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A minimally invasive technique for the one-stage treatment of complex pelvic floor diseases: Laparoscopic – Pelvic Organ Prolapse suspension (L- POPs)

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Abstract:	Objective . The aim of this prospective study was to assess the safety and effectiveness of a new single laparoscopic operation devised to relieve obstructed defecation, gynecologic and urinary symptoms in a large series of female patients with multi-organ pelvic prolapse. Methods. We submitted 384 female patients to Laparoscopic Pelvic Organ Prolapse Suspension (L-POPS) operation, a new technique based on suspension of the middle pelvic compartment, by using a polypropylene mesh,and followed-up 368 of them, with defecography performed 12 months after surgery and a standardized protocol. Results. The 368 patients were followed-up for 36.3 (±4.4) months, Recurrence rate was 4.9% for obstructed defecation syndrome and 3.3% for stress urinary incontinence. Complication rate was 2.9%. The mean period of daily activity resumption was 16.3 (±4.8) days. Ano-rectal and uro-gynecologic symptoms and scores significantly improved after the operation (P<0.001), with no worsening of anal continence. Incidence of postoperative fecal urgency was 0%. Postoperative defecography showed a significant (P < 0.001) improvement of all parameters in 315 patients (82%). SF36 Health Survey score significantly improved after the operation (P <0.01). An excellent/good overall Satisfaction Index was reported by 78.0% of patients. Conclusions. In our experience the Laparoscopic-Pelvic Organ Prolapse Suspension seems to be safe and effective as a one-stage treatment of associated pelvic floor diseases. Randomized studies with an appropriate control group and longer follow-up are now needed to assess the effectiveness of this promising technique
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A minimally invasive technique for the one-stage treatment of complex pelvic floor diseases: Laparoscopic – Pelvic Organ Prolapse suspension (L- POPs)

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ABSTRACT

Objective . The aim of this prospective study was to assess the safety and effectiveness of a new single laparoscopic operation devised to relieve obstructed defecation, gynecologic and urinary symptoms in a large series of female patients with multi-organ pelvic prolapse.

Methods. We submitted 384 female patients to Laparoscopic Pelvic Organ Prolapse Suspension (L-POPS) operation, a new technique based on suspension of the middle pelvic compartment, by using a polypropylene mesh and followed-up 368 of them, with defecography performed 12 months after surgery and a standardized protocol.

Results. The 368 patients were followed-up for 36.3 (±4.4) months, Recurrence rate was 4.9% for obstructed defecation syndrome and 3.3% for stress urinary incontinence. Complication rate was 2.9%. The mean period of daily activity resumption was 16.3 (±4.8) days. Ano-rectal and uro-gynecologic symptoms and scores significantly improved after the operation (P<0.001), with no worsening of anal continence. Incidence of postoperative fecal urgency was 0%. Postoperative defecography showed a significant (P < 0.001) improvement of all parameters in 315 patients (82%). SF36 Health Survey score significantly improved after the operation (P <0.01). An excellent/good overall Satisfaction Index was reported by 78.0% of patients.

Conclusions. In our experience the Laparoscopic-Pelvic Organ Prolapse Suspension seems to be safe and effective as a one-stage treatment of associated pelvic floor diseases. Randomized studies with an appropriate control group and longer follow-up are now needed to assess the effectiveness of this promising technique.

IN BRIEF

The laparoscopic suspension of the middle pelvic compartment with the new L-POPs technique is safe and gives good mid-term results in the one-stage treatment of associated pelvic floor diseases.

INTRODUCTION

The prevalence of pelvic floor diseases, including pelvic organ prolapse (POP), stress urinary incontinence (SUI), obstructed defecation syndrome (ODS) and fecal incontinence, is very high: more than 23% of community-dwelling women will have at least one of these conditions and the prevalence increases with age:[1] an epidemiologic study on the Swedish female population showed 19% urinary incontinence, 23% gas incontinence, 6% solid stools incontinence, and 14% digitations in over sixty-year old women.[2]

The association of two, or more, pelvic organ diseases in the same patient is very frequent, reaching 20% of old resident women**.**[3] In the study by Gonzales-Argente *et al.,* 50% of women with ODS due to rectal prolapse and rectocele, showed a concomitant genital prolapse and 50% of women with SUI reported symptoms of ODS.[4]

About 30% of women operated on for POP need further pelvic surgery.[5]

A safe and effective surgical treatment of patients with associated pelvic floor diseases would benefit of a multidisciplinary approach by a team of pelvic floor clinicians, including gynecologist, urologist and colorectal surgeon. On the contrary, different specialists usually treat these patients in two, or more steps, with different surgical procedures, complications and outcomes.

In the last decades an incredible number of surgical techniques to treat pelvic floor diseases have been described, but very few important studies on combined pelvic approaches have been published. Firm recommendations as to the optimal treatment of these conditions are yet to be developed.

In a previous study we demonstrated that combined rectal and urogynecologic one-stage surgery, performed by the same surgical team with one, or two colorectal surgeons and one urogynecologist, is safe and effective, and is associated with significant improvement of symptoms, quality-of-life, radiological parameters, and with low recurrences at 2 years.[6]

The possibility to treat concomitant pelvic floor diseases with a single operation is very attractive and laparoscopic techniques have all the theoretic requisites to reach this goal. The Laparoscopic Pelvic Organ Prolapse Suspension (L-POPs), proposed by Antonio Longo MD for the one-stage treatment of intussusception and rectocele even if associated with SUI and/ or genital prolapse, consists of the preperitoneal positioning of a V-shaped polypropylene mesh, with the vertex sutured to the vaginal and rectal wall and the lateral edges to the external oblique muscle fascia bilaterally, so as to create the suspension of the middle pelvic compartment. In the event of a residual symptomatic rectocele, STARR procedure,[7] or other form of rectocele repair can be considered.

