADS 3 score: however, all 7 Black men in the PI-RADS 4 group were found to have cancer, and the average PSA was 11.7, which was higher than the overall study population for PI-RADS 4 patients. It is unclear whether this suggests a selection bias for Black men being referred for Urologic consultation until their average PSA is higher than the rest of the population or other unidentified factors. One Black man had a PIRADS score of 5 and was also found to have cancer on biopsy.

For clinicians, several challenges exist. While many organizations advocate some form of screening for prostate cancer (at least with a PSA test) for patients between the approximate ages of 50 and 70 - 75, the best methods for this are debated. Another challenge is deciding which cancers are “clinically insignificant” (*i.e.* unlikely to cause harm to the individual during their lifespan) and

which are “clinically significant” (*i.e.* likely to progress and produce morbidity or mortality during their lifetime). It is this latter group that should be offered treatment for cancer. Many men are now in active surveillance protocols, in which definitive treatment for the prostate cancer is not immediately undertaken unless evidence of clinical progression is noted. Routine follow up biopsies or follow up pelvic MRI are frequently used to evaluate for the possibility of progression, in which case definitive treatment may be started. Prior studies have suggested that cancers identified on biopsies done for patients with a maximum score of PI-RADS 3 are associated with a low likelihood of clinically significant prostate cancer, defined as Gleason score 3 + 3 (Grade Group 1) [11]. Recently, however, several groups have questioned this, suggesting that clinically important prostate cancers may be missed with such an approach, particularly if other risk factors are present (older age, smaller median prostate size (which would correlate with a higher PSAD, such as found in our study) [12] [13]. These studies suggest that the size of the MRI-identified lesion did not have a positive correlation with the likelihood of finding cancer. These authors have called into question the frequent practice of not performing a biopsy for PI-RADS 3 lesions, finding that a higher than previously reported incidence of clinically significant prostate cancer may in fact be present. Findings of clinically significant prostate cancer (defined here as Grade group  $\geq 2$ ) may range as high as 27% for a first biopsy [10] [11]. Our data finds a significant percentage of all-grade prostate cancers (34%) in this group, with 5 of the 12 positive biopsies in the PI-RADS 3 group demonstrating a Gleason score of  $\geq 6$  (*i.e.*  $\geq$ Grade Group 2). This equates to the finding of “clinically significant” prostate cancer in 15.6% of all PI-RADS 3 findings on MRI.

The use of MRI will likely continue to increase, both at academic and community hospitals. This will lead to more findings of PI-RADS 3 cases, challenging Urologists who need to educate patients on the implications.

The newer literature has begun to suggest that the widespread practice of not offering a biopsy to a man with a PI-RADS 3 lesion may be short sighted, and that there are patients in this group that harbor clinically significant prostate cancer—thus excluding them from diagnosis simply based on an “equivocal” PI-RADS score. This may be an incorrect approach without including other factors that may favor a biopsy—PSA density is one such example [14]. We believe that our study is the only one of its kind that employed MRI-fusion guided biopsies for 100% of the study group, increasing the likelihood that the significant lesions identified on imaging were in fact the tissue that was sampled.

Finally, we note that most of the Urology practiced around the world is performed by community Urologists, and our large community hospital experience should add to the world’s experience with this challenging diagnosis and management.

## 5. Conclusion

Our findings, as well as the evolving literature, suggest that only performing a

prostate biopsy on an MRI PI-RADS finding of 4 or 5 may miss some men who have clinically significant (*i.e.* Grade Group 2 or higher) prostate cancer. An individualized approach is highly advised, utilizing as many additional decision making factors as possible.

## Funding

No author has any financial relationships to disclose.

This study was not funded by any individual, grant, or other funding agency, including private or governmental.

## Conflicts of Interest

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

## References

- [1] PI-RADS—Prostate Imaging-Reporting and Data System (2019) Version 2.1. The American College of Radiology, the European Society for Urologic Radiology and the AdMeTech Foundation.  
<https://www.acr.org/-/media/ACR/Files/RADS/Pi-RADS/PIRADS-V2-1.pdf>
- [2] Kasivasvanathan, V., Rannikko, A.S., Borghi, M., *et al.* (2018) MRI-Targeted or Standard Biopsy for Prostate-Cancer Diagnosis. *The New England Journal of Medicine*, **378**, 1767-1777.
- [3] Eklund, M., Jaderling, F., Discacciati, A., *et al.* (2021) MRI-Targeted or Standard Biopsy in Prostate Cancer Screening. *The New England Journal of Medicine*, **385**, 908-920. <https://doi.org/10.1056/NEJMoa2100852>
- [4] Lee, A.Y.M., Chen, K., Law, Y.M., *et al.* (2021) Robot-Assisted Magnetic Resonance Imaging-Ultrasound Fusion Transperineal Targeted Biopsy. *Urology*, **155**, 46.
- [5] Clinical Research Review Committee, Lowell General Hospital, a Member of Tufts Medicine, Lowell, MA.
- [6] Chen, Z., Pham, H., Abreu, A., *et al.* (2021) Prognostic Value of Cribriform Size, Percentage, and Intraductal Carcinoma in Gleason Score 7 Prostate Cancer with Cribriform Gleason Pattern 4. *Human Pathology*, **118**, 18-29.  
<https://doi.org/10.1016/j.humpath.2021.09.005>
- [7] Bruno, S., Falagario, U., D'Altilia, N., *et al.* (2021) PSA Density Help to Identify Patients with Elevated PSA due to Prostate Cancer Rather Than Intraprostatic Inflammation: A Prospective Single Center Study. *Frontiers in Oncology*, **11**, Article 693684. <https://doi.org/10.3389/fonc.2021.693684>
- [8] Yanai, Y., Kosaka, T., Hongo, H., *et al.* (2018) Evaluation of Prostate-Specific Antigen Density in the Diagnosis of Prostate Cancer Combined with Magnetic Resonance Imaging before Biopsy in Men Aged 70 Years and Older with Elevated PSA. *Molecular and Clinical Oncology*, **9**, 656-660.  
<https://doi.org/10.3892/mco.2018.1725>
- [9] Osses, D.F., Arsov, C., Schimmoller, L., Schoots, I.G., Van Lenders, G.J.L.H., Espósito, I., Remmers S., *et al.* (2020) Equivocal PI-RADS Three Lesions on Prostate Magnetic Resonance Imaging: Risk Stratification Strategies to Avoid MRI-Targeted Biopsies. *Journal of Personalized Medicine*, **10**, Article 270.  
<https://doi.org/10.3390/jpm10040270>

- [10] Park, K.J., Choi, S.H., Lee, J.S., *et al.* (2020) Interreader Agreement with Prostate Imaging Reporting and Data System Version 2 for Prostate Cancer Detection: A Systematic Review and Meta-Analysis. *Journal of Urology*, **204**, 661-670. <https://doi.org/10.1097/JU.0000000000001200>
- [11] Liddell, H., Jyoti, R. and Haxhimolla, H.Z. (2014) mpMRI Prostate Characterized PIRADS 3 Lesions Are Associated with a Low Risk of Clinically Significant Prostate Cancer-A Retrospective Review of 92 Biopsied PIRADS 3 Lesions. *Current Urology*, **8**, 96-100. <https://doi.org/10.1159/000365697>
- [12] Sheridan, A.D., Nath, S.K., Syed, J.S., *et al.* (2018) Risk of Clinically Significant Prostate Cancer Associated with Prostate Imaging Reporting and Data System Category 3 (Equivocal) Lesions Identified on Multiparametric Prostate MRI. *American Journal of Roentgenology*, **210**, 347-357. <https://doi.org/10.2214/AJR.17.18516>
- [13] Schoots, I.G. (2018) MRI in Early Prostate Cancer Detection: How to Manage Indeterminate or Equivocal PI-RADS 3 Lesions? *Translational Andrology and Urology*, **7**, 70-82. <https://doi.org/10.21037/tau.2017.12.31>
- [14] Tapia, M.F., Labra, A., Adlerstein, I., Olivares, J.P., Schultz, M., Silva, C., *et al.* (2019) Densidad de APE en pacientes PI-RADS 3. Un parámetro clínico útil para su manejo. *Revista Chilena de Radiología*, **25**, 119-127. <https://doi.org/10.4067/S0717-93082019000400119>

