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Relationship Between Testis Location and Age of Surgery with Testicular Atrophy and Re-Ascent in Undescended Testis Patients Undergoing Orchiopexy at Prof. Dr. I.G.N.G. Ngoerah Hospital

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ABSTRACT

Introduction: Undescended testis (UDT) is an anomaly characterized by the absence of one or both testes in the scrotum. Based on the location of the testis, UDT is broadly classified into abdominal UDT and extra-abdominal UDT, both of which require different surgical approaches. The ideal time for orchidopexy is between 6 months and 18 months of age. Common postoperative complications include reascension and testicular atrophy. In this study, researchers aimed to determine whether there is a relationship between the location of the testis and the age at which surgery is performed, with testicular atrophy and re-ascent in patients with UDT who underwent orchidopexy at Prof. Dr. I.G.N.G. Ngoerah Hospital. ***Methods:*** This research design was observational with a retrospective cohort study design. The sample in this study was all UDT patients who underwent orchidopexy surgery at Prof. Dr. I.G.N.G. Ngoerah Hospital from January 2019 to December 2024. Patients with incomplete data and those who refused to participate were excluded from the study. Data analysis was performed using SPSS software with the Chi-Square test and Mann-Whitney U test. ***Result:*** This study involved a total of 53 patients with 68 orchidopexy procedures, both laparoscopically and open surgery. The age distribution for orchidopexy ranged from 7 months to 443 months, with a median cut-off point at 46 months (IQR 23-98). Based on the location of the testis in UDT, 23 (33.82%) cases were abdominal UDT, and 45 (66.18%) cases were extra-abdominal UDT. The results of the study showed that there was no significant relationship between the location of the testis in UDT (abdominal vs. extra-abdominal) and the incidence of testicular atrophy (P = 0.222) or the incidence of re-ascent (P = 0.054) after orchidopexy. The results of this study also showed no significant relationship between the age at which orchidopexy was performed and the incidence of testicular atrophy (P = 0.779) and re-ascent (P = 0.569). Subgroup analysis also showed no relationship between the age at which orchidopexy was performed and the incidence of testicular atrophy (abdominal testis, P = 0.747; extra-abdominal testis, P = 0.393) and re-ascent (abdominal testis, P = 0.909; extra-abdominal testis, P = 0.390). ***Conclusion:*** No significant relationship was found between testis location and age at orchiopexy with testicular atrophy and re-ascent in patients undergoing orchiopexy at Prof. Dr. I.G.N.G. Ngoerah Hospital, Denpasar.

Keywords: abdominal undescended testis; extra-abdominal undescended testis; testicular atrophy; re-ascent.

INTRODUCTION

Cryptorchidism, or undescended testis (UDT), is an anomaly characterized by the absence of one or both testes within the scrotum. Although extensively studied, the condition remains incompletely understood. Testicular descent into the scrotum is a complex, prolonged process that typically completes in the third trimester of pregnancy or shortly after birth. The fetal structure responsible for guiding testicular descent, the gubernaculum, is well recognized anatomically; however, its precise mechanical function during this process is not fully elucidated. Genetic and/or environmental factors are believed to contribute to the failure of testicular descent, but many aspects remain unclear. Current evidence indicates that cryptorchidism is a multifactorial disorder, potentially involving genetic predispositions and exposure to endocrine-disrupting

chemicals (EDCs). (Campbell Walsh Wein Urology, 12th ed., 2020; Smith & Tanagho's General Urology, 19th ed., 2020)

The global prevalence of UDT is approximately 43–49% at birth, declining to 1–1.5% by three months of age and 0.8–2.5% by nine months. UDT has been identified in 1.5–4% of fathers and 6.2% of brothers of affected patients. A study in Estonia involving 5,014 newborns reported a 2.1% incidence of unilateral or bilateral undescended testes at birth, with prevalence varying by risk factors: 11.9% in preterm infants, 1.1% in full-term infants, and 16.7% in those with low birth weight. (Kübarsepp et al., 2022)

Traditionally, UDT is considered a congenital anomaly identifiable at birth; however, in clinical practice, it is often diagnosed after the neonatal period. An Indonesian study found that among patients diagnosed with UDT, 43.07% had bilateral UDT, 29.56% had left-sided unilateral UDT, and 27.37% had right-sided unilateral UDT. Furthermore, only 29.56% of cases were diagnosed before six months of age, 31.39% between six months and one year, and a significant 39.05% at older ages, reflecting delays in clinical diagnosis. (Lubis et al., 2013)