In the present prospective study we report the clinical and functional results of L-POPs operation in a large series of female patients with associated pelvic floor diseases.

MATERIAL AND METHODS

Study Population and Inclusion Criteria

Patients potentially candidates for the study were all women with association of rectal intussusception/rectocele and 3rd, or 4th genital prolapse referred to the Proctologic & Pelvic Surgery Unit of Humanitas Cliniche Gavazzeni,Bergamo .

These patients were recruited for the study on the basis of the following criteria :

Inclusion criteria:

Association of all the following conditions:

- internal rectal prolapse/intussusception and rectocele > 3cm ;
- continence score < 3 ;
- resting pressure < 40 mm/Hg and squeeze pressure >100 mm/Hg. The values of resting and squeeze pressure were chosen to avoid an operation in patients with sphincterial defects and risk of postoperative fecal incontinence , or patients with hypertonic and dissinergic sphincters with risk of postoperative severe pain and fecal urgency;
- 3rd, or 4th degree genital prolapse.
- Patients with the additional concomitant presence of enterocele 3-5 cm at rest, obstructing the rectum during straining, and/or SUI were also included. The presence of SUI was an additional criteria: patients with intussusception /rectocele with SUI, but without genital prolapse were excluded from the study

Exclusion criteria:

- 1st or 2nd degree genital prolapse,
- overactive bladder syndrome, urinary tract infections,
- previous pelvic radiotherapy, pelvic neoplasms,

- pudendal neuralgia, puborectalis syndrome,
- absolute contraindications to surgery.

The following are the key elements of our standardized evaluation of the recruited patients:

1) Validated Renzi ODS [8] and Wexner continence[9] scores. The Longo ODS score,[7,10] even though not yet validated, was also used, as we consider it more appropriate for our patients. The score, showed in Table 1, explores 9 parameters, ranging from 0 to 40: defecation frequency (0-3), intensity (0-2) and duration (0-2) of straining, feeling of incomplete evacuation (0-3), recto-perineal discomfort (0-3), activity reduction (0-6), use of laxatives (0-7), enema (0-7), and digitation (0-7).

2) Gynecological examination, with POP-Q (Pelvic Organ Prolapse Quantification System) classification;[12]

3) Proctologic examination and proctoscopy

4) Urodynamic study with uroflowmetry, cystomanometry and residual urine volume to exclude an overactive bladder syndrome in patients with SUI;

5) Quality of life with the validated SF36 Health Survey score;[11]

6) Colonoscopy to exclude concomitant colorectal diseases;

7) Anorectal manometry to evaluate the integrity of anal sphincters;

8) Dynamic colpocystodefecography with opacification of small bowel (dynamic pelvigraphy) to evaluate the grade of POP, the presence of morphological (rectocele, rectal prolapse, intussusception) and/or functional (puborectalis syndrome, incontinence) rectal disorders, and the presence of concomitant enterocele and/or cystocele. The following defecography parameters were recorded: extent of rectal prolapse/ intussusception, rectocele depth, perineum descent at rest and under strain, distance from the vaginal vault to the pubis and to the sacrum. The three parameters of Dvorkin classification were used to determine the extent of intussusception: anterior and posterior thickness of prolapsed tissue (< 3mm = mucosal prolapse, > 3mm = full-thickness intussusception), distance from

the point of take-off of the intussusception to the anorectal junction, and intussusception descent from the point of take-off to the most distal point of the intussusception;[13]

9) Patient Satisfaction Index, defined as follows: Excellent: no symptoms. Good: 1 episode /month of ODS with use of laxatives. Fairly good: 2/3 episodes/month of ODS with use of laxatives. Poor: more than 3 episodes/month of ODS with use of laxatives, or persistence of other symptoms.

The Ethical Committee approved the study protocol. All patients gave written informed consent. All patients were operated on by the same surgical team, using the technique described below, with no modifications.

Preoperative management

An enema washing is carried out on the day before surgery. The procedure is performed under general anesthesia. Immediately after the induction of anesthesia a Foley bladder catheter 16Ch is introduced and the patient receives routine antibiotic prophylaxis with a single shot of cefotaxime (2g) plus metronidazole (500 mg).

