

Minimally Invasive Repair of Rectus Diastasis (MILA) with Preservation of the Umbilical Ligament: A Technical Description

Descrição da correção minimamente invasiva da Diástase do Reto Abdominal (MILA) com preservação do ligamento umbilical

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ABSTRACT

Diastasis rectus abdominis (DRA) is a frequent condition of the anterior abdominal wall, with functional and aesthetic impact, whose surgical treatment has progressively evolved to less invasive approaches. Among these, MILA (Minimally Invasive Lipoabdominoplasty) stands out for allowing the correction of diastasis endoscopically in the supra-aponeurotic plane. The present article details the MILA technique with umbilical ligament preservation, emphasizing its technical and anatomical aspects, as well as the selection criteria and the fundamental surgical steps for its reproducibility. This is a technical description, without analysis of clinical outcomes or comparison between methods. The preservation of the umbilical ligament is a differential of the technique, contributing to the maintenance of the umbilical anatomy and the natural abdominal contour. The systematized description of MILA can help surgeons standardize the technique and serve as a basis for future comparative clinical studies.

Keywords: Diastasis Rectus Abdominis. Minimally Invasive Surgery. Laparoscopy. Abdominal Wall. Navel.

INTRODUCTION

Diastasis rectus abdominis (DRA) is characterized by excessive distancing of the rectus abdominis muscles along the linea alba, resulting from changes in the strength and integrity of its connective tissue. It is a condition often associated with pregnancy, but it can also occur in individuals with significant weight gain, previous abdominal surgeries, or constitutional factors^{1,2}. Epidemiological studies have shown high prevalence of DRA during pregnancy and in the postpartum period, which may persist in a sizable portion of patients¹.

Although sometimes considered an aesthetic alteration, DRA may be associated with relevant functional repercussions, including low back pain,

sensation of abdominal wall instability, decreased core strength, and negative impact on quality-of-life^{2,3}. From an anatomical point of view, linea alba plays a fundamental role in the transmission of forces from the abdominal muscles, and the pathological increase in its width is related to anterior abdominal wall dysfunction^{4,5}.

Therapeutic options for DRA include conservative and surgical approaches. Conservative treatment, based on physical therapy and muscle strengthening, has variable results and limited efficacy in cases of moderate to severe diastasis⁶. In these situations, surgical correction is the most effective alternative for restoring the abdominal wall's anatomy and function^{7,8}.

Traditionally, surgical correction of DRA has been performed using open techniques, such as conventional abdominoplasty. Although effective, these procedures are associated with greater morbidity, prolonged recovery time, and extensive scarring⁹. With the advancement of minimally invasive surgery, endoscopic and laparoscopic techniques have emerged that allow diastasis correction with less tissue aggression, lower complication rate, and faster recovery^{10,12}.

Among the minimally invasive approaches described in the literature, laparoscopic subcutaneous repair (SCOLA), endoscopic preaponeurotic repair (REPA), and endoscopic reconstruction of the linea alba stand out, all of which with promising results in the treatment of DRA, whether isolated or in association with midline defects^{10,13}. However, despite the increasing diffusion of these techniques, there is still heterogeneity in the nomenclature, indication criteria, and technical details described^{12,14}.

The MILA (Minimally Invasive Lipoabdominoplasty) technique has been proposed as an endoscopic approach in the supra-aponeurotic plane, allowing plication of the rectus muscles associated with complementary aesthetic procedures¹⁵. However, the systematized preservation of the umbilical ligament, especially in patients without associated umbilical hernia, still lacks a standardized technical description in the literature. Considering the anatomical importance of the umbilical ligament for the maintenance of the contour and viability of the umbilicus, its preservation may represent a relevant technical differential¹⁶.

This context justifies a detailed technical description of MILA with umbilical ligament preservation, emphasizing its anatomical foundations, selection criteria, and surgical steps, with the objective of contributing to the standardization of the technique and serving as a basis for future clinical investigations.

MATERIALS AND METHODS

Nature of the study

This is a descriptive study of surgical technique, whose objective is to systematically present the technical principles of minimally invasive correction of diastasis

abdominis by the MILA technique, with emphasis on the preservation of the umbilical ligament. There was no collection of individual clinical data, statistical analysis, or systematized follow-up of patients, and it was not configured as a case series or comparative study, in accordance with technical descriptions previously published in the minimally invasive surgical literature^{10,12}.

