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Outcome and risk factors of failure after Orchidopexy, a single institution experience

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ABSTRACT

Introduction: Cryptorchidism, or undescended testis (UDT), is the failure of one or both testes to descend to the base of the scrotum. It is a common problem that increases the risk of infertility and testicular malignancy. We aimed to review the outcomes of orchidopexy and evaluate the risk factors for failure after surgery. *Methods:* We retrospectively reviewed all boys who underwent orchidopexy between 2018 and 2021 at a tertiary pediatric hospital. Data on patient demographics, surgical approach, complications and follow-up period were collected. Descriptive data were generated and compared using t-test and chi-squared tests. Statistical significance was set at $p<0.05$. Multivariate and univariate analyses were used to assess the significance of each factor studied. *Results:* One hundred patients aged < 14 years underwent orchidopexy. Among them, 76 patients underwent the open approach, and 24 underwent the laparoscopic approach. Among the laparoscopic approaches, six patients were operated on in one stage while the remaining underwent a 2-stages approach. Postoperative complications, including Hematoma (8%), wound infection (2%), testicular atrophy (4%) and recurrence (5%), occurred in 16 patients. When analyzing the risk factors for testicular atrophy after orchidopexy, only the intra-abdominal location of the testis was found to be significant (P-value<0.0001). However, no factors were found to be significant when assessing for recurrence. *Conclusion:* Intra-abdominal testes are associated with a higher risk of postoperative testicular atrophy. Parents of patients with intra-abdominal testes should be aware of the higher risk.

Keywords: Cryptorchidism, undescended testes, orchidopexy

1. INTRODUCTION

Cryptorchidism or undescended testes (UDT) are one of the most common congenital anomalies of the genitourinary tract in boys. It is estimated to affect 2-5% of male infants (Vikraman et al., 2016). Testicular descent during fetal life occurs in two separate stages. The first stage is called the transabdominal stage and occurs at 8-15 weeks and is noticed through expansion in the

gubernaculum. The second stage is called the inguinoscrotal stage, which occurs between 25-35 weeks of gestation and is characterized by the emigration of the gubernaculum and testis from the inguinal area to the scrotum (Hutson et al., 2010). Several hormonal and physical factors regulate this process. However, the exact cause of the UDT remains unclear.

Boys with UDT are predisposed to developing testicular cancer and infertility. Most studies recommend early orchidopexy to increase the potential for fertility, decrease the risk of malignancy and eliminate the risk of torsion (Elder, 2016). Many aspects of the management of UDT remain controversial, including: The timing of orchidopexy, surgical approach, need for preoperative imaging, efficacy of hormonal treatment and others (Braga et al., 2017).

The success of orchidopexy varies in the literature and ranges between 74-92% in older studies (Docimo, 1995) to more than 95% in recent studies. Failure after orchidopexy is the main complication of surgery and includes testicular atrophy or recurrence/testicular ascent. The incidence of testicular atrophy (TA) after orchidopexy has been reported to range from 1 to 28% (Carson et al., 2014; American Academy of pediatrics, 1996; Ein et al., 2014; Kolon et al., 2014; Chan et al., 2014; Tseng et al., 2019; Yang et al., 2021; Allin et al., 2018; Durell et al., 2016; McIntosh et al., 2013).

Objective

This study aimed to evaluate outcomes after orchidopexy in children and to identify the risk factors for failure after surgery.

2. METHODS

A study was done retrospectively for patients who under the age of 14 years who underwent open or laparoscopic orchidopexy for undescended testes at Maternity and Children Hospital in Buraydah, Qassim region, Saudi Arabia, between 2018-2021 was done. The criteria of exclusion listed as follows: (1) patients who underwent emergency orchidopexy for testicular torsion, (2) those who were found intra-operatively to have atrophied or vanished testes or those with a testicular nubbin that was removed and (3) patients who have issues with sexual identity differentiation. Institutional Review Board approval was obtained (approval No. 607-43-4148). The need for consent from the patients' guardians was waived owing the retrospective nature of the study.

Patients with palpable testes or those identified to be in the inguinal area by ultrasound (US) underwent an inguinal or scrotal approach, whereas patients with non-palpable testes underwent a laparoscopic approach. In the laparoscopic approach, if the vessels were found to be of adequate length, a one-stage procedure was performed. If the vessels were short, two-stages (Fowler-Stephen or Shehata technique) were performed. All procedures were performed by a pediatric surgeon specialist or consultant.

