Chirurgia (2013) 108: 571-575
No. 4, July - August

E-NOTES Transumbilical Laparoscopic Appendectomy

F. Graur[1,2], R. Elisei[2], N. Al-Hajjar[1,2]

[1]University of Medicine and Pharmacy "Iuliu Hatieganu", Cluj-Napoca, Romania
[2]Regional Institute of Gastroenterology and Hepatology "Prof. O. Fodor", Cluj-Napoca, Romania

Rezumat

Apendicectomie laparoscopică transombilicală E – NOTES

Prezentăm un caz de apendicectomie laparoscopică transombilicală E – NOTES (Embryonic Natural Orifice Transumbilical Endoscopic Surgery). O pacientă în vârstă de 17 ani se prezintă în serviciul nostru unde în urma ultrasonografiei abdominale și a examenului clinic amănunțit se stabilește diagnosticul de apendicită cronică și se recomandă tratament chirurgical. Simptomatologia debutează insidios în urmă cu 4 luni prin dureri abdominale difuze, care s-au localizat ulterior în fosa iliacă dreaptă însoțite de inapetență, grețuri și vărsături. Sub anestezie generală se realizează pneumoperitoneul. Printr-o singură incizie ombilicală de 10 mm lungime se introduc în cavitatea peritoneala 3 trocare de 5 mm. La explorare s-a evidențiat apendicele cecal turgescent și edemațiat. După ligatura și secționarea mezoapendicelui cu pensa LigaSure se ligaturează baza apendicelui cu 2 noduri Roeder și se secționează distal cu pensa LigaSure. Se plasează un dren la nivelul fundului de sac Douglas. Durata intervenției a fost de 60 de minute. Nu au fost complicații intra și postoperatorii. Evoluția postoperatorie a fost favorabilă, iar pacienta a fost externată în ziua 4 postoperator. Evaluarea pacientei în primele 2 luni de la intervenția chirurgicală evidențiază dispariția simptomatologiei, precum și faptul că cicatricea postoperatorie este ascunsă în cicatricea ombilicală.

Cuvinte cheie: apendicectomie SILS, apendicectomie E-NOTES, apendicectomie laparoscopică, apendicectomie transombilicală

Abstract

We present a case of laparoscopic transumbilical single incision appendectomy. A 17-year-old patient with an insidious onset of symptoms 4 months ago by diffuse abdominal pain that later was localized in the right iliac fossa accompanied by loss of appetite, nausea and vomiting. Following clinical examination and abdominal ultrasound, she was diagnosed with chronic appendicitis and surgical treatment was recommended. Pneumoperitoneum was performed under general anesthesia. Three trocars of 5 mm diameter were inserted through a single umbilical incision of 10 mm length into the peritoneal cavity. The exploration has revealed a swollen appendix. After transsection of the mesoappendix with LigaSure forceps, two Roeder knots were placed at on the base of the appendix. Intervention duration was 60 minutes. Postoperative course was favorable. Patient assessment within 2 months after discharge showed disappearance of symptoms and the postoperative scar hidden in the umbilical scar.

Key words: SILS appendectomy, E-NOTES appendectomy, laparoscopic appendectomy, transumbilical appendectomy

Corresponding author: Nadim Al-Hajjar, MD
Regional Institute of Gastroenterology and Hepatology "Prof. O. Fodor"
19-21 Croitorilor Street, Cluj-Napoca
Romania
E-mail: dr_nadim_alhajjar@yahoo.com

Introduction

Laparoscopic surgery has become approach a routine in the

treatment of appendicitis not only because it offers a broader approach and facilitates a better visualization of the region concerned, but also due to the much improved cosmetic effect. Moreover, this procedure requires a significantly shorter hospitalization period and results in reduced postoperative pain (1-6). Conventional laparoscopic appendectomy uses three trocars of 5 and 10 mm. In recent years, new techniques have been developed using laparoscopic single port trocars (SILS techniques) or surgery by natural orifices (NOTES) to reduce complications and improve the appearance of incisional surgery cosmetic cosmetics (7-18). Currently, the use of the SILS technique has greatly increased in popularity, mainly because of the remarkable cosmetic outcome: abdomen without scars, obtained by placing the trocar at the umbilicus. The SILS (Single Incision Laparoscopic Surgery) technique includes endoscopic surgery through embryological natural orifices: E - NOTES (Embryonic Natural Orifice Endoscopic Surgery). The industry in the medical field noticed a very fast evolution of the market demand for these surgical techniques, evolution driven by the public pressure to improve postsurgical cosmetic effects and, as a result, a wide range of instruments and trocars for these techniques was developed. In this paper we present the first case of transumbilical laparoscopic appendectomy E - NOTES performed in The Regional Institute of Gastroenterology and Hepatology of Cluj-Napoca, Romania.

