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Case Report

Case report: incisional hernia as a complication of extreme lateral interbody fusion

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Abstract

BACKGROUND CONTEXT: Minimal access surgery is becoming more popular for spinal fusion because of a lower theoretical risk of complications and shorter postoperative recovery period, compared with the traditional open approach. The lateral approach uses retroperitoneal transpsoas access to the vertebra, obviating the need for an approach surgeon and minimizing muscular disruption, thus allowing a quicker recovery. Initial reports of the lateral transpsoas procedure described few complications. However, a number of complications have subsequently been documented. To our knowledge, there has not been a description of an incisional hernia after this approach.

PURPOSE: To report the rare complication of an incisional hernia after a minimal access lateral transpsoas approach for lumbar interbody fusion.

STUDY DESIGN: Case report.

METHODS: We reviewed the hospital charts, radiographs, and intraoperative photographs of a patient who underwent a minimally invasive lateral approach lumbar spine fusion with a subsequent incisional hernia that necessitated laparoscopic repair.

RESULTS: A 75-year-old woman with a history of low back and left lower extremity pain with radiographic evidence of foraminal stenosis and degenerative spondylolisthesis underwent a successful L4–L5 discectomy with an extreme lateral interbody fusion via a retroperitoneal transpsoas approach. This was supplemented with a posterior minimally invasive surgery instrumented fusion from L4 to L5. The patient reported significant improvement in symptoms on initial follow-up, however, complained of a prominence over her incision 4 weeks later. An incisional hernia was diagnosed and subsequently repaired laparoscopically, from which the patient recovered uneventfully.

CONCLUSIONS: Postoperative incisional hernia after extreme lateral interbody fusion is a complication that has not been previously described in the literature but is one that spine surgeons must recognize. This case may prompt surgeons to use a more posterior approach to avoid this complication. Additionally, direct repair of the transversalis fascia is critical to avoiding this complication.

Keywords: Incisional hernia; Extreme lateral interbody fusion; Minimal access lateral approach to lumbar spine; Transversalis fascia

FDA device/drug status: Not applicable.

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Introduction

The extreme lateral approach is a relatively new surgical technique that allows access to the lumbar disc space and vertebral body without an approach surgeon or extensive muscle dissection. The surgeon enters the retroperitoneum via a lateral incision and bluntly dissects through the abdominal wall and psoas muscle to gain access to the lumbar spine [1]. The lateral approach to the lumbar spine is increasing in popularity, as its early results are promising. This procedure has been shown to have decreased blood loss and transfusion rates, lower rates of postoperative back pain, quicker recovery, and shorter hospital stays [2]. Minimally invasive spine surgery can be used for a number of pathologic and degenerative conditions of lumbar, thoracic, and cervical spine [3]. A number of conditions can be successfully treated, including spinal trauma, deformity, and tumors, among others [4]. Initial reports did not demonstrate any higher rate of complications in obese patients undergoing lateral access surgery [5]. The minimal invasive approach is usually recommended for patients with multiple comorbidities who cannot endure a longer more invasive procedure or in very active patients who desire a quicker recovery.

Literature review

On September 3, 2010, we reviewed PubMed, MEDLINE, Ovid, and EMBASE for the following keywords: ''Complications'' or ''Incisional Hernia'' and ''XLIF,'' ''Extreme Lateral Interbody Fusion,'' ''Transpsoas Approach,'' ''Minimally Invasive Lateral Interbody Fusion,'' ''Minimally Invasive Transpsoas Approach to Lumbar Spine,'' ''Lateral Transpsoas Lumbar Spine Fusion.'' All years and languages were selected. We were unable to find a reported case of incisional hernia associated with this approach.

