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Laparoscopic Management of Undescended Testis: Results and Outcomes in a Pediatric Population

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Abstract

Aim: This study aimed to evaluate the results of the laparoscopic treatment of high and intra-abdominal undescended testes. **Methods:** A retrospective study was carried out from 2014 to 2021 at the *Centre medico-chirugicale d'urologie* in Douala. We consulted the clinical records of 27 patients aged 6 - 15 years who underwent laparoscopic orchiopexy at our hospital. We included patients with unilateral or bilateral undescended testes as detected by palpation and excluded patients with incomplete clinical records. The data collected were entered into Microsoft Excel 2016 and exported to Epi info 7 for analysis. Continuous variables were presented as mean values and standard deviations while categorical variables were presented as frequencies and percentages. The threshold for statistical significance was set at $p < 0.05$. **Results:** The ages of the 27 participants ranged from 6 years to 15 years, with a mean age of 10.22 ± 2.68 years. Hypospadias was an associated abnormality in 7.41% of participants. The mean duration of the surgical procedure was 80.56 ± 30.30 minutes. The overall success rate of the laparoscopic procedure was 95.83%. The mean duration of postoperative hospital stay was 26.67 ± 7.69 hours. The only postoperative complication we encountered was testicular atrophy, which occurred in 7.41% of participants. All our patients underwent single-stage laparoscopic procedures. **Conclusion:** Laparoscopy, which is the technique of choice for the diagnosis and management of undescended testis, is more rapid, more effective, and characterized by a shorter hospital stay and fewer postoperative complications compared to open surgery. Single-stage procedures are as effective and safe as two-stage procedures.

Keywords

Undescended Testis, Laparoscopy, Orchiopexy, Orchiectomy, Single-Stage Procedure

1. Introduction

The testes are the male genital organs. They are located outside the abdominal cavity in a sac known as the scrotum, where they are maintained at a temperature that is approximately 2.5˚C less than the normal body temperature [1]. The testes initially develop in the abdominal cavity and then descend into the scrotum. Testicular descent is a complex and multifactorial process [2] that begins by the eighth gestational week [3]. Testicular descent, just like other processes in embryology, could encounter abnormalities. Cryptorchidism, which is defined as the absence of the testes from the scrotal sac [4], is a result of abnormal testicular descent. This abnormality can occur either because the descending testis is arrested in its usual path of descent (true undescended testis) or can migrate from the usual path of descent (ectopic testis) [4]. In this study, we focused on true undescended testis. Undescended testis (UDT) affects 1% - 6% of male babies [5]. In most patients, undescended testes migrate into the lower scrotum within the first 3 months of life, probably as a consequence of a postnatal surge of testosterone. Only in less than 1% of the patients does the testis remain persistently undescended by the age of 1 year. Cryptorchidism occurs four times more commonly unilaterally than bilaterally [5]. Undescended testes are usually classified as low, high, or intra-abdominal, with the intra-abdominal ones being the most common [6]. In approximately 80% of patients with cryptorchidism, the testis is manually palpable in the inguinal canal [7]. Ultrasonography is the most widely used imaging technique in diagnosing cryptorchidism and locating the undescended testes [8]. However, there are other imaging techniques such as computed tomography, and magnetic resonance imaging [9]. The management of cryptorchidism is usually surgical, via a technique known as orchiopexy [10]. With advancements in technology, this procedure is performed nowadays via laparoscopy. Laparoscopy has the advantages of clearly demonstrating the anatomy and providing visual information upon which a definitive decision can be made for further management; thus, this technique is at the same time diagnostic and therapeutic [11]. In resource-limited settings such as ours, laparoscopic surgery is not a common medical practice, and there is a paucity of data on the efficacy of laparoscopic orchiopexy. Thus, we carried out this study that aimed to evaluate the results of the laparoscopic management of high and intra-abdominal undescended testes.

