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# LAPAROSCOPIC APONEUROPLASTY BY SUBCUTANEOUS AND INTRA-ABDOMINAL APPROACH WITH INLAY MESH (LASAIM)

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**ABSTRACT**
Rectus diastasis is an acquired condition in which the rectus muscles are separated by an abnormal distance along their length, but with no fascial defect. The classical performed by laparotomy is very invasive for the patient it comes with all complications of this type of surgery. We propose a laparoscopic minimally-invasive technique with subcutaneous dissection, percutaneous aponeurosis approximation and inlay mesh positioning.

**KEYWORDS:** subcutaneous dissection, percutaneous aponeurosis approximation and inlay mesh positioning.

## INTRODUCTION

The rectus muscles are normally fused in the midline with no more than 1 to 2 cm separating them. Rectus diastasis (RD) (diastasis recti or divarication of the rectus muscles) is an acquired condition in which the rectus muscles are separated by an abnormal distance along their length, but with no fascial defect.[1] Diastasis of the rectus abdominis muscles (DRAM) is characterized by a protruding midline following an increase in intra-abdominal pressure. There is a gradual thinning and widening of the linea alba, combined with a general laxity of the abdominal wall muscles.[2,3]

The main reason for this technique is the necessity of a new approach for the diastasis treatment. The classical diastasis treatment performed by laparotomy is very invasive for the patient it comes with all complications of this type of surgery. The actual surgical technique performed by laparoscopy seems to be reserved for the high skill laparoscopic surgeons. The aim was to establishing a very reproductive surgical technique by minimally invasive surgery. Due to the minimally invasive approach the complications related to this technique are less important than in the classic approach.

This technique can be performed and it accessible with no difference to the obese patient with no difference due to the laparoscopic dissection of the subcutaneous tissue. The aponeurosis approximation is reinforced by an abdominal mesh which guarantees a good postoperative result. LASAIM technique respects the modern principles of laparoscopy by the utilization of resorbable sutures and intraabdominal placement of a mesh.

## Operative technique

### General principles

The patient is placed in supine position on the operating table. The operation is performed under general anesthesia with oro-tracheal intubation. The surgical team is placed on the left side of the patient and the operative screen and the laparoscopy tour on the right side.

The port placement is on the left flank: two trocars of 5-mm for the instruments and one of 10 mm for the optical system. If there are contraindications like scars on the left flank then the trocars can be placed on the right side of the abdomen but also depend on the surgeon's preference.

The first stage of the surgery is the subcutaneous dissection. This is a very important step because the aponeurosis closure can result unaesthetic result if the subcutaneous plane is not liberated from the aponeurosis, forming an inverted ´´V shape´´ on the medial part of the abdomen. Besides the aesthetic aspect, this dissection can help also to reduce the tension during the aponeurosis closure. The second stage of the surgery is the intra-abdominal dissection with the aponeurosis approximation and placement of the mesh.

### Instruments

- Kit of laparoscopy surgery
- 10 mm trocar
- Two 5 mm trocars
- Endo Close suturing device (Covidien)
- Dual mesh

- SorbaFix Absorbable Fixation System (Davol Inc. Subsidiary of C. R. Bard, Inc)

**The operative steps**

The first stage: the subcutaneous dissection

**1. Trocar placement**

Three trocars are required for the procedure. One trocar of 10mm for the optical system and two trocars of 5 mm for grasper and electric hook.

A 10 mm incision is performed on the left flank on the anterior axillary line. The subcutaneous tissue is dissected to create the space for the trocar placement. For this step of the surgery a laparotomy electric scalpel is needed. In creation of space it can be combined blunt and cutting dissection. A good hemostasis control is mandatory. The dissection must be at least 5 cm wide and should be performed in close contact with the aponeurosis.

Once the space is a created a 10mm trocar is put in place and of the insufflation is started. A 5 mm trocar is placed at 5 cm cranially on the anterior axillary line in the left hypochondrium and is inserted under visual control. A 5 mm trocar its placed on the anterior axillary line at 5 cm caudally in the left iliac fossa also under visual control. (Fig. 1).

**2. Subcutaneous dissection**

The subcutaneous dissection is performed with the electric hook in the deep plain of the fatty tissue close to the aponeurosis. The dissection is continued until the right side of the abdomen, to the right anterior axillary line, in mirror. The limits of the dissection are: cranially the xyphoid appendix, caudally the umbilicus or the space under umbilical if the diastasis extends below the umbilicus, laterally the two anterior axillary lines. It is important that the limits of the diastasis are established preoperatively.

The using the electric hook instead of sealing devices can assure a correct homeostasis and decrease the cost of this technique. Using the $CO_2$ insufflations for the subcutaneous dissection at maximum 10 mmHg can limit the CO2 absorption into the blood, allowing the correct space for work and avoid the unwanted subcutaneous emphysema in the near topographic regions.

Hemostasis control is carried out carefully in order not to devascularize the subcutaneous tissue. For the skinny patients the danger is more important and dissection must be kept at distance from the skin. For the patients who present a well-represented fatty tissue the risk is less important. (Fig 2, 3).

The second stage: the intraabdominal dissection

**1. The trocar placement**

The pneumoperitoneum is created using a Veress needle place 1 cm under the costal grill on the anterior mammary line. This technique reserved for the obese patients. For the skinny patients the optical trocar placement is performed by the Hasson open technique. The pressure of insufflation it set to 13mmHg. The three trocars are passing through the different parts of the abdominal wall: the superficial fascia, the muscle, the lower fascia and the peritoneum until access of the abdominal cavity. The 10 trocar is placed by the same skin incision inside the abdomen under visual control and the 5mm trocars are placed under visual control inside the abdomen by the anterior cutaneous incisions. (Fig 4).

**2. Aponeurosis dissection**

On the medial side, the aponeurosis must be prepared and the fatty tissue must be cleaned up. The presence of fatty tissue can interfere with the aponeurosis approximation and mesh placement. On the cranial side, the round ligament must be uninserted, to allow the placement of the mesh. After the mesh is placed the round ligament can be re-fixated on the abdominal wall. Once the aponeurosis is prepared the exploration can put in evidence the presence of some small defects on the like hernias. If there are some hernias this technique can also allow the treatment of the hernias. (Fig 5).

**3. Landmark**

The limits of the diastasis are delimited using the electric hook creating a line. This will help to identify the lateral limits of the diastasis during the suture for approximation. No muscle should be involved in the suture due to the important residual post-operative pain. (Fig 6).

