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Transumbilical Single-Incision Laparoscopic Surgery: A single center experience

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ABSTRACT

During the last two years, the so called Single-incision-laparoscopic surgery is developing rapidly and seems to be the next step in reducing abdominal wall trauma for laparoscopic abdominal procedures. Different techniques and equipment are under development and reports cumulate regarding laparoscopic procedures which are performed through one single skin incision.

We report our first experiences in single incision laparoscopic surgery for cholecystectomy and transperitoneal hernia repair (TAPP repair). Until now, approximately 50 patients underwent cholecystectomy with this new approach in our clinic, experience for inguinal hernia repair have been made in experimental setup on anatomical specimen.

Keywords: Single-incision surgery, NOTES, Cholecystectomy, Hernia repair

INTRODUCTION

Laparoscopic techniques have supersede conventional surgery since the early 90s¹. Since a few years, the N.O.T.E.S. movement (Natural Orifice Transluminal Endoscopic Surgery) significantly stimulated the development of new instruments and new approaches into the abdominal cavity. However, the aim to operate only through natural orifices as mouth, vagina or rectum has been very ambitious, a milestone seems to be the reduction of abdominal trauma during laparoscopic surgery by using only one small skin incision. For this, multiple devices and additional instruments capture the market.

We report our experience of single-skin-incision surgery using standard laparoscopic equipment in combination with a 5 mm 30° laparoscope for chole-

cystectomy and inguinal hernia repair (TAPP). Altogether approximately 50 patients have been treated for cholecystectomy, the TAPP repair has been performed on anatomical specimen.

CHOLECYSTECTOMY:

Operative Technique

The operation is performed in general anaesthesia and the patient is positioned in a modified Anti-Trendelenburg position (Figure 1). The surgeon stands between the legs of the patient with the first surgical assistant right to the surgeon (Figure 2). A 15 mm large skin incision is performed intraumbilical and the central port (5 mm) is inserted perpendicularly after establishing a pneumoperitoneum by using a Verress-



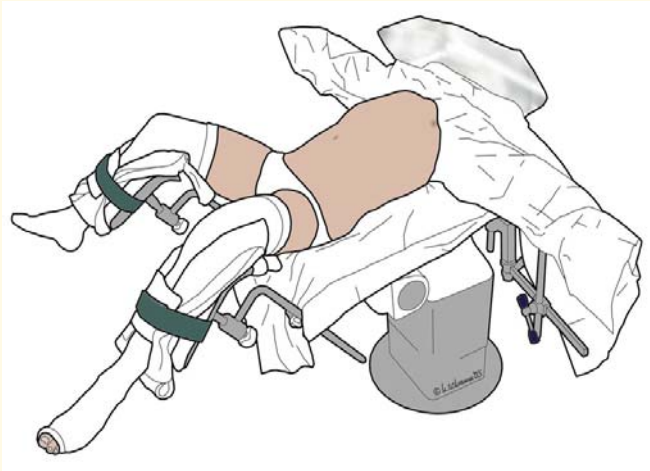


Figure 1: Positioning of the patient

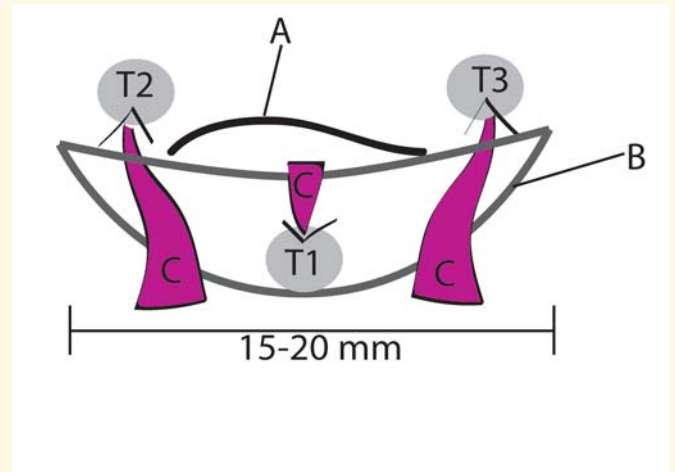


Figure 3: Schematic view of the incision with 3 trocars (T1= camera trocar, T2=left hand grasper, T3= right hand scissors)