Case Presentation

A 17 year-old female patient, with no significant pathological history, reported the appearance of diffuse abdominal pain, four months ago, which later localized in the right inferior abdominal quadrant, being accompanied by loss of appetite, nausea and vomiting. The intensity of these symptoms decreased after two weeks and the patient's general condition improved significantly. The symptoms reappeared a month ago and the pain got worse with every effort. The patient came to our Institute for investigations and treatment. The clinical examination revealed abdominal tenderness at palpation in the right iliac fossa. The ultrasound examination showed an elongated, thickened appendix wall with small intraluminal residual inclusions. The presence of small lymph nodes near the caecum was also noticed. There were no signs of fluid collection. The right ovary was normal in size, but showed numerous small follicular formations. The examination of the left ovary revealed a follicular cyst of 14 mm in diameter. The abdominal ultrasound exploration showed no other pathological images. Chronic appendicitis was diagnosed and surgery was recommended. The results of the laboratory tests performed were found to be within normal limits. The patient was admitted the day before surgery.

Taking into account the patient's age and given the aesthetic considerations, the use of the transumbilical laparos-copic technique E - NOTES (Embryonic Natural Orifice Endoscopic Surgery) was decided upon.

Surgery was performed under general anesthesia with oro-tracheal intubation. The patient was positioned in dorsal decubitus. Pneumoperitoneum was created using a Veress needle inserted at the umbilicus through a longitudinal incision 15 mm long. When intra-abdominal pressure reached 12 mm Hg, 3 trocars 5 mm in diameter were introduced at the umbilical level along with a tube at an angle of 90 degrees to maintain the pneumoperitoneum. Through the 3 trocars the following working tools were introduced: a 5 mm camera at 30 degrees, a 5 mm grasper and the LigaSure device of 5 mm in diameter. The patient was placed in the Trendelenburg position. The exploration of the peritoneal cavity revealed a swollen appendix with edematous walls, 7 cm in length. (Fig. 1) The mesoappendix was raised and exposed with the grasper. (Fig. 2) The LigaSure device coagulated and cut the mesoappendix and the appendicular artery at the base of the appendix. The appendix was ligated at the base with two Roeder knots and cut with the LigaSure device above the knots. (Fig. 3) A drain of 16 F was placed in the Douglas pouch. (Fig. 4) The appendix was extracted from the peritoneal cavity through the umbilical incision. The