Case report

A 75-year-old white woman with body mass index of 27.7 and a medical history of hypertension, hypothyroidism, and arthritis, and a surgical history of a laparoscopic cholecystectomy 7 years prior, complained of significant low back and left lower extremity pain. She has tried and failed nonoperative treatment including epidural injections and pain medications. Her imaging studies revealed a Grade I spondylolisthesis of L4 on L5 with resultant ventral and foraminal stenosis (Figs. 1 and 2). We recommended surgical intervention, and there were many viable surgical options for this patient. We discussed both open and minimal access approaches, with their advantages and disadvantages. We cited the decreased morbidity of the lateral approach compared with anterior exposure and the improved union rates compared with posterior fusion alone. She chose to proceed with a lateral and posterior spinal fusion via the lateral access approach interbody fusion at L4–L5, with L4–L5 posterior spinal fusion with instrumentation via percutaneous MIS technique. Extensive counseling regarding the lateral approach was also discussed with the patient, including nerve plexus injury, known psoas inhibition resulting from dissection, injury to sensory nerves (genitofemoral), and incomplete indirect foraminal decompression requiring future posterior decompression.

The senior surgeon uses a mini open lateral approach under direct visualization to protect the nerves during dissection through the psoas. The same skin incision length and

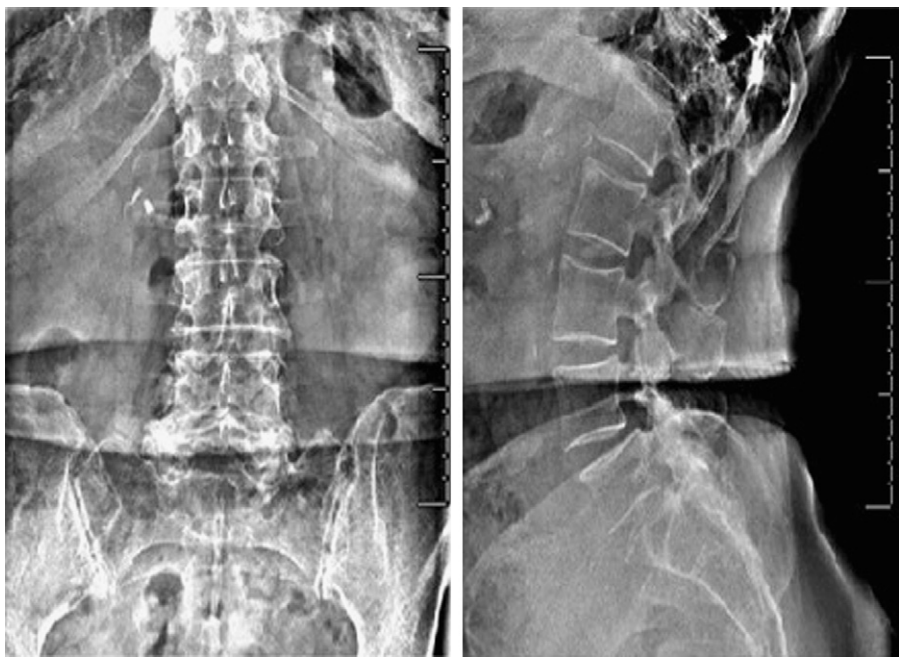

Fig. 1. (Left) Anteroposterior lumbar spine. (Right) Lateral lumbar spine radiograph, displaying L4–L5 spondylolisthesis.

