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Needlescopic herniorrhaphy using one umbilical 5-mm trocar and two lateral 3-mm trocars: A case series

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ABSTRACT

INTRODUCTION: Laparoscopic surgery has become a standard treatment for inguinal hernia, with it recently being characterized by the use of smaller instruments. However, reports on needlescopic transabdominal preperitoneal repair using one umbilical 5-mm and two lateral 3-mm trocars are extremely rare.

METHODS: Seven patients with unilateral inguinal hernia underwent this surgical procedure. A 5-mm trocar was inserted from the umbilical and two 3-mm trocars were inserted from the lateral. After dissection of the preperitoneal layer, a mesh was fixed using a tucker inserted from the umbilical 5-mm trocar while viewing through the 3-mm optics from the lateral trocar.

RESULTS: All procedures were completed without intraoperative complications and conversion to the conventional method. The surgical results of our needlescopic TAPP repair have been shown to not be inferior to those of the conventional method.

CONCLUSION: Our needlescopic herniorrhaphy using one umbilical 5-mm trocar and two lateral 3-mm trocars is minimally invasive hernia repair.

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1. Introduction

Inguinal hernia repair is the most frequently performed surgical procedure worldwide [1]. Following the spread of laparoscopic techniques, laparoscopic herniorrhaphy has been regarded as a standard treatment. The following three laparoscopic herniorrhaphy techniques have been reported: intraperitoneal onlay mesh (IPOM), transabdominal preperitoneal (TAPP), and totally extraperitoneal (TEP) [2]. Currently, IPOM repair has become largely unpopular, and it is concluded that surgical outcomes of TEP and TAPP repairs are probably similar, and the surgeon's experience is the most important factor when selecting a surgical method [3].

Laparoscopy has recently been characterized by an increased development of smaller laparoscopes, trocars, and operative instruments, in order to minimize nerve and muscle damage and to optimize aesthetic results [4]. It is reported that needlescopic TAPP repair induces further reduction of postoperative pain [5]. Aiming for a minimally invasive herniorrhaphy, we performed needlescopic TAPP repair using one umbilical 5-mm trocar and two lateral 3-mm trocars. To the best our knowledge, needlescopic TAPP repair using one umbilical 5-mm trocar and two lateral 3-mm trocars is extremely rare. Herein, we describe our experience with some literature review.

2. Methods

2.1. Patients

Two surgeons performed on seven patients with unilateral inguinal hernia at our general hospital. Patients' characteristics are shown in Table 1. Within the same period, the same surgeons performed 49 cases of conventional TAPP repair using one umbilical 12-mm and two lateral 5-mm trocars for unilateral inguinal hernia (Table 2). We compared retrospectively our needlescopic TAPP repair with the conventional method that was performed by the same surgeons. This case series has been reported in line with the PROCESS criteria [6].

2.2. Surgical procedures

The patient was placed in the supine position for the surgery. Under general anesthesia, a 5-mm trocar was inserted at the umbil-

Abbreviations: IPOM, intraperitoneal onlay mesh; TAPP, transabdominal preperitoneal; TEP, totally extraperitoneal; RPS, reduced-port surgery.

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Table 1
The clinical features and surgical results of 7 cases performed needlescopic herniorrhaphy. The patients in case 6 has surgical history of prostate cancer.

Case No	age/sex	Height (cm)/wait (kg)	BMI (kg/m^2)	affected side	hernia classification	operative time (min)	hospital stay
1	67/F	144/39.0	18.8	right	L-II	107	2day
2	75/M	159/46.0	18.2	right	unknown	62	2day
3	80/F	148/45.0	20.5	left	M-II	91	2day
4	66/M	164/65.4	24.3	left	L-II	87	2day
5	72/M	171/64.5	22.1	left	M-II	89	3day
6	85/M	156/46.5	19.1	right	L-II	143	3day
7	73/M	173/73.2	24.6	right	L-II	101	3day

Table 2
The clinical features and surgical results of 49 cases treated by conventional TAPP repair. 9 patients had a surgical history, 6 were prostate cancer, 2 were rectal cancer, and 1 was hepatectomy. 2 recurrent hernia cases were included.

Cases, n		49	
Gender, n	male		43
	female		6
Median age, years (range)		71	(32–86)
Median BMI, kg/m^2 (range)		21.9	(17.8–28.6)
Median operative time, min (range)		87	(42–164)
Median hospital stay, days (range)		3	(2–9)

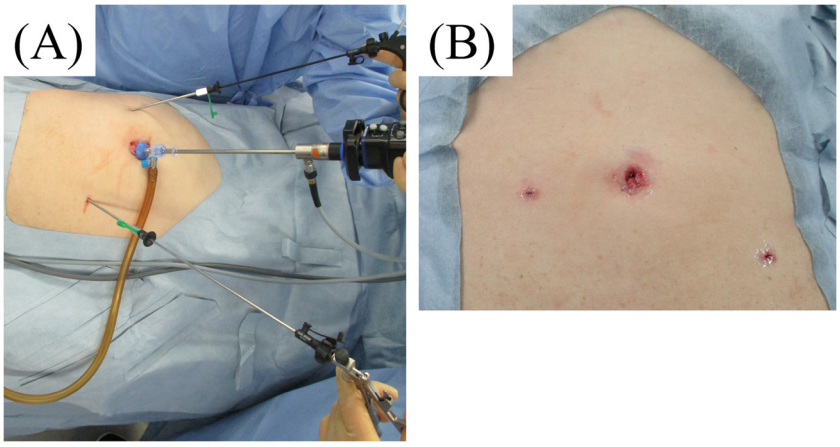

Fig. 1. Intraoperative (A) and postoperative (B) abdominal findings.