2. Patients and Methods

Patients and data collection

This was a retrospective study carried out on 27 boys aged 6 - 15 years who un-

derwent laparoscopic surgery for undescended testes at the *Centre medico-chirugicale d'urologie* in Douala, after excluding patients with incomplete clinical records. We consulted the clinical records of these patients and collected data on their ages, testicular findings on physical examination, imaging findings (including ultrasound, computed tomography, and magnetic resonance imaging), associated testicular abnormalities, surgical procedure performed, intra-abdominal pressure during surgery, intraoperative laparoscopy findings, surgical technique used, ultrasound findings at the first and second follow-up appointments (approximately one month and six months after surgery, respectively), testicular location and volume at the first and second follow-up appointments, outcome of the surgical procedures performed, and complications. During the initial physical examinations, we noted the absence of testes from the scrotum and went further to confirm the locations of these absent testes via ultrasound, doppler ultrasound, and even magnetic resonance imaging. We defined testicular atrophy with the help of the testicular atrophy index, which is calculated as follows: TAI = (contralateral testis volume—affected testis volume)/contralateral testis volume × 100, with a TAI value of 20% or more representing testicular atrophy [12].

Surgical procedure and postoperative follow-up

The aim of this laparoscopic procedure was to restore the testis (orchidopexy) to its normal position in the scrotum or remove the testis completely (orchidectomy) if orchiopexy is not possible. This is to prevent the testis from becoming cancerous, even though the risk of malignancy in such testicular remnants is low [13]. After consulting an anesthesiologist, all patients did laboratory tests, including prothrombin time, kaolin-cephalin time, complete blood count, serum urea and creatinine, and urinalysis. This procedure was performed under general anesthesia. During this procedure, the patient was placed in the dorsal decubitus position and a urinary catheter was placed to facilitate the process of dissection that is much easier when the bladder is empty. Thereafter, pneumoperitoneum was created via insufflation with carbon dioxide at a given pressure that is calculated as follows: Age (in years) + 2 mmHg, with a maximum pressure of 14 mmHg. This insufflation could either be done via a mini-laparotomy and insertion of an optical trocar (for younger patients) or by using a Veress needle (for older patients). Thereafter, a one-centimeter arc-shaped incision was made below the umbilicus, followed by either a mini-laparotomy or the use of a Veress needle, depending on the patient's age. Thereafter, the first 5-mm or 10-mm optical trocar was placed, depending on the patient's age. This was followed by a revision of the peritoneal cavity using the 10-mm optical trocar. Two other 5-mm trocars were placed in each iliac fossa, followed by a dissection of the posterior peritoneum and liberation of the spermatic vessels to mobilize the testis. Each vas deferens, spermatic cord, and testicular gubernaculum were identified and isolated while noting their gross anatomy and positions. The gubernaculum testis was identified and mobilized to ensure better clamping and traction of the testes using a pair of forceps. Then, the gubernaculum testis was then sectioned using a pair of monopolar scissors. Dissection was done cranially until a

sufficient length of the spermatic cord was obtained to perform orchiopexy without tensioning it. The peritoneum was perforated at the lateral face of the round ligament and the anteromedial part of the epigastric vessels. It is worth mentioning that the thirty-degree Trendelenburg position is often necessary to better visualize the testes and their associated structures. If the testis was not found, the procedure was stopped (which was the patient in two of our participants). If the testis was atrophied or vestigial, orchiectomy was performed (this was the patient in three of our study participants). If the testis had a normal appearance, orchiopexy was performed (this was the patient in 22 of our study participants), during which the testis was brought into the lower part of the scrotum and fixed to the scrotal wall. It is worth noting that in all patients, we successfully carried out one-stage laparoscopic procedures (orchiopexy or orchiectomy). We defined the success of the laparoscopic procedure as the presence of the testis in the lower scrotum (normal location) with no atrophy after surgery (for orchiopexy) and the successful removal of the dystrophic testis (for orchiectomy). Highlights of the laparoscopic procedure are presented in Figure 1 and Figure 2.

After the laparoscopic procedure, follow-up appointments were scheduled one month and six months postoperatively. During these follow-up appointments,

Figure 1. (a) Clinical aspect of bilateral undescend testis; (b) Gas insufflation with Veress needle; (c) Position of the trocarts; (d) Intra abdominal view of testis.