Patient data including age, weight, laterality, location of the testis, comorbidities, preoperative imaging evaluation and use of preoperative hormonal therapy were collected. Operative data including surgical approach, postoperative complications, ligation of the sac, presence of tension on the cord and operative time were extracted from electronic records. Descriptive data were generated and compared using the t-test for continuous variables and the chi-square test for categorical data. Statistical significance was set at $p<0.05$. Multivariate and univariate analyses were used to assess the significance of each factor.

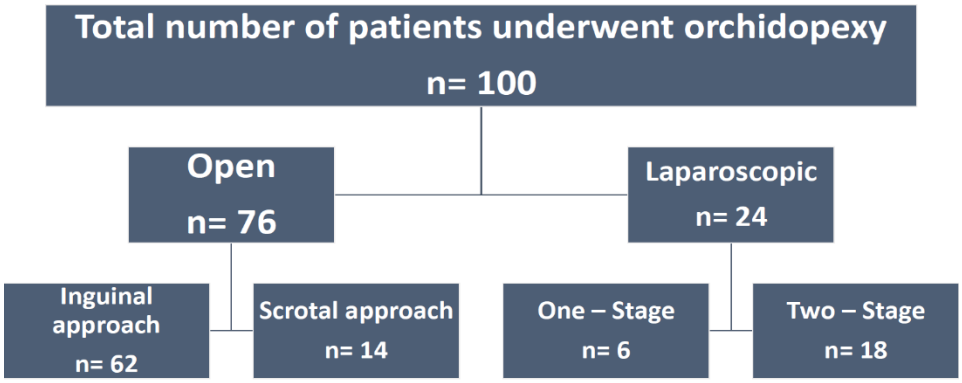
We defined failure of orchidopexy as a TA or if the testis did not reside in the scrotum (recurrence or ascent). TA was a clinical diagnosis. Factors that were evaluated for failure after orchidopexy included age, weight, comorbidities, location of the testes, surgical approach, ligation of the sac, presence of tension on the cord, wound infection and hematoma.

3. RESULTS

In total, 100 patients with UDT were included in this study. The mean follow-up period was 16 months. The mean age at the time of surgery was 33 months (2.7 years). The right testis was affected in 33%, the left in 35% and both in 32% of patients. US was performed in 19% of patients and the majority were requested by a pediatrician or family physician prior to referral. MRI was not performed on our patients as part of the evaluation. Hormonal therapy (in the form of hCG) was administered to 7% of the patients by a pediatric endocrinologist for 1 month and all of them received treatment prior to referral with no or mild response. Twenty-two patients in our cohort had associated diseases including congenital heart diseases, bronchial asthma and congenital hypotonia and others. Only 58 patients (58%) initially had clinically palpable testes; however, an additional 18 patients were found to have inguinal testes after US examination or intra-operatively by examination under anesthesia or by laparoscopy (Table 1).

Flowchart 1 shows the operative approach in the patient cohort. Seventy-six patients underwent an open approach. Among them, 62 patients underwent an inguinal approach while 14 patients underwent scrotal incision only. Hernial sac ligation was performed in 53% of cases and significant tension on the cord was documented in only 9% of cases. Twenty-four patients underwent laparoscopy. Among them, six patients underwent a one-stage approach, while 18 patients underwent a two-stages approach (15 Fowler-Stephen and 3 Shehata techniques). High ligation of the sac was performed in 53% of patients. Tension of the

cord was documented in 9% of patients (Table 2). Figure 1, displays the difference of time needed to conduct the procedure which relays on many factors like patients' anatomical variations and surgeons' experience.



Flow Chart 1 operative approach in the patient cohort

Table 1 Patient characteristics (n=100)

	N	%
Age at surgery (months)		
<24	27	27
24-72	50	50
>72	23	23
Weight (kgs)		
<10	18	18
10-30	76	76
>30	6	6
Associated diseases		
Yes	22	22
No	78	78
Side		
Right	33	33
Left	35	35
Bilateral	32	32
Palpable		
Yes	58	58
No	42	42
US		
Yes	19	19
No	81	81
Pre-hormonal therapy		
Yes	7	7
No	93	93

Table 2 Operative data (n=100)

