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Laparoscopic Abdominopexy: Surgery for Vaginal Prolapse

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ABSTRACT

Objectives: We present a new surgery based on the round ligament anatomy that is called laparoscopic abdominopexy, which uses a synthetic mesh without fixation at any pelvic point. The aim of this study is to provide a step-by-step description of the laparoscopic abdominopexy technique and present the first anatomical and functional results of the procedure.

Methods: This prospective cohort study included patients with apical and anterior vaginal prolapse who were subjected to laparoscopic abdominopexy. Before and after surgery, the Pelvic Organ Prolapse Quantification (POP-Q) scale, Overactive Bladder Questionnaire-Short Form (OABq-SF), and Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) were used to evaluate the vaginal prolapse stage, storage, and sexual symptoms, respectively. The surgical technique is described step by step.

Results: Twenty patients were included with follow-up times between 6 and 25 months. The mean surgical time was 78.4 minutes. A statistically significant improvement was observed in the Aa ($P \leq 10^{-5}$), Ba ($P \leq 10^{-5}$), C ($P = 5 \times 10^{-5}$), D ($P = .002$) and tvl ($P = .02$) POP-Q points and in OABq-SF (22.2%; $P = .02$). Successful surgery was observed in 100% of patients for the apical compartment and 90% of patients for the anterior compartment.

Conclusion: Laparoscopic abdominopexy is a quick, safe, and reproducible surgical technique with beneficial anatomical and functional results that preserve the pelvic floor anatomy.

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INTRODUCTION

Forty percent of women will develop pelvic organ prolapse (POP), with anterior prolapse being twice as frequent as posterior prolapse and three times more frequent than medium prolapse (apical). Furthermore, 6%–12% of women who require hysterectomy will develop apical prolapse, which is associated with anterior or posterior prolapse in two thirds of cases.[1] Colposacropexy (open, laparoscopic, or robotic) is considered the gold standard for the correction of apical prolapse, with a surgical success rate of 90%.[2]

However, the technical difficulty in exposing the anterior vertebral ligament, due to nearby vascular structures, promontory exostosis or intestinal adhesions, lengthens the surgical time. In addition, although complications are not frequent, they are important and include intraoperative hemorrhage, promontory osteomyelitis, ureteral injury, or constipation.[3]

New surgical techniques have been developed to fix the vaginal vault to more accessible places, simplifying the procedure and reducing the surgical risks. Laparoscopic pectopexy (PL) uses the iliopectineal ligament.[4] The round ligament,[5] inguinal ligament,[6] and even the aponeurosis of the external oblique muscle[7] have also been used. The laparoscopic lateral suspension (SLL), based on the principle of "tension-free meshes," suspends the vaginal vault to the abdominal wall, placing the legs of the mesh in a subperitoneal tunnel, avoiding fixing the vaginal vault to any structure of the bone of the pelvis.[8]

The round ligaments (LRU) arise from the horns of the uterus up to the inner inguinal ring, in its intrapelvic region, reaching the mons pubis and the labia majora, in its extrapelvic region.[9] This fact makes the LRU easily accessible surgically. In addition, LRU are a consistent structure in most patients, even in patients undergoing hysterectomy. During the hysterectomy, the LRU are sectioned, leaving fragments of them in the pelvis.

Based on the principle of "tension-free meshes" and the anatomy of the LRU, we present a surgical technique for the laparoscopic correction of anterior and/or apical prolapse, which we have denoted laparoscopic abdominopexy (LA). LA uses a synthetic mesh with two long side legs. The lateral legs are not fixed to any ligamentous structure of the pelvis and are placed following a path similar to the LRU to the Mons pubis. Therefore, LA is proposed as a surgical alternative that simplifies the procedure to correct POP, respecting the anatomy of the female pelvis and reducing surgical time. The objective of the present work is to provide a step-by-step description of the LA technique and present the anatomical and functional results of the first cases to undergo LA.