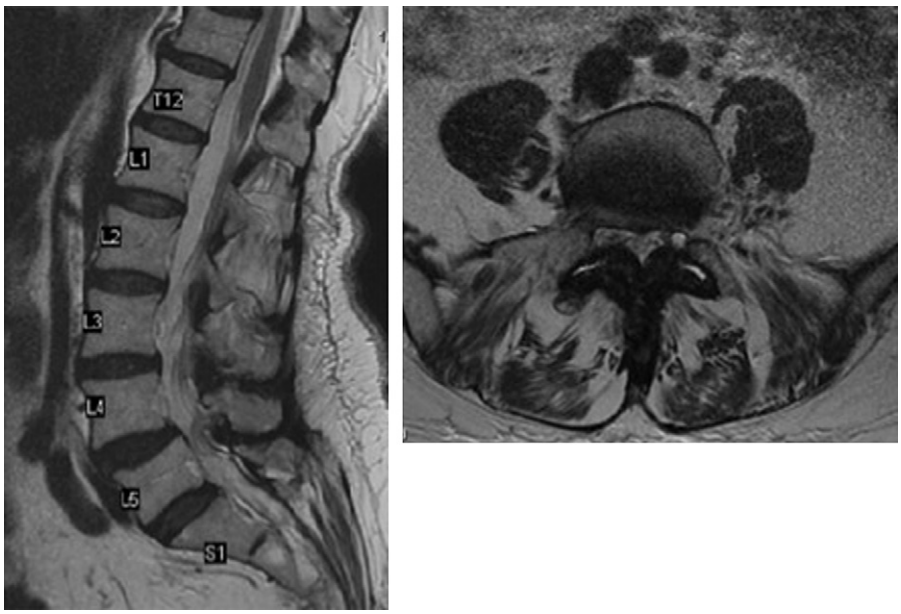

Fig. 2. (Left) T2 sagittal spine magnetic resonance imaging (MRI). (Right) Axial MRI demonstrating foraminal stenosis and left facet cyst.

tissue plane dissection is used as in a percutaneous approach. After the skin incision, the subcutaneous fat is dissected, and the external oblique muscle is visualized. The external and internal oblique muscles are then bluntly dissected in line with their fibers until the transversus muscle and transversalis fascia are identified. The transversalis fascia is sharply cut with metzenbaum scissors for direct repair later. The psoas muscle is then identified and dissected under direct visualization to minimize any neural injury. The discectomy and lateral interbody fusion are performed using standard technique (Oracle; Synthes, West Chester, PA, USA). The closure consists of direct repair of the transversalis fascia with 0 vicryl sutures and final skin closure. The patient was then placed prone for posterior percutaneous screws and decortication of the facet joints and a posterolateral fusion (Constellation; Synthes). There were no complications intraoperatively or postoperatively. The patient reported significant relief of her back and lower extremity pain during the follow-up visits (Fig. 3).

Approximately 4 weeks after surgery, the patient noticed a tender prominence over the lateral surgical incision on her flank. On examination, the incision was intact and the patient had no signs of infection. However, the baseball-size prominence was noted along her flank incision, which increased in size with Valsalva and bowel movements. The tissue was easily reducible but was painful, particularly

Fig. 3. (Left) Anteroposterior lumbar spine radiograph after the lateral interbody and percutaneous posterolateral fusion. (Right) Lateral lumbar spine radiograph displaying the interbody implant and posterior screws.

with lying down. A computed tomography scan was obtained, and it revealed a hernia with the sigmoid colon pushing through the transversalis fascia and attenuation of the oblique muscle layers (Fig. 4). The general surgery service was consulted for further evaluation. The patient chose to undergo a laparoscopic hernia repair. Intraoperatively, a 2×3-cm fascial defect was identified. Based on preoperative imaging and intraoperative findings, the hernia occurred through the attenuated transversalis fascia along the original suture line. The peritoneum was not disrupted, but peritoneal contents had herniated through the fascial defect, transversus abdominis, and internal oblique muscles. The external oblique muscle remained intact (Fig. 5). The sigmoid colon was easily reduced, and the defect was primarily closed using suture and reinforced with a polypropylene mesh (Figs. 6 and 7). The patient had an uneventful recovery and has resumed her normal activities.

Discussion

The minimal access lateral approach presents a novel option in the spine surgeon's armamentarium. As more surgeries are being performed using this technique, we have, however, began to observe a number of emerging complications. Injury to the nerves of the lumbar plexus traversing the psoas muscle is a well-documented complication, for which intraoperative neurophysiological monitoring is necessary to aid in its prevention [6]. Nevertheless, new thigh numbness, dysesthesias, pain, or weakness is reported in 30.4% of the patients undergoing lateral approach surgery [7]. There are reported cases of cerebrospinal fluid leak and intraoperative bowel injury, necessitating laparotomy and segmental bowel resection as well [7,8].