Figure 2: Positioning of the surgeon and assistants

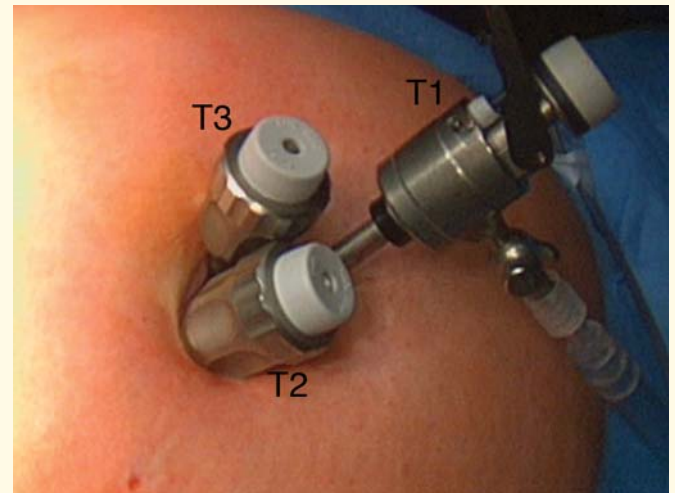


Figure 4: Intraoperative view of trocar placement

needle. The 5 mm 30 degree laparoscope is inserted and diagnostic laparoscopy is arranged. After excluding adhesions or other contraindications two further 5 mm trocars are inserted beneath the central one through separate facial penetrations (Figure 3, 4). The gallbladder is grasped via a grasping device which is placed through the left trocar and the preparation tool (monopolar hook or scissors) is installed through the right trocar. The cholecystectomy is performed as known from conventional laparoscopic cholecystectomy (Figure 5).

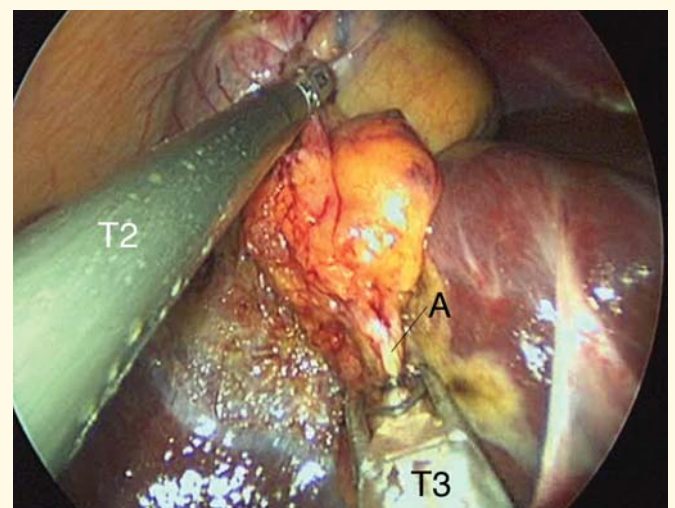


Figure 5: Clipping of the cystic duct with a 5mm clipping device



Own clinical results (Kirschniak et al ²)

A preliminary group of 38 patients (31 female, 7 male) with a BMI 27,8 (+3,25 kg/m², 22,2-34,6 kg/m²) have been operated and worked-up postoperatively. The mean age of the patients was 53,8 (+14,1, 26-81) years. The mean operation time was 67,1 min (+16,1, 45-114 min). In 4 Patients, one additional incision was necessary due to chronic cholecystitis. The hospital stay was 4,4 days (+ 0,93, 3-6 days). We noticed no major complications such as damaging hollow organs, the liver or postoperative cholestasis. Intraoperatively the mean blood loss was 35 ml (10-70, +-17 ml). We noticed no wound healing problems, in two patients small hematomas occurred postoperatively but resolved spontaneously without any intervention.

Personal considerations

Since the first reports have been published about single-incision surgery, medical databases explode with retrospective analyses about this operation technique ²⁻¹³. There is a general agreement in all reports that the “single-site”, “single-port” or “single-incision” technique for cholecystectomy is feasible and safe, accompanied with a higher satisfaction of the patients. However there is no consensus whether to use standard instruments or special trocar aids like the Triport System or the SILS-port. Additionally, many special instruments, e.g. curved graspers or articulated scissors are available at the time.

In our opinion, such a procedure is feasible, safe and cost-effective with 3 standard 5 mm trocars, a 5 mm 30° laparoscope and standard laparoscopic instruments. Beyond doubt, comfort and ergonomic aspects may improve the operation as well as the operating time by using deflected scopes or curved instruments, however most of this equipment will make the procedure much more expensive which is a problematic aspect regarding the German “Diagnose-related-system” (DRG-system). Additionally, the laparoscopic cholecystectomy is one of the most common training procedures for our young colleagues and the single-incision procedure still should be reserved for experienced laparoscopic surgeons.

With one single incision and uncurved instruments, the camera and the two working instruments work parallel to each other, which sometimes can make triangulation uncomfortable and hindering of the two working instruments extracorporally may occur sometimes. This can be avoided by using extra-long graspers/scissors.

At this time, no exact prediction regarding the postoperative incidence of incisional hernias is possible. By using a single port system, the postoperative rate of herniation might be higher due to the 2-3 cm large incision. In our technique, we perform a 1.5 -2cm large single incision and the fascia is penetrated with the trocars at 3 different points, so that we have one single skin incision and three single fascia incisions with 5mm defect. At this time, we did not see a patient with postoperative incisional hernia.