MATERIALS AND METHODS

We prospectively analyzed a cohort of patients with apical and/or anterior prolapse. A specific informed consent form was signed by each patient. All of them were underwent LA from February 2016 to September 2017 at the University Hospital of Cabueñes, Gijón (Asturias). Before and 6 months after surgery, the Pelvic Organ Prolapse Quantification (POP-Q) scale was used to define the stages of vaginal prolapse,[10] and the Overactive Bladder Questionnaire-Short Form (OABq-SF) questionnaire[11] and the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) questionnaire[12] were used to quantify bladder filling symptoms and evaluate the sexual sphere, respectively. The inclusion criteria were patients with symptomatic prolapse medium and/or anterior POP-Q > I, and the exclusion criteria were patients with posterior prolapse with symptomatic POP-Q ≥ 2. Recurrence of vaginal prolapse was considered when the POP-Q stage was higher than I in the middle and/or anterior compartment with persistence of symptoms and/or vaginal bulk sensation. The Clavien-Dindo scale was used to classify postoperative complications,[13] and patient satisfaction was analyzed at 6 months after surgery by answering the question, "Would you undergo this same procedure again if necessary?" The continuous quantitative variables are presented as the mean ± standard deviation (SD). Student *t*-test was used for paired data to compare preoperative and postoperative data, using the SPSS program version 20.0 (Statistical Package for Social Science, SPSS, Chicago, Illinois, USA). Statistically significant differences were considered when the *P*-value was less than .05. This project was approved by the local clinical research ethics committee.

Description of the Technique

Under general anesthesia, the patient is placed in the supine and Trendelenburg positions with the lower extremities flexed, with the upper extremities parallel to the trunk and with shoulder stops. Direct access to the intraperitoneal space is achieved by minilaparotomy and a 10-mm Hasson trocar (Coviden™, Gijon, Asturias, Spain). Three more trocars are placed: two of 5-mm trocars and one of 10-mm trocar (Endopath®, Gijon, Asturias, Spain). A conventional (Olympus®, Gijon, Asturias, Spain) laparoscopic tower with zero-degree optics, monopolar scissors, an aspiration-irrigation system and atraumatic grasping forceps is used. A monofilament mesh of polyvinylidene fluoride, (Dynamesh® PR2 soft 1 (7 cm × 4 cm) REF PV510636F1, Gijon,

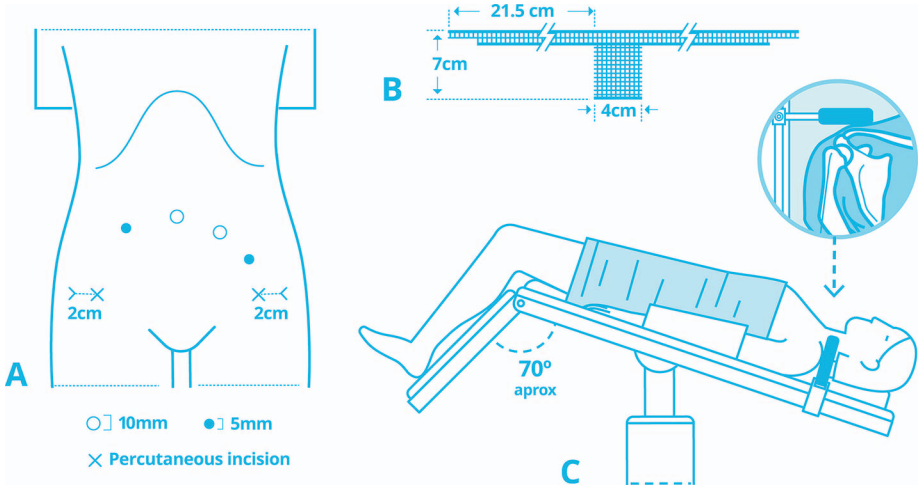

Figure 1. Preoperative details. (**A**) Placement of trocars. (**B**) Dimensions of the mesh. (**C**) Position of the patient.

Asturias, Spain), initially designed for the vaginal treatment of posterior prolapse (**Figure 1**), is used.

First, after opening the visceral peritoneum, an avascular plane dissection of the vesico-vaginal space to the trigone is performed. In this step, we use a malleable valve introduced into the vagina. The mesh is exposed on the anterior vaginal aspect. A double continuous suture is performed with 2 zeros absorbable braided sutures (Vicryl™) including the mesh and vaginal wall. The last point is applied to the uterine or vaginal vault knotting each suture together. A bilateral 3-mm incision in the skin is made with a cold scalpel, medial to 2 cm from the anterior superior iliac spine (EIAS). Straight atraumatic grasping forceps are introduced percutaneously into the parietal subperitoneal space. We advance the grasping forceps, carving a subperitoneal tunnel, following the path of the round ligament, passing under it and above the medial umbilical ligament. The clamp is externalized by the opening of the visceral peritoneum previously performed. The ends of the legs of the mesh are taken and externalized following the subperitoneal canal. The tobacco-pouch suture is used to close the peritoneum, isolating the mesh from the intraperitoneal space. After the pneumoperitoneum is emptied, a subcutaneous canal is made in the direction of the Mons of Venus following the fibers of the round ligament, where the legs of the mesh are placed without fixation (**Figure 2**).

