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Clinical Study of Outcome of Laparoscopic Surgery in Management of Impalpable Testis

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ABSTRACT

The management of impalpable testis has undergone considerable evolution over the years, with laparoscopic surgery emerging as a promising approach. Present study was aimed to study of outcome of laparoscopic surgery in management of impalpable testis. Present study was single center, prospective, observational study, conducted in children in the pediatric age group (up to 18 years of age), diagnosed with undescended testes, parents willing to participate in present study. A total of 43 patients were included in the study sample. Majority diagnosed with an undescended testis on the left side (52.2%), followed by right side (34.8%). Bilateral conditions are less common, with bilateral undescended testes observed in 13.1% (6 individuals). Consistent with the diagnoses, the majority underwent a Laparoscopic Orchidopexy on the left side, accounting for 52.18% (24 individuals), while 34.78% (16 individuals) had the procedure on the right side. Bilateral procedures were performed on 13.04% (6 individuals). A large portion, 84.8% (39 individuals), experienced successful outcomes, which highlights the efficacy of the procedure. However, complications were not absent., 8.7% (4 individuals) faced complications and a few had more specific issues such as testis atrophy (4.3%, 2 individuals) and a decrease in size and vascularity of the testis (2.2%, 1 individual). Laparoscopic surgery is a safe and extremely successful treatment for the management of impalpable testes, improving the patients' physical and mental well being.

INTRODUCTION

The failure of testicular descent can lead to various conditions, including cryptorchidism and impalpable testis. One or both testes missing from the scrotum is known as cryptorchidism, a common congenital abnormality that affects 1-4% of full-term male babies. A subtype of cryptorchidism known as impalpable testis occurs when the undescended testis is not perceptible upon physical examination[1]. The management of impalpable testis has undergone considerable evolution over the years, with laparoscopic surgery emerging as a promising approach. With the advent of less invasive techniques, particularly laparoscopic surgery, the management of impalpable testicles has undergone a significant transformation. Compared to open techniques, laparoscopy has several advantages such as increased accuracy, magnification and visualisation[2].

Several studies have evaluated the clinical outcomes and success rates of laparoscopic surgery in the management of impalpable testis. These studies have reported varying success rates ranging from 60-90%, depending on factors such as the surgeon's experience, patient age, anatomical anomalies and the presence of associated conditions. Factors influencing the success of laparoscopic surgery include the ability to identify and mobilize the undescended testis, the presence of an adequate length of spermatic vessels for orchidopexy and the absence of testicular atrophy or dysgenesis[3-5]. Present study was aimed to study of outcome of laparoscopic surgery in management of impalpable testis.

MATERIALS AND METHODS

Present study was single center, prospective, observational study, conducted in department of General Surgery, MGM Medical College, Aurangabad, India. Study duration was of 2 years (January 2022 to December 2023). Study approval was obtained from institutional ethical committee.

Inclusion Criteria:

Children in the pediatric age group (up to 18 years of age), diagnosed with undescended testes, parents willing to participate in present study.

Exclusion Criteria:

- Patients with retractile and ectopic testis.
- Patients not willing to undergo surgery.
- Patients with abnormal serum studies (serum testosterone and dihydrotestosterone, serum electrolytes) suggestive of intersex disorders.
- All patients who didn't give consent to be part of this study.

The surgery was performed using the same method that had been used for the previous 14 years. All patients had laparoscopic surgery in a supine posture with a 30° Trendelenburg tilt while under general anaesthesia, following the acquisition of informed permission. The following stages were included in the

Surgical Technique: All of the patients had general anaesthesia while supine and tilted 30 degrees Trendelenburg after giving their agreement. Through the umbilical tube, the telescope's first port was positioned using an open approach that involved a sub-umbilical transverse incision. In the lower quadrants at the level of the umbilicus along the mid-clavicular line, two 5-mm ports were used on either side. In order to find the testis, measure its size, distance from the internal ring and iliac arteries, determine whether a hernia was present and measure the length of the vas deferens loop, a diagnostic laparoscopy was first conducted. Verification of the vas deferens and testicular vessels was performed in the event that the testis was missing from the peritoneal cavity. Laparoscopic orchidectomy was carried out in an adult patient with unilateral undescended testis if the afflicted testis was atrophic and the contralateral normal-sized testis in the scrotum. One-stage orchiopexy was performed if the undescended testis was of the peeping type or was located closer to the internal ring. A two-stage Fowler-Stephens orchiopexy was scheduled if the testis was located nearer the iliac vessels than the internal ring. Testicular vitality and vascularization were evaluated using postoperative colour Doppler imaging for a duration of six months. Data were collected prospectively from medical records, surgical reports and follow-up visits. Patient identifiers were anonymized to ensure confidentiality and compliance with ethical guidelines. The surgical results, postoperative problems and patient demographics were compiled using descriptive statistics. Inferential statistics were utilized to examine correlations between variables, such as t-tests and chi-square tests. Software suitable for the task, SPSS 25.0 version, was used to do statistical analysis. Two-tailed tests were used in all analyses, with a significance level of $p<0.05$.