Surgical technique[7](see video 1)

The L-POPs operation is performed with the patient in Lloyd-Davis and Trendelenburg positions (30°). A Foerster sponge forceps with gauze is introduced in the rectum and a uterine manipulator into the vagina to recognize the anterior rectal wall and the posterior vaginal wall (or the vaginal vault in hysterectomized patients), respectively. A 13 mmHg pneumoperitoneum is created after positioning an umbilical 12 mm trocar with an open technique. A second 12 mm trocar is introduced through an incision in the right iliac fossa and a third 5mm trocar is positioned in the left iliac fossa. The Douglas pouch is exposed and a V-shaped mesh, with two 25 cm long and 2 cm wide branches is prepared. This is obtained by folding a macroporous, square shaped, 30 cm x 30 cm polypropylene mesh, (Microval , St Just Malmont, France) along the diagonal and then cutting a 2cm wide strip along one of the two short sides of the triangle. The V-shaped mesh is then introduced in

the pelvis through the right trocar. The uterus is suspended to the anterior abdominal wall with a straight transcutaneous needle. The uterine suspension is primary used for visualization. Concomitant SUI was not treated with a separate procedure, but suturing the apex of the mesh to the anterior and lateral vaginal fornix wall with 2-0 Prolene stitches, anteriorly to the uterus, after the dissection of vesico-uterine space: the same is done in case of prevalence of anterior descent. In patients with predominant rectal prolapse the apex of the mesh is sutured to the posterior vaginal fornix wall (or to the vaginal vault in hysterectomized patients) with plicature of the peritoneum of the Douglas pouch: fixing the vaginal vault to the cardinal ligaments is important to restore the De Lancey first level of hysterocele. The 2-0 Prolene stitch is then also fixed to the peritoneum so as to cover the anterior rectal wall, taking care of pushing the upper rectum with gauzed forceps introduced in the rectal lumen, in order to show the peritoneum and to avoid perforating the rectal wall. Normally two central and two lateral stitches are sufficient for correct positioning of the V mesh apex. The distance from the vaginal attachment of the mesh to the oblique external fascia is about 20 cm. Two bilateral incisions of the skin 2cm posterior and superior to the anterior iliac spine and dissection with scissors of the fascia and the muscular fibers of oblique muscle, allow reaching the preperitoneal space under laparoscopic control. Taking care to avoid injury to the iliac vessels and ureter, dissection of the lateral peritoneum and the broad ligament proceeds using a curved tip laparoscopic needle holder, introduced into the preperitoneal tunnel. The right lateral aspect of the mesh is gently pulled through the preperitoneal tunnel until the right external oblique muscle fascia incision is reached. The same is done on the left side.

Before fixing the mesh to the fascia, with the patient in 50° Trendelenburg position, the mesh is strained until the normal pelvic aspect is restored. In case of uterine retroversion the round ligaments are shortened and attached to the mesh arms to restore the normal anatomy of the middle pelvic compartment. The peritoneum is sutured with Vycril 2-0

stitches to cover the apex of the mesh. About 5 cm of the lateral aspects of the mesh are exteriorized through the skin incisions, tunneled under the external oblique muscle fascia and fixed with Vicryl 2-0 stitches. Finally, the trocar incisions are sutured.

Postoperative management

The patient is started on a clear liquid diet from the first postoperative day. Antibiotics are continued for three days. Acetaminophen 1gr plus Ketorolac 30mg i.v., t.i.d is used for postoperative pain control during hospitalization. Antithrombotic prophylaxis with enoxaparin 4000 U/day for 12 days is administered.

Follow-up

Pre and postoperative assessments were conducted by one of the surgeons of the team. Clinical examination is scheduled at 7 days and 1, 3, 6, 12 and 24 months after the operation**.** A dynamic defecography is repeated 12 months after surgery.

Primary outcome measure is the rate of failure at 2 years' follow-up defined as the persistence of any single or combination of the following conditions: ODS score > 5, persistence of SUI, presence of vaginal discomfort and/or dyspareunia, residual mucosal rectal prolapse > 2cm at proctoscopy, residual 2nd degree (or greater) genital prolapse at clinical examination. Secondary outcome measures are: operative time, complications, hospital stay, postoperative pain assessed using a NRS score (0 = no pain to 10 = maximum pain), time to resumption of daily activity, ODS score, quality of life with the SF36 Health Survey questionnaire, and patient overall Satisfaction index 12 months after the operation. Patients who did not strictly follow the postoperative protocol were excluded from the study: even skipping one the postoperative controls was considered a sufficient condition for exclusion. However a phone call was performed in these cases to assess at least the persistence of symptoms.

Statistical Analysis

Continuous data are shown as arithmetic mean (SD) and qualitative data as absolute and percent frequencies. The statistical software package SPSS 24.0 for Windows 7 Professional (SPSS Inc. Chicago, IL, USA) is used. The two-sample t-test for unpaired data, ANOVA for repeated measures and Chi Square test are used, as appropriate. Differences are considered significant with values of $P < 0.05$.

RESULTS

Preoperative data

From January 2013 to June 2017, 384 women (mean age 68 years, range 42-77) were selected through the above-described protocol and submitted to L-POPs. All patients had ODS and symptomatic 3rd degree genital prolapse and 61 (15.9%) had also a SUI. The BMI was 27.5 (±2.1). Two hundred and fifty-three patients (66.0%) were multiparous, with mean parity 2.5 (±0.8); 169 patients (44.0%) had had a previous hysterectomy. The incidence of preoperative symptoms is reported in Table 2. Mean resting and squeeze pressures were 64.5(±6.6) and 118.2(±11.4) mmHg, respectively. Preoperative defecography parameters are shown in Table 3.

Operative data (Table 4)

The ASA score was 2.6 (±0.4). Mean operating time was 89 (±5.9) minutes. There was no operative mortality. Major complications requiring reoperation occurred in 11 pts (2.9%): 3 bleedings within the trocar site requiring hemostasis, 2 intestinal occlusions for peritoneal adhesions treated with adhesiolysis, 2 bleedings for injury of the oblique muscle, 2 injuries of the bladder sutured by cystoscopy and 1 infection of the mesh treated with mesh removal the mesh. All reoperations were accomplished by laparoscopy. One right lower limb deep venous thrombosis was treated with enoxaparin 6000 U/day for one month. Mean hospital stay was 3.0 (±0.6) days, mean VAS score during hospitalization was 3.6 (±0.4) and no patient exceeded the daily dose of Acetaminophen 1gr plus Ketorolac 30mg x3 i.v.