RESULTS

We included 20 patients: 8 (40%) with anterior and middle vaginal prolapse, and 12 (60%) with only anterior vaginal prolapse, all of whom were symptomatic (100% discomfort in relation to the vaginal bulge, 25% dyspareunia, 10% infection of the urinary tract and 10% voiding difficulty). The average patient age (years), BMI (Body Mass Index) (kg/m^2), and parity were 69.2 ± 9.1, 28.3 ± 2.3, and 1.8 ± 1.3, respectively. Regarding previous surgery, 30% of patients had abdominal surgery, 25% of patients had pelvic floor surgery, and 20% of patients had a hysterectomy. All patients were subjected to LA. The follow-up time was a minimum of 6 months and a maximum of 25 months. The average follow-up time (months), surgical time (minutes) and hospitalization (days) were 12.8 ± 5.7, 78.4 ± 29.7, and 1.45 ± 0.7, respectively. Simultaneous surgery was performed in 5 cases (4 suburethral tape and 1 abdominal hysterectomy). Intraoperative complications occurred in 0% of patients, average of blood loss was less than 100 cc and postoperative complications occurred in 15% of patients; 2 patients had Clavien I postoperative complications due to analgesic needs, and one patient had Clavien IIIb complications due to the need to implant an automatic defibrillator due to postoperative atrial fibrillation. In one case (5%), stress incontinence was found "de novo" that did not require surgical treatment. No patient had constipation or mesh extrusion. Two patients (10%) had a

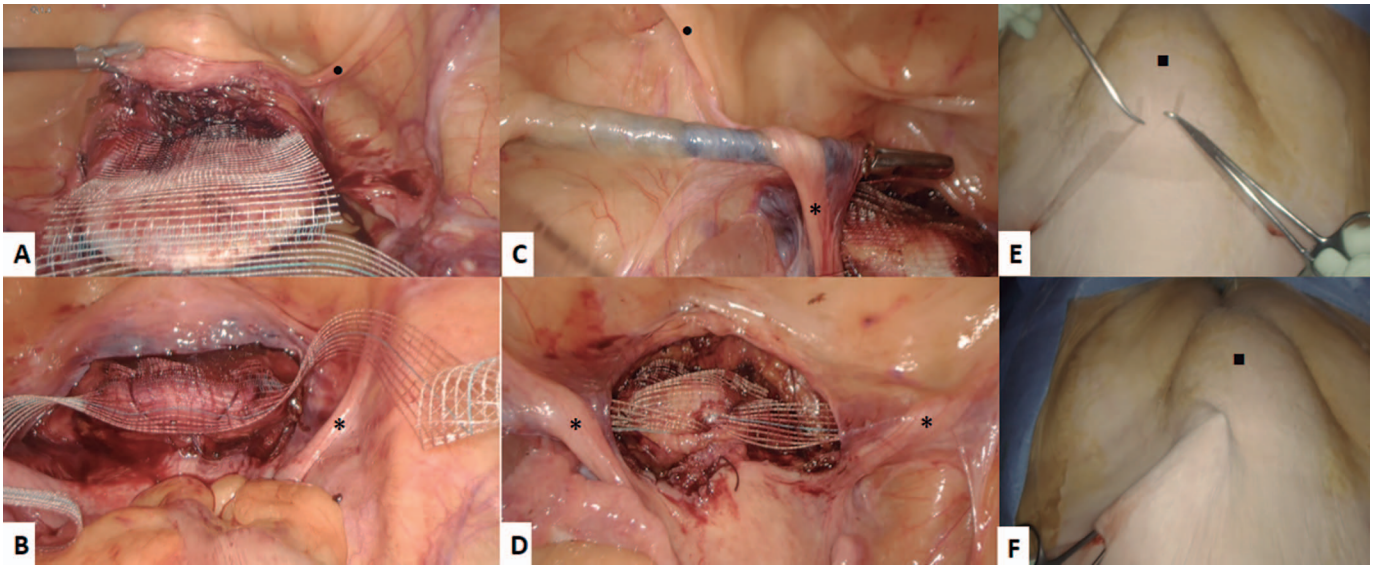

Figure 2. Surgical technique. (**A**) Mesh's exposure. (**B**) Suturing of the mesh. (**C**) The clamp through a subperitoneal tunnel. (**D**) Final position. (**E**) Direction of the legs. (**F**) Placement of the legs. ✻Round ligament. ●Medial umbilical ligament. ■Mons pubis.