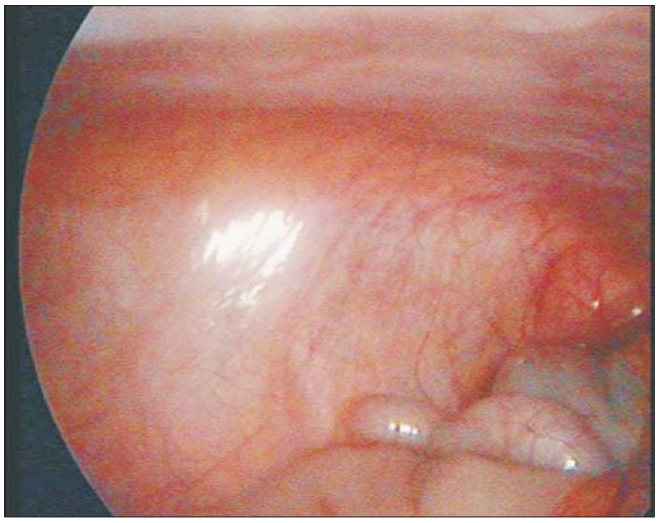

Figure 1. *The aspect of the appendix*

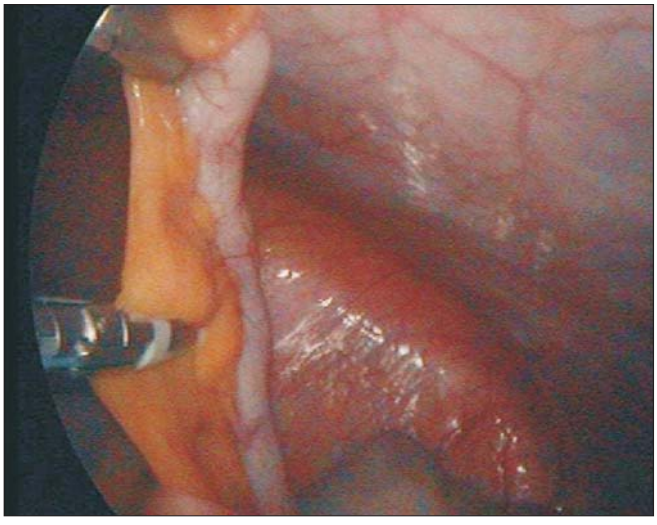

Figure 2. *Grasping and raising the appendix with the grasper*

Figure 3. *Placing two Roeder knots at the base of the appendix*

Figure 4. *Cutting the appendix with the LigaSure device above Roeder knots*

aponeurosis was closed with a thread of polypropylene and the skin was sutured with two separate stitches. The duration of surgery was 60 minutes.

The drainage was suppressed on day 1 postoperatively and the patient was discharged on day 4 after surgery, in good general condition, with no complaints of abdominal pain and without fever. (Fig. 5) The evolution proved to be favorable at the postoperative follow-up checks in the first two months after discharge, with no pain in the abdomen and with no post-operative complications. Pathology revealed: acute follicular appendicitis with a coprolite.

Figure 5. *The final aspect after one week*

Discussion

After the revolution brought forth by laparoscopic surgery, the technology in this area has continued to evolve rapidly, beginning with a reduction in the diameter of the instruments and a decrease in the number of trocars, along with the emergence of the idea leading to the development of the Natural Orifice Surgery. This development has been the result of the growing pressure exerted by patients for surgery without scars and of the desire to reduce hospitalization time and post-operative morbidity. Following the shift from classical laparoscopic appendectomy with three trocars to the intervention with two trocars, which was first performed by Schier (19) in 1998, there was only a small step to laparoscopic appendectomy through one incision, placed at the umbilicus (11-15) or in the right iliac fossa (16, 17). In 2009 Tae Ho Hong et al. published a paper that presents an innovative technique of laparoscopic appendectomy: TUSPLA (Transumbilical Single-Port Laparoscopic Appendectomy) (7). However, the surgical techniques mentioned above can be performed only in selected cases, when patients present no complications or history of abdominal surgery.

The NOTES and SILS techniques are the new trends in abdominal surgery. Up to now no standardization of these techniques has been implemented, so there are many papers describing variants of these techniques, presenting a wide range of tools and accessories used in these interventions. Appendectomy can be performed using the following methods: transumbilical (SILS), transvaginal and transoral (transgastric) (20).

Drawing a comparison between the E-NOTES appendectomy and the pure transvaginal appendectomy (NOTES), Bucher et al. pointed out that, through the transvaginal approach, the patient's sexual life is affected for a period of 15 days to 6 weeks (21-23). The E-NOTES appendectomy results in no restrictions on sex life. In addition, a French study points out that the transvaginal route is not preferred by women, 94% of them refusing this procedure (24). The transvaginal appendectomy is a technique which can be used only in the case of female patients, whereas the transumbilical method can be equally employed with patients of both sexes. The success rate is higher with the transumbilical approach than with the transvaginal one and, in some cases, the latter even

requires a transumbilical approach as well, for the 3 or 5 mm laparoscope to perform safely the transvaginal insertion of the trocars. The conclusion of Bucher et al. is that the transvaginal appendectomy is much more limited than other methods, such as the transumbilical approach (21). Transgastric appendectomy was performed in humans, but with transumbilical laparoscopic control (laparoscope 3 or 5 mm) and through the same port one can extract the appendix. This technique has its limitations, such as those imposed by gastric wall incision and suture. The first transgastric appendectomy was performed by Rao and Reddy in India (25), but on this particular procedure there has been no paper published in extenso. Other publications support the effectiveness of the method on experimental animal models (26).

Regarding the indications some authors performed SILS in all grades of inflammation of the appendix. Hong et al. (7) performed appendectomy even for grangrenous appendicitis or perforated appendicitis with local abscess.