In our opinion, the unproblematic intraoperative conversion from the single incision procedure to the laparoscopic procedure by adding one or two further trocars is one of the main advantages of this procedure. This aspect might be a certain argument for this access technique in comparison to real NOTES procedures with penetration of other hollow organs.

In summary, the single incision cholecystectomy, when performed standardized, can be a safe and effective and also cost-effective alternative to the “conventional” laparoscopic procedure. We look forward to new instrument developments and further indication for this access in abdominal surgery.

SINGLE-INCISION LAPAROSCOPIC TRANSABDOMINAL INGUINAL HERNIA REPAIR

Experimental experiences:

In an experimental setup, we performed a single-incision transumbilical laparoscopic hernia repair (TAPP) on anatomical specimen, which have been donated for research and medical education to the Institute of Anatomy of the University of Tübingen. The cadavers were preserved with alcohol-glycerol and stored airtightly under refrigerated conditions (8° Cel-



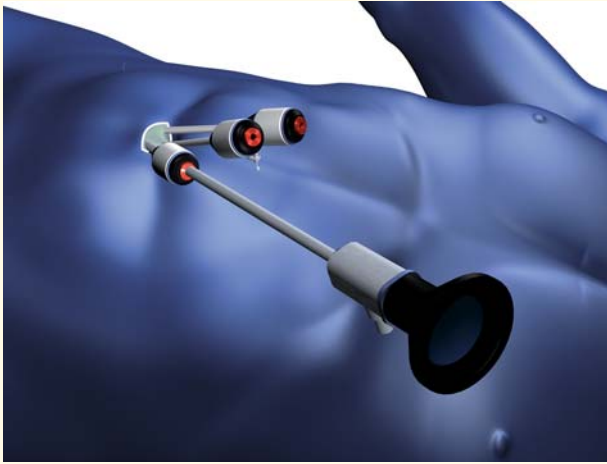


Figure 6. Trocar placement for inguinal TAPP repair

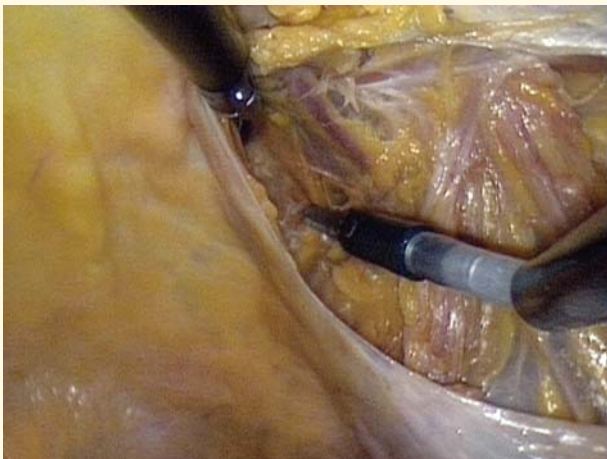


Figure 7: Preperitoneal preparation of the fossa medialis



Figure 8: Completed medial preparation (Ramus ossis pubis)



Figure 9: Preperitoneal region after mesh placement

sus). The fixation allows the preservation of the tissue properties¹⁴.

We used a standard 5 mm 30° laparoscope with three trocars, which have been placed transumbilically as we do for the cholecystectomy procedure. The laparoscope is inserted into a lateral trocar, the central and the third are used for the grasper and the scissors (Figure 6). In our setup we used rotatable arcuated instruments (Covidien, USA).

The procedure is performed as known from the conventional laparoscopic transabdominal procedure. The peritoneum is cut and prepared in the inguinal region and the landmarks are visualized (Figure 7,8). We placed a standard 10*15 mm mesh and fixed it with Protack® (Covidien, USA) spiral needles (Figure 9). The peritoneum is adapted continuously with a monofilament running suture (Figure 10). All procedures could be finished and the steps described could be finished. The operation time as 45,5 min in average (35-55, +- 7 min).

Single incision laparoscopic hernia repair seems to be possible and feasible using available laparoscopic instruments. However, from an ergonomic point of view, there is a need for improvement for establishment in clinical practice. The anatomical specimen, beneath computer simulation, is one available model for simulating operations in the inguinal region. However, the prepared specimen had no relevant inguinal hernia and the





Figure 10: Closed peritoneum with a running suture



Figure 11: Postoperative result on day 2:

results must be interpreted critically from this point of view.

In our opinion, the inguinal TAPP repair with a single incision access might be good procedure in the future. At this time, we did not implement this procedure in our clinical practice for educational reasons and due to increasing costs. Our experience on the anatomical specimen showed us, that this procedure has to be done with articulated instruments for an

optimal triangulation especially in the inguinal region. Most of these instruments are not reusable at the time, so we will wait for suitable instruments, before we will perform this procedure routinely in our clinic.

In the literature only one report could be found describing the feasibility of single-site transabdominal hernia repair¹⁵. It seems to be the next step for reducing postoperative pain, scars (Figure 11) and trocar hernias also for this indication.

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