short-term discomfort in round ligaments area without the need to be treated.

There was no case of midcompartment recurrence, which means a surgical success rate of 100% for the apical compartment. There were 2 patients (10%) with a recurrence in the anterior compartment, indicating a surgical success rate of 90% for the anterior compartment. The first patient had an anterior prolapse stage III and a medium prolapse stage II, in which the medium prolapse was reduced to stage I while the anterior prolapse relapsed to stage III. The second patient had an anterior prolapse of stage III (point Aa 2) that was reduced to stage II (point Aa 0), although the patient reported the presence of a vaginal bulge. New surgery was not required in any case. No posterior prolapse was corrected since all patients were asymptomatic. Despite this, improvement in the posterior compartment was observed in 7 patients (35%), the stage in the posterior compartment was maintained in 11 patients (55%), and 2 patients (10%) presented worsening of the stage in the posterior compartment ("de novo" prolapse) from stage 0 to stage I (point Ap-2) and no case was symptomatic (**Table 1**).

A statistically significant improvement was obtained in points Aa ($P \leq 10^{-5}$), Ba ($P \leq 10^{-5}$), C ($P = 5 \times 10^{-5}$), D ($P = .002$), and tvl ($P = .02$) of the POP-Q scale at 6 months after surgery (**Table 2** and **Figure 3**). The filling symptoms were evaluated by means of the OABq-SF questionnaire, obtaining a statistically significant improvement of 22.2% ($P = .02$), 6 months after surgery. The PISQ-12 questionnaire was used to evaluate the sexual sphere. It was only completed by 4 sexually active patients. Despite the presentation of a better score in the PISQ-12 questionnaire at 6 months after surgery, it was not possible to calculate the *P*-value due to the small sample size. Satisfaction and the absence of feelings of a vaginal bulge were 90%; only 2 patients (10%) were not satisfied with the surgical results and reported feelings of a vaginal bulge, and prolapse recurrence was observed in these patients.

DISCUSSION

LA is a simple and easily reproducible technique. The LRU, the main anatomical reference of LA, are accessible and constant structures in patients with or without previous hysterectomy. In addition, LA, based on the principle of "tension-free meshes," offers a clear technical advantage: the legs of the mesh do not attach to any structure of the female pelvis. This principle was used in the SLL of Dr. Dubuisson, who obtaining an anatomical success rate of 85%–94% 1 year after surgery.[14] This fact makes it possible to avoid dissection in areas close to vascular structures during LA, such as the external iliac vein in the PL (Laparoscopic Pectopexy) or the middle sacral vessels in laparoscopic colposacropexy (CSL). This decreases the technical complexity and surgical time, in our series to 78.4 minutes, making this time the lowest compared to other surgical techniques for POP correction: 130 minutes for the inguinal ligament technique,[6] 180 minutes for SLL,[15] 50 minutes for PL,[16] and 120 minutes for the 6-point technique.[17]

In LA, the legs of the mesh are placed in a manner that reproduced a path similar to the LRU. The LRU have greater elasticity and less rigidity than other ligaments of the female pelvis[18]; therefore, using them as a fixation point may not be appropriate for POP correction. However, it has been shown that the presence of nonresorbable material close to the LRU can increase their rigidity.[5] Therefore, in LA, the legs of the mesh are placed close to the path of the LRU to give rigidity to the LRU, which is necessary for vaginal suspension. In our series, we obtained a surgical success rate of 100% for the correction of apical prolapse. It should be noted that 80% of the patients had a uterus, and hysterectomy was necessary only in one patient with a large uterus. The surgical success rate for the correction of the anterior prolapse was 90%, with a reoperation rate of 0%. These data are similar to those of a CSL series[3] and other surgical techniques[4,6,14] that describe success rates above 85%.