The equipment necessary for laparoscopic appendectomy includes various instruments depending of the technique type. In Dapri technique the surgeon uses one 5 or 10 mm trocar for the laparoscope and special Dapri grasper and hook are inserted along the trocar. When the surgeon uses special trocars like SILS port or S-Portal with EndoCone Cuschieri port all instruments are inserted through the trocar. The instruments are special curved graspers and hooks to improve the surgeon's movements.

There are some advantages of SILS technique versus NOTES such as: avoiding peritoneal contamination (present in the natural orifice access), easy adaptation for the surgeon because of similar approach, avoiding the use of endoscopic translumenal access (difficult for the surgeon), use of standard laparoscopic techniques with minimal modifications.

Advantages of SILS technique: reduced postoperative pain and low doses of pain killers, faster recovery, less incision related complications, faster social reintegration, better cosmetic result - the scar is hidden in the umbilical scar, there is always the possibility to convert to standard laparoscopic surgery.

The disadvantages of SILS technique are: the surgeon has a reduced operatory field with fewer degrees of freedom, there is a single port with one or more access points, the instruments are very close at the entrance point with the possibility of crossing and restricted movements, requires more time and patience, the indications are restricted to non-complicated cases, special instruments could cost more than usual laparoscopic instruments, postoperative hernia at the insertion point if the trocar has a larger diameter.

Complications post SILS appendectomy are: wound infection (range 11.6-14%) and intraabdominal abscess (range 0-7%). The conversion rate is 4.65-21% (27,28).

The most frequent complication after laparoscopic appendectomy is intraabdominal abscess and in open appendectomy is wound infection (29). Other authors found no difference between the two approaches regarding intraabdominal abscess (30).

Conclusions

The presentation of the case detailed above shows that transumbilical laparoscopic appendectomy E - NOTES is a type of surgery that can effectively be employed and whose efficiency is obvious not only in what regards the aesthetic considerations, but also in what concerns the reduction of hospitalization time, so that social reintegration is accelerated. The future will clearly show whether the SILS and NOTES techniques are to become the standard in minimally invasive surgery and will, most definitely, also determine the specific indications for each technique separately.

Conflict of interest statement

Florin Graur and other co-authors have no conflicts of interest.

References

1. Nguyen NT, Zainabadi K, Mavandadi S, Paya M, Stevens CM, Root J, et al. Trends in utilization and outcomes of laparoscopic versus open appendectomy. Am J Surg. 2004;188(6):813-20.
2. Chung RS, Rowland DY, Li P, Diaz J. A meta-analysis of randomized controlled trials of laparoscopic versus conventional appendectomy. Am J Surg. 1999;177(3):250-6.
3. Champault A, Polliand C, Mendes da Costa P, Champault G. Laparoscopic appendectomies: retrospective study of 2074 cases. Surg Laparosc Endosc Percutan Tech. 2008;18(2):168-72.
4. Jitea N, Angelescu N, Burcoş T, Cristian D, Voiculescu S, Mircea N. Laparoscopic appendectomy in obese patients. A comparative study with open appendectomy. Chirurgia (Bucur). 1996;45(4):203-5. Romanian
5. Munteanu R, Copăescu C, Lițescu M, Turcu F, Iosifescu R, Timişescu L, et al. Laparoscopic appendectomy - considerations in about 1000 cases. Chirurgia (Bucur). 2005;100(6):541-9. Romanian
6. Nicolau AE. Laparoscopic appendectomy. Chirurgia (Bucur). 2011;106(4):495-503. Romanian
7. Hong TH, Kim HL, Lee YS, Kim JJ, Lee KH, You YK, et al. Transumbilical single-port laparoscopic appendectomy (TUSPLA): scarless intracorporeal appendectomy. J Laparoendosc Adv Surg Tech A. 2009;19(1):75-8.
8. Oltmann SC, Garcia NM, Ventura B, Mitchell I, Fischer AC. Single-incision laparoscopic surgery: feasibility for pediatric appendectomies. J Pediatr Surg. 2010;45(6):1208-12.
9. Ateş O, Hakgüder G, Olguner M, Akgür FM. Single-port laparoscopic appendectomy conducted intracorporeally with the aid of a transabdominal sling suture. J Pediatr Surg. 2007;42(6):1071-4.
10. Nguyen NT, Reavis KM, Hinojosa MW, Smith BR, Stamos MJ. A single-port technique for laparoscopic extended stapled appendectomy. Surg Innov. 2009;16(1):78-81.
11. Rispoli G, Armellino MF, Esposito C. One-trocar appendectomy. Surg Endosc. 2002;16(5):833-5. Epub 2002 Feb 8.
12. D'Alessio A, Piro E, Tadini B, Beretta F. One-trocar transumbilical laparoscopic-assisted appendectomy in children: our experience. Eur J Pediatr Surg. 2002;12(1):24-7.
13. Valla J, Ordorica-Flores RM, Steyaert H, Merrot T, Bartels A, Breaud J, Ginier C, et al. Umbilical one-puncture laparoscopic-assisted appendectomy in children. Surg Endosc. 1999;13(1):83-5.
14. Esposito C. One-trocar appendectomy in pediatric surgery.