Ethical issues

As it is exclusively a technical description, there was no direct participation of patients or animals, nor collection of identifiable information. The images used have a strictly didactic and illustrative character, not allowing individual identification. Thus, the study does not fit the criteria that require submission and approval by the Ethics in Research Committee, according to practices adopted in similar publications of technical description in abdominal wall surgery^{10,11}.

Inclusion and exclusion criteria

The criteria described below refer to the technical indication of MILA with umbilical ligament preservation, and not to the definition of a clinical sample

Inclusion criteria

Body mass index (BMI) ≤ 27 kg/m²; diastasis rectus abdominis of up to 4 cm, measured by physical examination and/or imaging methods; absence of associated umbilical hernia; good skin quality and adequate thickness of the subcutaneous tissue, allowing the in-plane, supra-aponeurotic approach.

These criteria agree with recommendations described for minimally invasive approaches to diastasis rectus abdominis^{8,15,17}.

Exclusion criteria

Presence of umbilical hernia or other midline hernias; previous complex abdominal surgeries involving the midline; high BMI; severe skin flaccidity that contraindicates the minimally invasive approach.

Patient Preparation

The preoperative evaluation includes detailed anamnesis, careful physical examination of the abdominal wall, and imaging tests, such as ultrasound or computed tomography, to confirm diastasis extent and exclude associated hernias¹⁷. Discontinuation of anticoagulants and non-steroidal anti-inflammatory drugs is recommended, according to institutional protocols.

Before the procedure, the patient is instructed about the technique characteristics, potential risks and limitations of the approach, and signs an informed consent for the surgical procedure. The preoperative demarcation is performed with the patient in the orthostatic position, identifying the abdominal midline, the projection of the umbilicus, and the endoscopic access points, following principles described for minimally invasive surgeries of the abdominal wall^{10,11}.

Detailed Surgical Technique

First stage:

Liposuction of the anterior abdomen is previously performed by the plastic surgery team, with the aim of facilitating the creation of the supra-aponeurotic space and optimizing the abdominal contour. The procedure is conducted using 3 mm cannulas and negative pressure less than 0.5 atm, strictly respecting the limits established by the current standards of the Federal Council of Medicine for combined procedures. The incisions used for liposuction, including those in the upper abdomen and periumbilical region, are reviewed and closed, allowing the proper construction of the supra-aponeurotic workspace.

Second stage:

Endoscopic Plication of DRA

1. Positioning and Antisepsis:

- Position: Supine position with arms in abduction at 90° and legs open (French position).
- Antisepsis of the abdominal wall: 2% alcoholic chlorhexidine (or according to the service's protocol).
- Sterile surgical drape with xiphopubic exposure.



Figure 1. Positioning and Antisepsis.

2. Minimally Invasive Access:

- Optic portal (11 mm): A 1.5-cm transverse incision in the suprapubic sulcus, with blunt dissection up to the supra-aponeurotic space in the midline.
- Working portals (5 mm): Right and left, using previous liposuction cannula incisions.

3. Workspace Creation:

- CO₂ insufflation at 10 mmHg from the previously dissected space, allowing endoscopic visualization of the supra-aponeurotic space and the trabecular network after liposuction.
- Conical dissection in the cranial direction of the subcutaneous cellular tissue, careful identification of the umbilical ligament, which is fully preserved in cases without associated umbilical hernia. In the presence of an umbilical hernia, the ligament can be released as technically needed.

4. Plication of Rectus Abdominis:

- Continuous craniocaudal suture with bidirectional monofilament barbed suture without knot (preferably 0 or 1.0), in an inverted "U" pattern, with a spacing of 1 cm between stitches (usually two units for complete coverage of the defect along the midline).
- Correction of the umbilical defect (when associated with hernia).



Figure 2. Minimally Invasive Access.