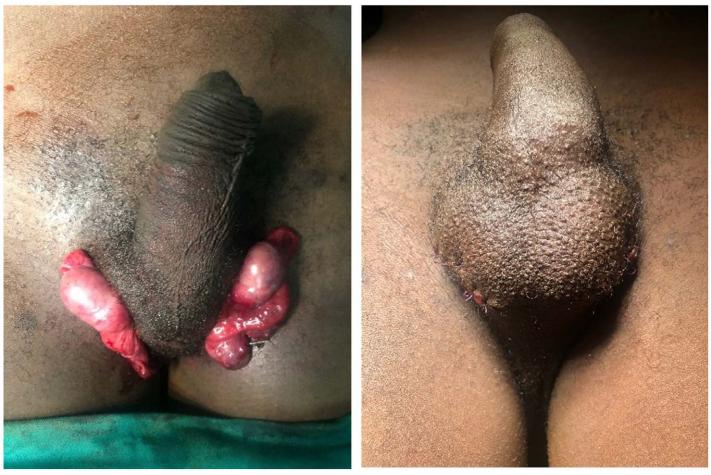

Figure 2. (a) Intermediate stage of orchiopexy with descended testes visible. (b) Final stage of orchiopexy with both testes in the lower scrotum.

the patients were examined and ultrasound examination was performed to determine the positions and volumes of the testes.

Data management

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 as mean values and standard deviations for normally distributed data and as median values with interquartile ranges for skewed data. Categorical variables were presented as frequencies and percentages.

Ethical approval

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-chirugicale d'urologie* in Douala. The requirement for informed consent was waived due to the retrospective nature of the study.

3. Results

The ages of the 27 participants ranged from 6 years to 15 years, with a mean age of 10.22 ± 2.68 years. The undescended testis was unilateral in 8 (29.63%) patients and bilateral in 19 (70.37%) patients. Five of the unilateral cases included the left testis while three involved the right testis. Upon physical examination, the right testis was found in 5 (18.52%) patients and not found in 22 (81.48%) patients, whereas the left testis was found in 3 (11.11%) patients and not found in 24 (88.89%) patients. Hypospadias was the only identified associated anomaly, and it occurred in 2 (7.41%) of our study participants. Apart from the absence of one or both testes and the presence of hypospadias, there were no other remarkable findings on physical examination in these patients. The patients with hypospadias were later operated upon to correct this congenital anomaly. Imaging modalities (abdominal ultrasound, Doppler ultrasound, and magnetic resonance imaging) were performed. The right testis was found on abdominal ultrasound in 19 (70.37%) patients, on Doppler ultrasound in 00 (0.00%) patients, on magnetic resonance imaging (MRI) in 2 (7.41%) patients. The left testis was identified on abdominal ultrasound in 22 (81.48%) patients, on Doppler ultrasound in 00 (0.00%) patients, and on MRI in 1 (3.7%) patient. The preoperative characteristics of the study participants are presented in Table 1. Apart from the locations and sizes (volumes) of the testes, the various imaging techniques revealed no other remarkable findings.

The time-lapse from hospitalization till surgery ranged from 14 days to 67 days, with a mean value of 34.67 ± 13.20 days. The intraabdominal pressure during surgery ranged from 8 mmHg to 14 mmHg, with a mean value of 11.81 ± 2.13 mmHg. Peritoneal insufflation was done via mini-laparotomy in 16 (59.26%) patients and via the use of a Veress needle in 11 (40.74%) patients. Concerning the findings on laparoscopy, on the right side, a functional testis was found in 19 (90.48%) patients and a vestigial testis was found in 2 (9.52%) patients while on

Table 1. Preoperative characteristics of the study participants.

VARIABLE	FREQUENCY (%)
Age (years)	
6 - 10	11 (40.74)
11 - 15	16 (59.26)
Laterality	
Unilateral	8 (29.63)
Bilateral	19 (70.37)
Physical examination findings	
Right testis found	5 (18.52)
Right testis not found	22 (81.48)
Left testis found	3 (11.11)
Left testis not found	24 (88.89)
Associated abnormality	
Hypospadias	2 (7.41)
Imaging methods that identified the right testis	
Abdominal ultrasound	19 (70.37)
Doppler ultrasound	00 (0.00)
Magnetic resonance imaging	2 (7.41)
Imaging methods that identified the left testis	
Abdominal ultrasound	22 (81.48)
Doppler ultrasound	00 (0.00)
Magnetic resonance imaging	1 (3.70)

the left side, a functional testis was found in 22 (95.65%) patients and a vestigial testis was found in 1 (4.35%) patient.

