Incisional Hernia in a 12-mm Non-Bladed Trocar Site following Laparoscopic Nephrectomy

Erik J. Kouba    J. Slade Hubbard    Eric Wallen    Raj S. Pruthi
Division of Urologic Surgery, The University of North Carolina at Chapel Hill, Chapel Hill, N.C., USA

Key Words
Laparoscopy · Nephrectomy · Hernia, complications · Port-site hernia

Abstract
Non-bladed trocars, radially-dilating systems, and conical blunt devices are considered less traumatic to the abdominal wall because they do not incise the fascia itself. Consequently, several authors have suggested that closure of the abdominal fascia may be unnecessary if such non-bladed laparoscopic trocars are used. We report of a case in whom a port-site hernia was diagnosed at the site of a 12-mm non-bladed trocar 11 days after laparoscopic nephrectomy.

Introduction
Non-bladed trocars, radially-dilating systems, and conical blunt devices are considered less traumatic to the abdominal wall because they do not incise the fascia itself. Rather, the tissue fibers are arrayed in a criss-cross fashion as the trocar stretches the fibers of the fascia. Since the fascia is not cut, it is believed that the fascia closes by itself. Moreover, it has been postulated that the misalignment of the fascial defects may inhibit herniation [1]. Consequently, several authors have suggested that closure of the abdominal fascia may be unnecessary when such non-bladed laparoscopic trocars are used [2, 3]. We report of a case in whom a port-site hernia was diagnosed at the site of a 12-mm non-bladed trocar 11 days after laparoscopic nephrectomy.

Case Report
A 63-year-old female underwent a hand-assisted left laparoscopic radical nephroureterectomy at an outside institution for transitional cell carcinoma of the left renal pelvis. The procedure itself was deemed uneventful. A 7-cm incision for the hand-assist port was made just cephalad to the umbilicus, and two 12-mm non-bladed ports were placed in the left upper quadrant and left lower quadrant (Ethicon Endosurgical Inc., Cincinnati, Ohio, USA). Of note, there was not fascial closure at the 12-mm port sites during the original operation due to use of the non-bladed trocars. This was confirmed by the operative report and through personal correspondence with the original surgeon.

The patient had an unremarkable hospital stay and was discharged on the 5th postoperative day. Six days after discharge (postoperative day 11) she presented to our facility with a 5-day history of persistent nausea, vomiting, and left lower quadrant pain. Physical examination and abdominal computerized tomography revealed findings consistent with possible bowel obstruction secondary to port-site hernia in the left lower quadrant (fig. 1). The patient underwent an exploratory laparotomy through the prior hand port site. Upon exploration, a loop of incarcerated...
small bowel was noted at the level of the interior abdominal wall fascia through the 12-mm port site in the left lower quadrant (fig. 2). The bowel was reduced, a 10-cm segment resected (due to areas of bowel ischemia at the site of incarceration) and the small bowel was reanastomosed. Fascial closure of both 12-mm port sites and the midline incision was performed. The patient had an unremarkable postoperative course and was discharged on the 5th postoperative day.

Discussion

This is the second reported case of a symptomatic incisional port-site hernia using 10-mm or larger non-bladed laparoscopic trocars without fascial closure [4]. The sequelae of bowel herniation through port sites are significant and may include emergent re-operation, as in this case, or even more critical outcomes.

Several investigators have examined the incidence of incisional hernias after the use of non-bladed laparoscopic trocars without fascial closure. In a series of 70 patients undergoing laparoscopic live donor nephrectomy, Siqueira et al. [5] have reported that no patients had developed symptomatic hernias in which the fascia of non-bladed 12-mm ports was not closed. Additionally, in a prospective study of 244 patients comparing 10-mm port-site fascial closure versus non-closure, Bhoyrul et al. [6] reported that no patient developed an incisional hernia after elective laparoscopic procedures in either cohort. In another study of fascial non-closure, Liu et al. [1] observed no incisional hernias in 70 patients after laparoscopic surgery using non-bladed trocars.

The rationale for non-closure of blunt trocar sites is derived from several animal studies which have shown that blunt trocar fascial defects were smaller in area, shorter in length, shorter in width, and had less destruction of fascial tissue compared to bladed trocars. Furthermore, separation (rather than transection) of musculature has been observed with blunt trocar insertion, and this separation generally re-apposes after trocar removal [7, 8].

However, such preclinical study does not necessarily support the elimination of fascial closure in non-cutting trocars due to several variables that may be present during non-experimental conditions. First, the use of cannulas made of different materials of construction (i.e. thick plastic as compared to thin steel) may add several millimeters to the outside diameter of the cannula (despite a similar internal diameter), and this may result in a larger radius of tissue damage. Second, factors such as the angle of insertion, repeated movements of the cannula while changing instruments, the use of large forces to insert the trocar, and multiple thrusting attempts during entry can impact fascial damage [7, 9]. Third, forced dilation of the fascial layer during specimen removal may increase port-site damage and might be involved with occurrence of trocar-site hernias [10, 11]. Last, patient co-
morbidities such as obesity, infection, steroids use, and diabetes mellitus can also influence the incidence of trocar-site hernias [10, 11].

In conclusion, although it may be true that in many cases port-site closure is unnecessary and does not result in bowel herniation, this case along with the prior report in a transplant donor serve as important reminders that port-site hernias are possible even in the use of non-bladed or radial dilating systems [4]. There exist a number of potential variables that may predispose to herniation and consequently the ability to predict such events in individual patients remains uncertain. Moreover, port-site closure techniques such as the Endoclose suture and the Carter-Thomason device, among others, have allowed secure and efficient port closure [12]. As such, we recommend closing 10-mm or larger port sites irrespective of trocar design.