Incisional hernias are a relatively common complication after abdominal surgery, including anterior approaches to the spine. Reports show an incidence of 2% to 14% [9–11]. A hernia may occur when the abdominal muscle is weakened and allows intra-abdominal tissue to protrude through. Incisional scar tissue is especially prone to developing hernias because of their disorganized histologic structure. Hollinsky and Sandberg [12] determined that abdominal scar tissue ruptures at 69% to 73.3% of the load, compared with the normal tissue from the linea alba.

Incisional hernias may be electively repaired when they are symptomatic or if they are cosmetically unappealing. Incisional hernias pose a risk of incarceration, strangulation, respiratory dysfunction, abdominal wall fibrosis, and skin problems [13]. Fear of incarceration is the most frequent motivation for repair. After a hernia becomes incarcerated and strangulated, it needs an emergent surgery. This bears different risks and complications of itself. Incarceration or strangulation was a reason to operate in 6% to 14.6% of incisional hernias [14–16]. However, the true risk for incarceration or strangulation has not been reported [13].

Abdominal viscera that are left unreduced will protrude through the abdominal wall and over time will cause muscle retraction. This will increase the abdominal wall defect and decrease the abdominal capacity. The area surrounding the defect will undergo atrophic changes and develop fibrosis, leading to poorer cosmesis and, potentially, respiratory dysfunction [13,17]. General surgeons typically offer surgical repair of an incisional hernia for both cosmesis and prevention of any late complications even if the patient is asymptomatic.

Currently, there are no reliable methods to prevent incisional hernias. Even pre-emptive intraoperative mesh placement is not a viable solution, as a study performed by Herbert et al. [18] demonstrated that prophylactic mesh placement after a traditional anterior approach resulted in an unacceptably high rate of complications, including infection and persistent symptomatic seroma, necessitating mesh excision.

An incisional hernia that occurred 8 months after an anterior lumbar interbody fusion surgery for degenerative spondylolisthesis at L4–L5 has recently been described

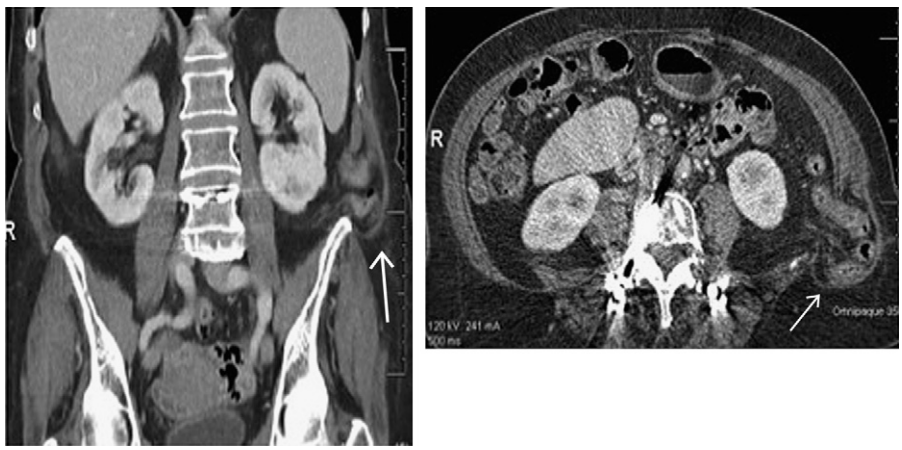

Fig. 4. (Left) Coronal computed tomography (CT) displaying colonic herniation through the abdominal wall (arrow). (Right) Axial CT displaying colon herniating through the abdominal wall (arrow).