As concerns the laparoscopic technique carried out in the patients, right orchiopexy was performed in 19 (90.48%) patients, right orchiectomy in 2 (9.52%) patients, left orchiopexy in 22 (95.65%) patients, and left orchiectomy in 1 (4.35%) patient. The duration of the laparoscopic procedure ranged from 20 minutes to 130 minutes, with a mean duration of 80.56 ± 30.30 minutes. The intraoperative details are found in Table 2.

Twenty-four (88.89%) of the 27 patients were hospitalized for 24 hours after surgery while 3 (11.11%) were hospitalized for 48 hours. The mean postoperative hospitalization duration was 26.67 ± 7.69 hours. The time-lapse from surgery to the first follow-up appointment ranged from 25 days to 43 days, with a mean value of 34.04 ± 4.36 days. The location of the right testis during the first follow-up appointment was normal (in the lower scrotum) in 23 (95.83%) patients and abnormal (in the upper scrotum) in 1 (4.17%) patient. For the left testis, the location

Table 2. Intraoperative details of the study participants.

VARIABLE	FREQUENCY (%)
Time lapse until surgery (days)	
0 - 20	5 (18.52)
20 - 40	17 (62.96)
40 - 60	4 (14.81)
>60	1 (3.70)
Intra-abdominal pressure (mmHg)	
≤10	8 (29.63)
11 - 12	8 (29.63)
13 - 14	11 (40.74)
Method of peritoneal insufflation	
Mini-laparotomy	16 (59.26)
Veress needle	11 (40.74)
Right-side findings	
Normal testis	19 (90.48)
Vestigial testis	2 (9.52)
Left-side findings	
Normal testis	22 (95.65)
Vestigial testis	1 (4.35)
Surgical procedure performed	
Right orchiopexy	19 (90.48)
Right orchiectomy	2 (9.52)
Left orchiopexy	22 (95.65)
Left orchiectomy	1 (4.35)
Duration of surgery (minutes)	
≤60	8 (29.63)
60 - 120	18 (66.67)
>120	1 (3.70)

was normal in all 25 patients who underwent laparoscopic procedures to the left. During the first follow-up appointment, testicular ultrasound was carried out. The volume of the right testicle on ultrasound ranged from 5 cc to 14 cc, with a mean volume of 9.04 ± 2.65 cc. The volume of the left testicle ranged from 6 cc to 14 cc, with a mean value of 9.92 ± 2.36 cc.

The time-lapse from surgery to the second follow-up appointment ranged from 177 days to 194 days, with a mean time-lapse of 185.81 ± 4.57 days. The mean time-lapse between the two follow-up appointments was 151.78 ± 4.62

days. The location of the right testis during the second follow-up appointment was normal in 23 (95.83%) patients and abnormal in 1 (4.17%) patient. For the left testis, the location was normal in all 25 patients who underwent laparoscopic procedures to the left. Testicular ultrasound was also performed during the second follow-up appointment. The volume of the right testicle on ultrasound ranged from 2 cc to 13 cc, with a mean volume of 9.13 ± 2.68 cc. The volume of the left testicle ranged from 4 cc to 13 cc, with a mean value of 9.8 ± 2.41 cc. The volume of one patient's left testis that could not be measured during the first follow-up appointment was measurable during the second follow-up appointment and found to be 12 cc. After the second follow-up appointment, the definitive positions and volumes of the testicles were determined. The only postoperative complication we recorded was testicular atrophy, which occurred in two patients (one with left testicular atrophy and the other with right testicular atrophy). The postoperative features of the study participants are presented in **Table 3**.

