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ANALYSIS OF THE EFFICACY OF TRANSUMBILICAL SINGLE-SITE LAPAROSCOPIC TOTAL EXTRAPERITONEAL TESTICULAR DESCENT FIXATION IN THE TREATMENT OF INGUINAL CRYPTORCHIDISM IN CHILDREN

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Abstract: Objective: To explore the safety and feasibility of transumbilical single-site laparoscopic completely extraperitoneal approach for testicular descent in the treatment of inguinal cryptorchidism in children. Methods: A total of 63 cases of pediatric cryptorchidism treated with transumbilical single-site laparoscopic completely extraperitoneal approach testicular descent fixation (extraperitoneal approach group) from April 2023 to April 2025 were retrospectively analyzed, as well as traditional transumbilical single site surgery during the same period. Site: Clinical data of a total of 64 children who underwent laparoscopic descending testicular fixation (abdominal approach group). The general condition of the children, operation time, intraoperative blood loss, hospitalization time, postoperative complications and other indicators were collected. Results: The surgical procedures of both groups of patients were smooth. There were no surgery-related complications such as testicular retraction, testicular atrophy, or incision infection. One case in the abdominal approach group suffered from choking on milk while eating after surgery, but recovered well after treatment. The average operating time of the extraperitoneal approach group was 62.5 minutes, which was not significantly different from that of the intraperitoneal approach group (the average operating time of the intraperitoneal approach group was 62.75 minutes, P=0.91). There was no significant difference in intraoperative blood loss between the two groups (P=1). During the postoperative follow-up of 2 to 7 months, no case in the two groups required secondary surgery, and there were no recent postoperative complications. Conclusion: Transumbilical single-site laparoscopic total extraperitoneal approach for the treatment of children with inguinal cryptorchidism by descending testicular fixation has less trauma, less interference with abdominal organs, faster recovery, lower incidence of postoperative complications, and the therapeutic effect is comparable to that of traditional laparoscopic surgery. The effect is equivalent, the efficacy is reliable, and it is worthy of clinical application.
Keywords: Cryptorchidism; Single-port laparoscopy; Extraperitoneal approach; Orchiopexy

1 INTRODUCTION

Cryptorchidism is one of the common congenital genitourinary malformations in pediatric urology. Refers to testes not reaching the scrotum from the abdomen according to normal developmental procedures[1]. Most cryptorchidism declines spontaneously within 3 months of birth, with a significantly reduced chance of decline after 6 months[2]. Clinically, approximately 80% of cryptorchid testes are palpable[3]. Surgery is the gold standard for the treatment of cryptorchidism[1]. With the popularization of minimally invasive techniques in pediatric surgery, the number of laparoscopic orchiopexy procedures has gradually increased, minimally invasive surgery evolved from three ports to a single port, and transumbilical single-port laparoscopic techniques have become increasingly mature[4]. Total extraperitoneal approach is mostly used for adult inguinal hernia repair and other operations, which is characterized by direct access to the preperitoneal space without entering the abdominal cavity for operation to reduce intraoperative injury and the occurrence of postoperative abdominal adhesions[5]. The authors combined the two and first performed transumbilical single-site laparoscopic total extraperitoneal orchiopexy for cryptorchidism. The clinical data of 63 cases of cryptorchidism in children treated with single-port endoscopic orchiopexy via total extraperitoneal approach (extraperitoneal approach group) from April 2023 to April 2025 in our hospital were analyzed and compared with 64 cases treated with laparoscopic surgery via abdominal approach. Reported below.