	N	%
Approach		
Open	76	76
Laparoscopic	24	24
If open		
inguinal approach	62	62
scrotal approach	14	14
If laparoscopic		
1 stage	6	25
2 stages	18	75
Operative time (minutes)		
<30	29	29
30-60	57	57
>60	14	14
Ligation of hernia sac		
Yes	53	53
No	47	47
Tension on the cord		
Yes	9	9
No	91	91

Table 3 Postoperative complications (n=100)

	Number	%
Complication		
Yes	16	16
No	84	84
Hematoma		
Yes	8	8
No	92	92
Wound infection		
Yes	2	2
No	98	98
Testicular Atrophy		
Yes	4	4
No	96	96
Recurrence\ascending		
Yes	5	5
No	95	95

Postoperative complications occurred in 16% of patients and included hematoma (8%), wound infection (2%), TA (4%) and recurrence/ascending testis (5%) (Table 3). No cases of intra-operative vas injury or postoperative inguinal hernia have been reported. All patients with hematomas and wound infections were treated conservatively and antibiotics respectively. Four of five patients with recurrence/ascending testes underwent redo orchidopexy while the 5th patient was being followed up the clinic. All TA were intra-abdominal testes. The incidence of TA in patients with intra-abdominal testes was 16% (4/24). Among these 4 patients, two-stages Fowler-Stephen orchidopexy was performed in 3 patients while one-stage laparoscopy performed done in the 4th patient.

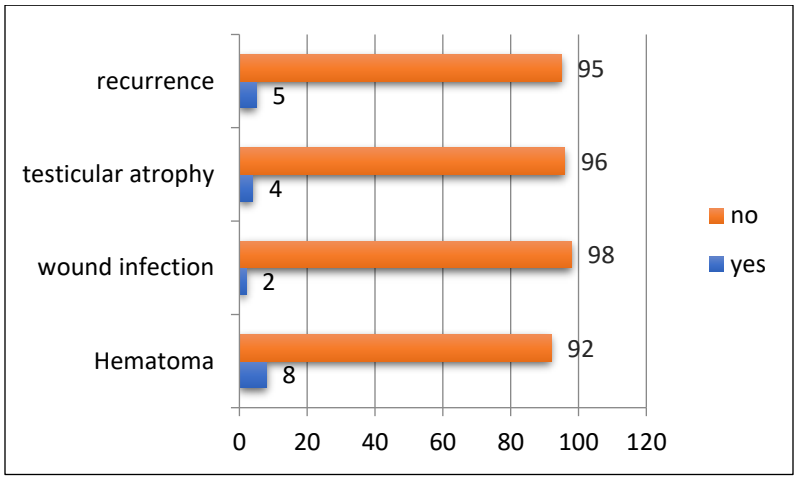


Figure 1 Postoperative complication among patients

When evaluating the risk factors for testicular atrophy, only a high testicular location (intra-abdominal testes) was found to be significantly associated with TA (P=<0.0001) (Table 4). No factors were found to be significant when evaluating the risk factors for recurrence/ascending testes (Table 5).

In figure 1 different variable were analyzed among patients for complications after operation. It showed that out of 100 patients, highest percentage of post-operative complication was hematoma (8%) followed by recurrence (5%). In figure 2, risk factors for atrophy were compared with control and experimental group. From all variables, only location of testis shows significance value (<0.00001) among other non-significant variables.

Table 4 Risk factors for testicular atrophy after orchidopexy (n=100)

	Control (no atrophy) N=96	Atrophy N=4	P-value	OR (95% CI)
Mean Age at surgery (months) <24 24-72 >72	33 months 34 61 1	34 months 2 2 0	0.827	2.63(2.29-2.97)
Mean Weight (kg) <10 10-30 >30	17.7 kgs 23 34 39	18.5 kgs 1 1 2	0.903	2.04(4.84-5.24)
Associated diseases Yes No	 20 76	 2 2	0.168	0.263(0.35-1.986)
Testis Location Inguinal Abdominal	 76 20	 0 4	<0.0001	1.200(1.003-1.435)
Wound infection Yes No	 94 2	 4 0	0.771	0.959(0.921-0.999)
Hematoma Yes No	 89 7	 3 1	0.201	4.238(0.388-46.270)
Ligation of hernia sac Yes No	 52 44	 1 3	0.252	3.545(0.356-35.310)
Tension on the cord Yes No	 9 87	 0 4	0.521	1.046(1.001-1.093)