RESULTS AND DISCUSSIONS

A total of 43 patients were included in the study sample. This sample size was determined based on feasibility considerations and the anticipated rate of patient recruitment. The majority were under five years old (63%), followed by five and ten (8.7 %) and a minor (4 individuals) are over fifteen years old,

cumulatively accounting for all 46 participants. Substantial individuals were diagnosed with an undescended testis on the left side (52.2%), followed by right side (34.8%). Bilateral conditions are less common, with bilateral undescended testes observed in 13.1% (6 individuals). Consistent with the diagnoses, the majority underwent a Laparoscopic Orchidopexy on the left side, accounting for 52.18% (24 individuals), while 34.78% (16 individuals) had the procedure on the right side. Bilateral procedures were performed on 13.04% (6 individuals). There was an even distribution with 52.2% (24 individuals) having testes at the deep ring and 47.8% (22 individuals) located intra -abdominally. The testes sizes most commonly ranged between 10-15mm (86.95 %) and 15-20mm (8.69%).

Table 1: General Characteristics

	No. of patients	Percentage
Age groups (in years)		
<5	29	63.0
>15	4	8.7
5-10	13	28.3
Diagnosis		
Undescended testes bilateral	6	13.1
undescended testis- left	24	52.2
Undescended testis-right	16	34.8
Intraop Procedure		
Laparoscopic Orchidopexy - B/L	6	13.04
Laparoscopic Orchidopexy - left	24	52.18
Laparoscopic Orchidopexy - right	16	34.78
Intraop Location of Testis Position		
Deep ring	24	52.2
Intrabdominal	22	47.8
Size Range		
5-10 mm	2	4.34
10-15 mm	40	86.95
15-20 mm	4	8.69

The vast majority of cases, 89.1% (41 individuals), were treated using a single stage procedure, while only 10.9% (5 individuals) required a double stage approach, underscoring a strong preference for or effectiveness of the single stage method in this cohort. The majority, 91.3% (42 individuals), had their testes located in the scrotum, which is the desired outcome, whereas a smaller fraction, 8.7% (4 individuals), ended up with testes in the inguinal region, suggesting suboptimal relocation or descent.

A large portion, 84.8% (39 individuals), experienced successful outcomes, which highlights the efficacy of the procedure. However, complications were not absent., 8.7% (4 individuals) faced complications, and a few had more specific issues such as testis atrophy (4.3%, 2 individuals) and a decrease in size and vascularity of the testis (2.2%, 1 individual). The most common duration was between 60 and 65 minutes, observed in 45.65% (21 individuals) of the cases, suggesting a typical surgical window for this procedure. The majority of the cases had bleeding within the range of 15-20ml, accounting for43.75% (21 individuals), followed by 25% (12 individuals) experiencing 10-15ml of bleeding.

Table 2: Surgical Characteristics

	No. of patients	Percentage
Procedure		
Double Stage	5	10.9
Single stage	41	89.1
Location		
Inguinal Region	4	8.7
Scrotum	42	91.3
Outcome of Laparoscopic Surgery		
Atrophied testis	2	4.3
Complicated	4	8.7
dec in size and vascularity of testis	1	2.2
Successful	39	84.8
Time Range(min)		
45-49	2	4.347
50-54	3	6.521
55-59	1	2.173
60-64	21	45.65
65-69	0	0
70-74	9	19.565
75-79	3	6.521
80-84	2	4.347
85-89	0	0
90-94	3	6.521
115-120	2	4.347
Intra-operative Bleed (ml)		
10-15	10	21.739
15-20	10	21.739
20-25	21	45.652
25-30	2	4.347
30-35	3	6.521

The most common duration was four days, accounting for half of the cases (50%, 23 individuals). A large majority, 89.2% (41 individuals), showed normal size and maintained vascularity in the testis, indicating successful surgical outcomes. Conversely, 10.8% (5 individuals) experienced complications such as atrophy or reduced size and vascularity. Most patients (78.3%, 36 individuals) experienced a pain level of 4.0.

The majority of follow-ups occurred at six months (71.7%, 33 individuals), indicating that most clinical assessments were planned for a substantial period after the procedure to monitor long-term outcomes. The vast majority of patients (87%, 40 individuals) showed either anormal size or maintained, which is indicative of successful surgical outcomes. However, a small percentage (10.9%, 5 individuals) experienced a decrease in testis size. Vascularity of the testis as per Color Doppler imaging. noted that 89.1% (41 individuals) maintaining normal vascularity, while 10.9% (5 individuals) showed reduced vascularity, suggesting issues in testicular blood flow post-surgery. Most patients (89.1%, 41 individuals) did not face any issues with testis size, while a small group (11.9%, 5 individuals).