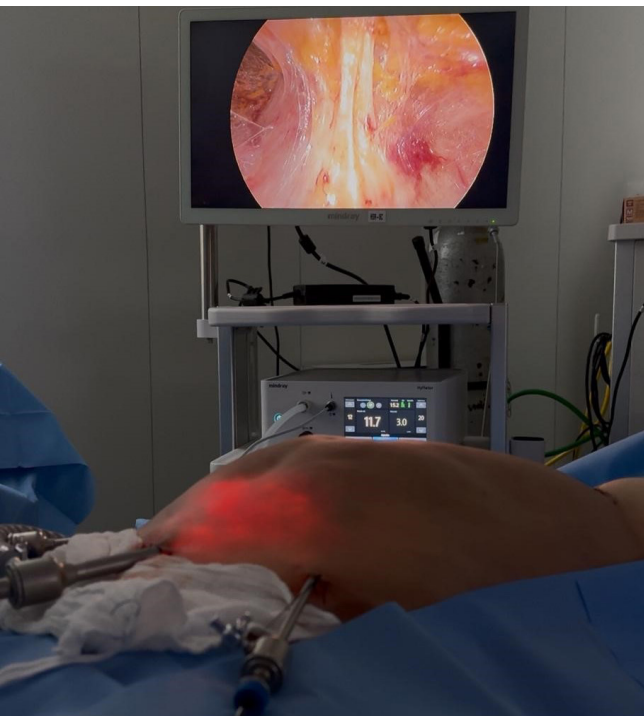


Figure 3. Workspace Creation.

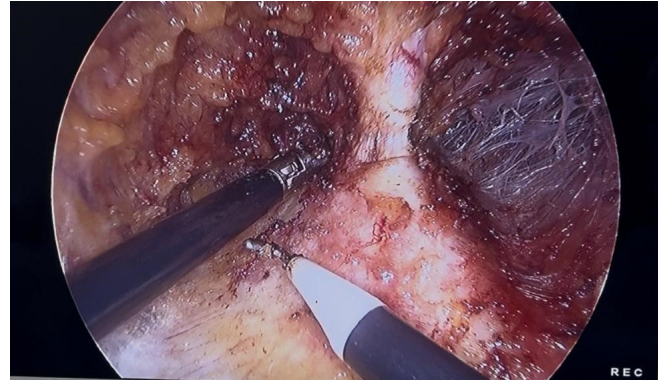


Figure 4. Identification of the umbilical ligament.

5. Finishing:

- Removal and cutting of the needle under the sight of the 11-mm portal.
- Deflation of the supra-aponeurotic space.
- Skin synthesis with absorbable intradermal suture or surgical glue on the portals.



Figure 5. Preservation of the umbilical ligament.



Figure 6. Xiphopubic cone visualization.

Third stage:

In the final stage, adjuvant skin retraction technologies can be used, such as radiofrequency,

ultrasound, laser, or others available at the service. The choice of technology is based on clinical criteria, skin characteristics, and institutional availability, and does not interfere with the execution or reproducibility of the MILA technique itself.

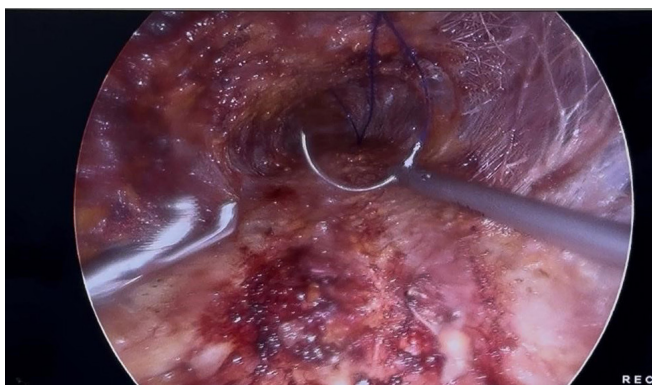


Figure 7. Continuous craniocaudal suture.

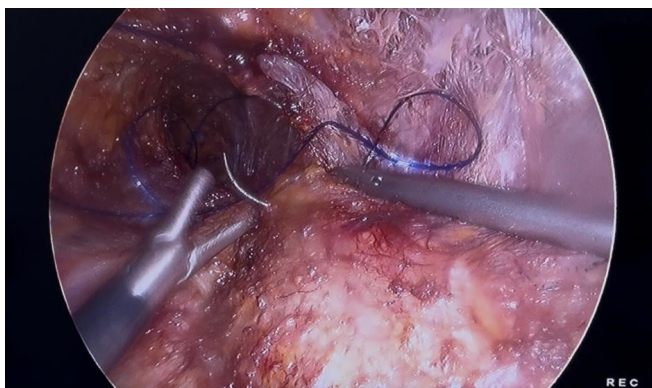


Figure 8. DRA plication.



Figure 9. Supra-aponeurotic space deflation.

At the end of the procedure, the drain is positioned and fixed with a vacuum system, followed by sterile dressing and placement of a compressive modeling band.



Figure 10. Positioning for the initiation of skin retraction technologies.