The surgical anatomy of LA has an important repercussion on functional results. The first of these is that the direction of traction of the vaginal vault is lateral, not posterior. CSL generates posterior traction towards the promontory region, modifying the natural direction of the vaginal axis (toward S2) and narrowing the space occupied by the rectum. The PL changes the direction of traction towards a lateral position, fixing the mesh to the iliopectineal ligaments (level of S2), which cause a decrease in de novo incontinence compared with that of CSL, namely, 5% versus 25%, and in constipation, namely, 0% versus 19.5%.[4] LA follows a direction of lateral traction that is similar to the PL, a fact that determines that the results of our series of incontinence "de novo" and constipation, namely, 5% and 0%, respectively, are superimposable to those of PL.

The legs of the mesh are placed in a position that is similar to an existing structure, the LRU, avoiding alterations to the anatomy of the female pelvis and reducing the risk of generating new lines of force in the pelvic floor. Accord-

Table 1.
POP-Q Stages Classified by Pre- and Postsurgical Compartments

POP-Q Stages			Breakdown by POP-Q Stages After Surgery			
Vaginal Compartment	Pre-Surgery, N (%)	Post-Surgery, N (%)	N	Presurgery Stage (POP-Q Point)	Postsurgery Stage (POP-Q Point)	Vaginal Bulge Sensation or Symptoms
Anterior						
0	0 (0)	9 (45)	3	II	0	No
			6	III	0	No
I	0 (0)	5 (25)	4	II	I	No
			1	III	I	No
II	9 (45)	5 (25)	2	II (Aa 1)	II (Aa -1)	No
			2	III (Aa 2)	II (Aa -1)	No
			1	**III (Aa 2)**	**II (Aa 0)**	**YES**
III	11 (55)	1 (5)	**1**	**III (Aa 3)**	**III (Aa 2)**	**YES**
IV	0 (0)	0 (0)				
Apical						
0	7 (35)	17 (85)	7	0	0	No
			4	I	0	No
			5	II	0	No
			1	III (C 3)	0 (C -8)	No
I	5 (25)	3 (15)	1	I (C -5)	I (C -7)	No
			1	II (C 0)	I (C -5)	No
			1	II (C 1)	I (C -4)	No
II	7 (35)	0 (0)				
III	1 (5)	0 (0)				
IV	0 (0)	0 (0)				
Posterior						
0	10 (50)	13 (65)	8	0	0	No
			5	I (Ap -2)	0 (Ap -3)	No
I	7 (35)	6 (30)	*2*	*0 (Ap -3)*	*I (Ap -2)*	*No*
			2	I (Ap -2)	I (Ap -2)	No
			2	II (Ap -1)	I (Ap -2)	No
II	3 (15)	1 (5)	1	II (Ap -1)	II (Ap -1)	No
III	0 (0)	0 (0)				
IV	0 (0)	0 (0)				

The postsurgical stages are shown, broken down according to the presurgical stage and the sensation of a vaginal bulk and/or symptoms.

In bold, cases of recurrence are indicated.

In italics, cases of worsening prolapse are indicated.

Table 2.
Values of the Points (cm in Relation to the Hymen) of the POP-Q Scale and Scores of the OAB-SF and PISQ-12 Questionnaires Before and 6 Months After Surgery

	Presurgery, Average ± SD	Postsurgery, Average ± SD	Difference	*P*
POP-Q (N = 20)				
Aa	1.4 ± 0.9	−1.9 ± 1.2	−3.3 (−75%)	$<10^{-5}$
Ba	1.5 ± 1.2	−2 ± 1.3	−3.5 (−77.7%)	$<10^{-5}$
C	−3.3 ± 3.3	−6.8 ± 1.4	−3.5 (−81.3%)	5×10^{-5}
Ap	−2.3 ± 0.7	−2.6 ± 0.6	−0.3 (−43%)	.059
Bp	−2.3 ± 0.7	−2.5 ± 0.8	−0.2 (−28.5%)	.13
D	−5.3 ± 3.2	−7.5 ± 0.9	−2.2 (−66.7%)	.002
gh	3.5 ± 0.9	3.4 ± 0.9	−0.1 (−2.8%)	.27
pb	2.1 ± 0.5	2.2 ± 0.5	0.1 (4.7%)	.14
tvl	8.1 ± 0.9	8.6 ± 0.8	0.5 (6.2%)	.02
OAB-SF TOTAL (N = 12)	34.2 ± 14.9	26.6 ± 12.1	−7.6 (−22.2%)	.02
OAB-SF 1° QUESTIONS	14 ± 7.1	10.7 ± 6.4	−3.3 (−23.5%)	.04
OAB-SF 2° QUESTIONS	20.2 ± 8.1	15.9 ± 5.9	−4.3 (−21.2%)	.01
PISQ-12 (N = 4)	30.3 ± 3.5	32.3 ± 7.5	2 (6%)	—