# Comparison of Combination Treatments of Distigmine and either Mirabegron or Solifenacin for Rats with Partial Bladder Outlet Obstruction

Kimio Sugaya<sup>1\*</sup>, Saori Nishijima<sup>1</sup>, Katsumi Kadekawa<sup>1</sup>, Katsuhiko Noguchi<sup>1</sup>, Katsuhiko Ashitomi<sup>1</sup>, Seiji Matsumoto<sup>2</sup>, Hideyuki Yamamoto<sup>3</sup>

<sup>1</sup>Southern Knights' Laboratory, Okinawa, Japan

<sup>2</sup>Center for Advanced Research and Education, Asahikawa Medical University, Asahikawa, Japan

<sup>3</sup>Department of Biochemistry, Graduate School of Medicine, University of the Ryukyus, Okinawa, Japan

Email: \*sugaya@sklabo.co.jp

**How to cite this paper:** Sugaya, K., Nishijima, S., Kadekawa, K., Noguchi, K., Ashitomi, K., Matsumoto, S. and Yamamoto, H. (2022) Comparison of Combination Treatments of Distigmine and either Mirabegron or Solifenacin for Rats with Partial Bladder Outlet Obstruction. *Open Journal of Urology*, 12, 366-375.

<https://doi.org/10.4236/oju.2022.126035>

**Received:** May 17, 2022

**Accepted:** June 27, 2022

**Published:** June 30, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



## Abstract

**Objective:** Detrusor hyperactivity with impaired contractility (DHIC) is not an uncommon bladder disorder, and is often difficult to treat. Therefore, using a rat model featuring both urinary frequency and residual urine, we investigated whether an anticholinergic agent (solifenacin) or a  $\beta$ -agonist (mirabegron) is more suitable to combine with distigmine to treat DHIC. **Methods:** The partial bladder outlet obstruction (BOO) rat model was used. Rats were treated for 2 weeks: BOO/Solifenacin group was treated with 0.1 mg/kg solifenacin (n = 8), BOO/Mirabegron group was treated with 1 mg/kg mirabegron (n = 8), BOO/- group was not drug-treated but was given distilled water (n = 8), and the control group was also given distilled water (n = 8). Then the urethral ligature was removed under urethane anesthesia, and continuous cystometry was performed to evaluate bladder function. Baseline measurements were taken, then distigmine was administered to all groups, and cystometry was performed again to measure changes in bladder function. **Results:** Residual volumes increased in the BOO/- group, and the detrusor contractions were more frequent than that of the control group. Solifenacin treatment did not influence changes, except for threshold pressure, to any cystometric measurements. However, mirabegron treatment decreased the residual volume and residual volume rate; it also decreased detrusor contraction frequency similar to measurements obtained from the control group. Distigmine treatment enhanced detrusor contractions, which resulted in less residual volume, and decreased detrusor contraction frequency in the BOO model. **Conclusions:** The combination of distigmine and mirabegron was

---

determined to be a better treatment than the combination of distigmine and solifenacin for DHIC.

## Keywords

Bladder Outlet Obstruction, Detrusor Hyperactivity with Impaired Contractility, Distigmine, Mirabegron, Solifenacin

---

## 1. Introduction

Detrusor hyperactivity with impaired contractility (DHIC) is not an uncommon bladder disorder, which occurs when the detrusor muscle is both overactive during the storage phase and underactive during the voiding phase in the same patient. DHIC is typically diagnosed in patients with bladder outlet obstruction (BOO), enlarged prostates, diabetes, or spinal cord injuries [1] [2] [3], and is often difficult to treat. The treatment for overactive detrusors involves antimuscarinic agents [4] [5]; while  $\alpha$ 1-blockers and/or cholinesterase inhibitors are used to treat underactive detrusors [6] [7]. However, it is challenging to treat DHIC patients who have both overactive bladder (OAB) and a large residual urine volume; treatment with anticholinergic agents sometimes results in a further increase of residual urine or even urinary retention. If an  $\alpha$ 1-blocker drug is not sufficiently effective for reducing the residual urine volume [8], then adding a cholinesterase inhibitor, such as distigmine bromide (distigmine), should be considered. Physicians may be hesitant to combine an anticholinergic drug and a cholinesterase inhibitor for an overactive and underactive detrusor. However, in a previously published study, treating rats with spinal cord injuries using a combination of distigmine and the antimuscarinic agent (propiverine hydrochloride) increased detrusor activity in the voiding phase and decreased detrusor activity during the storage phase [9].

In addition to anticholinergic agents, a  $\beta$ 3-agonist (mirabegron) is prescribed for overactive detrusor treatment [10] [11]. Mirabegron has a high-binding agonist affinity for  $\beta$ 3-adrenoceptors in the bladder, which signals the relaxation of the detrusor muscle to reduce OAB symptoms.  $\beta$ 3-adrenoceptors are also present in the urethra [12], and that mirabegron exhibits not only  $\beta$ 3-adrenoceptor agonism promoting urethral relaxations, but also selective  $\alpha$ 1A- and  $\alpha$ 1D-adrenoceptor antagonism [13]. Therefore, we investigated whether an anticholinergic agent (solifenacin succinate: solifenacin) [4] [5] or a  $\beta$ 3-agonist (mirabegron) [10] [11] was more suitable to combine with distigmine for treating DHIC in a rat model that featured both urinary frequency and residual urine [14].

## 2. Materials and Methods

Adult female Sprague-Dawley rats (n = 32) weighing 210 - 240 g were used. Twenty-four rats underwent BOO-inducing surgical procedures, as previously described [14]. These BOO rats were assigned to 1 of 3 groups: BOO/- group (n

= 8), BOO/Solifenacin group (n = 8), and BOO/Mirabegron group (n = 8). The remaining 8 rats were anesthetized with 2% isoflurane and underwent sham surgery that did not involve tying a 4-0 silk ligature around the urethra (control group). After surgery, all rats were given a subcutaneous injection of 30 mg of ampicillin. The rats were allowed to recover from surgery for one week before treatment began.

The BOO/Solifenacin group was given an intragastric administration of 0.1 mg/kg solifenacin (Vesicare® tablet). Rats in the BOO/Mirabegron group received intragastric administration of 1 mg/kg mirabegron (Betanis® tablet). The dosages were calculated to be similar to those given to patients. For each rat, a tablet was dissolved in 1 mL of distilled water and administered via a lavage once daily for 2 weeks. The control group and the BOO/- group received intragastric administration of 1 mL distilled water once daily for 2 weeks, which was given in the same manner as the groups receiving drug-treated water.