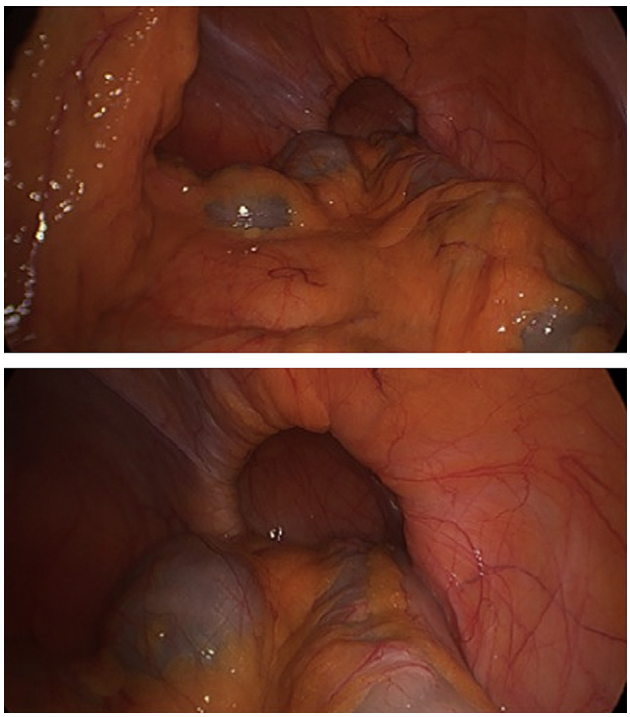

Fig. 5. (Top) Intraoperative photograph showing a partially reduced hernia and defect. (Bottom) A closer view, intraoperative photograph of the abdominal wall defect.

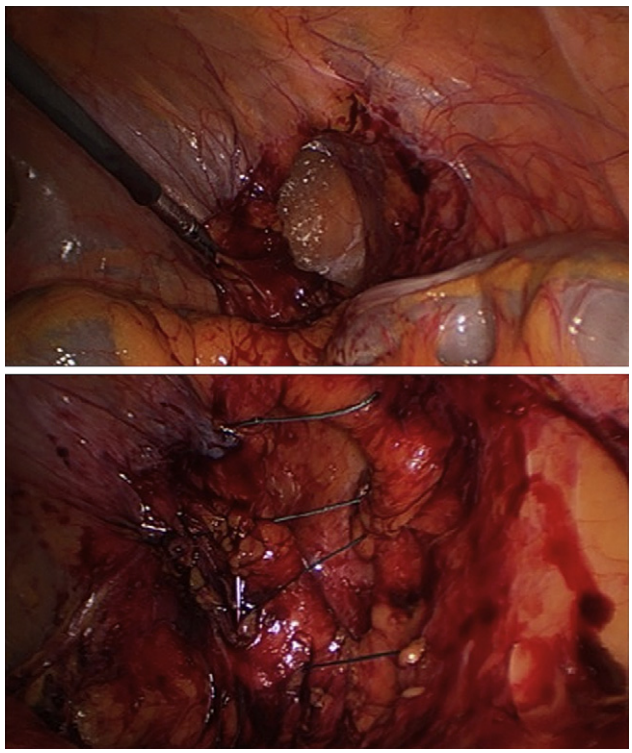

Fig. 6. (Top) Intraoperative photograph after colon mobilization. (Bottom) Intraoperative photograph showing primary closure of the hernia.

by Paik [19]. However, the etiology of an incisional hernia occurring after a far lateral interbody fusion is not completely understood.

The anatomic layers of the abdominal wall include skin, subcutaneous tissue, superficial fascia, deep fascia, muscle, extraperitoneal fascia, and peritoneum. The major source of structural integrity and strength of the lateral abdominal wall is provided by the deep musculofascial layer. The main paired abdominal muscles include the external oblique muscles, internal oblique muscles, transversus abdominis muscles, and their respective aponeuroses, which provide core strength and protection to the abdominal wall viscera. The external oblique muscle is the largest and thickest of the flat abdominal wall muscles [20]. Transversalis fascia, deep to the transverses muscle, may be relatively thin over the lateral abdominal wall that is closest to the peritoneum. However, it becomes thicker more posteriorly as it runs along to its attachment to the transverse processes. Transversalis fascia is one of the main components that maintain structural integrity of the retroperitoneal space.

The retroperitoneum is not typically prone to herniation. However, retroperitoneal hernias have been described after a lateral approach surgery for aortic aneurysm repairs and nephrectomies [21–23]. Patients typically present with a bulging flank mass months to years after the surgery. Computed tomography scans demonstrate that hernias occur largely because of muscular degeneration and atrophy. Iatrogenic denervation is the most likely explanation for these findings on computed tomography [24,25]. Marquez and Finol [26] demonstrated that muscular denervation is followed by significant alterations in fiber content on the cellular level. These changes translate into attenuated structural integrity and can subsequently result in herniation. Muscle denervation during surgery may not always be avoided. However, the risk can be minimized by using blunt dissection of the abdominal wall muscles during lateral approach surgery and avoiding injuring the neurovascular structures.