References

1. Liu CD, McFadden DW: Laparoscopic port sites do not require fascial closure when non-bladed trocars are used. Am Surg 2000; 66: 853–854.
2. Shalhav AL, Barret E, Lifshitz DA, Stevens LH, Gardner TA, Lingeman JE: Transperitoneal laparoscopic renal surgery using blunt 12-mm trocar without fascial closure. J Endourol 2002;16:43–46.
3. Shekarriz B, Gholami SS, Rudnick DM, Duh QY, Stoller ML: Radially expanding laparoscopic access for renal/adrenal surgery. Urology 2001;58:683–687.
4. Lowry PS, Moon TD, D’Alessandro A, Nakada SY: Symptomatic port-site hernia associated with a non-bladed trocar after laparoscopic live-donor nephrectomy. J Endourol 2003;17:493–494.
5. Siqueira TM Jr, Paterson RF, Kuo RL, Stevens LH, Lingeman JE, Shalhav AL: The use of blunt-tipped 12-mm trocars without fascial closure in laparoscopic live donor nephrectomy. JSLS 2004:8:47–50.
6. Bhoyrul S, Payne J, Stefes B, Swanstrom L, Way LW: A randomized prospective study of radically expanding trocars in laparoscopic surgery. J Gastrointest Surg 2000;4:392–397.
7. Tarnay CM, Glass KB, Munro MG: Incision characteristics associated with six laparoscopic trocar-cannula systems: a randomized, observer-blinded comparison. Obstet Gynecol 1999:94:89–93.
8. Kolata RJ, Ransick M, Briggs L, Baum D: Comparison of wounds created by non-bladed trocars and pyramidal tip trocars in the pig. J Laparoendosc Adv Surg Tech A 1999:9:455–461.
9. Baggish MS, Gandhi S, Kasper G: Force required by laparoscopic trocar devices to penetrate the human female’s anterior abdominal wall. J Gynecol Surg 2003;19:1–11.
10. US Food and Drug Administration. Laparoscopic Trocar Injuries: A report from a US Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH) Systematic Technology Assessment of Medical Products (STAMP) Committee 2003 [cited 2005 March 1]. Available from URL: http://www.fda.gov/cdrh/medicaldevicessafety/stamp/trocar.html
11. Leibl BJ, Schmidt CG, Schwarz J, Kraft K, Bittner R: Laparoscopic surgery complications associated with trocar tip design: review of literature and own results. J Laparoendosc Adv Surg Tech A 1999:9:135–140.
12. Elashry OM, Nakada SY, Wolf JS Jr, Figen-shau RS, McDougall EM, Clayman RV: Comparative clinical study of port-closure techniques following laparoscopic surgery. J Am Coll Surg 1996;183:335–344.

Clinical Comment

Tomás Concepción Masip
Canary Islands, Spain

According to the literature, the overall incidence of trocar site hernias is around 1%. This complication of minimally invasive surgery is rare but potentially dangerous. Case reports [1, 2] show that fascial defects at trocar sites should be closed in any patients. Only in selected cases can this be omitted.

Herniation of small bowel at a laparoscopic trocar site occurs immediately after the operation, the small-bowel obstruction is a distinct clinical entity that is often difficult to differentiate from postoperative ileus and requires early reintervention [3]. It is useful to clearly classify trocar site hernias to improve the management of laparoscopic procedures. Bowel herniation is mostly associated with larger trocar sites of ≥10 mm, but can also occur through 5–3-mm trocar sites following prolonged operative laparoscopy, especially in obese, diabetic or female patients.

Transperitoneal laparoscopic renal surgery using a blunt 12-mm trocar without fascial closure may be safe and efficacious and eliminates the last step in transperitoneal laparoscopic renal surgery. The new trocar devices (nonbladed trocar, radially dilating systems and conical blunt trocars) are less traumatic to the abdominal wall. These trocars do not cut the fascia and their place-
ment through muscular parts of the abdominal wall relies on muscle splitting and eventual muscle retraction at trocar removal with spontaneous fascial closure. This mechanism may reduce the incidence of port-side herniation. Despite substantial differences in the design of the trocars, no statistically significant differences in the associated risk of bleeding, hematoma formation, postoperative pain or cosmetic results have been established. Individual goals of the surgical procedure and conditions specific to each patient appear to be the best criteria for selection of the type of trocar used [4]. The Endopath trocar system shows a trend toward reducing trocar-site hernias, decreasing bowel obstruction, and eliminating the need for time-consuming fascial closure, although further studies are needed to confirm these findings [5].

References

1. Kouba EJ, Hubbard JS, Wallen E, Pruthi RS: Incisional hernia in a 12-mm non-bladed trocar site following laparoscopic nephrectomy. Urol Int 2007;79:276–279.
2. Lowry PS, Moon TD, D’Alessandro A, Nakada SY: Symptomatic port-site hernia associated with a non-bladed trocar after laparoscopic live-donor nephrectomy. J Endourol 2003;17:493–494.
3. Sajja SB, Schein M: Early postoperative small bowel obstruction. Br J Surg 2004;91:683–691.
4. Stepanian AA, Winer WK, Isler CM, Lyons TL: Comparative analysis of 5-mm trocars: dilating tip versus non-shielded bladed. J Minim Invasive Gynecol 2007;14:176–183.
5. Rosenthal RJ, Szomstein S, Kennedy CJ, Zundel N: Direct visual insertion of primary trocar and avoidance of fascial closure with laparoscopic Roux-en-Y gastric bypass. Surg Endosc 2007;21:124–128.