ical natural defect of the fascia through an open technique. After exploration of the abdominal cavity, two lateral 3-mm trocars were inserted from the lateral. We used the following needle instruments: two grasping forceps, one electric scissor, and one needle holder (KARL STORZ, Inc.). After transection of the hernial sac, the preperitoneal layer was dissected until the mesh overlapped the myopectineal orifice by 3 cm. Next, the mesh was inserted through the umbilical 5-mm trocar. We generally use a 3D Max Light mesh, size M (Bard Inc.) or Porysoft mesh (Bard Inc.). The mesh was then expanded to cover the dissection area under observation using 5-mm optics. This was then switched to 3-mm optics. By viewing through the 3-mm optics from the lateral trocar, the mesh was fixed with AbsorbaTack (Covidien Inc.) inserted from the umbilical 5-mm trocar. A needle of 3–0 Vicryl (Ethicon Inc.) was deformed for insertion from the 5-mm trocar, and the peritoneum was sutured. At the umbilical 5-mm trocar wound site, the fascial defect was sutured by 2–0 5/8 circle Vicryl (Ethicon Inc.), but the 3-mm trocar wound site was not sutured. All wounds were protected using DERMABOND (Ethicon Inc.) (Figs. 1 and 2).

3. Results

All procedures were completed without the requirement for conversion to conventional TAPP repair. The hernia classification and surgical results of our needlescopic TAPP repair are shown in Table 1. There were no intraoperative complications, and only a small amount of blood loss was observed in all cases. Conversely, Table 2 shows surgical results of the conventional method. One patient treated using conventional TAPP repair was hospitalized for 9 days for heparinization. The group treated using conventional TAPP repair comprised more patients with abdominal surgical history and complicated inguinal hernia. It is essential to consider the difference of both backgrounds, however, surgical results of our needlescopic TAPP repair have been shown to not be inferior to those of the conventional method. Although the observation period was short, no recurrence of hernia has been noted thus far.

4. Discussion

Laparoscopic surgery has become a standard treatment as a minimally invasive surgery, and various efforts are being made for advancement in minimally invasive approaches. Recently, reduced-port surgery (RPS) has become a focus of minimally invasive laparoscopic surgical approaches. RPS can be divided into two techniques: needlescopic and single-incision port surgeries. Needlescopic instruments are used for various laparoscopic procedures [7]. There are some studies on needlescopic inguinal hernia repair; however, the definition of “needlescopic” is ambiguous. Needlescopic instruments have a diameter of ≤3 mm [8,9]. According to this criterion, reports on needlescopic hernia repair in adults are still rare.