In this case, perhaps with an increase in intra-abdominal pressure, as with a bowel movement, the patient's sigmoid colon pushed against the peritoneal sac and a weakened retroperitoneal fascia, thus protruding through the abdominal muscles at the incision site. This resulted in a defect of the surgically repaired transversails fascia and internal oblique muscles as seen on imaging and the laparoscopy. The external oblique muscle, however, remained intact.

If surgeons performing a lateral approach are aware of this complication, it will be possible to recognize the incisional hernia early and perhaps possible to avoid it altogether. We recommend placing the surgical incision as posterior as possible in the thicker transversalis fascia. Utilization of blunt dissection technique is important to avoid denervation and resultant muscle atrophy. Additionally, direct repair of the fascia is critical and perhaps a nonabsorbable suture may provide a more durable closure. Precautions to minimize postoperative strain and increased

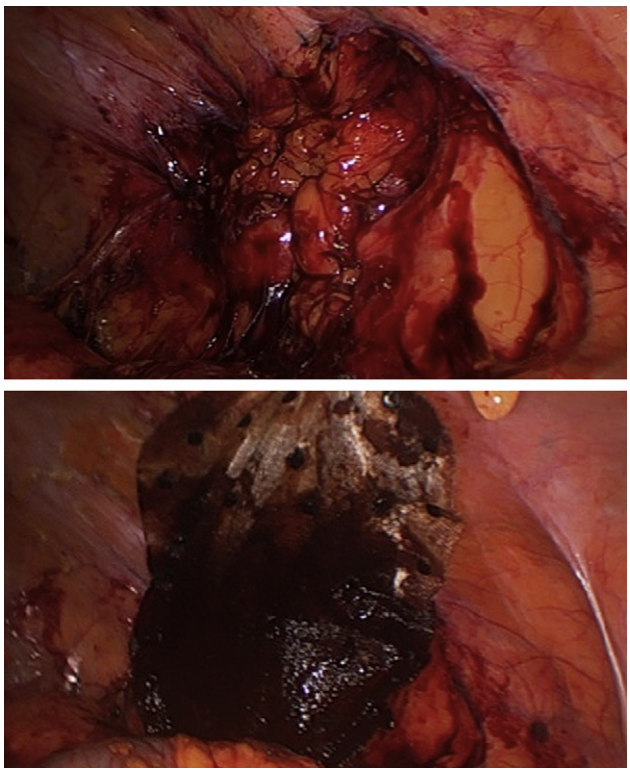

Fig. 7. (Top) Intraoperative photograph displaying a closed hernia. (Bottom) Intraoperative photograph displaying reinforcement of hernia defect with a polypropylene mesh.

intra-abdominal pressure should also be taken. Our patients are placed on an aggressive bowel care program to avoid postoperative constipation. Finally, patient and surgeons need to be made aware of this entity, understand the additional risks of the lateral approach, and expedite the recognition of complications.

References

[1] Shields DC, Khoo LT, Goldberg G, Vaccaro AR. Anatomical approaches for minimally invasive spine surgery. In: Vaccaro AR, Bono CM, eds. Minimally invasive spine surgery. New York, NY: Informa Healthcare, 2007:1–11.

[2] Park Y, Ha JW. Comparison of one-level posterior lumbar interbody fusion performed with a minimally invasive approach or a traditional open approach. Spine 2007;32:537–43.

[3] Oppenheimer JH, DeCastro I, McDonnell DE. Minimally invasive spine technology and minimally invasive spine surgery: a historical review. Neurosurg Focus 2009;27:E9.

[4] Hsieh PC, Koski TR, Sciubba DM, et al. Maximizing the potential of minimally invasive spine surgery in complex spinal disorders. Neurosurg Focus 2008;25:E19.