**4. Aponeurosis approximation**

Once the cranial, caudal and lateral limits are the diastasis are established, an Endoclose device is inserted to through the skin in the middle line of the cranio-caudal line of the diastasis. The aponeurosis it's approximate using resorbable sutures. An "X" suture is placed. By the same skin incision is possible to perform one suture on the cranial side and one on the caudal side. The distance between the stitches should not be more than 1 cm. Using the same technique, the entire length of the aponeurosis it's approximate. (Fig 7, 8).

**5. Mesh placement**

Due to the intraabdominal position of the mesh, a special mesh with a non-adherent side must be placed. The size of the mesh corresponds to the length of the diastasis approximation. The fixation of the mesh to the posterior side of the abdominal wall is performed with absorbable tacks. The fixation can be completed by adding some stitches placed using the Endoclose device on the lateral side of the mesh. (Fig 9).

**6. Trocars removal**

The aponeurosis and the mesh placement is inspected and the trocars are removed under visual control. If there are some umbilication of the skin due to suture placement there is the possibility to return to the

subcutaneous plane and the free completely the subcutaneous tissue. (Fig 10).

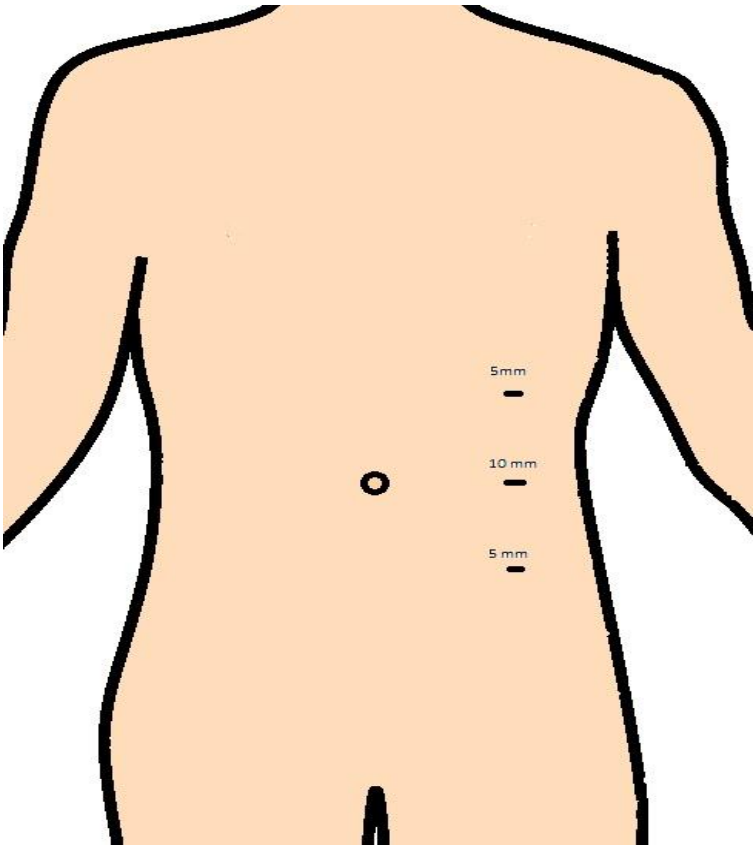


**Fig. 1: Trocar disposition.**

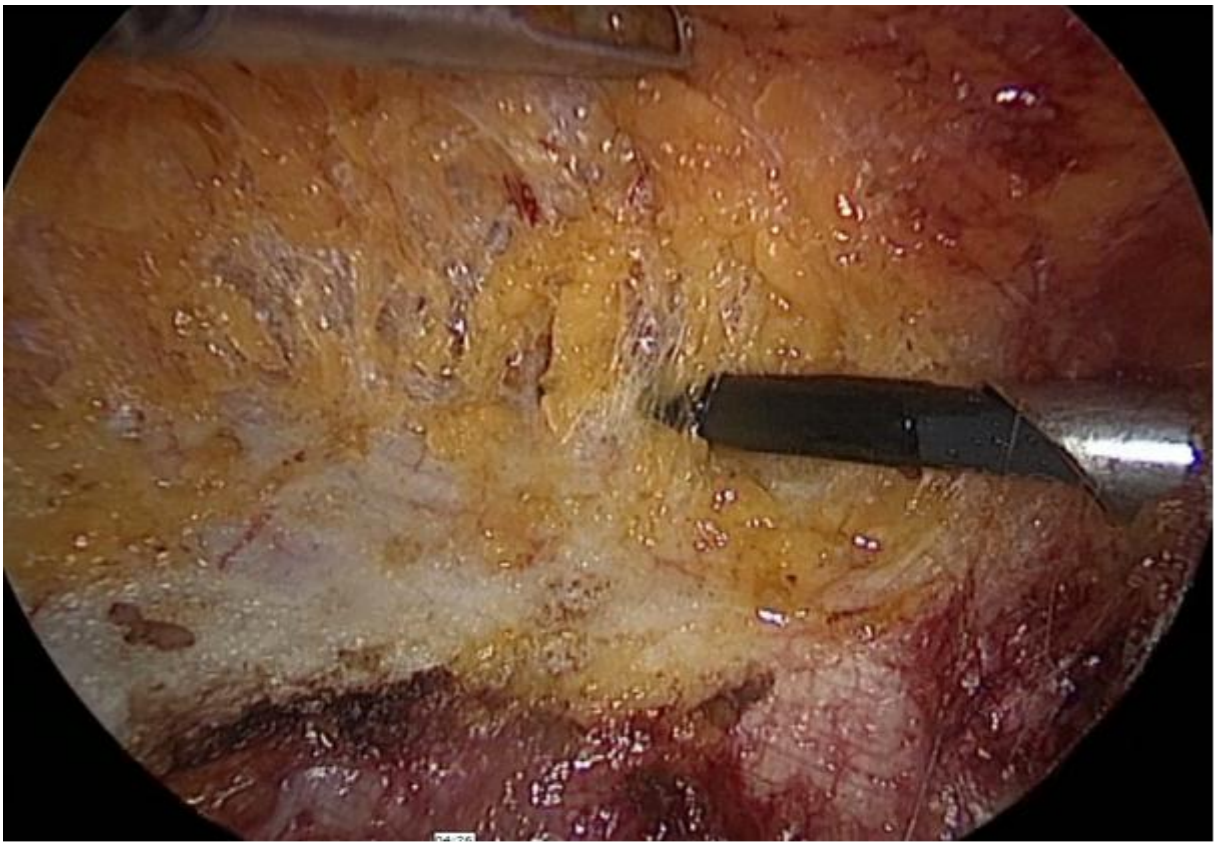

**Fig. 2: Subcutaneous dissection is performed with the electric hook.**

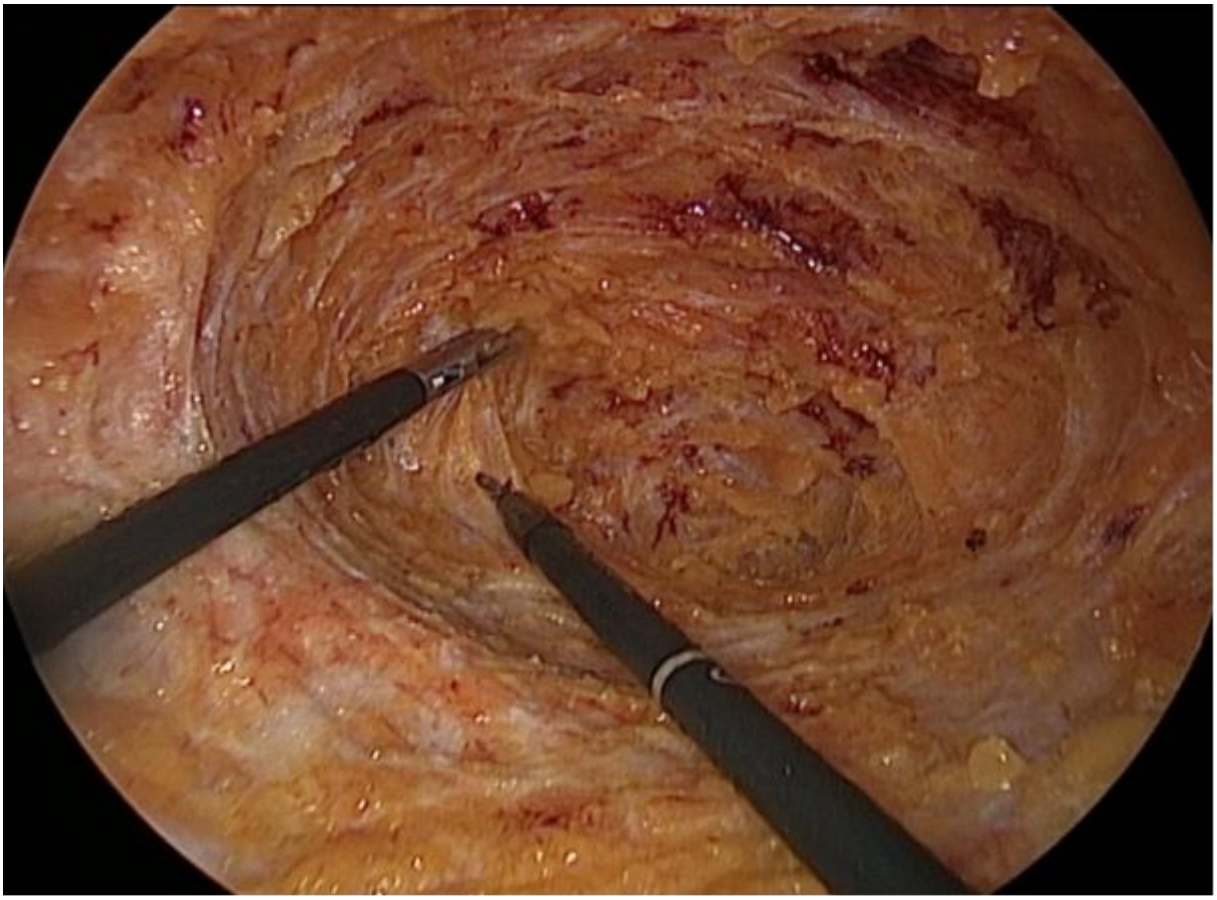

**Fig. 3: The subcutaneous plane is dissected by the aid of the $CO_2$ pressure of insufflation.**

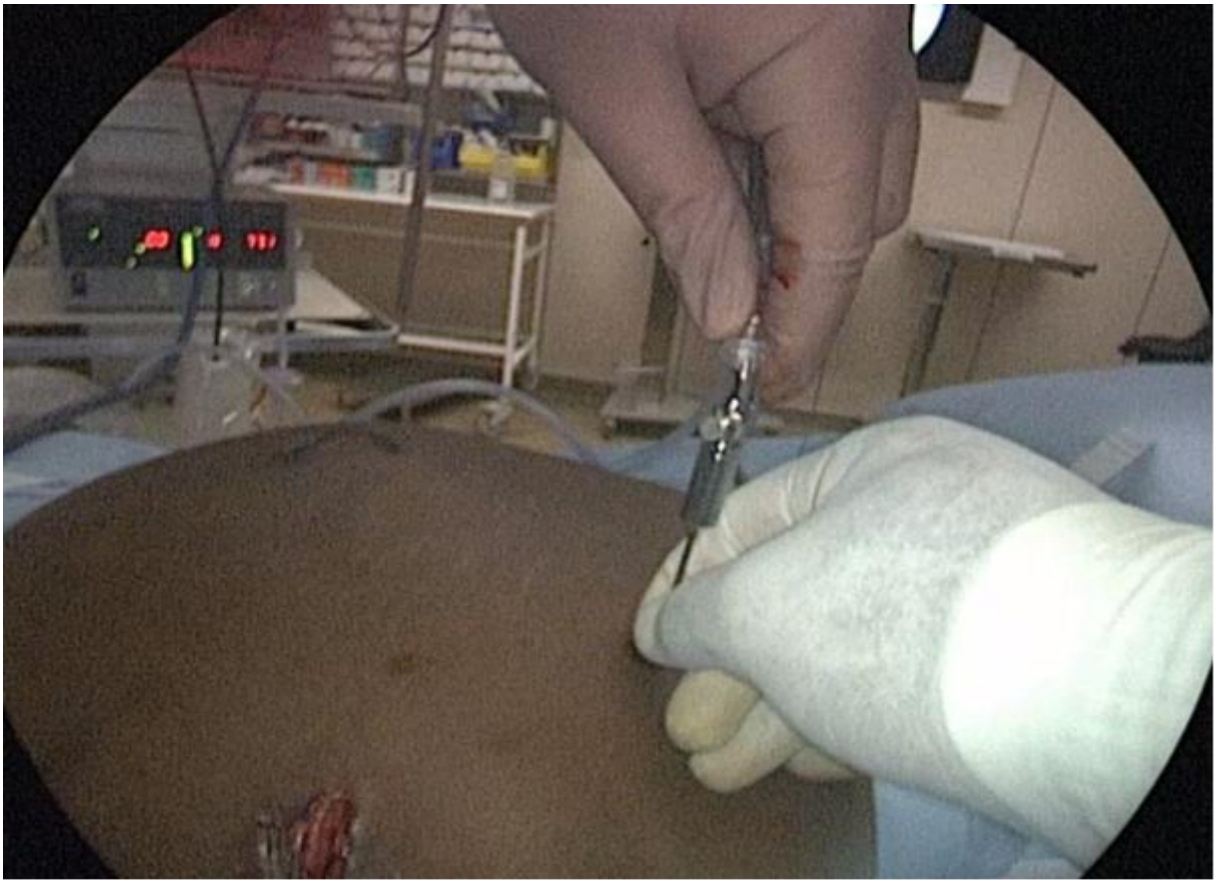

**Fig. 4: The Veress needle is place on the anterior axillary line under the costal grill.**

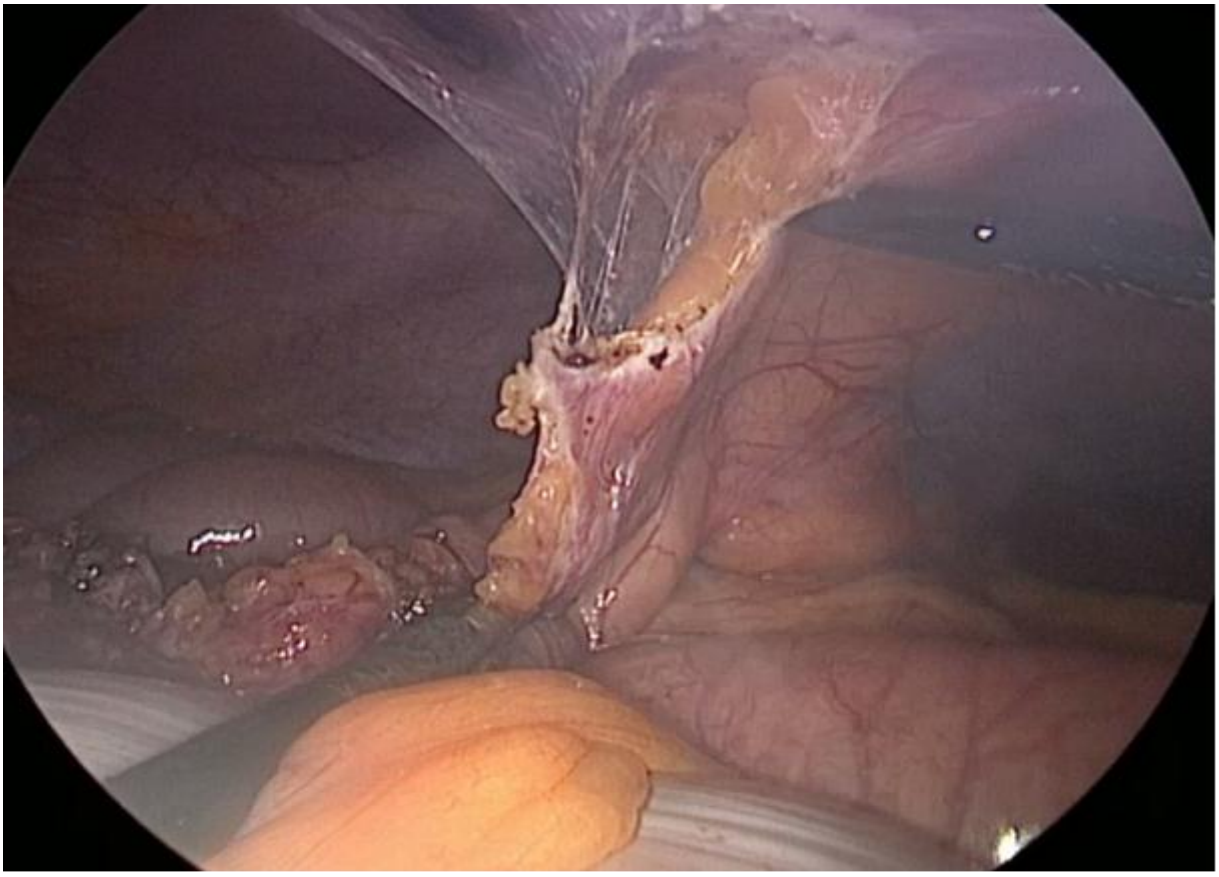

**Fig. 5: The preperitoneal plane is dissected and the round ligament is disinserted.**

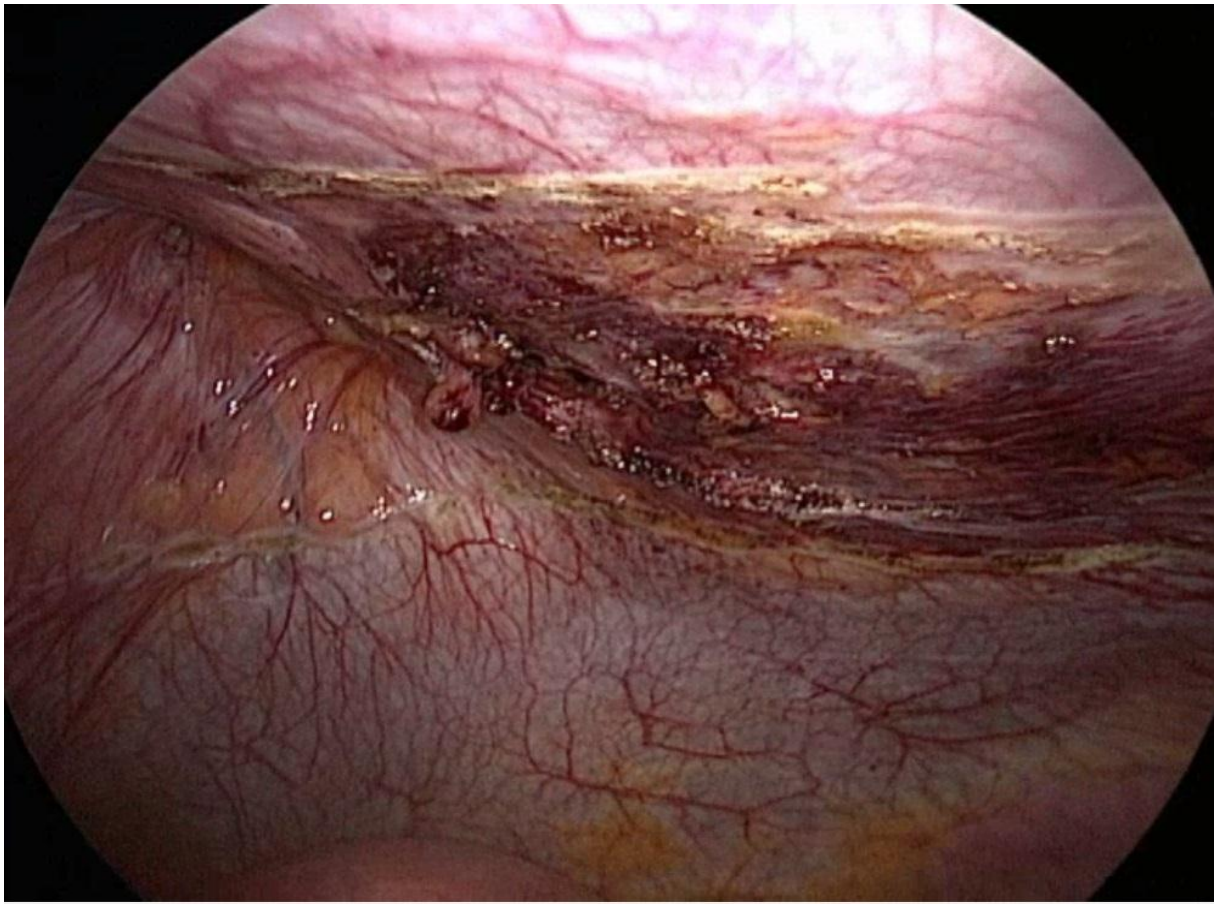

**Fig. 6: The medial side of the rectus abdominis is scored using the electric hook.**

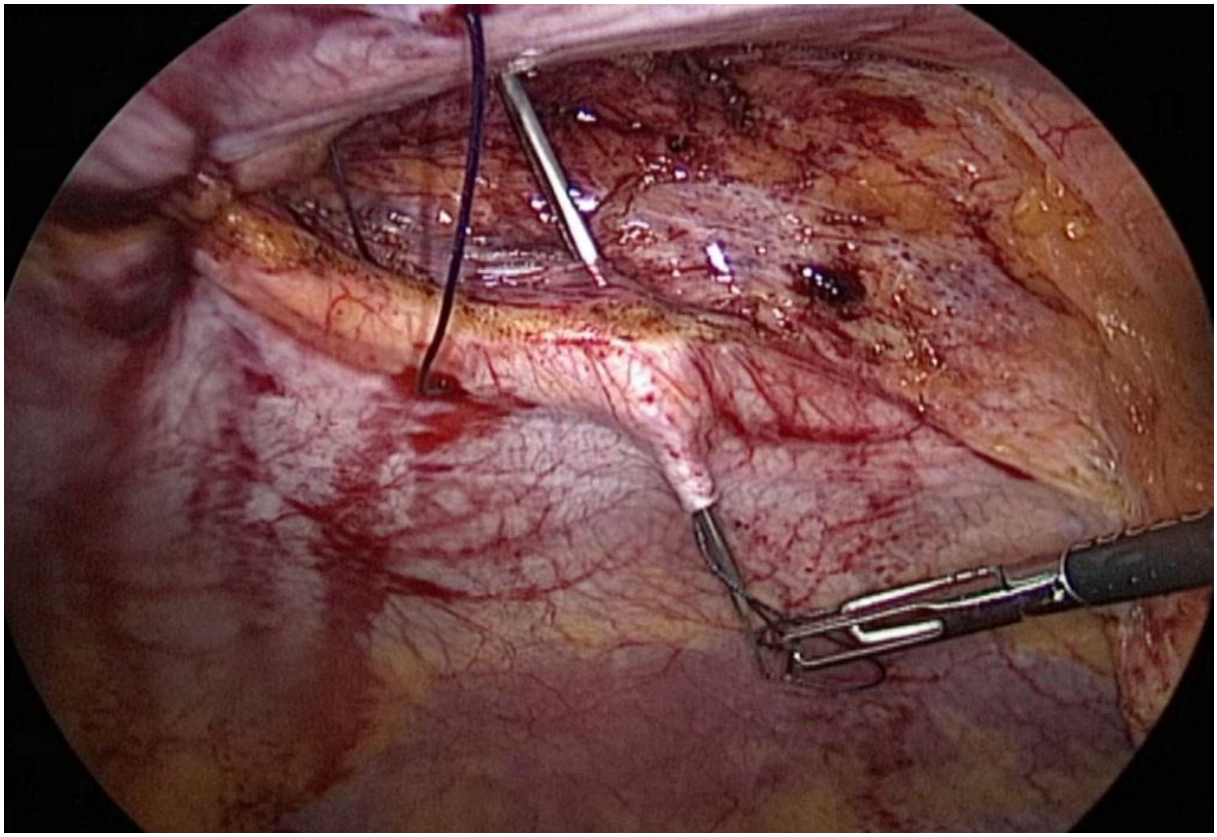

**Fig. 7: The aponeurosis is approximated using the Endoclose device.**

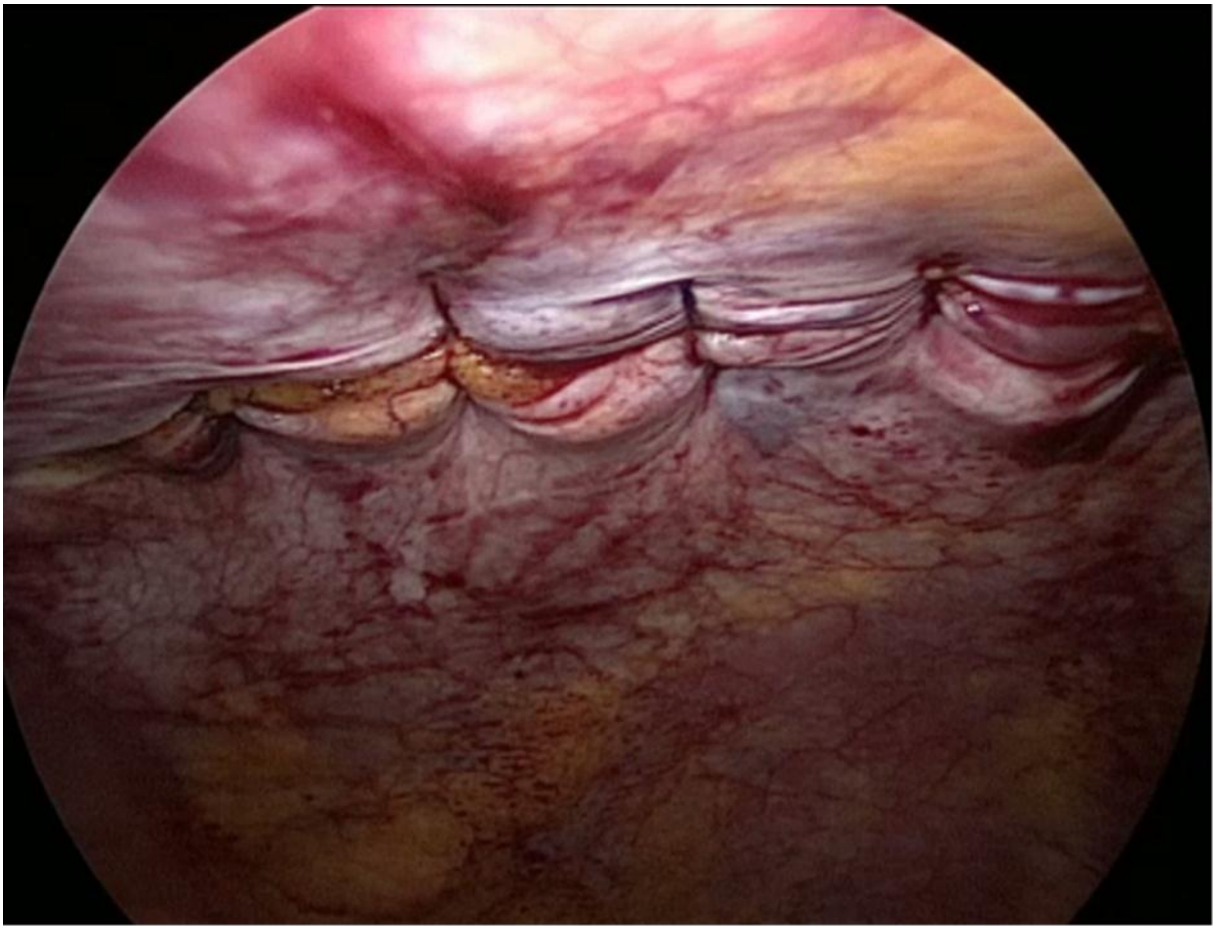

**Fig 8: Final result after the aponeurosis approximation.**

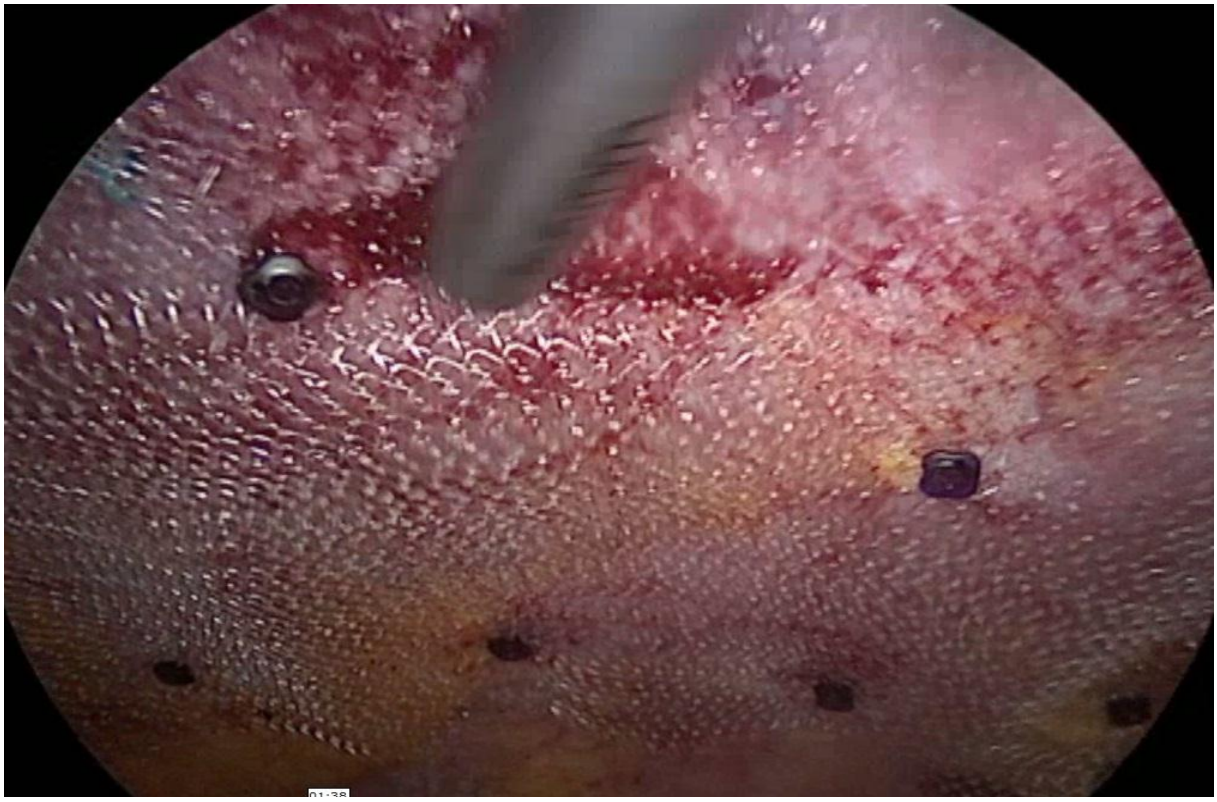

**Fig. 9: The mesh is fixated using the absorbable tacks.**

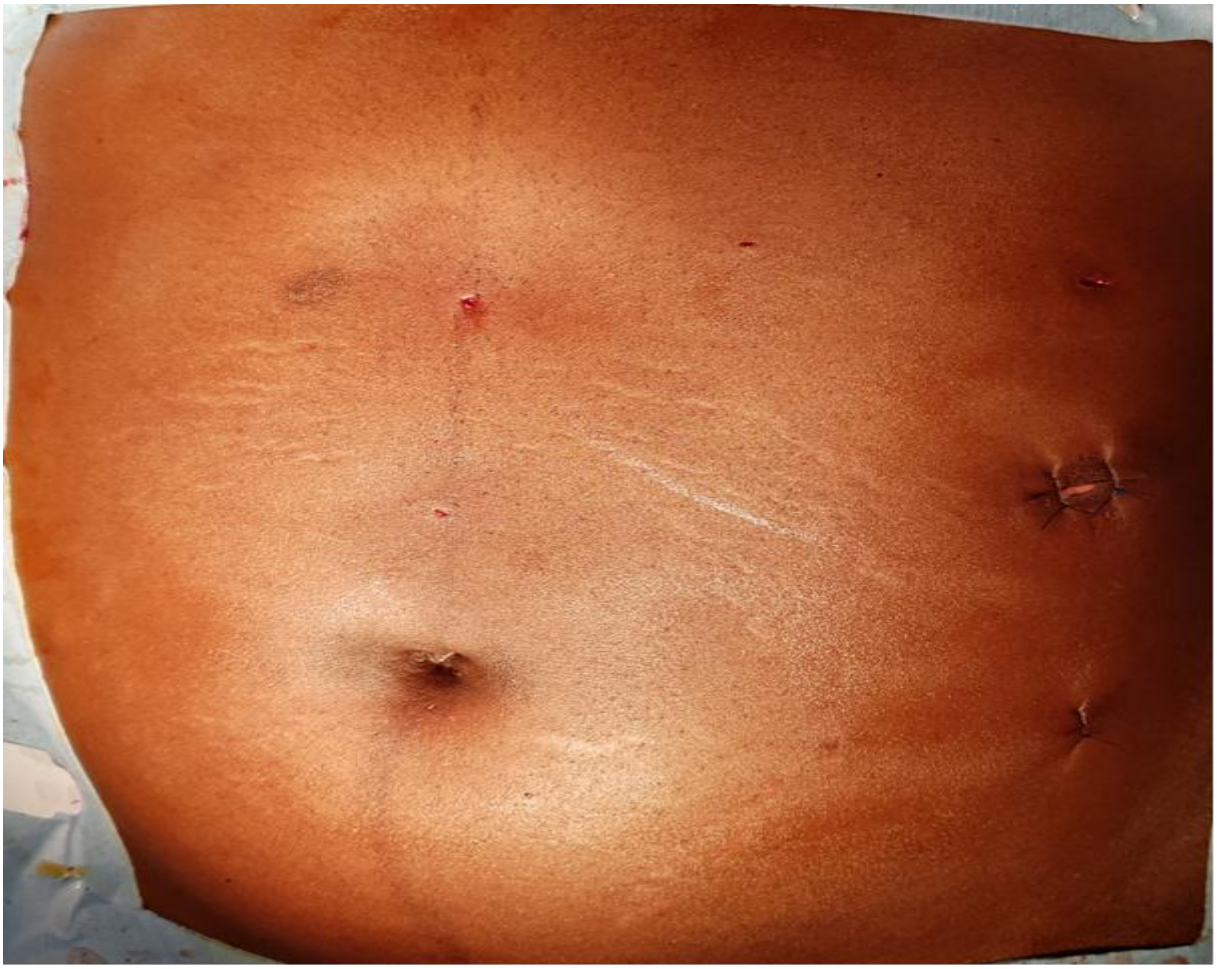