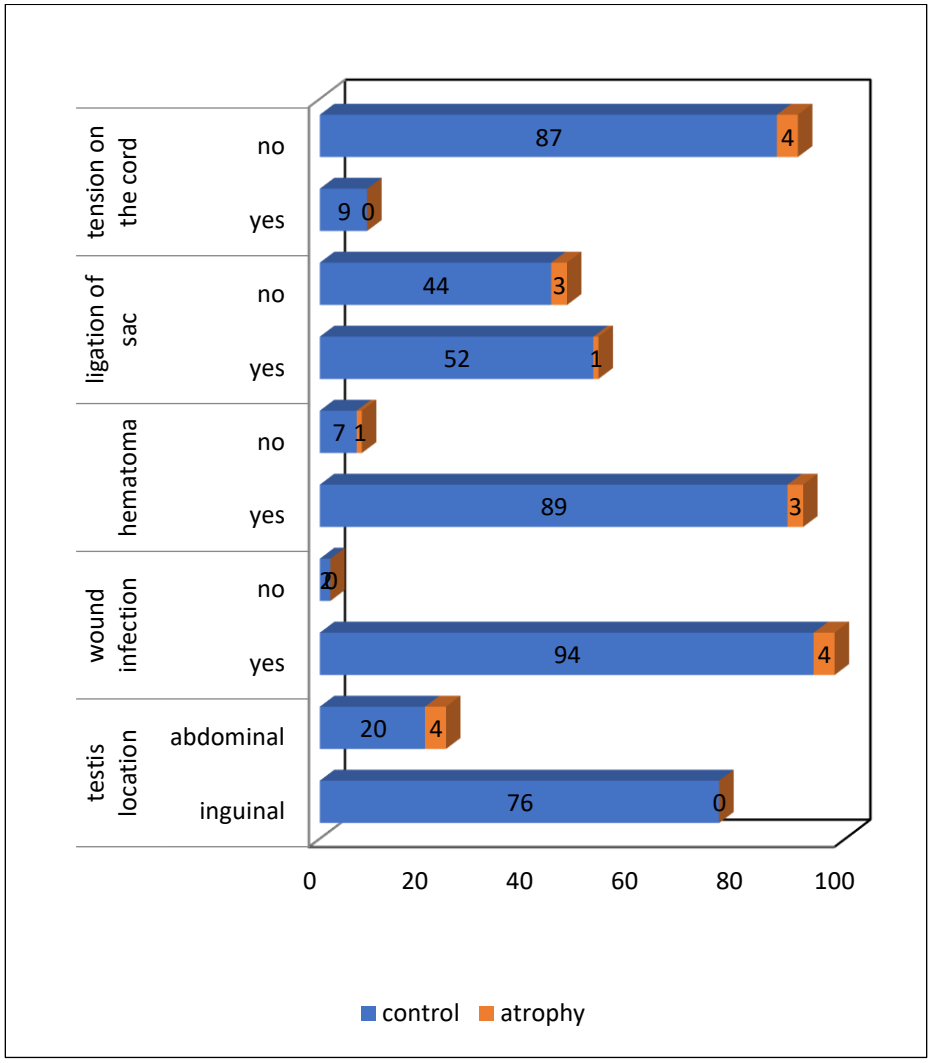


Figure 2 Risk factor for atrophy after orchidopexy

4. DISCUSSION

The current recommendation from the American Academy of Pediatrics and the guidelines from the American Urological Association (AUA) is that orchidopexy should be performed before one year of age (American Academy of pediatrics, 1996; Kolon et al., 2014), ideally among 6 and 12 months (Chan et al., 2014). There is no clear reason for the delay in orchidopexy in our cohort (mean age is 33 months) however, a probable reason is the delay in referral from pediatricians and general practitioners to the surgery clinic.

The reported incidence of complications after orchidopexy ranges from 1- 28% (Carson et al., 2014; American Academy of pediatrics, 1996; Ein et al., 2014; Kolon et al., 2014; Chan et al., 2014; Tseng et al., 2019; Yang et al., 2021; Allin et al., 2018; Durell et al., 2016; Mclntosh et al., 2013). However, the definition of TA is not universally clear. Some authors define TA as a loss of >50% of testicular volume (TV) by US (Tseng et al., 2019) while others use a loss of >1/3 of TV (Ein et al., 2014). Others used the testicular atrophy index (TAI) for assessment (Zvizdic et al., 2014). Because US was not routinely performed in our center for UDT and because of the retrospective nature of the study, TA was a clinical diagnosis.