[5] Rodgers WB, Cox CS, Gerber EJ. Early complications of extreme lateral interbody fusion in the obese. J Spinal Disord Tech 2010;23:393–7.

[6] Gonzalez AA, Jeyanandarajan D, Hansen C, et al. Intraoperative neurophysiological monitoring during spine surgery: a review. Neurosurg Focus 2009;27:E6.

[7] Wang MY, Mummaneni PV. Minimally invasive surgery for thoracolumbar spinal deformity: initial clinical experience with clinical and radiographic outcomes. Neurosurg Focus 2010;28:E9.

[8] Tormenti MJ, Maserati MB, Bonfield CM, et al. Complications and radiographic correction in adult scoliosis following combined transpsoas extreme lateral interbody fusion and posterior pedicle screw instrumentation. Neurosurg Focus 2010;28:E7.

[9] Halm JA, Lip H, Schmitz PI, Jeekel J. Incisional hernia after upper abdominal surgery: a randomized controlled trial of midline versus transverse incision. Hernia 2009;13:275–80.

[10] Voeller G. Ventral abdominal hernia. In: Fischer JE, Bland KI, eds. Mastery of surgery, Vol 2. Philadelphia, PA: Lippincott Williams & Wilkins, 2007:1947–57.

[11] Mudge M, Hughes LE. Incisional hernia: a 10-year prospective study of incidence and attitudes. Br J Surg 1985;72:70–1.

[12] Hollinsky C, Sandberg S. Measurement of the tensile strength of the ventral abdominal wall in comparison with scar tissue. Clin Biomech (Bristol, Avon) 2007;22:88–92.

[13] Nieuwenhuizen J, Halm JA, Jeekel J, Lange JF. Natural course of incisional hernia and indications for repair. Scand J Surg 2007;96:293–6.

[14] Read RC, Yoder G. Recent trends in the management of incisional herniation. Arch Surg 1989;124:485–8.

[15] Manninen MJ, Lavonius M, Perhoniemi VJ. Results of incisional hernia repair. A retrospective study of 172 unselected hernioplasties. Eur J Surg 1991;157:29–31.

[16] Courtney CA, Lee AC, Wilson C, O'Dwyer PJ. Ventral hernia repair: a study of current practice. Hernia 2003;7:44–6.

[17] DuBay DA, Choi W, Urbanchek MG, et al. Incisional herniation induces decreased abdominal wall compliance via oblique muscle atrophy and fibrosis. Ann Surg 2007;245:140–6.

[18] Herbert GS, Tausch TJ, Carter PL. Prophylactic mesh to prevent incisional hernia: a note of caution. Am J Surg 2009;197:595–8.

[19] Paik NC. Incisional hernia after anterior lumbar interbody fusion. Spine 2010;10:844.

[20] Grevious MA, Cohen M, Shah SR, Rodriguez P. Structural and functional anatomy of the abdominal wall. Clin Plast Surg 2006;33:169–79.

[21] Matsen SL, Krosnick TA, Roseborough GS, et al. Preoperative and intraoperative determinants of incisional bulge following retroperitoneal aortic repair. Ann Vasc Surg 2006;20:183–7.

[22] Gardner GP, Josephs LG, Rosca M, et al. The retroperitoneal incision. An evaluation of postoperative flank 'bulge'. Arch Surg 1994;129:753–6.

[23] Chatterjee S, Nam R, Fleshner N, Klotz L. Permanent flank bulge is a consequence of flank incision for radical nephrectomy in one half of patients. Urol Oncol 2004;22:36–9.

[24] Goodman P, Balachandran S. Postoperative atrophy of abdominal wall musculature: CT demonstration. J Comput Assist Tomogr 1991;15:989–93.

[25] Yamada M, Maruta K, Shiojiri Y, et al. Atrophy of the abdominal wall muscles after extraperitoneal approach to the aorta. J Vasc Surg 2003;38:346–53.

[26] Marquez A, Finol HJ. Effects of neurotomy on human skeletal muscle ultrastructure. Acta Cient Venez 1991;42:319–25.