Follow-up data

Sixteen patients (4.2%) were excluded from the analysis for skipping one of the postoperative examination: 5 patients skipped the 1st-month, 5 the 6th-month, and the other 6 the 12th-month control. All of them were living in other regions of Italy far from our Istitutions. At a phone call after the missed control 2 out of the 16 had residual anorectal

symptoms.

The mean follow-up was 36.3 (±4.4) months. Nineteen patients (4.9%) with persistence of symptomatic rectal internal prolapse and/or rectocele with ODS score > 5 were submitted to a STARR operation after 1- year follow-up. Two patients with residual SUI (3.3%) were submitted to trans-obturator tape (TOT) sling.

The mean period of daily activity resumption was 16.3(±4.8) days. Anal/rectal/uro-gynecologic symptoms and ODS scores significantly improved after the operation (P<0.001) with no worsening of anal continence (Table 2). Incidence of postoperative fecal urgency was 0%. Postoperative defecography showed a significant (P < 0.001) reduction of all parameters in 315 pts (82%) with a strict correlation with symptoms relieve and excellent/good Satisfaction Index. The mean reduction of the perineal descent was 3.0 (±0.2) cm.

As shown in Table 5, quality of life by the SF36 Health Survey score significantly improved after the operation (P <0.01); 78.0% of patients reported an excellent/good overall Satisfaction Index, 15.5% fairly good and 6.5% poor (Table 6)

DISCUSSION

The attempt to resolve frequently associated pelvic floor diseases with a single operation is attractive for reducing morbidity and costs, and also considering the pathophysiology of pelvic organ prolapse. Genital prolapse can, in fact, be considered a total pelvic prolapse often including enterocele, cystocele, rectocele and rectal prolapse and the pelvic surgeon's mission ideally should be to restore anatomy and function of the pelvis. Traditional surgery for POP does not correct a concomitant rectal prolapse with ODS and usually involves removal of the uterus, which is a very important organ for the anatomy of the pelvis and the physiology of defecation.

In the last decade experience we studied a great number of patients with complex pelvic floor diseases by a dynamic pelvigraphy and we observed that the uterus and the small intestine assist the emptying of the bladder and the rectum. The rectal emptying begins after an intense straining, which is completed by the action of the other pelvic organs, the uterus moves towards the anterior compartment, compressing the bladder and stimulating urination, while the small intestine, slipping on the uterus, seems contributing to squeeze the sigma-rectum through the Douglas pouch, assisting the evacuation (as shown in video 2). In hysterectomized patients the bladder appears to be dilated and the sigmoid colon interferes with bladder repletion and emptying. An enterocele can develop, compressing the rectum and ODS can follow. The L-POPs aims at simultaneous correction of pelvic multiorgan prolapse, preserving the uterus, which continues to divide the pelvis into an anterior and a posterior compartment, modulating evacuation and urination.

We believe that fixation of the vaginal vault to the Mackenrodt ligaments is important for restoring a normal pelvic floor anatomy, in the attempt to treat sexual, urinary and defecatory symptoms. As demonstrated by De Lancey stretching and breaking of the cardinal ligaments is the primary cause of hysterocele, while the other changes (lengthening of utero-sacral ligaments, round and pubo-cervical ligaments etc.) are

secondary to the traction by the prolapsed uterus.[14] Shortening the round ligaments during the L-POPs operation is directed to correct the uterine retroversion. The L-POPs can be successfully performed in hysterectomized patients too. Finally, in the event of a big preoperative rectocele, or a rectocele residual to L-POPs, a STARR procedure can be added.

Laparoscopy has all the theoretic benefits to be considered the ideal approach to the pelvic floor for its minimal invasivity, the good exposition of the pelvis and the optimal cosmetic impact. On the other hand, up to now laparoscopic techniques for corrective pelvic floor surgery, showed many limitations and none offered a single-stage correction of total pelvic prolapse.

In 1967 Kapandji described a Colpo-Isthmo-Cystopexy, with transverse sub-peritoneal strips from the anterior superior iliac spines to the vagina, associated with Douglassectomy and reconstruction of the round ligaments. The limits were the 4-hour operative time and the excessive anterior shifting of the vagina, resulting in the widening of the recto-vaginal space, which is a well-known open door for the onset of an enterocele.[15]

The Laparoscopic Colpo-Sacropexy (LCS) is technically difficult, requires high operative skills and is not infrequently complicated by bladder injury (5%).[16] Even if the reported global success rate of LCS is very high, this operation cannot correct an associated symptomatic rectal prolapse, and can even worsen the defecatory function due to partial occlusion and stiffness of the Douglas pouch caused by the mesh.[16] In case of concomitant rectal prolapse the association of a rectopexy to LCS is technically feasible, nevertheless it is well known that a rectopexy without resection could worsen an ODS, independently from the technique used.[17]