Management of UDT includes hormonal and surgical approaches, with surgery currently being the primary treatment modality. The choice between open and laparoscopic orchidopexy depends on individual patient indications. Nevertheless, operative management is not without risks. Intraoperative and postoperative complications can occur, with long-term complications such as testicular atrophy due to devascularization reported in approximately 15–36% of cases, and testicular re-ascent or secondary cryptorchidism occurring in about 10%, often attributed to incomplete retroperitoneal dissection. (Coran et al., Pediatric Surgery, 7th ed., 2012; Wakabayashi et al., 2020; Sumfest et al., 2022; Hamadani et al., 2023)

At the Department of Surgery, Prof. Dr. I.G.N.G. Ngoerah General Hospital, surgical intervention, whether open or laparoscopic, remains the mainstay of treatment. Data from medical records indicate that the age at surgery varies, with only a minority (19.18%) undergoing orchidopexy before 18 months of age. Postoperative care typically involves hospitalization for 1–2 days in uncomplicated cases, followed by outpatient follow-up until primary wound healing (7–14 days post-surgery). However, long-term follow-up to assess late complications such as testicular atrophy or re-ascent is not routinely performed.

Given these considerations, this study aims to investigate whether testicular location and age at surgery are associated with long-term complications, specifically testicular atrophy and re-ascent among patients undergoing orchidopexy for UDT at Prof. Dr. I.G.N.G. Ngoerah General Hospital.

MATERIALS AND METHODS

Study Design and Patients

This retrospective cohort study included patients with cryptorchidism (undescended testis, UDT) who underwent orchidopexy at Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Indonesia. Data were collected from January 2019 to December 2024. We identified eligible patients through surgical records and included those with complete clinical and operative data. Patients with incomplete records or who declined participation were excluded. Patient demographics, primary UDT location, age at surgery, surgical technique, and postoperative outcomes were extracted from medical records. Physical examinations were performed to assess scrotal position and testicular volume. In cases of bilateral UDT, volumes were compared to normative data.

Data were analyzed using SPSS v30.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as medians with interquartile ranges (IQR) and compared using Mann–Whitney U tests. Categorical variables were compared using Chi-square tests. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to assess associations. A p-value <0.05 was considered statistically significant.

Primary UDT Location and Age at Surgery

Primary testicular location was categorized as abdominal or extra-abdominal (inguinal or high scrotal), confirmed by physical examination or intraoperative findings. Patients were further stratified by age at orchidopexy: <46 months or ≥46 months.

Surgical Techniques

All procedures were performed by experienced pediatric surgeons or urologists. The choice of surgical technique (open inguinal/scrotal or laparoscopic orchidopexy) depended on testicular location and surgeon preference. Postoperative care was standardized, with follow-up visits at 7–14 days for wound evaluation.

Outcomes and Definitions

The primary outcomes were long-term postoperative complications:

- *Testicular atrophy:* defined as ≥20% reduction in testicular volume compared to the contralateral side or age-matched normative values, assessed by ultrasonography or orchidometry.
- *Re-ascent:* recurrence of cryptorchidism after previous orchidopexy.

RESULTS

Characteristics of Research Subjects

From January 2019 to December 2024, a total of 94 patients underwent orchidopexy (open or laparoscopic) at Prof. Dr. I.G.N.G. Ngoerah General Hospital. Of these, 53 patients with UDT met the inclusion criteria and were included in this study. The median age at surgery was 46 months (IQR: 76), ranging from 7 months to 443 months (36 years, 11 months).

A total of 68 orchidopexy procedures were performed on these patients (accounting for separate interventions on right and left testes). Of these, 40 procedures (58.8%) were performed before 46 months of age and 28 (41.2%) at or after 46 months. Based on primary testicular location, 23 cases (33.8%) involved abdominal UDT and 45 cases (66.2%) extra-abdominal UDT.

For subgroup analysis, the mean age at surgery for abdominal UDT was 50.8 ± 32.0 months, while for extra-abdominal UDT, the median was 68 months (IQR: 87.5). In the abdominal group, 14 surgeries (60.9%) were performed before 51 months, and 9 (39.1%) after. In the extra-abdominal group, 26 surgeries (57.8%) were performed before 68 months, and 19 (42.2%) after. Patient characteristics are summarized in Table 1.

TABLE 1: Patient Characteristics and Age Distribution at Orchidopexy in Abdominal and Extra-Abdominal UDT Cases.

Variable	Cases (%)
UDT location	
Abdominal	23 (33.8%)
Extra-abdominal	45 (66.2%)
Age at orchidopexy	
<46 months	40 (58.8%)
≥46 months	28 (41.2%)
Age at orchidopexy in abdominal UDT	
<51 months	14 (60.9%)
≥51 months	9 (39.1%)
Age at orchidopexy in extra-abdominal UDT	
<68 months	26 (57.8%)
≥68 months	19 (42.2%)

Association Between UDT Location and Testicular Atrophy

Among the 68 orchidopexy cases, testicular atrophy occurred in 2 abdominal UDT cases and 1 extra-abdominal case. Mann–Whitney analysis showed no significant association between testicular location and atrophy (OR: 0.239; 95% CI: 0.020–2.782; p=0.222) (Table 2).