Surg Endosc. 1998;12(2):177-8.
15. Pelosi MA, Pelosi MA 3rd. Laparoscopic appendectomy using a single umbilical puncture (minilaparoscopy). J Reprod Med. 1992;37(7):588-94.
16. Inoue H, Takeshita K, Endo M. Single-port laparoscopy assisted appendectomy under local pneumoperitoneum condition. Surg Endosc. 1994;8(6):714-6.
17. Ng PC. One-puncture laparoscopic appendectomy. Surg Laparosc Endosc. 1997;7(1):22-4.
18. Tomulescu V, Popescu I. NOTES (Natural orifice translumenal endoscopic surgery) - present and perspectives. Chirurgia (Bucur). 2008;103(2):135-8. Romanian
19. Schier F. Laparoscopic appendectomy with 1.7-mm instruments. Pediatr Surg Int. 1998;14(1-2):142-3.
20. Palanivelu C, Rajan PS, Rangarajan M, Parthasarathi R, Senthilnathan P, Prasad M. Transvaginal endoscopic appendectomy in humans: a unique approach to NOTES--world's first report. Surg Endosc. 2008;22(5):1343-7.
21. Bucher P, Ostermann S, Pugin F, Morel P. E-NOTES appendectomy versus transvaginal appendectomy: similar cosmetic results but shorter complete recovery? Surg Endosc. 2009;23(4):916-7.
22. Zorron R, Maggioni LC, Pombo L, Oliveira AL, Carvalho GL, Filgueiras M. NOTES transvaginal cholecystectomy: preliminary clinical application. Surg Endosc. 2008;22(2):542-7.
23. Zornig C, Mofid H, Emmermann A, Alm M, von Waldenfels HA, Felixmüller C. Scarless cholecystectomy with combined transvaginal and transumbilical approach in a series of 20 patients. Surg Endosc. 2008;22(6):1427-9.
24. Slim K, Launay-Savary MV. Launay-Savary, NOTES, the debate continues. Surg Endosc. 2008;22(10):2326; author reply 2327.
25. ASGE; SAGES. ASGE/SAGES Working Group on Natural Orifice Translumenal Endoscopic Surgery White Paper October 2005. Gastrointest Endosc. 2006;63(2):199-203.
26. Jayaraman S, Schlachta CM. Transgastric and transperineal natural orifice translumenal endoscopic surgery (NOTES) in an appendectomy test bed. Surg Innov. 2009 Sep;16(3):223-7.
27. Ahmed K, Wang TT, Patel VM, Nagpal K, Clark J, Ali M, et al. The role of single-incision laparoscopic surgery in abdominal and pelvic surgery: a systematic review. Surg Endosc. 2011; 25(2):378-96.
28. Kim HJ, Lee JI, Lee YS, Lee IK, Park JH, Lee SK, et al. Single-port transumbilical laparoscopic appendectomy: 43 consecutive cases. Surg Endosc. 2010;24(11):2765-9.
29. Slim K, Pezet D, Chipponi J. Chipponi, Laparoscopic or open appendectomy? Critical review of randomized, controlled trials. Dis Colon Rectum. 1998;41(3):398-403.
30. Garbutt JM, Soper NJ, Shannon WD, Botero A, Littenberg B. Meta-analysis of randomized controlled trials comparing laparoscopic and open appendectomy. Surg Laparosc Endosc. 1999;9(1):17-26.