Laparoscopic Lateral Suspension (LLS) , in which the mesh, fixed to the dissected anterior and posterior vaginal wall, is laterally suspended to the abdominal wall, posterior to the

anterior superior iliac spine, is effective for repairing the vaginal wall prolapse, as well than the traditional sacrocolpopexy, with lower complication rate, particularly regarding vascular or nerve lesions. However the limits of this procedure are almost the same than LCS, as it cannot correct an associated rectocele and can accelerate the onset of an enterocele and a rectal prolapse.[18] Furthermore, a 3.8% rate of mesh erosion after LLS was reported.[19]

The recent technique of Laparoscopic Vaginal Suspension and Rectopexy, which consists in the fixation of three strips of polypropylene mesh to the posterior vaginal vault (or the vaginal apex) and bilaterally to the sacral promontory, associated with a rectopexy, is considered indicated in patients with full-thickness rectal prolapse and fecal incontinence but not in patients with ODS.[20]

The Laparoscopic Ventral Mesh Rectopexy (LVR), which is at reason very popular because of the good results achieved in the cure of ODS and enterocele, is devised for treating internal and external rectal prolapse and enterocele but does not entail the correction of a concomitant 3rd/4th grade POP and/or cystocele. According to the proposing author, about one in three patients will not benefit from surgery and careful selection of indications is mandatory. [21,22]

In our series, LPOPs was very effective in correcting the associated 3rd, or 4th degree genital prolapse, ODS, and SUI with no mortality, low morbidity and only 2/61 patients showing persistent urinary symptoms. We did not observe any erosion of the mesh in vagina or rectum. Finally, the 19 patients (< 5 %) presenting recurrent ODS one year after L-POPs were successfully submitted to a STARR.

There is common agreement that the difficulty in managing patients with associated pelvic floor diseases with the very large number of one, two or more stage surgical approaches described in Literature, prompt for the creation of pelvic surgery units, involving skilled specialists dedicated to diagnosis and treatment of these conditions. However, in our country only very few pelvic Units have been created, due to the lack of training, funding,

and regulations. A formal specialization in pelvic surgery does not exist in Italy and policy and funding of this issue among the country's 20 Regions are not homogeneous.

The laparoscopic surgery of the pelvic floor requires specific surgical skills. Pucher *et al* reported a learning curve from 25 to 30 cases based on operative time and length of stay, with 3.2% of morbidity for laparoscopic ventral mesh rectopexy.[23] In our hand 15 to 20 cases were sufficient for L-POPs, considering our previous experience of colorectal surgeons with training in laparoscopy and the more than 100 operations performed with general urologists and gynecologists.

The collection of such a large series of patients with rigorous surgical indications in a single center during a limited time frame was determined by the fact that our Unit is a referral center in Italy with more than 50 % of our patients living in other Regions of the country.

However, our study had some limitations, and namely: it is a non-randomized, unicentric experience, without a control group, and follow-up was limited, Longo score has yet not been validated and the assessments have been unblinded which cause a potential bias. On the other hand, the series is very large and the operation, as well as the pre and postoperative controls, were standardized with few drop–outs.

CONCLUSIONS

In our series The L-POPs operation proved to be a safe and effective cure of multiorgan pelvic prolapse, followed by significant improvement of anal/rectal and uro-gynecologycal symptoms and radiological parameters in the medium period. Multicentric randomized studies comparing L-POPs with an appropriate control group and longer follow-up are now needed to assess the real effectiveness of this promising technique.

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LEGENDS

Video 1 shows the steps of LPOP-s technique, using a polypropylene mesh, knitted in double thread, with pore size 0.7mm

Video 2 shows a dynamic pelvigraphy in a patient with ODS and genital prolapse

A minimally invasive technique for the one-stage treatment of complex pelvic floor diseases: Laparoscopic – Pelvic Organ Prolapse suspension (L- POPs)

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ABSTRACT

Objective . The aim of this prospective study was to assess the safety and effectiveness of a new single laparoscopic operation devised to relieve obstructed defecation, gynecologic and urinary symptoms in a large series of female patients with multi-organ pelvic prolapse.

Methods. We submitted 384 female patients to Laparoscopic Pelvic Organ Prolapse Suspension (L-POPS) operation, a new technique based on suspension of the middle pelvic compartment, by using a polypropylene mesh and followed-up 368 of them, with defecography performed 12 months after surgery and a standardized protocol.

Results. The 368 patients were followed-up for 36.3 (±4.4) months, Recurrence rate was 4.9% for obstructed defecation syndrome and 3.3% for stress urinary incontinence. Complication rate was 2.9%. The mean period of daily activity resumption was 16.3 (±4.8) days. Ano-rectal and uro-gynecologic symptoms and scores significantly improved after the operation (P<0.001), with no worsening of anal continence. Incidence of postoperative fecal urgency was 0%. Postoperative defecography showed a significant (P < 0.001) improvement of all parameters in 315 patients (82%). SF36 Health Survey score significantly improved after the operation (P <0.01). An excellent/good overall Satisfaction Index was reported by 78.0% of patients.

Conclusions. In our experience the Laparoscopic-Pelvic Organ Prolapse Suspension seems to be safe and effective as a one-stage treatment of associated pelvic floor diseases. Randomized studies with an appropriate control group and longer follow-up are now needed to assess the effectiveness of this promising technique.

IN BRIEF

The laparoscopic suspension of the middle pelvic compartment with the new L-POPs technique is safe and gives good mid-term results in the one-stage treatment of associated pelvic floor diseases.