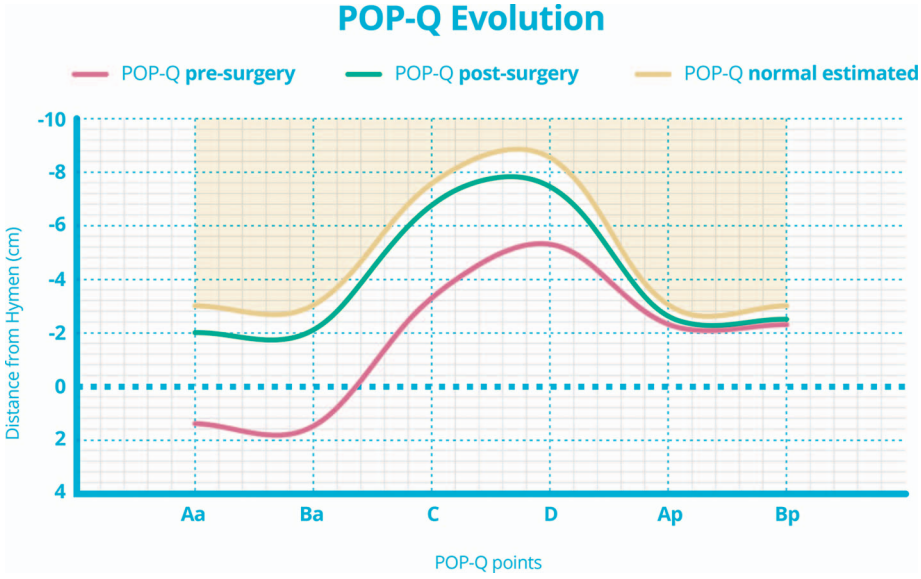

Figure 3. POP-Q Evolution: Graphic representation of the average values of the POP-Q points pre- (red) and postsurgically (green). The estimated POP-Q normal values are in yellow. Note that the postsurgical points are very similar to the normal POP-Q points.

ing to the integral theory, an imbalance in the pelvic floor force lines can trigger "de novo" prolapse.[19] In our series, only 10% of patients presented a worsening of their posterior compartment POP-Q stage ("de novo" prolapse), going from stage 0 to stage I (Ap-3 to Ap-2), without any symptoms and without requiring intervention in any case. These data are similar to those for PL (9.5%)[4] and SLL (12%).[20] However, the patients with "de novo" posterior prolapses in SLL are all POP-Q II stages and had a reoperation rate of 8.2%. In addition, in some cases, preventive colpoperineorrhaphy was performed during SLL to prevent the appearance of "de novo" posterior prolapse. In our series, even though no

surgical actions were made to prevent or treat posterior prolapse, 35% of patients showed improvements in their posterior compartment POP-Q stages, and the posterior compartment stages of 55% of patients remained the same. A theory that explains this fact can be that the percutaneous access point in the LA next to the EIAS places the legs of the mesh in the path of the LRU. However, in SLL, this point is 2 cm higher and 4 cm outside the EIAS, placing the legs of the mesh in a position that can generate a new line of force, producing an imbalance in the forces of the pelvic floor.

Functionally, LA significantly improves 22% of the symptoms of overactive bladder measured by the OAB-SF questionnaire. This may be because the LA repositions the vaginal vault in all patients, and according to the integral theory, apical prolapse, even of a small magnitude, may be responsible for the clinical filling[19]. On the other hand, LA is a safe technique with 0% intraoperative complications and 5% postoperative Clavien III complications, comparable to other techniques for the repair of POP[4,14].

CONCLUSION

LA is a fast, safe, easily reproducible surgical technique with good anatomical and functional results and preserves the anatomy of the female pelvis.

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