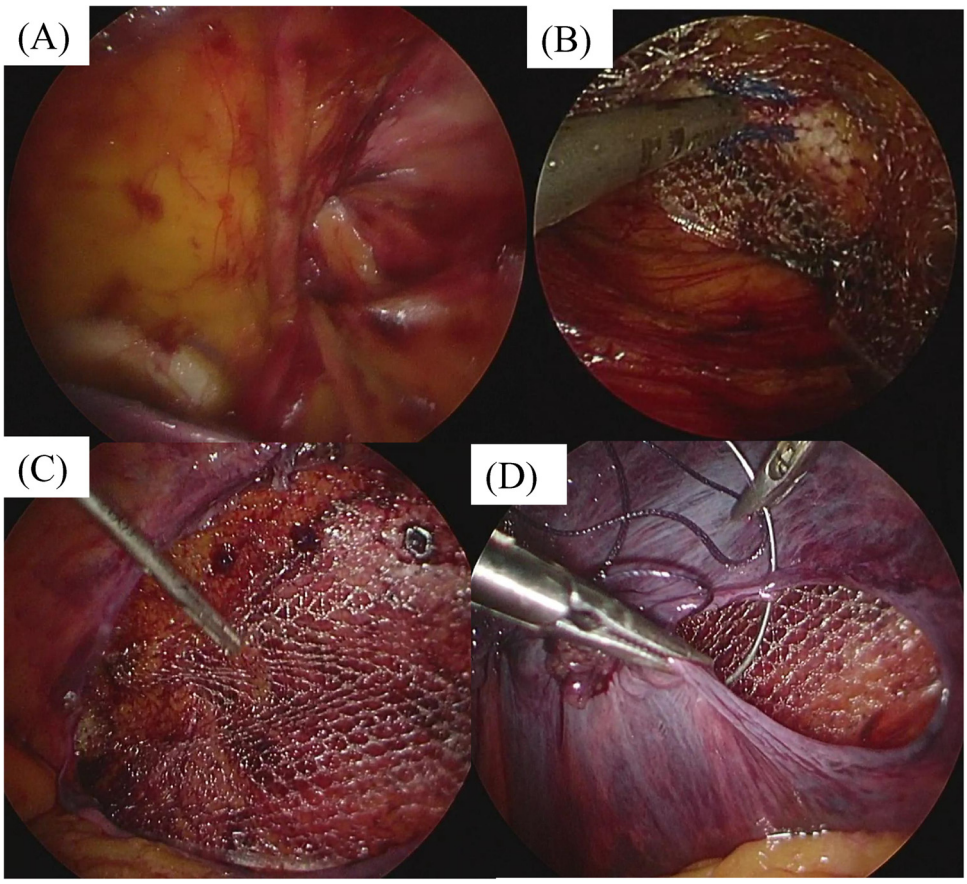

Fig. 2. Intraoperative images.
(B) is image of 3 mm scope.
(A) At the end of the dissection of the preperitoneal cavity.
(B) Mesh fixation to Cooper ligament.
(C) After fixing the mesh.
(D) Suture the peritoneum.

In this needlescopic herniorrhaphy, there are some differences from conventional method, such as using needlescopic instrument or mesh fixation. First, needlescopic instruments is seemed to be not inferior and does not require specialized techniques. Second, laparoscopic coagulation shears cannot be used, therefore we use monopolar scissors in the conventional method. The most challenging technique is mesh fixation. The tucker can be inserted only from a 5-mm port. During mesh fixation, the surgical field of view provided by 3-mm optics from the lateral trocar is not the usual view. Although it is crucial to capture an image while confirming the surgical field of view from the lateral trocar, it appears to require experience.

The longstanding standard practice for TAPP has been to use mesh fixation with tuckers to prevent recurrence [10]. Several reports have revealed that the recurrence rate is not altered during TAPP repair with or without mesh fixation [10,11], although discussions on the necessity of mesh fixation have been inconclusive. For preventing recurrence, the optimal mesh size is the one that overlaps the defect by $\geq$3 cm in a porcine model [12].

The field of view during mesh fixation in the present method was poorer than that during mesh fixation in the conventional method, and the certainty of mesh fixation seems debatable. Guidelines of the International Endohernia Society suggest that non-fixation can be considered for types L-I, II and M-I, II hernias. This procedure is equivalent to conventional methods with respect to the transection of the hernial sac, dissection of the preperitoneal layer, and utilization of an appropriate mesh that covers the myopectineal orifice. Therefore, we believe that the recurrence rate for this procedure is comparable to that for conventional methods for types L-I, II and M-I, II hernias. However, in cases with high risk of recurrence, such as EHS classification type L-III/M-III hernia, the conventional method seems to be desirable.

Several studies on single-incision surgery exist [13,14]; however, whether needlescopic or single-incision port surgery is recommended for inguinal hernia remains unclear. Blinman T has reported that multiple smaller trocars, which are smaller than a single large trocar, have clinically good results [15]. Certain studies have reported the advantages of needlescopic surgery, which does require the removal of specimen, such as the natural orifice transluminal endoscopic surgery [16,17]. Inguinal hernia repair does not require specimen removal, which means that there is no requirement for larger trocar and incision size. In addition, some reports have stated that single-incision port surgery has a longer operational time [13]. Collectively, needlescopic surgery is considered to be superior to single-incision surgery for laparoscopic hernia repair.

Compared with TEP, TAPP can cause port-site hernia [3,18]. Systematic reviews [19,20] revealed that the frequency of port-site hernia was 0%–5.2%, and port-site hernia occurred with an incidence of 96% with a 10- or 12-mm trocar and was mostly located in the umbilical region (82%). Lambertz has noted that using the smallest trocars helps reduce the risk of the development of port-site hernia [21]. Needlescopic surgery seems to be a significant effort in preventing the development of a new hernia after hernia surgery. In addition to changing the 12-mm trocar to a 5-mm trocar, insert-

ing a 5-mm trocar from the umbilical physiological fascia defect and suturing the fascia defect are our ingenuities for minimizing abdominal wall damage.

Despite the small number of cases and short term follow up in this report, we consider that needlescopic herniorrhaphy is minimally invasive.

5. Conclusion

We describe our needlescopic TAPP repair using one umbilical 5-mm trocar and two lateral 3-mm trocars. We recommend this needlescopic herniorrhaphy as a minimally invasive hernia repair. Further large research is necessary to evaluate the impact of this surgical procedure.

Conflicts of interest

The authors have no conflict of interest to declare.

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Ethical approval

This report was approved by the ethics committee in Nagoya Tokushukai General Hospital (Institutional Review Board approval 2017-10-002).

Consent

Consent was obtained from patients for publication.

Author contribution

Toru Imagami and Satoru Takayama performed operation. Toru Imagami drafted the manuscript. Satoru Takayama contributed data interpretation and participated in the correction of the manuscript. All authors read and approved the final manuscript.

Registration of research studies

This research registry UIN is 4163 (June 10, 2018 13:30).

Guarantor

Toru Imagami, Satoru Takayama.

Provenance and peer review

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