INTRODUCTION

The prevalence of pelvic floor diseases, including pelvic organ prolapse (POP), stress urinary incontinence (SUI), obstructed defecation syndrome (ODS) and fecal incontinence, is very high: more than 23% of community-dwelling women will have at least one of these conditions and the prevalence increases with age:[1] an epidemiologic study on the Swedish female population showed 19% urinary incontinence, 23% gas incontinence, 6% solid stools incontinence, and 14% digitations in over sixty-year old women.[2]

The association of two, or more, pelvic organ diseases in the same patient is very frequent, reaching 20% of old resident women**.**[3] In the study by Gonzales-Argente *et al.,* 50% of women with ODS due to rectal prolapse and rectocele, showed a concomitant genital prolapse and 50% of women with SUI reported symptoms of ODS.[4]

About 30% of women operated on for POP need further pelvic surgery.[5]

A safe and effective surgical treatment of patients with associated pelvic floor diseases would benefit of a multidisciplinary approach by a team of pelvic floor clinicians, including gynecologist, urologist and colorectal surgeon. On the contrary, different specialists usually treat these patients in two, or more steps, with different surgical procedures, complications and outcomes.

In the last decades an incredible number of surgical techniques to treat pelvic floor diseases have been described, but very few important studies on combined pelvic approaches have been published. Firm recommendations as to the optimal treatment of these conditions are yet to be developed.

In a previous study we demonstrated that combined rectal and urogynecologic one-stage surgery, performed by the same surgical team with one, or two colorectal surgeons and one urogynecologist, is safe and effective, and is associated with significant improvement of symptoms, quality-of-life, radiological parameters, and with low recurrences at 2 years.[6]

The possibility to treat concomitant pelvic floor diseases with a single operation is very attractive and laparoscopic techniques have all the theoretic requisites to reach this goal. The Laparoscopic Pelvic Organ Prolapse Suspension (L-POPs), proposed by Antonio Longo MD for the one-stage treatment of intussusception and rectocele even if associated with SUI and/ or genital prolapse, consists of the preperitoneal positioning of a V-shaped polypropylene mesh, with the vertex sutured to the vaginal and rectal wall and the lateral edges to the external oblique muscle fascia bilaterally, so as to create the suspension of the middle pelvic compartment. In the event of a residual symptomatic rectocele, STARR procedure,[7] or other form of rectocele repair can be considered.

In the present prospective study we report the clinical and functional results of L-POPs operation in a large series of female patients with associated pelvic floor diseases.

MATERIAL AND METHODS

Study Population and Inclusion Criteria

Patients potentially candidates for the study were all women with association of rectal intussusception/rectocele and 3rd, or 4th genital prolapse referred to the Proctologic & Pelvic Surgery Unit of Humanitas Cliniche Gavazzeni, Bergamo .

These patients were recruited for the study on the basis of the following criteria :

Inclusion criteria:

Association of all the following conditions:

- internal rectal prolapse/intussusception and rectocele > 3cm ;
- continence score < 3 ;
- resting pressure < 40 mm/Hg and squeeze pressure >100 mm/Hg. The values of resting and squeeze pressure were chosen to avoid an operation in patients with sphincterial defects and risk of postoperative fecal incontinence , or patients with hypertonic and dissinergic sphincters with risk of postoperative severe pain and fecal urgency;
- 3rd,or 4th degree genital prolapse.
- Patients with the additional concomitant presence of enterocele 3-5 cm at rest, obstructing the rectum during straining, and/or SUI were also included. The presence of SUI was an additional criteria : patients with intussusception /rectocele with SUI, but without genital prolapse were excluded from the study

Exclusion criteria:

- 1st or 2nd degree genital prolapse,
- overactive bladder syndrome, urinary tract infections,
- previous pelvic radiotherapy, pelvic neoplasms,

- pudendal neuralgia, puborectalis syndrome,
- absolute contraindications to surgery.

The following are the key elements of our standardized evaluation of the recruited patients:

1) Validated Renzi ODS [8] and Wexner continence[9] scores. The Longo ODS score,[7,10] even though not yet validated, was also used, as we consider it more appropriate for our patients. The score, showed in Table 1, explores 9 parameters, ranging from 0 to 40: defecation frequency (0-3), intensity (0-2) and duration (0-2) of straining, feeling of incomplete evacuation (0-3), recto-perineal discomfort (0-3), activity reduction (0-6), use of laxatives (0-7), enema (0-7), and digitation (0-7).

2) Gynecological examination, with POP-Q (Pelvic Organ Prolapse Quantification System) classification;[12]

3) Proctologic examination and proctoscopy

4) Urodynamic study with uroflowmetry, cystomanometry and residual urine volume to exclude an overactive bladder syndrome in patients with SUI ;

5) Quality of life with the validated SF36 Health Survey score;[11]

6) Colonoscopy to exclude concomitant colorectal diseases;

7) Anorectal manometry to evaluate the integrity of anal sphincters;

8) Dynamic colpocystodefecography with opacification of small bowel (dynamic pelvigraphy) to evaluate the grade of POP, the presence of morphological (rectocele, rectal prolapse, intussusception) and/or functional (puborectalis syndrome, incontinence) rectal disorders, and the presence of concomitant enterocele and/or cystocele. The following defecography parameters were recorded: extent of rectal prolapse/ intussusception, rectocele depth, perineum descent at rest and under strain, distance from the vaginal vault to the pubis and to the sacrum. The three parameters of Dvorkin classification were used to determine the extent of intussusception: anterior and posterior thickness of prolapsed tissue (< 3mm = mucosal prolapse, > 3mm = full-thickness intussusception), distance from

the point of take-off of the intussusception to the anorectal junction, and intussusception descent from the point of take-off to the most distal point of the intussusception;[13]

9) Patient Satisfaction Index, defined as follows: Excellent: no symptoms. Good: 1 episode /month of ODS with use of laxatives. Fairly good: 2/3 episodes/month of ODS with use of laxatives. Poor: more than 3 episodes/month of ODS with use of laxatives, or persistence of other symptoms.