2 MATERIALS AND METHODS

2.1 General Information

From April 2023 to April 2025, 127 children with unilateral inguinal cryptorchidism were treated in our department, of which 63 underwent transumbilical single-site laparoscopic total extraperitoneal orchiopexy, which was set as the extraperitoneal approach group. Sixty-four patients underwent traditional transumbilical single-site laparoscopic

laparoscopic orchiopexy and were set as the abdominal approach group.
Inclusion criteria:
(1) Unilateral cryptorchidism;
(2) Preoperative examination showed empty scrotum;
(3) Scrotal ultrasound confirmed the presence of the testis and its location above the external ring of the inguinal canal.
Exclusion Criteria:
(1) Secondary surgery;
(2) Combined hypospadias, hermaphroditism and other genitourinary system related diseases;
(3) Ectopic testis, abdominal type testis, retracted testis or sliding testis;

2.2 Surgical Method

Extraperitoneal approach group: A 2-cm arcuate incision was made on the left or right side of the umbilical ring, and the subcutaneous tissue and rectus abdominis muscle were incised to expose the posterior rectus sheath. The space between the posterior rectus sheath and peritoneum was divided to establish the preperitoneal space (Figure 1 single port laparoscopic device was placed connecting the laparoscopic system . Continue dissection down to expose the inferior epigastric artery with the processus vaginalis laterally and the spermatic vessels and vas deferens posteriorly. Ligate and cut the processus vaginalis and free it simultaneously free spermatic vessels and vas deferens (Figure 2-3). The testis was explored and pulled into the preperitoneal space, the spermatic vessels were freed to a sufficient length, and the gubernaculum was cut off (Figure 4-5). A transverse incision of about 1.5 cm was made in the middle of the ipsilateral scrotum, and the skin and flesh membrane were incised to dilate the flesh membrane to form a pocket. Endoscopic dissection forceps separate directly into the scrotal incision from Hy 's triangle in the direction of the scrotum to form a tunnel. The testes were pulled down the tunnel into the scrotal incision and fixed (Figure 6) , ensuring no torsion. End procedure.

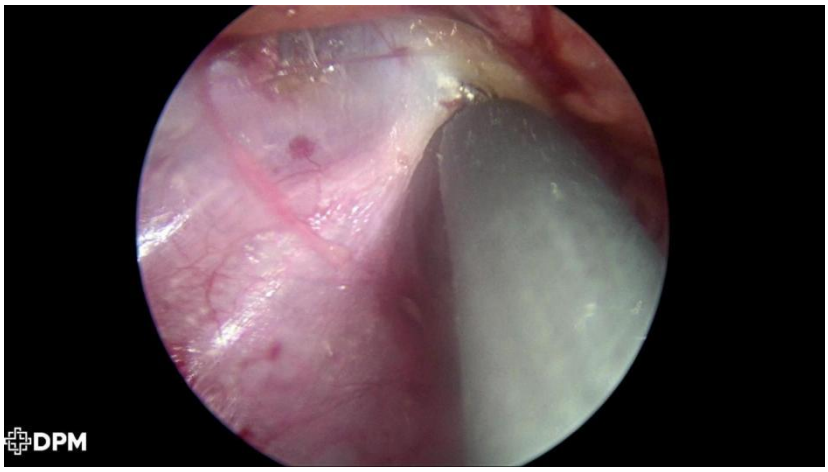

Figure 1 Establishment of the Extraperitoneal Space

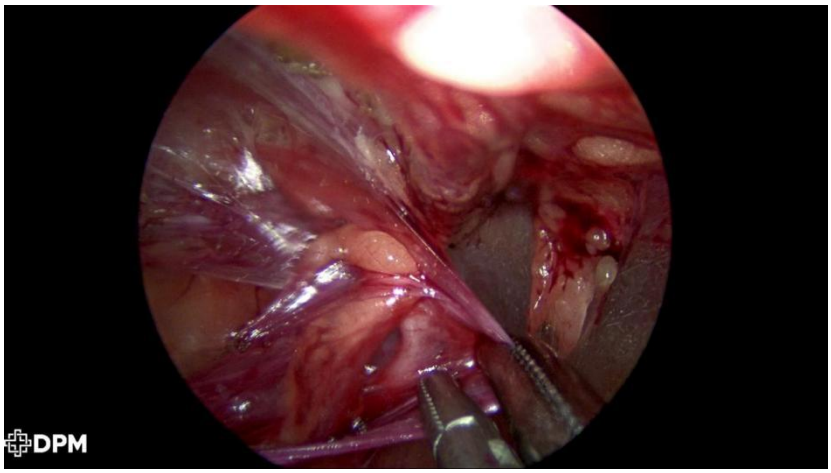

Figure 2 Dissection of the Spermatic Cord Vessels, Vas Deferens and Processus Vaginalis

