Single-Incision Laparoscopic Nontraumatic Left Lateral Diaphragmatic Hernia Repair

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Abstract: Diaphragmatic hernia is a quite uncommon disease, being congenital or posttraumatic. Its diagnosis is frequently accidental. Surgical treatment can be performed through the abdomen as well as through the chest. Laparoscopy and thoracoscopy offer a surgical benefit because of reduced wall trauma and added advantages of minimally invasive surgery. Besides the improved cosmetic result, transumbilical single-incision laparoscopy can add other advantages to minimally invasive surgery like reduced postoperative pain, shorter hospital stay, and improved patient's comfort. The authors describe the technique of transumbilical single-incision laparoscopic suture and mesh reinforcement for a nontraumatic left lateral diaphragmatic hernia, discovered accidentally in a 45-year-old male.

Key Words: diaphragmatic hernia, repair, single-incision, single-port, single-site, laparoscopy

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Single-incision laparoscopy (SIL) gained interest in the last decade, but after a lot of enthusiasm in different surgical fields, it remains less popular than the conventional multitrocar laparoscopy (CML). The main issues remain the cost of the disposable material, the surgeon's learning curve, the difficulty to work through a single access, and the patient's selection. In contrast, thanks to the era of SIL, surgeons have assisted to an increased research and material development with the appearance on the market of new instruments, port devices, and optical systems.[1]

Although the majority of the reports regard procedures like cholecystectomy, appendectomy, foregut surgery, colon resection and solid organs removal, uncommon disease like lateral diaphragmatic hernia is still not considered to be approached through SIL due to its access difficulties and complex treatment.

The authors report a 45-year-old male consulted for a nontraumatic left lateral diaphragmatic hernia, discovered accidentally. The patient was not previously submitted to surgery. Preoperative work-up, including thoracoabdominal computed tomography scan, showed a left lateral diaphragmatic defect, with migration into the chest of transverse colon segment (Fig. 1). A transumbilical SIL (TSIL) repair by suture and mesh placement was proposed and accepted by the patient [Technique (with video, Supplemental Digital Content 1, http://links.lww.com/SLE/A121)].

The umbilicus was extroflexed and incised centrally for 1.5 cm. The central umbilical fatty tissue was found and enlarged to directly access the peritoneal cavity. A purse-string suture using polydioxanon (PDS) 1 was placed in the umbilical fascia. A reusable 11-mm trocar was inserted inside the purse-string suture and the pneumoperitoneum was created. A 10-mm, 30-degree, rigid, and standard-length scope was introduced. The exploration of the abdominal cavity showed adherences between the left diaphragmatic dome and the greater omentum.

A bicurved grasping forceps (Fig. 2A) was inserted without trocar through a separate fascia window, created by a 6-mm trocar's wire, 5 mm outside the purse-string suture at 10 o'clock position. The other instruments, like the monocurved coagulating hook (Fig. 2B), the bicurved needle holder (Fig. 2C), the monocurved scissors (Fig. 2D), and the straight 5-mm tack device were introduced at 3

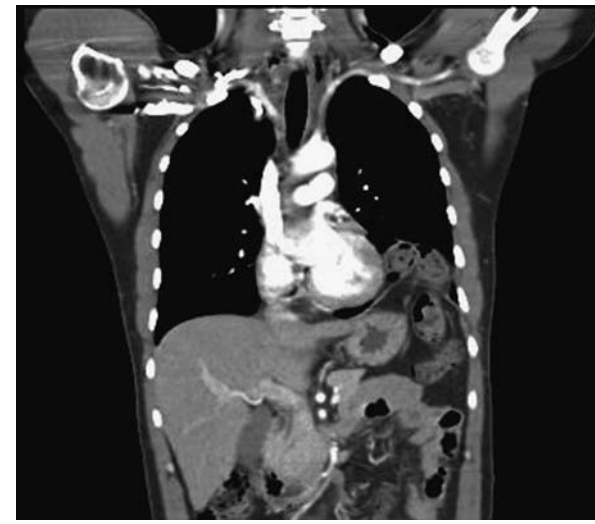

FIGURE 1. Preoperative thoracoabdominal computed tomography scan.