**Fig. 10: Final external result.**

## DISCUSSIONS

Determining a DRAM is done using as criteria a separation of more than 2 cm at one or more points of the linea alba, including the level of the umbilicus or 4.5 cm above or below it or a visible midline bulge with exertion. Rectus abdominis separation is more predominant in the supra-umbilical region and can be linked to the patient's age as well as and body mass index.[4-6] Increased intraabdominal pressure causes tissue expansion of the abdominal wall, particularly at the linea alba. Certain conditions (such as genetic predisposition or chronic obstructive pulmonary disease) increase the risk of developing rectus diastasis. Most women develop rectus diastasis after pregnancy, particularly those involving multiple gestations or sequential large infants.

Female pattern rectus diastasis is centered at the level of the umbilicus, but can extend up to the xiphoid and down to the symphysis pubis. Male pattern rectus diastasis, in contrast develops more frequently as a sequela of increased intraabdominal fat volume, on supra-umbilical position. It occurs usually in the fifth to sixth decades of life.[7] DRA is highly prevalent throughout pregnancy and postpartum. An estimated 30% to 70% of pregnant women have this condition and 35-60% remain affected into the postpartum period.[8–10] Furthermore, it has been found that 23-32% of women have persistent DRA at 1-year post-partum.[11,12] Some of the reported consequences of DRA include: cosmetic concerns; lumbopelvic pain; and pelvic floor dysfunctions manifested as urinary incontinence, fecal incontinence, and pelvic organ prolapse.[13–15] Due to its high prevalence and associated functional impairment secondary, and understanding of best conservative care strategies are important for women's health physiotherapists and other relevant perinatal care practitioners.

DRAM repair is challenging for most general surgeons since guidelines on indication and methods for repair do not exist. The similarity to primary ventral hernias causes frequent misclassification of the disease and potential mistreatment of DRAM. Over the years, the overall complexity of evidence concerning DRAM treatment has increased. This is due to the development and implementation of several new reconstructive techniques, combined with heterogenous outcome measurements, heterogenous definitions for DRAM, and the lack of high-quality data.