After treatment (3-week postoperatively), the urethral ligature was surgically removed under urethane anesthesia (0.3 g/kg, intraperitoneally and 0.9 g/kg, subcutaneously; total dose of 1.2 g/kg). This removal of the urethral ligature assumed the administration of an  $\alpha 1$  blocker to the obstructed bladder in clinical practice. A femoral venous catheter was inserted to administer the distigmine-injected treatments. Rats were given 0.05 mL/min physiological saline infusions into the bladder through an urethral catheter (PE-50, Clay-Adams, Parsippany, NJ, USA) to perform continuous cystometry, as previously described [4].

After bladder contractions and fluid voided from the external urethral meatus had been stable for at least 30 min, the baseline measurements for detrusor activity were measured as listed in **Figure 2** and in previously published work [4]. After the baseline measurements were taken, 0.1 mg/kg distigmine was injected intravenously [4], and we acquired measurements for detrusor activity again and recorded the results in **Figure 2**.

The study protocol was approved by the President of the University of the Ryukyus based on approval from the Institutional Animal Care and Use Committee (No. A2017011 and A2017190).

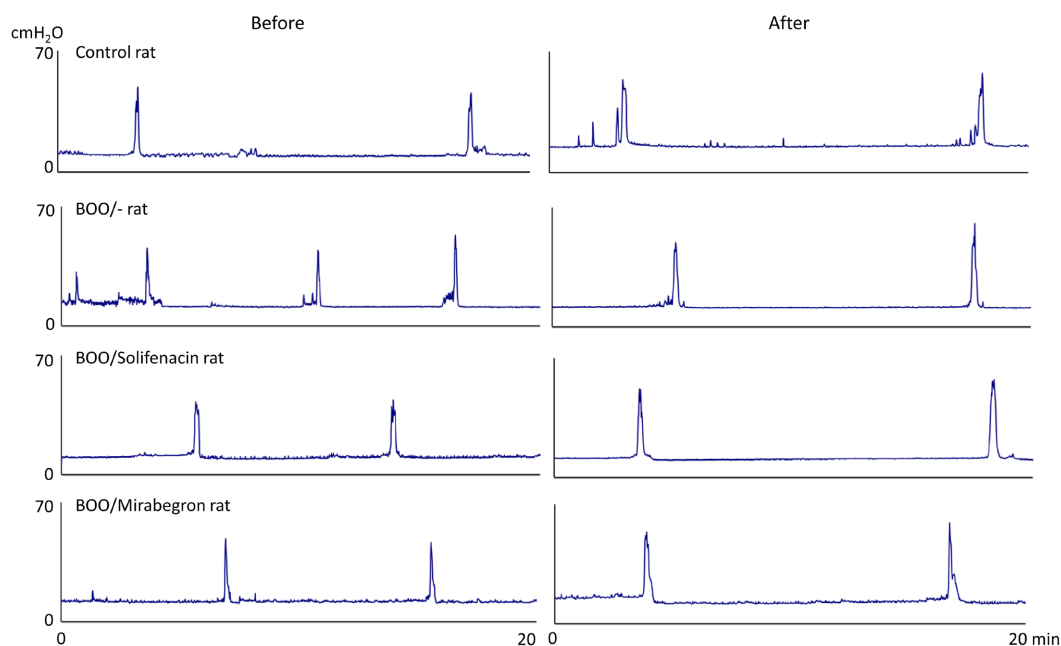
Results were reported as the mean  $\pm$  standard error of the mean (SEM). Statistical analysis was performed, as we have previously published, using ANOVA, Tukey's multiple comparison tests, and a paired Student's *t*-test. A  $p < 0.05$  indicated statistical significance.

### 3. Results

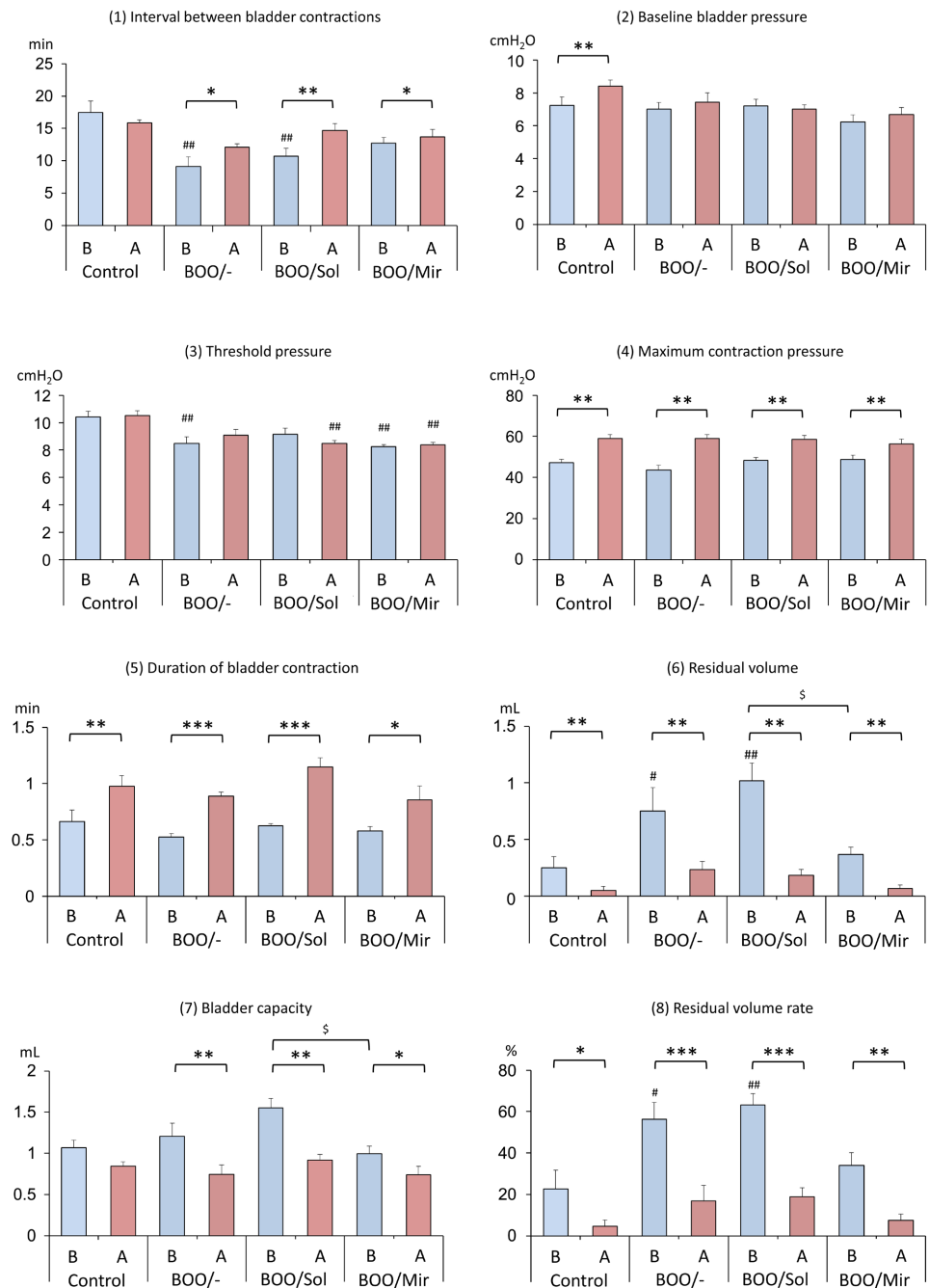
*Effects of solifenacin, and mirabegron:* After 2 weeks of treatment, we acquired baseline measurements for detrusor activity for the 4 groups of rats. At the start of continuous cystometry, many small no-voiding bladder contractions were recorded in the BOO/- group. However, within 30 minutes from the start, these no-voiding bladder contractions almost disappeared. There were several differences observed between the baseline measurements for the BOO/- and