TABLE 2: Association Between UDT Location and Testicular Atrophy.

UDT Location	Atrophy	No Atrophy	Total	OR (95% CI)	p-value
Abdominal	2	21	23	0.239 (0.020–2.782)	0.222
Extra-abdominal	1	44	45		
Total	3	65	68		

Association Between UDT Location and Re-Ascent

Seventeen cases (25%) developed re-ascent: 9 in abdominal UDT and 8 in extra-abdominal UDT. Chi-square analysis found no significant association (OR: 0.336; 95% CI: 0.108–1.045; p=0.054) (Table 3).

TABLE 3: Association Between UDT Location and Re-Ascent.

UDT Location	Re-Ascent	Normal	Total	OR (95% CI)	p-value
Abdominal	9	14	23	0.336 (0.108–1.045)	0.054
Extra-abdominal	8	37	45		
Total	17	51	68		

Association Between Age at Surgery and Testicular Atrophy

Atrophy occurred in 2 cases operated on before 46 months and 1 case after 46 months. Mann–Whitney analysis showed no significant association (OR: 0.704; 95% CI: 0.061–8.160; p=0.779) (Table 4).

TABLE 4: Association Between Age at Surgery and Testicular Atrophy.

Age at Surgery	Atrophy	No Atrophy	Total	OR (95% CI)	p-value
<46 months	2	38	40	0.704 (0.061–8.160)	0.779
≥46 months	1	27	28		
Total	3	65	68		

Association Between Age at Surgery and Re-Ascent

There were 11 re-ascent cases in patients operated on before 46 months and 6 cases after. Chi-square analysis revealed no significant association (OR: 0.719; 95% CI: 0.230–2.245; p=0.569) (Table 5).

TABLE 5: Association Between Age at Surgery and Re-Ascent.

Age at Surgery	Re-Ascent	Normal	Total	OR (95% CI)	p-value
<46 months	11	29	40	0.719 (0.230–2.245)	0.569
≥46 months	6	22	28		
Total	17	51	68		

Subgroup Analyses: Abdominal UDT

In abdominal UDT, one atrophy case occurred before 51 months and one after. No significant association was found (OR: 1.625; 95% CI: 0.089–29.781; p=0.747) (Table 6).

TABLE 6: Subgroup Analysis: Age at Surgery and Testicular Atrophy in Abdominal UDT.

Age at Surgery	Atrophy	Normal	Total	OR (95% CI)	p-value
<51 months	1	13	14	1.625 (0.089–29.781)	0.747
≥51 months	1	8	9		
Total	2	21	23		

Re-ascent was seen in 5 patients operated before 51 months and 3 after, with no significant association (OR: 0.900; 95% CI: 0.154–5.258; p=0.909) (Table 7).

TABLE 7: Subgroup Analysis: Age at Surgery and Re-Ascent in Abdominal UDT.

Age at Surgery	Re-Ascent	Normal	Total	OR (95% CI)	p-value
<51 months	5	9	14	0.900 (0.154–5.258)	0.909
≥51 months	3	6	9		
Total	8	15	23		

Subgroup Analyses: Extra-Abdominal UDT

In extra-abdominal UDT, one atrophy case was found in patients operated before 68 months and none after (OR: 0.962; 95% CI: 0.890–1.038; p=0.393) (Table 8).

TABLE 8: Subgroup Analysis: Age at Surgery and Testicular Atrophy in Extra-Abdominal UDT.

Age at Surgery	Atrophy	Normal	Total	OR (95% CI)	p-value
<68 months	1	25	26	0.962 (0.890–1.038)	0.393
≥68 months	0	19	19		
Total	1	44	45		

For re-ascent, 3 cases occurred before 68 months and 4 after. No significant association was detected (OR: 0.686; 95% CI: 0.117–4.015; p=0.390) (Table 9).

TABLE 9: Subgroup Analysis: Age at Surgery and Re-Ascent in Extra-Abdominal UDT.