The Ethical Committee approved the study protocol. All patients gave written informed consent. All patients were operated on by the same surgical team, using the technique described below, with no modifications.

Preoperative management

An enema washing is carried out on the day before surgery. The procedure is performed under general anesthesia. Immediately after the induction of anesthesia a Foley bladder catheter 16Ch is introduced and the patient receives routine antibiotic prophylaxis with a single shot of cefotaxime (2g) plus metronidazole (500 mg).

Surgical technique[7](see video 1)

The L-POPs operation is performed with the patient in Lloyd-Davis and Trendelenburg positions (30°). A Foerster sponge forceps with gauze is introduced in the rectum and a uterine manipulator into the vagina to recognize the anterior rectal wall and the posterior vaginal wall (or the vaginal vault in hysterectomized patients), respectively. A 13 mmHg pneumoperitoneum is created after positioning an umbilical 12 mm trocar with an open technique. A second 12 mm trocar is introduced through an incision in the right iliac fossa and a third 5mm trocar is positioned in the left iliac fossa. The Douglas pouch is exposed and a V-shaped mesh, with two 25 cm long and 2 cm wide branches is prepared. This is obtained by folding a macroporous, square shaped, 30 cm x 30 cm polypropylene mesh, (Microval , St Just Malmont, France) along the diagonal and then cutting a 2cm wide strip along one of the two short sides of the triangle. The V-shaped mesh is then introduced in

the pelvis through the right trocar. The uterus is suspended to the anterior abdominal wall with a straight transcutaneous needle. The uterine suspension is primary used for visualization. Concomitant SUI was not treated with a separate procedure, but suturing the apex of the mesh to the anterior and lateral vaginal fornix wall with 2-0 Prolene stitches, anteriorly to the uterus, after the dissection of vesico-uterine space: the same is done in case of prevalence of anterior descent. In patients with predominant rectal prolapse the apex of the mesh is sutured to the posterior vaginal fornix wall (or to the vaginal vault in hysterectomized patients) with plicature of the peritoneum of the Douglas pouch: fixing the vaginal vault to the cardinal ligaments is important to restore the De Lancey first level of hysterocele. The 2-0 Prolene stitch is then also fixed to the peritoneum so as to cover the anterior rectal wall, taking care of pushing the upper rectum with gauzed forceps introduced in the rectal lumen, in order to show the peritoneum and to avoid perforating the rectal wall. Normally two central and two lateral stitches are sufficient for correct positioning of the V mesh apex. The distance from the vaginal attachment of the mesh to the oblique external fascia is about 20 cm. Two bilateral incisions of the skin 2cm posterior and superior to the anterior iliac spine and dissection with scissors of the fascia and the muscular fibers of oblique muscle, allow reaching the preperitoneal space under laparoscopic control. Taking care to avoid injury to the iliac vessels and ureter, dissection of the lateral peritoneum and the broad ligament proceeds using a curved tip laparoscopic needle holder, introduced into the preperitoneal tunnel. The right lateral aspect of the mesh is gently pulled through the preperitoneal tunnel until the right external oblique muscle fascia incision is reached. The same is done on the left side.

Before fixing the mesh to the fascia, with the patient in 50° Trendelenburg position, the mesh is strained until the normal pelvic aspect is restored. In case of uterine retroversion the round ligaments are shortened and attached to the mesh arms to restore the normal anatomy of the middle pelvic compartment. The peritoneum is sutured with Vycril 2-0

stitches to cover the apex of the mesh. About 5 cm of the lateral aspects of the mesh are exteriorized through the skin incisions, tunneled under the external oblique muscle fascia and fixed with Vicryl 2-0 stitches . Finally, the trocar incisions are sutured.

Postoperative management

The patient is started on a clear liquid diet from the first postoperative day. Antibiotics are continued for three days. Acetaminophen 1gr plus Ketorolac 30mg i.v., t.i.d is used for postoperative pain control during hospitalization. Antithrombotic prophylaxis with enoxaparin 4000 U/day for 12 days is administered.

Follow-up

Pre and postoperative assessments were conducted by one of the surgeons of the team. Clinical examination is scheduled at 7 days and 1, 3, 6, 12 and 24 months after the operation**.** A dynamic defecography is repeated 12 months after surgery.

Primary outcome measure is the rate of failure at 2 years' follow-up defined as the persistence of any single or combination of the following conditions: ODS score > 5, persistence of SUI, presence of vaginal discomfort and/or dyspareunia, residual mucosal rectal prolapse > 2cm at proctoscopy, residual 2nd degree (or greater) genital prolapse at clinical examination. Secondary outcome measures are: operative time, complications, hospital stay, postoperative pain assessed using a NRS score (0 = no pain to 10 = maximum pain), time to resumption of daily activity, ODS score, quality of life with the SF36 Health Survey questionnaire, and patient overall Satisfaction index 12 months after the operation. Patients who did not strictly follow the postoperative protocol were excluded from the study: even skipping one the postoperative controls was considered a sufficient condition for exclusion. However a phone call was performed in these cases to assess at least the persistence of symptoms.