control groups. Shorter interval between detrusor contractions, lower threshold pressure for inducing detrusor contractions, larger residual volumes, and higher residual volume rates were observed in the BOO/- group when compared to the control group (**Figure 1** and **Figure 2**). None of the cystometry baseline measurements were significantly different between the BOO/- and BOO/Solifenacin groups. The threshold pressure level of the BOO/Solifenacin group was the same as that of the control group. When the BOO/- and BOO/Mirabegron groups were compared, there were no significant differences in the baseline cystometric measurements between these groups. The BOO/Mirabegron group had reduced bladder capacity than the BOO/Solifenacin group; in addition, the BOO/Solifenacin group had larger residual volumes. When the control group and the BOO/Mirabegron group were compared, there were no significant differences in cystometric baseline measurements between these groups, except for the threshold pressure. Therefore, mirabegron treatment decreased outflow resistance either at the bladder neck or the urethra in the BOO model.

*Effect of distigmine:* After the distigmine treatment, we again acquired measurements for detrusor activity for the 4 groups of rats. In the control group, distigmine increased baseline bladder pressure, as well as the maximum pressure and duration of detrusor contractions, but decreased residual volumes and residual volume rates without having any influence on bladder capacity. In the 3 BOO groups, distigmine extended the interval between bladder contractions and the duration of detrusor contractions, and also increased the maximum bladder contraction pressure; while bladder capacity, residual volumes, and residual volume rates decreased. Residual volumes and residual volume rates were lower in



**Figure 1.** Representative continuous cystometrograms which were acquired before and after distigmine treatment, are shown for the 4 groups in this study: control, BOO/-, BOO/Solifenacin, and BOO/Mirabegron. Before: before distigmine treatment, After: after distigmine treatment.



**Figure 2.** Effects of solifenacin and mirabegron on continuous cystometry measurements in the 4 groups before and after distigmine treatment (n = 8 for each group). BOO/Sol: BOO/Solifenacin, BOO/Mir: BOO/Mirabegron, B: before distigmine treatment, A: after distigmine treatment. Mean  $\pm$  SEM, \*: p < 0.05, \*\*: p < 0.01, \*\*\*: p < 0.001 between before and after intravenous injection of distigmine in each group. #: p < 0.05, ##: p < 0.01 vs. the control group before or after distigmine treatment. \$: p < 0.05 between BOO/Solifenacin and BOO/Mirabegron groups before distigmine treatment.

the BOO/Mirabegron group than in both the BOO/- and BOO/Solifenacin groups. However, none of the differences measured after distigmine were statistically significant among the BOO groups.

## 4. Discussion

The present rat model of BOO showed an increase of residual volume and percent residual volume without any change of bladder capacity or the duration of bladder contractions compared to the control group, resulting in a shorter interval between bladder contractions and a lower threshold pressure inducing bladder contraction. Thus, the BOO model induced mild overactive detrusors. Administration of solifenacin to BOO rats did not influence any cystometric parameters except for threshold pressure. The dosage of solifenacin might be low for rats. However, administration of mirabegron to BOO rats decreased residual volume and residual volume rate, and prolonged the interval between bladder contractions to the level of control group. These results suggest that mirabegron decreased outflow resistance at the bladder neck or urethra in BOO rats. Administration of distigmine prolonged the interval between bladder contractions, and decreased residual volume and residual volume rate without any adverse consequences, especially in the BOO/Mirabegron group. Therefore, distigmine plus mirabegron may be a more suitable combination for overactive bladder associated with residual urine than distigmine plus solifenacin.

As an antimuscarinic agent, solifenacin targets the M3 receptors in the bladder, which mediate detrusor contractions [15], to ameliorate OAB symptoms in patients by significantly decreasing urgency [4] [5]. In addition, others have reported that solifenacin increased bladder capacity in an overactive detrusor rat model [16]. It is thought that urgency results from overactivation of afferent bladder nerves by adenosine triphosphate (ATP) released from the urothelium [17], and solifenacin partly inhibits afferent bladder activity by suppressing non-neuronal release of ATP. Clinically, solifenacin ameliorates OAB symptoms and particularly achieves a significant decrease of urgency [4] [5] [18]. In contrast,  $\beta$ -adrenoceptor activation in the bladder by mirabegron is known to facilitate bladder filling [19] [20].  $\beta$ -adrenoceptor agonists have been reported to increase bladder capacity without altering residual urine volume [21]. The  $\beta$ -adrenoceptor may be the main receptor facilitating detrusor relaxation [22]. In models consisting of both OAB and BOO, detrusor relaxation is stimulated by  $\beta$ -adrenoreceptor agonists, like mirabegron, in a dose-dependent manner [19] [23] [24]. Moreover, the  $\beta$ -adrenoceptor was found to directly inhibit afferent nervous activity in rats after spinal cord transection [21]. Thus, both solifenacin and mirabegron could be expected to relax bladder smooth muscle and directly or indirectly inhibit afferent bladder nervous activity during the storage phase.

To treat patients who have an underactive detrusor with increased residual urine volume, it is necessary to decrease urethral resistance and increase detrusor contraction pressure. The urethral closing pressure could be reduced by treatment with an adrenergic  $\alpha$ 1-receptor antagonist [8]. In the present study, removal of the urethral ligature prior to cystometry was performed as a treatment similar to reducing urethral resistance with an  $\alpha$ 1-receptor antagonist. Distigmine treatment enhanced detrusor contractions by increasing the maximum

pressure and length of contractions, which decreased residual urine and extended the interval between contractions. Similarly, in a guinea pig model treated with distigmine, the pressure for detrusor contractions increased to help alleviate underactive detrusor symptoms, but no changes were observed that might exacerbate overactive detrusor symptoms, including urethral closing pressure [25] [26]. These results indicate that distigmine corrects detrusor underactivity during voiding phase without deteriorating storage phase parameters. Thus, it might be logical to use antimuscarinic agents or mirabegron for bladder overactivity causing, while employing distigmine to treat bladder underactivity.

In patients with spinal cord injuries, mirabegron reduced urinary frequency, but some patients displayed an exacerbation of urinary incontinence [27]. Recently, Lee and Kuo reported that mirabegron improved OAB symptoms and decreased post-void residual volume in patients with DHIC [28].  $\beta$ -adrenoceptors are also expressed in the urethra [12], and mirabegron exhibits not only  $\beta$ -adrenoceptor agonism promoting urethral relaxations, but also selective  $\alpha$ 1A- and  $\alpha$ 1D-adrenoceptor antagonism [13]. In the present study, administration of mirabegron to BOO rats decreased residual volume and residual volume rate. Thus, our findings in the present study suggest that mirabegron decreases outflow resistance at either the bladder neck or the urethra. Although not significantly different, we determined that the residual volumes and residual volume rates tended to decrease with the combination of mirabegron and distigmine rather than solifenacin and distigmine. Therefore, a combination treatment of distigmine plus mirabegron may be more suitable than a combination treatment of distigmine plus solifenacin for overactive detrusor associated with residual urine. It is challenging to treat DHIC patients. However, the combination treatment of distigmine plus mirabegron during treatment with an adrenergic  $\alpha$ 1-receptor antagonist might improve detrusor overactivity during the collection phase, reduce residual urine, and improve lower urinary tract symptoms.