High testis location (i.e., intra-abdominal) has been found to be a predictor of atrophy after orchidopexy in many studies. In a large series reported a testicular atrophy rate 14% after orchidopexy. In their study, low testicular volume ratio, high testicular location, deferens and epididymis anomaly and in two-stage Fowler-Stephens orchidopexy were predictors of testicular atrophy after orchidopexy (Yang et al., 2021). They reported a 7.7% of TA rate after orchidopexy. The intra-abdominal testis is independently associated with increased postsurgical atrophy (Carson et al., 2014). In a systematic review evaluating outcomes following orchidopexy previous to the first year of life and after it, reported no significant differences in atrophy and other complication rates between early and late orchidopexy (Allin et al., 2019). In this study, the TA was 4%, which is at the zone

mentioned in the literature. We divided the patients into three groups: < 2 years, 2-6 years, and > 6 years. We found that the age at orchidopexy was not a significant factor for atrophy or recurrence.

Table 5 Risk factors for recurrence after orchidopexy (n=100)

	Control (no recurrence) N=95	Recurrence N=5	P-value	OR (95% CI)
Mean age at surgery (months) <24 24-72 >72	33 months 35 59 1	33 months 1 4 0	0.716	2.36(2.21-2.96)
Mean Weight (kg) <10 10-30 >30	17.2 kgs 24 32 39	14.6 kgs 0 3 2	0.332	3.42(3.84-4.12)
Associated diseases Yes No	 20 75	 2 3	0.319	0.400(0.063-2.559)
Testis Location Inguinal Abdominal	 72 23	 4 1	0.830	0.783(0.831-7.359)
Wound infection Yes No	 93 2	 5 0	0.743	0.949(0.906-0.994)
Hematoma Yes No	 88 7	 4 1	0.310	3.143(0.308-32.062)
Ligation of hernia sac Yes No	 50 45	 3 2	0.748	0.741(0.118-4.636)
Tension on the cord Yes No	 9 86	 0 5	0.471	1.058(1.007-1.112)

A large series evaluated 1400 orchidopexies from 1969 to 2003. The incidence of TA is 8%. The most significant risk factors associated with atrophic testes were high testicles, vas problems and pre-operative torsion (Ein et al., 2014). They reported a 2.6% risk of TA among 234 patients. There was no significant difference in outcome when comparing the surgeon grade (trainee vs consultant) (Durell et al., 2016). They evaluated 1538 boys who underwent orchidopexy and found that repeat orchidopexy was performed in 31 patients (1.6%). The failure rate increased to 1.9% for bilateral cryptorchidism per testicle when the primary operation was synchronous bilateral orchidopexy (Mclntosh et al., 2013). The rate of recurrence/ascending testes after orchidopexy in our cohort was 5% and no factor was found to be associated with recurrence/ascending testes.

Limitations

Retrospective nature

Small sample size

Short follow up period

5. CONCLUSION

Intra-abdominal testis is associated with higher risk for testicular atrophy after orchidopexy. Families of patients with intra-abdominal testis should be counselled about this high risk.

Ethical considerations

Ethical approval was obtained from the Subcommittee of Health Research Ethics, Qassim Province and registered by the National Committee of Bio & Med. Ethics (NCBE) registration no H-04-Q-001 to conduct this research. We will ensure the protection and anonymity of participants.

Acknowledgement

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Authors contributions

Dr. Osamah Almosallam: I coordinated and oversaw the entire project from the start of the research proposal to its conclusion and I participated in all phases of the study.

Abdulaziz Alanazi: From the creation of the idea to the completion of the study, I was involved at every level.

Nawaf Alrubaysh: I participated in the majority of the research phases and analyzed the data, from proposal writing through conclusion.

Feras Algjofaily: I was in charge of writing the discussion and conclusion and was heavily involved throughout the study process, from developing the proposal to writing the conclusion.

Saleh Aldubayyan: I was in charge of collecting and analyzing the data.

Ali Alshaya: From the creation of the study proposal to its completion, I was involved at every level.

Dr. Waleed Almutairi: I was in charge of writing the discussion and conclusion

Ethical Approval

Registered at National Committee of Bio & Med Ethics (NCBE) Registration No H-04-Q-001.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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