DISCUSSION

The MILA technique was originally developed as a minimally invasive approach in the supra-aponeurotic plane for correction of diastasis rectus abdominis, combining principles of endoscopic surgery of the abdominal wall with complementary aesthetic objectives¹⁵. The present description proposes the systematized preservation of the umbilical ligament as a differential in selected patients without associated umbilical hernia, an aspect that is still poorly detailed in the literature.

In the context of minimally invasive approaches, several techniques have been described for the treatment of diastasis of the rectus abdominis, including laparoscopic subcutaneous repair (SCOLA), endoscopic preaponeurotic repair (REPA), and endoscopic reconstruction of the linea alba^{10,13}. Although they share similar technical principles, these approaches present variations in plane dissection, plication systematization, and umbilicus management. The preservation of the umbilical ligament is not addressed in a standardized manner in these techniques, and its release is often performed when necessary for surgical exposure.

Umbilical ligament preservation, as described in this technique, is based on well-established anatomical

principles. The umbilical ligament plays a key role in maintaining vascularization and the anatomical position of the umbilicus, and its preservation can contribute to the maintenance of the natural abdominal contour and to the reduction of umbilical complications described in open techniques and in some endoscopic approaches¹⁸. Previous studies suggest that anatomical integrity of the umbilicus is associated with better aesthetic outcomes, although comparative clinical evidence is still limited¹⁶.

Compared to traditional open techniques such as conventional abdominoplasty, minimally invasive approaches to DRA have well-documented theoretical advantages, including less tissue aggression, faster recovery, and lower incidence of wound-related complications⁹. In this scenario, MILA is an alternative technique that allows endoscopic correction of diastasis, maintaining principles of functional reconstruction of the linea alba described in other minimally invasive techniques^{10,11}.

It is important to emphasize that the present manuscript is limited to the technical description, and does not present its own clinical data, casuistry, or analysis of functional and aesthetic outcomes. This characteristic is an inherent limitation of the study, but it is compatible with previous publications of technical description in abdominal wall surgery^{10,12}. The absence of clinical follow-up and comparative evaluation prevents inferences as to the superiority of the technique in relation to other

approaches, and these aspects should be explored in future studies.

Thus, prospective studies, case series, and multicenter investigations with medium- and long-term follow-up are necessary to objectively evaluate the functional and aesthetic outcomes, and the complication profile of the MILA technique with umbilical ligament preservation, as well as to compare it with other currently available minimally invasive approaches^{8,12,15}.

CONCLUSIONS

The MILA technique represents a minimally invasive approach for the correction of diastasis rectus abdominis in the supra-aponeurotic plane, allowing endoscopic plication of the linea alba. The preservation of the umbilical ligament, as described in this article, constitutes a technical differential that aims to maintain the anatomical integrity of the umbilicus in selected patients without associated umbilical hernia.

The systematized description of the technique, with a clear definition of the surgical steps, indication criteria, and technical care contributes to its reproducibility and standardization, and can help surgeons in the planning and execution of the procedure. As this is a technical description, the present study does not allow inferences regarding clinical, functional, or aesthetic outcomes, which should be evaluated in future studies.

RESUMO

A diástase do reto abdominal (DRA) é uma condição frequente da parede abdominal anterior, com impacto funcional e estético, cujo tratamento cirúrgico tem evoluído progressivamente para abordagens menos invasivas. Entre essas, a técnica MILA (Minimally Invasive Lipoabdominoplasty) destaca-se por permitir a correção da diástase por via endoscópica no plano supra-aponeurótico. O presente artigo tem como objetivo descrever detalhadamente a técnica MILA com preservação do ligamento umbilical, enfatizando seus aspectos técnicos e anatômicos, bem como os critérios de seleção e os passos cirúrgicos fundamentais para sua reprodutibilidade. Trata-se de uma descrição técnica, sem análise de desfechos clínicos ou comparação entre métodos. A preservação do ligamento umbilical constitui um diferencial da técnica, contribuindo para a manutenção da anatomia umbilical e do contorno abdominal natural. A descrição sistematizada da MILA pode auxiliar cirurgiões na padronização da técnica e servir de base para futuros estudos clínicos comparativos.

Palavras-chave: Diástase do Reto Abdominal. Cirurgia Minimamente Invasiva. Laparoscopia. Parede Abdominal. Umbigo.

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Data availability

Datasets related to this article will be available upon request to the corresponding author.

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