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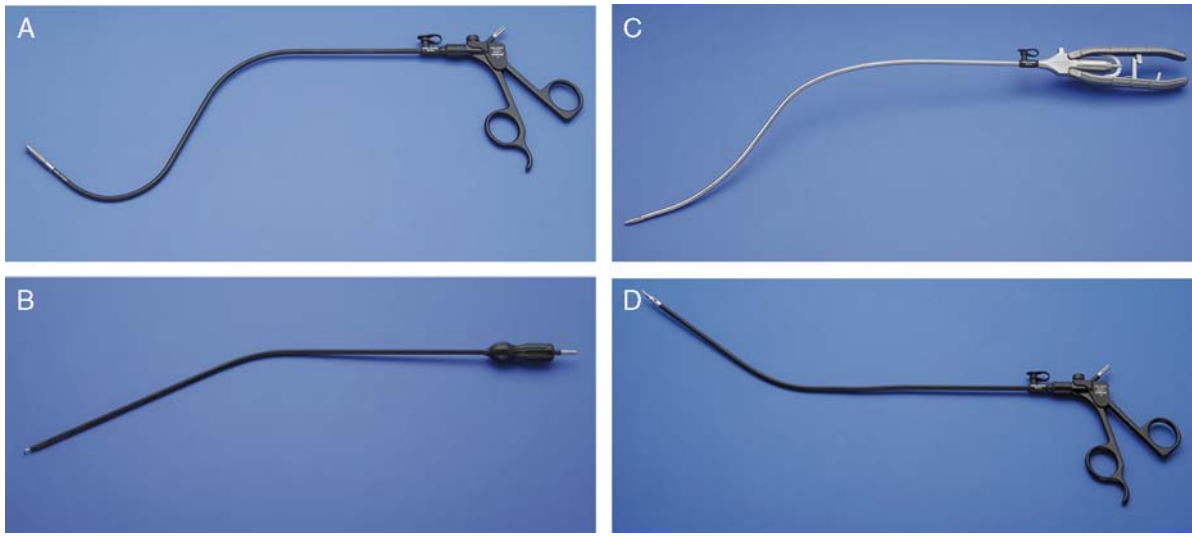

FIGURE 2. A–D, DAPRI curved reusable instruments (Endoskope; Karl Storz, Tuttlingen, Germany): bicurved grasping forceps (A), monocurved coagulating hook (B), bicurved needle holder (C), monocurved scissors (D).

o'clock position, parallel to the 11-mm trocar and inside the purse-string suture.

The operative room table was positioned in a reversed Trendelenburg position, with an increased right-sided tilt. The procedure started with the adhesiolysis between the greater omentum and the left diaphragmatic peritoneal sheet, using the bicurved grasping forceps and the monocurved coagulating hook. The migration of the transverse colon was confirmed and put in evidence (Fig. 3A). This latter was reduced into the abdominal cavity, after it has been freed from the attachments with the hernia sac (Fig. 3B). During the entire procedure, thanks to the curves of the instruments, surgeon was able to work with an intracorporeal triangulation, and under ergonomic positions.

The hernia defect was exposed and its intracorporeal measurement, performed by a tape, appeared to be 6 cm in length and 4 cm in width. The defect was firstly repaired by 2 converging running sutures using Polypropylene (Prolene) 1. Thanks to the bicurved grasping forceps and the bicurved needle holder, the intracorporeal triangulation was established and surgeon was able to perform intracorporeal sutures as during CML (Fig. 4A). Moreover, surgeon worked outside the abdomen with the flexed arms like CML (Fig. 4B). Preformed knots at 1 extremity of each suture facilitated the intracorporeal sutures.

Once the defect was closed, a dualface mesh (Sepramesh; Bard, Davol Inc., Warwick, RI) of 14 cm in length and 10 cm in width was chosen. The mesh was rolled tightly and inserted by a straight 5-mm grasper into the abdominal cavity through the 11-mm trocar. The mesh was open and placed correctly into the diaphragm, covering the closed defect. The mesh was fixed into the diaphragm by tacks (Sorbafix; Bard) on its superior, inferior, and lateral edges. The medial edge, because close to the pericardium, was fixed by interrupted sutures using Prolene 2/0 (Figs. 5A, B). These latter sutures were tied extracorporeally.

Finally, the abdominal cavity was desufflated under view and the access site was closed by figure of 8 absorbable sutures.