## 5. Conclusion

In conclusion, a combination of distigmine (a cholinesterase inhibitor) and mirabegron (a  $\beta$ -adrenoceptor agonist) would be a better treatment for DHIC rather than the treatment combination of distigmine and solifenacin (an antimuscarinic agent).

## Acknowledgements

We thank Dr. H. Ichise, Institute for Animal Experiments, Faculty of Medicine, University of the Ryukyus, for his assistance in this study.

## Conflicts of Interest

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

## References

- [1] Haferkamp, A., Dörsam, J., Resnick, N.M., Yalla, S.V. and Elbadawi, A. (2003) Structural Basis of Neurogenic Bladder Dysfunction. II. Myogenic Basis of Detrusor Hyperreflexia. *The Journal of Urology*, **169**, 547-554. [https://doi.org/10.1016/S0022-5347\(05\)63951-1](https://doi.org/10.1016/S0022-5347(05)63951-1)
- [2] Lee, W.C., Wu, H.P., Tai, T.Y., Yu, H.J. and Chiang, P.H. (2009) Investigation of Urodynamic Characteristics and Bladder Sensory Function in the Early Stages of Diabetic Bladder Dysfunction in Women with Type 2 Diabetes. *The Journal of Urology*, **181**, 198-203. <https://doi.org/10.1016/j.juro.2008.09.021>
- [3] Liao, C.H., Chung, S.D. and Kuo, H.C. (2011) Diagnostic Value of International Prostate Symptom Score Voiding-to-Storage Subscore Ratio in Male Lower Urinary Tract Symptoms. *International Journal of Clinical Practice*, **65**, 552-558. <https://doi.org/10.1111/j.1742-1241.2011.02638.x>
- [4] Yamaguchi, O., Marui, E., Kakizaki, H., Itoh, N., Yokota, T., Okada, H., Ishizuka, O., Ozono, S., Gotoh, M., Sugiyama, T., Seki, N., Yoshida, M. and Japanese Solifenacin Study Group (2007) Randomized, Double-Blind, Placebo- and Propiverine-Controlled Trial of the Once-Daily Antimuscarinic Agent Solifenacin in Japanese Patients with Overactive Bladder. *BJU International*, **100**, 579-587. <https://doi.org/10.1111/j.1464-410X.2007.07031.x>
- [5] Cardozo, L., Hessdörfer, E., Milani, R., Arañó, P., Dewilde, L., Slack, M., Drognidijk, T., Wright, M., Bolodeoku, J. and SUNRISE Study Group (2008) Solifenacin in the Treatment of Urgency and Other Symptoms of Overactive Bladder: Results from a Randomized, Double Blind, Placebo-Controlled, Rising-Dose Trial. *BJU International*, **102**, 1120-1127. <https://doi.org/10.1111/j.1464-410X.2008.07939.x>
- [6] Bougas, D.A., Mitsogiannis, I.C., Mitropoulos, D.N., Kollaitis, G.C., Serafetinides, E.N. and Giannopoulos, A.M. (2004) Clinical Efficacy of Distigmine Bromide in the Treatment of Patients with Underactive Detrusor. *International Urology and Nephrology*, **36**, 507-512. <https://doi.org/10.1007/s11255-004-0847-8>
- [7] Yamanishi, T., Yasuda, K., Kamai, T., Tsujii, T., Sakakibara, R., Uchiyama, T. and Yoshida, K. (2004) Combination of a Cholinergic Drug and an Alpha-Blocker Is More Effective than Monotherapy for the Treatment of Voiding Difficulty in Patients with Underactive Detrusor. *International Journal of Urology*, **11**, 88-96. <https://doi.org/10.1111/j.1442-2042.2004.00753.x>
- [8] Chapple, C.R., Herschorn, S., Abrams, P., Wang, J.T., Brodsky, M. and Guan, Z. (2010) Efficacy and Safety of Tolterodine Extended-Release in Men with Overactive Bladder Symptoms Treated with an  $\alpha$ -Blocker: Effect of Baseline Prostate-Specific Antigen Concentration. *BJU International*, **106**, 1332-1338. <https://doi.org/10.1111/j.1464-410X.2010.09359.x>
- [9] Sugaya, K., Nishijima, S., Kadekawa, K., Ashitomi, K. and Yamamoto, H. (2012) Effect of Distigmine Combined with Propiverine on Bladder Activity in Rats with Spinal Cord Injury. *International Journal of Urology*, **19**, 480-483. <https://doi.org/10.1111/j.1442-2042.2011.02953.x>
- [10] Chapple, C.R., Cardozo, L., Nitti, V.W., Siddiqui, E. and Michel, M.C. (2014) Mirabegron in Overactive Bladder: A Review of Efficacy, Safety, and Tolerability. *Neurourology and Urodynamics*, **33**, 17-30. <https://doi.org/10.1002/nau.22505>
- [11] Yamaguchi, O., Marui, E., Igawa, Y., Takeda, M., Nishizawa, O., Ikeda, Y. and Ohkawa, S. (2015) Efficacy and Safety of the Selective  $\beta_3$ -Adrenoceptor Agonist Mirabegron in Japanese Patients with Overactive Bladder: A Randomized, Double-Blind, Placebo-Controlled, Dose-Finding Study. *Lower Urinary Tract Symptoms*, **7**, 84-92.