Age at Surgery	Re-Ascent	Normal	Total	OR (95% CI)	p-value
<68 months	3	23	26	0.686 (0.117–4.015)	0.390
≥68 months	4	15	19		
Total	7	38	45		

DISCUSSION

Cryptorchidism, or undescended testis (UDT), is defined as the absence of one or both testes in the scrotum, resulting from arrested descent at any point along the normal pathway. UDT is generally classified as palpable or non-palpable, each requiring different surgical approaches. Surgical correction is recommended between 6 and 18 months of age to optimize testicular development and reduce long-term risks such as infertility, hormonal dysfunction, microtestis, re-ascent, atrophy, or total infarction. This study aimed to evaluate the association between primary testicular location and age at orchidopexy with the incidence of postoperative testicular atrophy and re-ascent.

A total of 53 patients (68 orchidopexies) were included, with a wide age range at surgery (7 to 443 months; median 46 months). Subgroup analyses were performed for abdominal versus extra-abdominal UDT. The mean age at surgery was 50.8 ± 32.0 months for abdominal UDT and a median of 68 months (IQR 87.5) for extra-abdominal UDT. The observed delay in surgery, compared to the recommended age by the EAU Paediatric Urology Guidelines (6–18 months), was likely due to late diagnosis, often related to parental unawareness. This aligns with findings by Lubis et al. (2013), who reported increased detection rates of UDT after 2 years of age. In our cohort, abdominal UDT accounted for 33.8%, consistent with EAU estimates that approximately 80% of UDT cases are palpable.

Association Between UDT Location and Testicular Atrophy

Our results demonstrated no significant association between testicular location (abdominal vs. extra-abdominal) and postoperative testicular atrophy ($p = 0.222$). This suggests that location alone may not be a determining factor for atrophy risk following orchidopexy. This finding is in line with the study by Chen et al. (2023), who reported no significant differences in testicular growth or volume between laparoscopic and open approaches up to 18 months postoperatively (97.7% vs. 97.0%; $p > 0.05$). It is plausible that other factors, such as preoperative testicular condition, surgical expertise, and patient comorbidities, play more substantial roles in the development of atrophy.

Association Between UDT Location and Re-Ascent

Similarly, there was no significant association between UDT location and re-ascent ($p = 0.054$). Although the p-value approached significance, it may reflect a potential trend not detected due to the limited sample size. Youssef et al. (2019) highlighted that factors such as short spermatic vessels, inadequate retroperitoneal dissection, failure of high ligation of a patent processus vaginalis, and fibrotic scarring around the cord structures are more critical contributors to re-ascent than initial testicular location.

Association Between Age at Surgery and Testicular Atrophy

No significant association was observed between age at orchidopexy (<46 vs. ≥46 months) and testicular atrophy ($p = 0.779$). This contrasts with literature advocating early surgery to optimize outcomes. Aljadani et al. (2025), in a systematic review, emphasized the benefits of performing orchidopexy ideally between 6 and 12 months, citing improved testicular growth, enhanced spermatogenesis, and reduced long-term complications, including atrophy. The discrepancy in our study may stem from the small, single-center sample.

Association Between Age at Surgery and Re-Ascent

Likewise, there was no significant relationship between age at orchidopexy and re-ascent ($p = 0.569$). This aligns with observations by Youssef et al. (2019), who identified anatomic and surgical factors rather than the timing of intervention as primary contributors to the need for redo orchidopexy. Few studies have directly linked the timing of orchidopexy to re-ascent rates, underscoring the need for further investigation.

Subgroup Analysis (Abdominal vs. Extra-Abdominal UDT)

Subgroup analyses showed that in both abdominal and extra-abdominal UDT, age at surgery did not significantly influence the risk of either atrophy or re-ascent. This reinforces the main findings and suggests that while early intervention remains standard practice to reduce long-term risks, other intraoperative and anatomical factors may be more critical determinants of these complications.

CONCLUSION

Summary of Findings

This study found no significant association between the initial location of the undescended testis or the age at orchidopexy and the rates of postoperative testicular atrophy or re-ascent. These findings suggest that while timely intervention remains standard practice, other factors such as surgical technique, anatomical variations, and perioperative management may play more critical roles in determining long-term outcomes. Larger, prospective multicenter studies are warranted to further delineate predictors of complications and to optimize management strategies for cryptorchidism.

Study Limitations

This study is limited by its relatively small sample size and retrospective single-center design, which may limit generalizability. The lack of continuous long-term follow-up after orchidopexy, absence of detailed preoperative testicular assessments, and intraoperative measurements also constrained the ability to determine whether atrophy was pre-existing or postoperative in origin. Additionally, retrospective data are inherently prone to recall and information biases.

Recommendations for Future Research

Future prospective studies with larger multicenter cohorts are needed to validate these findings and explore additional risk factors influencing postoperative outcomes in cryptorchidism. Investigations focusing on surgical technique standardization, vascular anatomy, and detailed pre- and postoperative testicular measurements may further elucidate determinants of long-term complications.

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