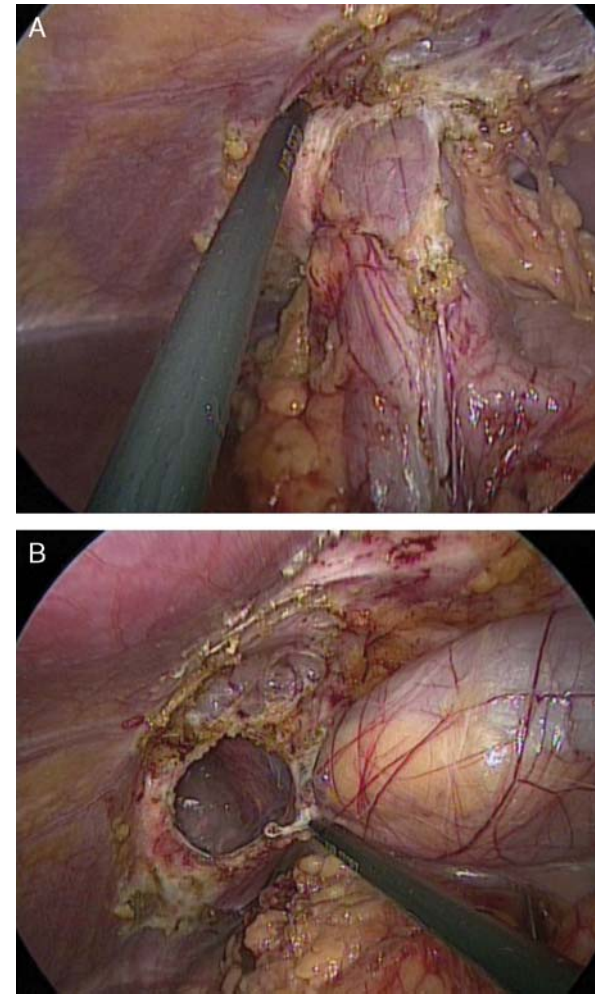

FIGURE 3. A and B, Migration of the transverse colon through the left diaphragmatic defect (A) and its mobilization from the hernia sac (B).

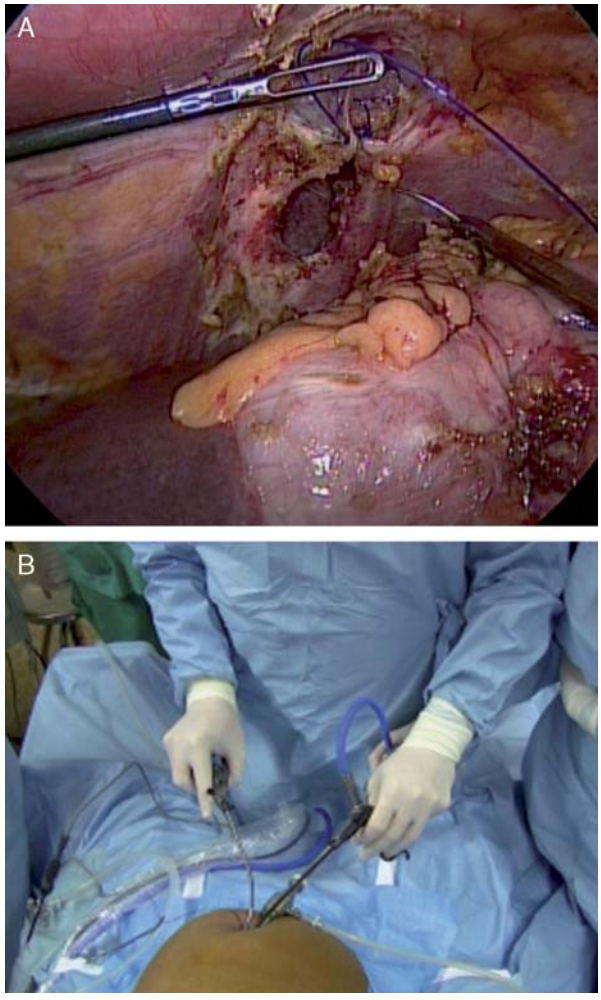

FIGURE 4. A and B, Repair of left diaphragmatic defect by 2 converging running sutures (A), under surgeon's external ergonomy (B).