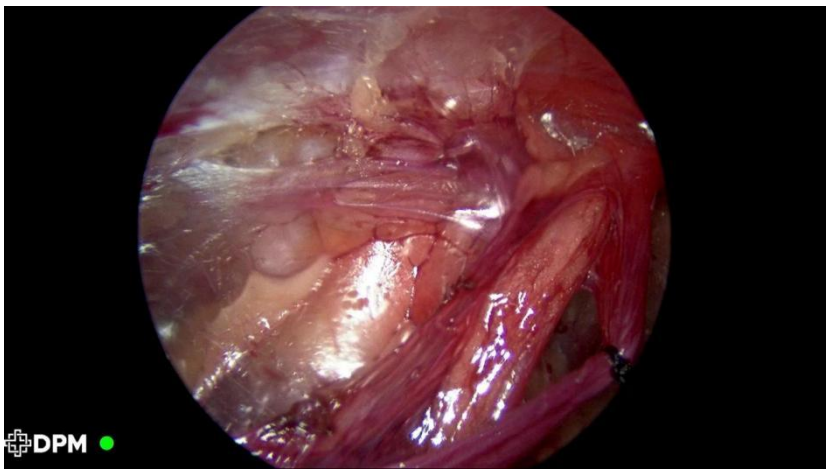

Figure 3 Ligation of the Processus Vaginalis

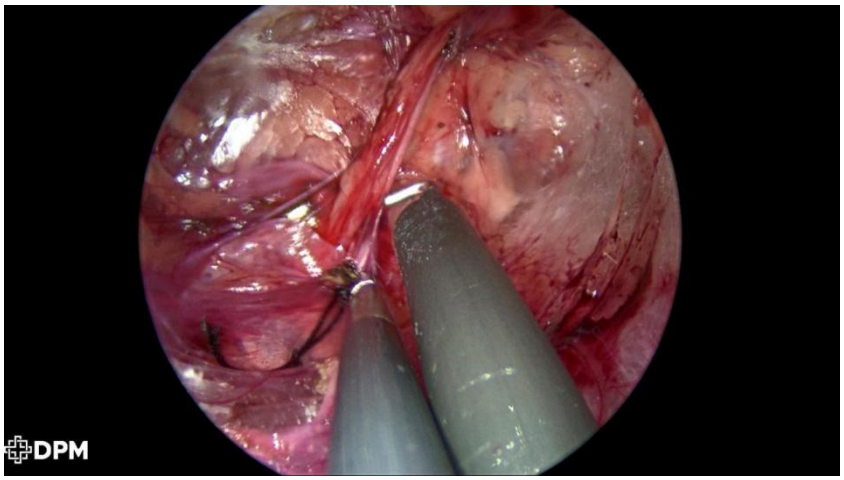

Figure 4 Dissection of the Spermatic Cord Vessels

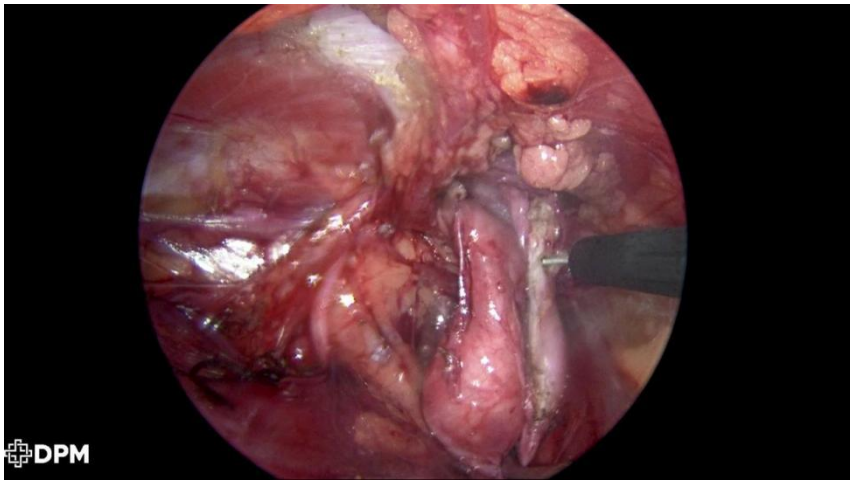

Figure 5 Transection of the Gubernaculum

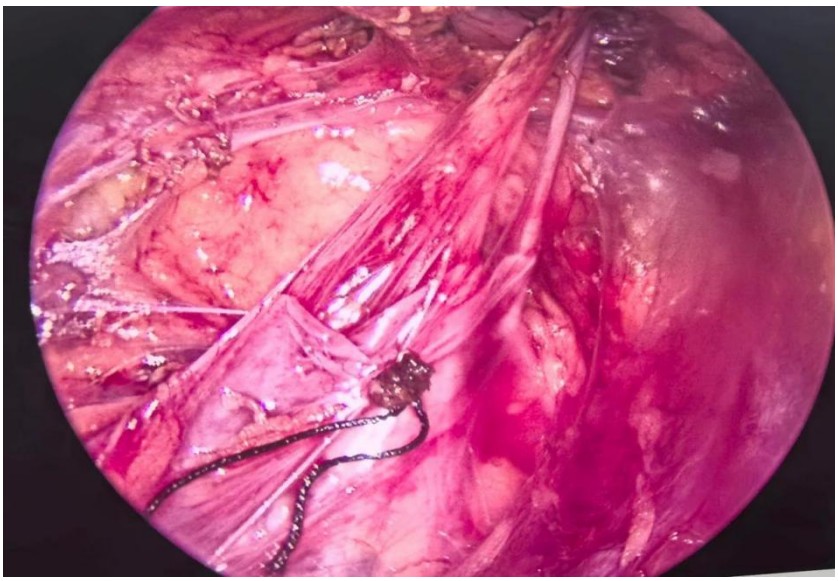

Figure 6 Orchiopexy for Testicular Descent and Fixation

Abdominal approach group: Establish pneumoperitoneum, free processus vaginalis, spermatic vessels and vas deferens, and tunnel orchiopexy through Hy's triangle to scrotal incision.

2.3 Statistical Processing

SPSS 26.0 software was used to process the data. Measurement data ($\overline{x} \pm s$) were analyzed by t test and enumeration data (%) were analyzed by χ^2 test. $P < 0.05$ was considered statistically significant.

3 RESULTS

Both extraperitoneal approach group and abdominal approach group successfully completed the operation, and there was no conversion to open surgery. The mean operation time was 62.5 min in the extraperitoneal approach group and 62.75 min in the abdominal approach group (P = 0.91). In the abdominal approach group, there was 1 case of choking milk asphyxia during postoperative feeding, which recovered well after treatment. The patients were followed up for 2-7 months, and none had surgery-related complications like testicular retraction, testicular atrophy or incision infection in the two groups. There were no macroscopically visible surgical scars on the body surface after surgery in either group (Table 1).

The operation was successful in both groups. None had surgery-related complications such as testicular retraction, testicular atrophy, or incision infection. The average operation time of extraperitoneal approach group was 62.5 min, which was not significantly different from that of abdominal approach group (the average operation time of abdominal approach group was 62.75 min, P = 0.91). There was no significant difference in intraoperative blood loss between the two groups (P = 1).