DRAM can be treated conservatively by physiotherapy. If conservative therapy is preferred, patients can be referred to a physiotherapist for training programs that specifically target DRAM. Benjamin et al. evaluated the efficacy of these training programs, but due to the low quality of the included studies, no conclusions could be drawn.[7]

The assessment of DRA should encompass other parameters including the tension generating capability of the linea alba (LA) with a voluntary pelvic floor or transversus abdominis (TA) contraction and assessing the integrity of the LA with digital palpation.14 Currently there is not an established method of operationalizing these assessment techniques. There are no published guidelines for the optimal conservative management of DRA, a widely used and well-accepted, although yet to be proven effective.[8,11,12,14,15] Based on the current literature, no clear distinction can be made in the recurrence rate, postoperative complications, or patient reported outcomes.[13]

There are numerous innovative minimally invasive techniques recently reported in the literature for treatment of RD with concomitant ventral hernias.[14,16–29] The promising results of new procedures with extraperitoneal mesh placement and anatomical restoration of the linea alba, such as the endoscopic-assisted or endoscopic mini open sublay repair (MILOS, EMILOS), endoscopic assisted linea alba reconstruction (ELAR), laparoscopic linea alba stapler repair, enhanced total extraperitoneal ventral hernia repair (eTEP), laparoscopic intracorporeal rectus aponeuroplasty (LIRA), preaponeurotic endoscopic repair (REPA) and totally endoscopic sublay (TES), have to be confirmed in future trials.[14,16–25] For enhanced comparability of the treatment results of hernia surgery a recognized classification system is indispensable.[26]

## CONCLUSION

Classically the treatment of rectus diastasis is performed by a large abdominal incision that causes a post-operative pain and an anesthetic damage. We describe a laparoscopic technique for the rectus diastasis treatment with subcutaneous aponeurosis dissection, transcutaneous aponeurosis approximation and intraabdominal placement of a mesh. LASAIM procedure is accessible starting to mid-level laparoscopic surgeons, the equipment used is usual and is very reproductible.