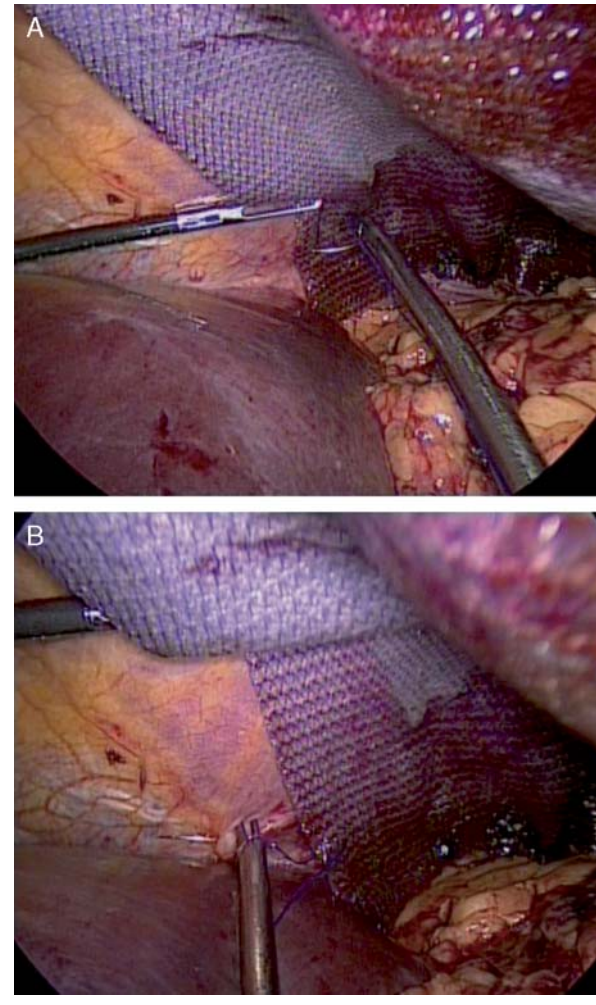

FIGURE 5. A and B, Mesh fixation on its medial edge close to the pericardium by interrupted sutures.

RESULTS

Laparoscopic time was 104 minutes and perioperative bleeding was insignificant. The final umbilical scar was 15 mm. During the postoperative course, only 4 g of paracetamol were used. The patient was discharged on the first postoperative day, after chest x-ray control. At visit consultation, the patient referred any use of painkillers and, at 1, 3, and 6 months, the chest x-ray control was negative for recurrence.

DISCUSSION

Diaphragmatic hernia, out of the transhiatal location, are congenital or subsequent to a vehicle/motorcycle trauma. Usually they are asymptomatic and discovered during a control realized for other medical reasons.[2,3] Preoperative work-up is simplified by the realization of the thoracoabdominal computed tomography scan,[4,5] which permits to identify the exact location of the hernia defect and to recognize the organs usually interested in.

The advent of minimally invasive surgery (MIS), in the years ninety, added a revolutionary benefit to the surgical treatment because the trauma, created with open surgery into the abdominal and thoracic walls, was reduced. Moreover, other advantages like the postoperative pain, the hospital stay, the patient's comfort, and the cosmetic results were improved dramatically. In the last decade the introduction of SIL, and its feasibility applied to the different abdominal diseases,[6] enhanced these positive advantages obtained with MIS.

SIL currently remains less popular than CML because of different issues. The cost of SIL, compared with CML, can increase if the use of disposable port devices and disposable instruments are implemented.[7] In this technique, this aspect is solved by the use of a common reusable trocar for the optical system and reusable curved instruments.

Another SIL problematic is the creation of an intracorporeal working triangulation and surgeon's external ergonomy.[8–10] Also this aspect is solved with the technique described. Thanks to the curves of the instruments, surgeons are able to work under correct ergonomy and the internal working triangulation permits firstly to expose the hernia defect, and then to repair it by intracorporeal suturing.

Obviously, the difficulty of diaphragmatic hernia treatment like the lateral defects, remain present during MIS as well as during SIL. In front of a lateral diaphragmatic hernia, the defect has to be well exposed and

freed from the organs involved; then, it has to be repaired by suture. This method offers to the diaphragmatic muscular fibers a certain uniformity of muscular contractions and a reduced risk of hernia recurrence due to the negative thoracic pressure.[11] Moreover, as the negative thoracic pressure is higher than the abdominal pressure, the hernia defect has to be subsequently reinforced by a mesh placement to avoid an early recurrence.[11] This mesh has to be large enough with the recommended overlapping of 3 to 5 cm[12] and fixed to the diaphragmatic dome by tacks or glue.[13] Sometimes placement of the tacks into the diaphragm can be difficult due to the absence of the classic extracorporeal counterpressure, usually realized by the surgeon's hand at this step. Care has to be taken to fix the mesh medially close to the pericardium because of the risk of pericardial tamponade.[11,14] In the technique reported here, superficial sutures have been used to fix the mesh to the pericardial sheet.

Thanks to the technique of TSIL reported here, the final scar length is 15 mm. This result is obtained because only one 11-mm trocar and two 5-mm instruments were inserted through the same access without trocars. The risk of incisional hernia at the access site with this technique was reported to be 1.4%.[6]

The use of painkillers postoperatively is another positive aspect of the technique described here, because the patient required a minimal use of paracetamol and only during the postoperative 24 hours. This result can be explained at the access site by the fact that the umbilical fascia opening was small and of 10 mm; at the hernia site by the fact that the muscular fibers contraction is less painful than the fibers contraction of other muscles like the central and lateral abdominal muscles.[15]

Finally, the follow-up control is fundamental after the treatment of these diaphragmatic defects, and it can be simplified by the prescription of chest x-rays.[16]

CONCLUSION

Uncommon disease like lateral diaphragmatic hernia, can be approached by TSIL, because this technique adds an improved cosmetic result, reduces the postoperative pain and hospital stay, and improves the patient's comfort.

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