- <https://doi.org/10.1111/luts.12053>
- [12] Michel, M.C. (2011)  $\beta$ -Adrenergic Receptor Subtypes in the Urinary Tract. *Handbook of Experimental Pharmacology*, **202**, 307-318. [https://doi.org/10.1007/978-3-642-16499-6\\_15](https://doi.org/10.1007/978-3-642-16499-6_15)
- [13] Alexandre, E.C., Kiguti, L.R., Calmasini, F.B., Silva, F.H., da Silva, K.P., Ferreira, R., Ribeiro, C.A., Mónica, F.Z., Pupo, A.S. and Antunes, E. (2016) Mirabegron Relaxes Urethral Smooth Muscle by a Dual Mechanism Involving  $\beta_3$ -Adrenoceptor Activation and  $\alpha_1$ -Adrenoceptor Blockade. *British Journal of Pharmacology*, **173**, 415-428. <https://doi.org/10.1111/bph.13367>
- [14] Miyazaki, N., Yamaguchi, O., Nomiya, M., Aikawa, K. and Kimura, J. (2016) Preventive Effect of Hydrogen Water on the Development of Detrusor Overactivity in a Rat Model of Bladder Outlet Obstruction. *The Journal of Urology*, **195**, 780-787. <https://doi.org/10.1016/j.juro.2015.10.117>
- [15] Ohtake, A., Saitoh, C., Yuyama, H., Ukai, M., Okutsu, H., Noguchi, Y., Hatanaka, T., Suzuki, M., Sato, S., Sasamata, M. and Miyata, K. (2007) Pharmacological Characterization of a New Antimuscarinic Agent, Solifenacin Succinate, in Comparison with Other Antimuscarinic Agents. *Biological and Pharmaceutical Bulletin*, **30**, 54-58. <https://doi.org/10.1248/bpb.30.54>
- [16] Suzuki, M., Ohtake, A., Yoshino, T., Yuyama, H., Hayashi, A., Ukai, M., Okutsu, H., Noguchi, Y., Sato, S. and Sasamata, M. (2005) Effects of Solifenacin Succinate (YM905) on Detrusor Overactivity in Conscious Cerebral Infarcted Rats. *European Journal of Pharmacology*, **512**, 61-66. <https://doi.org/10.1016/j.ejphar.2005.02.023>
- [17] Yoshida, M., Masunaga, K., Nagata, T., Maeda, Y., Miyamoto, Y., Kudoh, J. and Homma, Y. (2009) Attenuation of Non-Neuronal Adenosine Triphosphate Release from Human Bladder Mucosa by Antimuscarinic Agents. *Lower Urinary Tract Symptoms*, **1**, 88-92. <https://doi.org/10.1111/j.1757-5672.2009.00049.x>
- [18] Ohtake, A., Sato, S., Sasamata, M. and Miyata, K. (2010) The Forefront for Novel Therapeutic Agents Based on the Pathophysiology of Lower Urinary Tract Dysfunction: Ameliorative Effect of Solifenacin Succinate (Vesicare), a Bladder-Selective Antimuscarinic Agent, on Overactive Bladder Symptoms, Especially Urgency Episodes. *Journal of Pharmacological Sciences*, **112**, 135-141. <https://doi.org/10.1254/jphs.09R13FM>
- [19] Takasu, T., Ukai, M., Sato, S., Matsui, T., Nagase, I., Maruyama, T., Sasamata, M., Miyata, K., Uchida, H. and Yamaguchi, O. (2007) Effect of (R)-2-(2-aminothiazol-4-yl)-4-(2-(2-hydroxy-2-phenylthyl)amino)ethyl)acetanilide (YM178), a Novel Selective Beta 3-Adrenoceptor Agonist on Bladder Function. *Journal of Pharmacology and Experimental Therapeutics*, **321**, 642-647. <https://doi.org/10.1124/jpet.106.115840>
- [20] Aizawa, N., Homma, Y. and Igawa, Y. (2012) Effects of Mirabegron, a Novel  $\beta_3$ -Adrenoceptor Agonist, on Primary Bladder Afferent Activity and Bladder Microcontractions in Rats Compared with the Effects of Oxybutynin. *European Urology*, **62**, 1165-1173. <https://doi.org/10.1016/j.eururo.2012.08.056>
- [21] Sacco, E. and Bientinesi, R. (2012) Mirabegron: A Review of Recent Data and Its Prospects in the Management of Overactive Bladder. *Therapeutic Advances in Urology*, **4**, 315-324. <https://doi.org/10.1177/1756287212457114>
- [22] Takeda, M., Obara, K., Mizusawa, T., Tomita, Y., Arai, K., Tsutsui, T., Hatano, A., Takahashi, K. and Nomura, S. (1999) Evidence for beta-3-AR Subtypes in Relaxation of the Human Urinary Bladder Detrusor: Analysis by Molecular Biological and Pharmacological Methods. *Journal of Pharmacology and Experimental Therapeutics*, **288**, 1367-1373.

- [23] Hatanaka, T., Ukai, M., Watanabe, M., Someya, A., Ohtake, A., Suzuki, M., Ueshima, K., Sato, S. and Kaku, S. (2013) Effect of Mirabegron, a Novel  $\beta$ -Adrenoceptor Agonist, on Bladder Function during Storage Phase in Rats. *Naunyn-Schmiedeberg's Archives of Pharmacology*, **386**, 71-78. <https://doi.org/10.1007/s00210-012-0814-3>
- [24] Woods, M., Carson, N., Norton, N., Sheldon, J. and Argentieri, T. (2001) Efficacy of the Beta-3-adrenergic Receptor Agonist CL-316243 on Experimental Bladder Hyperreflexia and Detrusor Instability in the Rat. *The Journal of Urology*, **166**, 1142-1147. [https://doi.org/10.1016/S0022-5347\(05\)65936-8](https://doi.org/10.1016/S0022-5347(05)65936-8)
- [25] Sekiya, S., Michikawa, H., Tanaka, Y. and Koike, K. (2006) Effects of Distigmine on the Intraurethral Pressure of Anesthetized Guinea-Pigs. *Pharmacometrics*, **71**, 19-27.
- [26] Sekiya, S., Ookawa, N., Horinouchi, T., Tanaka, Y. and Koike, K. (2006) Effects of Distigmine, a Long-Acting Cholinesterase Inhibitor, on Urinary Bladder Contractile Functions Assessed by Using Cystometry Method in Anesthetized Guinea-Pigs. *Pharmacometrics*, **70**, 29-34.
- [27] Wöllner, J. and Pannek, J. (2016) Initial Experience with the Treatment of Neurogenic Detrusor Overactivity with a New  $\beta$ -3 Agonist (Mirabegron) in Patients with Spinal Cord Injury. *Spinal Cord*, **54**, 78-82. <https://doi.org/10.1038/sc.2015.195>
- [28] Lee, C.L. and Kuo, H.C. (2019) Efficacy and Safety of Mirabegron, a  $\beta$ -Adrenoceptor Agonist, in Patients with Detrusor Hyperactivity and Impaired Contractility. *Lower Urinary Tract Symptoms*, **11**, O93-O97. <https://doi.org/10.1111/luts.12224>

## Abbreviations

ANOVA = Analysis of Variance  
ATP = Adenosine Triphosphate  
BOO = Bladder Outlet Obstruction  
OAB = Overactive Bladder  
SEM = Standard Error of the Mean

# Management of Trauma to the External Genitalia at the Nianankoro-Fomba Hospital in Segou Mali

Sory Ibrahim Koné<sup>1\*</sup>, Abdoulaye Kassogué<sup>2</sup>, Brehima Samaké<sup>3</sup>, Mahamoudou Keita<sup>3</sup>, Tidiani Traore<sup>4</sup>, Abdoulaye Nouhoum Coulibaly<sup>5</sup>, Mamadou Adama Togo<sup>5</sup>, Thierno Boubacar Bagayoko<sup>6</sup>, Adama Bah<sup>2</sup>, Aminata Fofana<sup>7</sup>, Alpha Sanogo<sup>8</sup>, Damissa Coulibaly<sup>9</sup>, Sidi Modibo Doucouré<sup>10</sup>, Honoré Jean Gabriell Berthé<sup>11</sup>

<sup>1</sup>Urology Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>2</sup>Paediatric Ward, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>3</sup>General Surgery Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>4</sup>Obstetrics and Gynaecology Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>5</sup>Ophthalmology Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>6</sup>Forensic Medicine Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>7</sup>ENT Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>8</sup>Cardiology Department, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>9</sup>Department of General Medicine, The Nianankoro Fomba Hospital, Ségou, Mali

<sup>10</sup>Social Security Fund, Ségou, Mali

<sup>11</sup>Department of Urology, CHU du Point G, Bamako, Mali

Email: \*sorykone72@gmail.com

**How to cite this paper:** Koné, S.I., Kassogué, A., Samaké, B., Keita, M., Traore, T., Coulibaly, A.N., Togo, M.A., Bagayoko, T.B., Bah, A., Fofana, A., Sanogo, A., Coulibaly, D., Doucouré, S.M. and Berthé, H.J.G. (2022) Management of Trauma to the External Genitalia at the Nianankoro-Fomba Hospital in Segou Mali. *Open Journal of Urology*, 12, 376-382.