## REFERENCES

1. Brooks DC. Overview of Abdominal Wall Hernias in Adults. (2015).
2. Brauman D (2008) Diastasis recti: clinical anatomy. Plast Reconstr Surg, 122(5): 1564–1569.
3. Dumanian GA. Abdominal wall reconstruction. In: Thorne CH, Chung KC, Gosain AK, editors. In: Grabb and Smith's Plastic Surgery. 7th ed. Philadelphia: Wolters Kluwer, 2014; 933–940.
4. Lo T, Candido G, Janssen P. Diastasis of the recti abdominis in pregnancy: risk factors and treatment. Physiother Can., 1999; 51(l): 32-7.
5. Gilleard WL, Brown JM. Structure and function of the abdominal muscles in primigravid subjects during pregnancy and the immediate postbirth period. Phys Ther., 1996; 76(7): 750-62.

6. Noble E. Essential exercises for the childbearing year: a guide to health and comfort before and after your baby is born, 4th ed. Harwich, MA: New Life Images, 1995.
7. Brauman D. Reply. Plast Reconstr Surg, 2009; 124: 334–335.
8. da Mota P, Pascoal A, Carita A, et al. Prevalence and risk factors of diastasis recti abdominis from late pregnancy to 6 months postpartum, and relationship with lumbo-pelvic pain. Man Ther., 2015; 20(1): 200– 205.
9. Boissonnault JS, Blaschak MJ. Incidence of diastasis recti abdominis during the childbearing year. Phys Ther., 1988; 68(7): 1082–1086.
10. Bursch SG. Interrater reliability of diastasis recti abdominis measurement. Phys Ther., 1987; 67(7): 1077–1079.
11. Sperstad j, Tennfjord M, Hilde G, et al. Diastasis recti abdominis during pregnancy and 12 months after childbirth: prevalence, risk factors and report of lumbopelvic pain. Br J Sports Med., 2016; 50(17): 1092–1096.
12. Mommers EHH, Ponten JEH, Al Omar AK, de Vries Reilingh TS, Bouvy ND, Nienhuijs SW. The general surgeon's perspective of rectus diastasis. A systematic review of treatment options. Surg Endosc., 2017; 31: 4934–49. doi: 10.1007/s00464-017-5607-9
13. Köhler G, Kuketina RR, Emmanuel K. Sutured repair of primary small umbilical and epigastric hernias: concomitant rectus diastasis is a significant risk factor for recurrence. World J Surg., 2015; 39: 121–6. doi: 10.1007/s00268-014-2765-y
14. Bellido Luque J, Bellido Luque A, Valdivia J, Suarez Grau JM, Gomez Menchero J, Garcia Moreno J, et al. Totally endoscopic surgery on diastasis recti associated with midline hernias. The advantages of a minimally invasive approach. Prospective cohort study. Hernia, 2014; 19: 493–501. doi: 10.1007/s10029-014-1300-2
15. Hickey F, Finch JG, Khanna A. A systematic review on the outcomes of correction of diastasis of the recti. Hernia, 2011; 15: 607–14. doi: 10.1007/s10029-011-0839-4
16. Reinpold W, Schröder M, Berger C, Nehls J, Schröder A, Hukauf M, et al. Mini- or Less-open Sublay Operation (MILOS): a new minimally invasive technique for the extraperitoneal mesh repair of incisional hernias. Ann Surg. (2018). doi: 10.1097/SLA.0000000000002661
17. Schwarz J, ReinpoldW, Bittner R. Endoscopic mini/less open sublay technique (EMILOS) – a new technique for ventral hernia repair. angenbecks Arch Surg., 2017; 402: 173–8. doi: 10.1007/s00423-016-1522-0
18. Reinpold W, Schröder M, Schröder A, Berger C, Nehls J, Stoltenberg W, et al. Minimally invasive sublay mesh repair of incisional and primary abdominal wall hernias using the MILOS technique. Eur Surg., 2017; 49: 59–64. doi: 10.1007/s10353-017-0475-z
19. Bittner R, Schwarz J. Endoscopic mini/less open sublay operation for treatment of primary and secondary ventral hernias of the abdominal wall. Eur Surg., 2017; 49: 65–70. doi: 10.1007/s10353-017-0472-2
20. Köckerling F, Botsinis MD, Rohde C, Reinpold W, Schug-Pass C. Endoscopic-assisted linea alba reconstruction new technique for treatment of symptomatic umbilical, trocar, and/or epigastric hernias with concomitant rectus abdominis diastasis. Eur Surg., 2017; 49: 71–5. doi: 10.1007/s10353-017-0473-1
21. Köckerling F, Botsinis MD, Rohde C, Reinpold W. Endoscopic-assisted linea alba reconstruction plus mesh augmentation for treatment of umbilical and/or epigastric hernias and rectus abdominis diastasis – early results. Front Surg., 2016; 3: 27. doi: 10.3389/fsurg.2016.00027
22. Belyansky I, Daes J, Radu VG, Balasubramanian R, Zahiri HR, Weltz AS et al. A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. Surg Endosc., 2018; 32: 1525–32. doi: 10.1007/s00464-017-5840-2
23. Köhler G, Fischer I, Kaltenböck R, Schrittwieser R. Minimal invasive linea alba reconstruction for the treatment of umbilical and epigastric hernias with coexisting rectus abdominis diastasis. J Laparoendosc Adv Surg Tech A, 2018; 28: 1223–8. doi: 10.1089/lap.2018.0018
24. Goez-Menchero J, Guadalajara Jurado JF, Suarez Grau JM, Bellido Luque JA, Garcia Moreno JL, Alarcon del Agua I, et al. Laparoscopic intracorporeal rectus aponeuroplasty a step forward in minimally invasive abdominal wall reconstruction for ventral hernia repair (LVHR). Surg Endosc., 2018; 32: 3502–8. doi: 10.1007/s00464-018-6070-y
25. Costa TN, Abdalla RZ, Santo MA, Tavares RRFM, Abdalla BMZ, Cecconello I. Transabdominal midline reconstruction by minimally invasive surgery: technique and results. Hernia, 2016; 20: 257–65. doi: 10.1007/s10029-016-1457-y
26. Muysoms FE, Miserez M, Berrevoet F, Campanelli G, Champault GG, Chelala E, et al. Classification of primary and incisional abdominal wall hernias. Hernia, 2009; 13: 407–14.