Table 1 Comparison of the Operation Time between the Two Groups of Patients

Group	Number of subjects (n)	Operative Time (min)
Extraperitoneal group	63	62.50
Abdominal group	64	62.75
T value		0.10
P value		0.92

4 CONCLUSION AND DISCUSSION

Cryptorchidism is one of the most common germline malformations in children and refers to the fact that the testis does not descend to the scrotum after birth and stays on the way to normal descent, that is, stays in the abdominal cavity, inguinal canal, or above the scrotum[6]. The treatment age is recommended to start at 6 months (corrected for gestational age)[7], preferably before 12 months and at least before 18 months[2, 8-9]. Failure to actively lower the

testis to the normal position of the scrotum by surgery can increase the risk of malignant transformation of the testis, infertility, torsion, trauma, and even affect the psychological health of children . About 20% of cryptorchidism is not palpable on the body surface before surgery, but true intra-abdominal cryptorchidism is only 6%, and the rest are located in the groin or scrotum[10]. Commonly used surgical methods for cryptorchidism include inguinal incision orchiopexy, transscrotal incision orchiopexy, and laparoscopic orchiopexy. Simple scrotal incision surgery, the incision is concealed, do not dissect the inguinal canal, but the appropriate syndrome is narrow, need to strictly grasp the indications. Laparoscopic orchiopexy is the best surgical approach for abdominal cryptorchidism[11]. Cortesi first reported that the application of laparoscopic technique in the diagnosis of cryptorchidism[12], with the development of laparoscopic technique, has the advantages of small trauma, beautiful incision, sufficient spermatic cord mobilization, and rapid recovery, and has gradually become the main means of cryptorchidism treatment, especially in the diagnosis and treatment of abdominal or high inguinal cryptorchidism. Because laparoscopic surgery can more thoroughly free the spermatic cord and reduce the probability of fractional surgery, it has become the preferred surgical method for orchiopexy in children. Single-port laparoscopic surgery is increasingly popular because only one incision is at the umbilicus and postoperative scars are more concealed. However, because in single-port laparoscopic surgery, the lens, curved forceps, and coagulating hook all pass through an operating port, the operating space is narrow. And because the devices are blocked from each other, the operator needs a relatively long adaptation time. In the early stages of single-port laparoscopic surgery, the operation time will be longer than that of the traditional three-port method[13]. At present, laparoscopic surgery is used through the abdominal approach, inevitably interfering with the abdominal organs, with the risk of intestinal obstruction and abdominal pain caused by the formation of postoperative adhesions. Laparoscopic total extraperitoneal approach is mostly used for the treatment of adult inguinal hernia, prostate and other diseases, without entering the abdominal cavity, directly entering the preperitoneal space for operation, effectively avoiding abdominal surgery-related complications[5]. In the control intraperitoneal group, there was one case of choking milk asphyxia after surgery, while there were no postoperative complications in the extraperitoneal group. There was no difference with the intraperitoneal approach in terms of mobilization of the spermatic vessels and vas deferens. Moreover, ligation and transection of the processus vaginalis via an extraperitoneal approach reduces the risk of postoperative complications of indirect inguinal hernia or hydrocele.

In single-port endoscopic orchiopexy for extraperitoneal approach , the experience of this procedure in practice is as follows: (1) The real operating space in the total extraperitoneal approach surgical approach is not between the deep and superficial layers of the transversalis fascia, but between the superficial layer of the transversalis fascia and the peritoneum, the deep layer of the transversalis fascia needs to be incised to enter the preperitoneal space. (2) Gentle operation and careful identification, the space between the posterior rectus sheath and the peritoneum is small at the initial stage and the operating space can be increased by blunt dissection of the fingers, directly to the semilunar line. (3) When freeing the processus vaginalis, more delicate procedures should be performed to avoid perforating the peritoneum. Otherwise, air enters the abdominal cavity, which greatly reduces the extraperitoneal space. Access to the abdominal cavity may be changed if necessary.

In conclusion, totally extraperitoneal single-port endoscopic orchiopexy , as a new surgical method, has definite effect, has the significant advantages of reducing abdominal trauma, reducing abdominal organ harassment, cosmetic appearance of the surgical incision , and can achieve the same surgical effect as traditional laparoscopy, which is worthy of clinical promotion. However, this study still has shortcomings such as short duration of development, small number of cases, and lack of long-term follow-up results, which still need to be further improved.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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