Table 3: Outcome and Follow-up

	No. of patients	Percentage
Hospital stay		
3	14	30.4
4	23	50.0
5	5	10.9
6	4	8.7
USG		
atrophic testis/Reduce size and vascularity	5	10.8
Normal size and maintained vascularity	41	89.2
Pain		
2.0	1	2.2
4.0	36	78.3
5.0	1	2.2
6.0	8	17.4
Follow up months		
1.0	2	4.3
2.0	1	2.2
3.0	1	2.2
4.0	9	19.6
6.0	33	71.7
Increase in Size of Testis		
Decreased size	5	10.9
Normal or Maintained Size	40	87.0
Vascularity of Testis		
Maintained	41	89.1
Reduced	5	10.9
Complications		
Dec size	5	11.9
Normal size	41	89.1

Impalpable testis, a condition characterized by the absence of a descended testis within the scrotum, poses a significant challenge in pediatric surgery. Laparoscopic surgery for impalpable testis provides various advantages compared to standard open methods. Firstly, it offers a full study of the intra-abdominal anatomy, including the location of the testis, vascular and related tissues, which may not be effectively examined with physical examination alone. By facilitating improved surgical planning and decision-making, this thorough evaluation raises the success rates of testicular salvage. Second, compared to open operations, laparoscopic surgery has less surgical stress, postoperative discomfort and recovery time due to its less intrusive nature. This is particularly beneficial in pediatric patients, where minimizing surgical morbidity and optimizing long-term outcomes are paramount. Additionally, laparoscopy allows for concurrent management of associated conditions, such as hernias or Müllerian duct anomalies, further enhancing the overall surgical outcome.

Present study indicates that the procedure is predominantly performed on younger patients. The majority, 63% of the participants, are under the age of five. This high proportion of younger patients is consistent with the need for early intervention to optimize surgical outcomes and mitigate potential complications associated with undescended testes. The distribution pattern is similar to that observed by, Liu[6] and Starmer[7]. The most common condition treated was an undescended testis on the left side, accounting for 52.2% of the cases. This prevalence is slightly higher than in studies conducted by Mao[7] who reported a predominance of left-sided undescended testes but at a slightly lower percentage. The right-sided undescended testis was also significant, comprising 34.8% of the cases, aligning closely with findings from Anderson[9] who noted a similar distribution of right-sided cases.

The prevalence of testes located at the deep ring, suggests that many of the testes were close to the inguinal canal, potentially less complex in terms of surgical management. This finding is consistent with research by Papparella[10] who reported similar distributions, emphasizing that testes at the deep ring are often more accessible and have better postoperative outcomes. On the other hand, the significant percentage of intrabdominal locations presents a different set of surgical challenges, as these require more extensive maneuvering and may have varied prognostic implications, as highlighted by Dawood[11]. The data show a gradual decrease in frequency with increasing size of the testis, with only minor percentages observed in the larger size categories (15mm and above). This pattern is consistent with findings from other studies such as those by Erdogan[12] who noted that smaller testicular size is typically associated with impalpable testes, likely due to their abnormal development or ectopic positioning.

89.1% of the procedures performed as single-stage operations. This significantly high proportion underscores the effectiveness and feasibility of completing the surgery in one stage, likely reflecting a preference for minimizing surgical risk and recovery time for the patient. The much smaller proportion of double-stage procedures (10.9%) suggests these are reserved for more complex cases, where initial positioning or size of the testis may require a staged approach to achieve optimal outcomes. This is consistent with the findings from Wang[13] who documented that double-stage procedures are typically employed in scenarios where the testis is severely malpositioned or where additional factors complicate the surgical environment.

This pattern of follow-up is consistent with best practices described in the literature, where the initial months following surgery are crucial for monitoring healing, testicular positioning and function and later assessments are important for confirming the long-term success of the procedure. For example, Elgaili Salah[14] discuss the importance of a six-month follow-up as a standard in assessing the ultimate success of testicular surgeries, particularly for determining the viability and functional status of relocated testes. Yang[15] which reported high rates of preserved testicular vascularity post-laparoscopic

surgery, highlighting the minimal invasive nature of the technique and its benefits in preserving organ function. In present study, vast majority of cases, 89.1%, vascularity was maintained post-surgery, suggesting that the laparoscopic procedures were effective in preserving the blood supply essential for testicular function and health. This high rate of preserved vascularity highlights the precision and effectiveness of the laparoscopic approach in handling sensitive structures such as blood vessels.

A small proportion of cases, 10.9%, experienced reduced vascularity. This reduction can be associated with several risks, including diminished testicular function or viability. Such outcomes underscore the importance of surgical technique and careful handling during the procedure to minimize risks to blood supply. The finding that most patients maintained testicular vascularity aligns with other research in the field. For instance, Abouheba[16] reported similar success rates in maintaining testicular vascularity after laparoscopic procedures, emphasizing the role of advanced imaging and surgical tools in achieving these outcomes.

CONCLUSION

Laparoscopic surgery is a safe and extremely successful treatment for the management of impalpable testes, improving the patients' physical and mental well being. The findings advocate for the continued use of this minimally invasive technique as the standard approach in pediatric urology for managing impalpable testes.

- Laparoscopic surgery in impalpable testis should be used as diagnostic as well as a therapeutic modality.
- Laparoscopic surgery in impalpable testis should be considered gold standard.
- Early Identification and early management in impalpable testis is the key in salvaging the testis, thus maintaining adequate blood supply and functioning and size of testis.

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