4. Discussion

This retrospective study aimed to evaluate the results of the laparoscopic treatment of high and intra-abdominal undescended testes. We included 27 patients with a mean age of 10.22 ± 2.68 years, which differs from the mean age of 6.7 years reported by Bakr and Kotb [14]. The mean age in our study is higher because of the relative unawareness of this condition in our context. The parents of children with undescended testes often tell us they were reassured by midwives, general practitioners, and even pediatricians that their children's undescended testes will descend with time and that there was no need for any specialized treatment or surgical intervention. Such false information leads to the late diagnosis of the condition. In our study, 70.37% of patients had bilateral undescended testes, which is similar to the 64.4% reported by Barbotin *et al.* in 2019 [15], although it is well known that the prevalence of unilateral undescended testis is approximately four times that of bilateral undescended testis [16]. The misinformation of the population by primary healthcare providers in resource-limited settings like ours is also the main reason for this discrepancy, as unilateral undescended testis is usually considered a benign and self-limiting condition and, as such, children with unilateral undescended testis are often not taken to the hospital. Thus, pediatricians, general practitioners, midwives, and other primary healthcare providers in resource-limited settings should be sensitized about this condition through capacity-building seminars so that cases could be diagnosed and managed early. We identified hypospadias as the only associated abnormality in our patients, occurring in 7.41% of them. This is in line with the findings of Sabetkish *et al.* who reported that undescended testis and hypospadias occur concomitantly in 6% - 31% of cases [17]. The participants in this study all underwent laparoscopic surgery, which was either orchiopexy or orchiectomy. Orchiectomy was performed in the 4.35% - 9.52% of patients who had testicular remnants, which is lower than the 24.2% reported by Vilijoen *et al.* in 2020 [18]. The difference in the

Table 3. Postoperative details of the study participants.

VARIABLE	FREQUENCY (%)
Duration of hospitalization (hours)	
24	24 (88.89)
48	3 (11.11)
Right testis location during first follow-up	
Normal	23 (95.83)
Abnormal	1 (4.17)
Left testis location during first follow-up	
Normal	25 (100.00)
Abnormal	0 (0.00)
Left testicular volume at first follow-up (cc)	
<10	13 (54.17)
≥10	11 (45.83)
Right testicular volume at first follow-up	
<10	10 (41.67)
≥10	14 (58.33)
Right testis location during second follow-up	
Normal	23 (95.83)
Abnormal	1 (4.17)
Left testis location during second follow-up	
Normal	25 (100.00)
Abnormal	0 (0.00)
Left testicular volume during second follow-up (cc)	
<10	14 (56.00)
≥10	11 (44.00)
Right testicular volume during second follow-up	
<10	12 (50.00)
≥10	12 (50.00)
Complications	
Testicular atrophy	2 (7.41)

rates of orchiectomy is probably because Vilijoen *et al.* carried out their study on adolescents and young adults with a mean age of 25.4 years. In this population, the malignant potential of the undescended testes, which increases with age, was higher than that in our study population; as such, the rate of orchiopexy had to be higher since it has been proven that the malignant potential of undescended

testis increases with age and early orchiectomy significantly reduces the risk of malignancy [19].

The mean duration of the laparoscopic procedure in our study was 80.56 ± 30.30 minutes, which is higher than the 62.50 ± 15.20 minutes reported by Yang *et al.* in 2020 [20]. This difference in surgery duration could be attributed to the fact that Yang *et al.* are probably more experienced in carrying out this procedure since they handle many more cases than we do, as can be seen by their larger sample size of 256 patients. The overall success rate of the laparoscopic procedure in our study was 95.83%, which is similar to the 96% reported by Chang *et al.* in 2001 [21] although they studied both one-stage and two-stage laparoscopic orchiopexy and all our patients underwent one-stage laparoscopic orchiopexy. This is proof of the fact that in the right hands, the one-stage procedure has the same safety and efficacy as the two-stage procedure, as reported by Wang *et al.* in 2017 [22]. The only postoperative complication we recorded in our study was testicular atrophy, which occurred in 7.4% of our study participants. This rate is similar to the 5.6% reported by Jawdat *et al.* in 2016 [23]. The laparoscopic procedure is also known to be associated with fewer complications, shorter postoperative hospitalizations, and a higher likelihood to be carried out in the outpatient department [24].

5. Conclusion

Laparoscopy is the technique of choice for the diagnosis and management of undescended testis. It is more rapid, more effective, and characterized by a short hospital stay and minimal postoperative complications. Laparoscopic surgery should be encouraged in resource-limited settings for better management of undescended testes.

Acknowledgments

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Authors' Contributions

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-chirugicale 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 declare no conflicts of interest regarding the publication of this pa-

per.

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