<https://doi.org/10.4236/oju.2022.126036>

**Received:** April 14, 2022

**Accepted:** June 27, 2022

**Published:** June 30, 2022

## Abstract

Trauma to the male genitalia is not very common and mainly affects a young population. There is probably a particular instinct in men to defend their external genitalia; indeed, in the flaccid state, the penis is little exposed, and fairly well protected and its mobility allows it to move with the impact of trauma and thus reduce the vulnating force. Open trauma is rare, as is testicular dislocation, the most common being closed trauma. Testicular trauma is an uncommon accident that affects young people. Trauma is most often caused by road and traffic accidents. Animal bites are rare, as is genital self-mutilation related to a psychiatric disorder. Surgical exploration is the rule except in cases of moderate testicular trauma. Our objective was to report our experience in an emergency context where treatment is poorly codified and to review the literature. We recorded four patients with external genitalia trauma managed in the urology department from April 2013 to March 2022. Our patients were children with open genitalia trauma following a traffic accident, scrotal injuries were encountered in three patients, and additional penile in-



juries in one patient. All patients were treated surgically. The follow-up was straightforward.

## Keywords

Trauma, Genitalia, Open, Segou

## 1. Introduction

Trauma to the male genitalia is uncommon and mainly affects a young population [1] [2]. There is probably a particular instinct in men to defend their external genitalia; indeed, in the flaccid state, the penis is little exposed, and fairly well protected and its mobility allows it to move with the impact of trauma and thus reduce the vulnating force. Open trauma is rare, as is testicular dislocation, the most common being closed trauma. These genital injuries are a part of urogenital trauma. Urogenital trauma is the set of open or closed lesions following an attack on the urinary or genital system. The diagnosis of urological lesions is an integral part of the systematic lesion assessment, from which this type of patient must benefit and which aims to detect all the lesions and their different associations. These genito-urinary (urogenital) lesions can be found in the context of polytrauma. Trauma in general, which accounts for 9% of mortality worldwide, is a public health problem because it leads to approximately 5 million deaths worldwide and many survivors have after-effects [3]. In France, traumatology is mainly represented by closed traumas secondary to public road accidents, falls from great heights (voluntary defenestration, leisure or work accidents), or crushing accidents (mainly work accidents). These injuries, therefore, occur in patients whose violent trauma generates psychological and physical polytrauma [4] [5]. Urogenital trauma is part of physical trauma [6].

Testicular trauma is an uncommon accident that affects young people. Trauma is most often caused by road and traffic accidents. Animal bites are rare [7] as is genital self-mutilation related to a psychiatric disorder. Surgical exploration is the rule except in cases of moderate testicular trauma [1].

Our aim was to report our experience in the management of open trauma to the male genitalia in an emergency setting where treatment is poorly codified and to review the literature.

## 2. Patients and Observations

We report the observations of four patients treated in the urology department of the Nianankoro Fomba Hospital in Segou between April 2013 and March 2022.

### 2.1. Observation 1

This was a 10-year-old patient admitted to the emergency room 1.5 hours after a road traffic accident, who had been thrown and dragged by a motor cultivator with

open trauma to the genitalia. Clinical examination revealed a scrotal opening exposing the testicles, a detachment of the skin of the penis from the balanopreputial groove to its root, multiple suprapubic wounds.

Emergency exploration under anaesthesia revealed a large scrotal wound, fully exposed testicles without rupture of the albuginea, without haematoma.

We performed scrotal trimming, penile trimming and suprapubic lesions in the direction of the broken line wounds (**Figure 1**).

Peri-operative antibiotic therapy was given with a combination of amoxicillin and clavulanic acid. Tetanus serotherapy was administered as well as the booster vaccine.

2 days after the operation, an X-ray of the pelvis revealed a fracture of the left ischio-pubic ramus without displacement, which was monitored after advice from the orthopaedic surgeon.

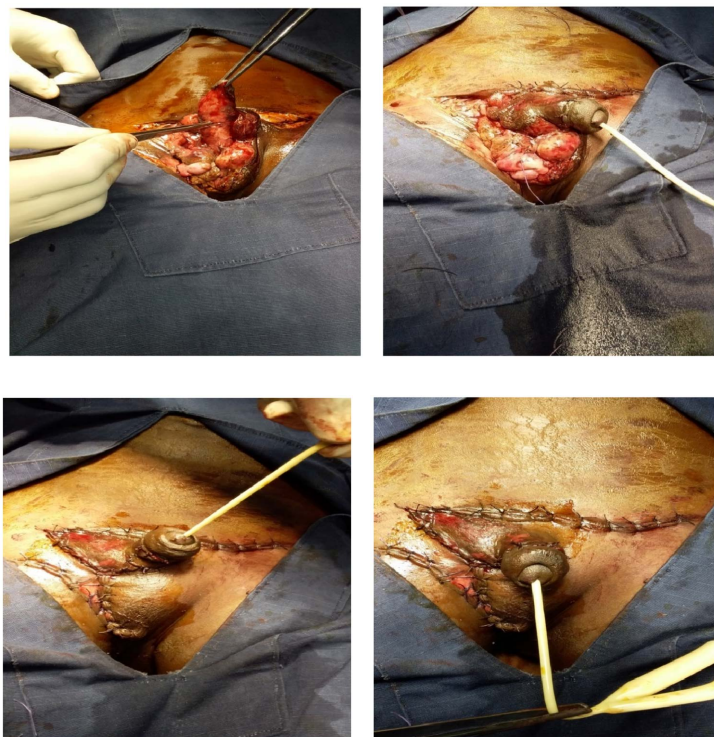
Follow-up was straightforward, and the patient was discharged at D15.

## 2.2. Observation 2

A 12 year old patient admitted to the ward following a cycling accident with a fall astride the frame and damaged saddle tip with a large scrotal lesion extending from the perineum to the root of the penis on the left side.

On examination, there was no opening of the tunica vaginalis or testicular lesions.

We proceeded to cut and suture the lesion in two planes under general anaesthesia (**Figure 2**).



**Figure 1.** Investigation of lesions and suture cutting in patient 1.



**Figure 2.** Investigation of lesions and suture cutting in patient 2.

Peri-operative antibiotic therapy was given with a combination of amoxicillin and clavulanic acid. Tetanus serotherapy was administered as well as the booster vaccine.

The postoperative course was straightforward, with the patient discharged on the second postoperative day.

### 2.3. Observation 3

This was a 13 year old child admitted to the urology department for trauma to the bursa. Following a bicycle accident, examination revealed a penetrating arcuate bursal wound on the left side, starting from the perineum and ending at the root of the penis. The testicle was not affected as it had been bypassed by the injury, however an abrasion of the scrotal skin was noted opposite the testicles (**Figure 3**). The rest of the examination was normal.

### 2.4. Observation 4

This is the case of a 7-year-old patient who was brought to the emergency room by his parents for a trauma to the bursa following a bicycle accident. On examination, there was no notion of initial loss of consciousness. On examination, the patient was conscious with a blood pressure of 110/60 mmHg, a temperature of 37°C and a scrotal wound of about 2 cm, longitudinal on the right hemi scrotum, superficial without testicular involvement (**Figure 4**). The patient was discharged after 24 hours of observation under paracetamol-based analgesics, and the after-effects were simple.



**Figure 3.** Exploration of lesions in patient 3.



**Figure 4.** Exploration of lesions in patient 4.

### 3. Discussion

We have recorded four cases of open trauma of the genitals in 9 years of activity in the urology department of the Nianankoro Fomba hospital, which testifies to the rarity of these open traumas of the genitals. Unlike a previous study that focused on urogenital trauma, our study [6] focused only on open genital trauma. This previous study, despite taking into account urological lesions in addition to genital lesions, reported that urogenital trauma represented 0.2% of all traumas with only 60 cases of urogenital trauma out of a total of 2650 patients received for trauma over a period of 9 years [6]. And of these urogenital injuries 33.3% were open injuries (20 cases) compared to 66.7% for closed injuries [6]. According to other studies, trauma to the genitals is not very common in general [2] [8]. Open genital trauma is even less common [1], with closed trauma being the most common. Open genital trauma can be open bursal trauma, open penile trauma (laceration, zip trauma and amputations), which are less common [2]. In our study, all our patients were children.

The average age of our patients was 10.5 years, the youngest patient was 7 years old and the oldest 13 years old.

The young age of the patients is reported in several series [1] [2]. Our patients were cases of open trauma to the genitals, mainly the bursa, with injuries often extending to the perineum and penis. The most frequent mechanism of injury was a straddle fall on the bicycle frame, landing partly on a damaged saddle, in three out of four patients. One case of throwing and then pulling the victim onto the road by a motor cultivator was reported. Thus, all our patients were victims of road or highway accidents. The predominant role of these accidents in the genesis of genital trauma has been reported in several previous studies [8] [9]. In our study, the diagnosis was clinical in all our patients and was established by physical examination. However, an X-ray of the pelvis revealed an associated fracture of the left ischiopubic branch of the pelvis, without displacement, in one patient. In the literature, the diagnosis is based mainly on clinical examination, which is made difficult by pain and oedema. The role of complementary examinations is not always well defined, but they help in the management, as in the case of Doppler ultrasound in closed trauma [10]. Complementary tests are often not necessary in the management of open trauma [11]. All our patients received emergency surgical treatment.

Emergency treatment is surgical in the majority of cases (1, 2, 4). In the follow-up, the practitioner must be attentive to the after-effects on sexual function and fertility (2).

#### 4. Conclusion

Open trauma of the genitals is a urological emergency that affects more young people. The diagnosis is essentially clinical and the management surgical.

#### Conflicts of Interest

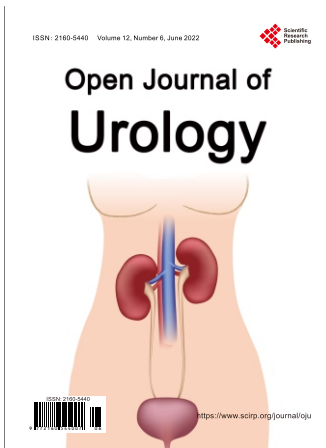
The authors declare no conflicts of interest regarding the publication of this paper.

#### References

- [1] Coffin, G., Méria, P. and Desgrandchamps, F. (2012) Traumatismes des organes génitaux externes.  
<https://www.em-consulte.com/article/743250/traumatismes-des-organes-genitaux-externes>
- [2] Nedjar, M., Brassart, E., Bart, S., Bigot, P. and Culty, T. (2021) Traumatismes des organes génitaux externes.  
<https://www.em-consulte.com/article/1467691/traumatismes-des-organes-genitaux-externes>
- [3] OMS, Bureau régional de la Méditerranée orientale.  
<http://www.emro.who.int/fr/health-topics/injuries/Page-1.html>
- [4] Educasante. Définition et classification des traumatismes.  
<https://www.educasante.org/connaissances/epidemiologie/definition-et-classification-des-traumatismes/>
- [5] Josse, E. (2007) Le traumatisme psyclinique: Quelques repères notionnels.

[http://www.resilience-psy.com/IMG/pdf/reperes\\_trauma.pdf](http://www.resilience-psy.com/IMG/pdf/reperes_trauma.pdf)

- [6] Kambout, T., Ouattara, A., Zare, C., Ouattara, A.M., Pare, A.K. and Sanon, B.G. (2014) Urogenital Trauma: Epidemiological Profile and Lesion Aspect at the Centre Sourosanon University Hospital of BOBO DIOULASSO (Burkina Faso). *Uro'ANDRO*, **1**, 83-90.
- [7] Dubosq, F., Traxer, O., Boubilil, V., Gattegno, B. and Thibault, P. (2004) What to Do in Case of Genital Trauma due to a Dog Bite? *Progress in Urology*, **14**, 232-233
- [8] Coulibaly, M.T., Issa, A., Kassogué, A. and Ouattara, Z. (2017) Scrotal Traumas: Clinical and Therapeutic Aspects in the Service of Urology of the Gabriel Touré University Hospital. *Le Mali Medical*, **32**, 17-21.
- [9] Sirmonino, O., Carcenac, A., Decpparentt, T., Karsentyg, G. and Serment, G. (2006) Trauma to the Penis and Genitalia. *Andrologie*, **16**, 187-196.  
<https://doi.org/10.1007/BF03034858>
- [10] Khan, R.M., Malik, M.A., Jamil, M., Khan, D. and Shah, I.H. (2008) Penile Fracture: Experience at Ayud Teading Hospital. *Journal of Ayud Medical College, Abbottabad: JAMC*, **20**, 49-50.
- [11] Latabi, A., Erraihan, M., Errai, A., Talha, H., Moudouni, S. and Sarf, I. (2018) Surgical Treatment of Male External Genitalia Trauma (Approximately 321 Cases). *Progress in Urology*, **28**, 692. <https://doi.org/10.1016/j.purol.2018.07.153>



# Open Journal of Urology (OJU)

ISSN 2160-5440 (Print) ISSN 2160-5629 (Online)

<https://www.scirp.org/journal/oju>

**Open Journal of Urology (OJU)** is an international journal dedicated to the latest advancement of urology. The goal of this journal is to provide a platform for researchers and academics all over the world to promote, share, and discuss various new issues and developments in urology related problems. All manuscripts must be prepared in English, and are subject to a rigorous and fair peer-review process. Accepted papers will immediately appear online followed by printed hard copy.

## Subject Coverage

The journal publishes original papers including but not limited to the following fields:

- Female Pelvic Medicine and Reconstructive Surgery
- General Urology
- Male and Female Sexual Dysfunction
- Pediatric Urology
- Reconstructive Urology
- Stone Disease
- Urinary Physiology
- Urodynamics and Neurourology
- Urologic Oncology

We are also interested in: 1) Short reports—2-5 page papers where an author can either present an idea with theoretical background but has not yet completed the research needed for a complete paper or preliminary data; 2) Book reviews—Comments and critiques.

## Notes for Intending Authors

Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. Paper submission will be handled electronically through the website. All papers are refereed through a peer review process. For more details about the submissions, please access the website.

## Website and E-Mail

<https://www.scirp.org/journal/oju>

E-mail: [aju@scirp.org](mailto:aju@scirp.org)

## ***What is SCIRP?***

Scientific Research Publishing (SCIRP) is one of the largest Open Access journal publishers. It is currently publishing more than 200 open access, online, peer-reviewed journals covering a wide range of academic disciplines. SCIRP serves the worldwide academic communities and contributes to the progress and application of science with its publication.

## ***What is Open Access?***

All original research papers published by SCIRP are made freely and permanently accessible online immediately upon publication. To be able to provide open access journals, SCIRP defrays operation costs from authors and subscription charges only for its printed version. Open access publishing allows an immediate, worldwide, barrier-free, open access to the full text of research papers, which is in the best interests of the scientific community.

- High visibility for maximum global exposure with open access publishing model
- Rigorous peer review of research papers
- Prompt faster publication with less cost
- Guaranteed targeted, multidisciplinary audience



**Scientific  
Research  
Publishing**

**Website: <https://www.scirp.org>**

**Subscription: [sub@scirp.org](mailto:sub@scirp.org)**

**Advertisement: [service@scirp.org](mailto:service@scirp.org)**