Statistical Analysis

Continuous data are shown as arithmetic mean (SD) and qualitative data as absolute and percent frequencies. The statistical software package SPSS 24.0 for Windows 7 Professional (SPSS Inc. Chicago, IL, USA) is used. The two-sample t-test for unpaired data, ANOVA for repeated measures and Chi Square test are used, as appropriate. Differences are considered significant with values of $P < 0.05$.

RESULTS

Preoperative data

From January 2013 to June 2017, 384 women (mean age 68 years, range 42-77) were selected through the above-described protocol and submitted to L-POPs. All patients had ODS and symptomatic 3rd degree genital prolapse and 61 (15.9%) had also a SUI. The BMI was 27.5 (±2.1). Two hundred and fifty-three patients (66.0%) were multiparous, with mean parity 2.5 (±0.8); 169 patients (44.0%) had had a previous hysterectomy. The incidence of preoperative symptoms is reported in Table 2. Mean resting and squeeze pressures were 64.5(±6.6) and 118.2(±11.4) mmHg, respectively. Preoperative defecography parameters are shown in Table 3.

Operative data (Table 4)

The ASA score was 2.6 (±0.4). Mean operating time was 89 (±5.9) minutes. There was no operative mortality. Major complications requiring reoperation occurred in 11 pts (2.9%): 3 bleedings within the trocar site requiring hemostasis, 2 intestinal occlusions for peritoneal adhesions treated with adhesiolysis, 2 bleedings for injury of the oblique muscle, 2 injuries of the bladder sutured by cystoscopy and 1 infection of the mesh treated with mesh removal the mesh. All reoperations were accomplished by laparoscopy. One right lower limb deep venous thrombosis was treated with enoxaparin 6000 U/day for one month. Mean hospital stay was 3.0 (±0.6) days, mean VAS score during hospitalization was 3.6 (±0.4) and no patient exceeded the daily dose of Acetaminophen 1gr plus Ketorolac 30mg x3 i.v.

Follow-up data

Sixteen patients (4.2%) were excluded from the analysis for skipping one of the postoperative examination: 5 patients skipped the 1st-month, 5 the 6th-month, and the other 6 the 12th-month control. All of them were living in other regions of Italy far from our Istitutions. At a phone call after the missed control 2 out of the 16 had residual anorectal

symptoms.

The mean follow-up was 36.3 (±4.4) months. Nineteen patients (4.9%) with persistence of symptomatic rectal internal prolapse and/or rectocele with ODS score > 5 were submitted to a STARR operation after 1- year follow-up. Two patients with residual SUI (3.3%) were submitted to trans-obturator tape (TOT) sling.

The mean period of daily activity resumption was 16.3(±4.8) days. Anal/rectal/uro-gynecologic symptoms and ODS scores significantly improved after the operation (P<0.001) with no worsening of anal continence (Table 2). Incidence of postoperative fecal urgency was 0%. Postoperative defecography showed a significant (P < 0.001) reduction of all parameters in 315 pts (82%) with a strict correlation with symptoms relieve and excellent/good Satisfaction Index. The mean reduction of the perineal descent was 3.0 (±0.2) cm.

As shown in Table 5, quality of life by the SF36 Health Survey score significantly improved after the operation (P <0.01); 78.0% of patients reported an excellent/good overall Satisfaction Index, 15.5% fairly good and 6.5% poor (Table 6)

DISCUSSION

The attempt to resolve frequently associated pelvic floor diseases with a single operation is attractive for reducing morbidity and costs, and also considering the pathophysiology of pelvic organ prolapse. Genital prolapse can, in fact, be considered a total pelvic prolapse often including enterocele, cystocele, rectocele and rectal prolapse and the pelvic surgeon's mission ideally should be to restore anatomy and function of the pelvis. Traditional surgery for POP does not correct a concomitant rectal prolapse with ODS and usually involves removal of the uterus, which is a very important organ for the anatomy of the pelvis and the physiology of defecation.

In the last decade experience we studied a great number of patients with complex pelvic floor diseases by a dynamic pelvigraphy and we observed that the uterus and the small intestine assist the emptying of the bladder and the rectum. The rectal emptying begins after an intense straining, which is completed by the action of the other pelvic organs, the uterus moves towards the anterior compartment, compressing the bladder and stimulating urination, while the small intestine, slipping on the uterus, seems contributing to squeeze the sigma-rectum through the Douglas pouch, assisting the evacuation (as shown in video 2). In hysterectomized patients the bladder appears to be dilated and the sigmoid colon interferes with bladder repletion and emptying. An enterocele can develop, compressing the rectum and ODS can follow. The L-POPs aims at simultaneous correction of pelvic multiorgan prolapse, preserving the uterus, which continues to divide the pelvis into an anterior and a posterior compartment, modulating evacuation and urination.

We believe that fixation of the vaginal vault to the Mackenrodt ligaments is important for restoring a normal pelvic floor anatomy, in the attempt to treat sexual, urinary and defecatory symptoms. As demonstrated by De Lancey stretching and breaking of the cardinal ligaments is the primary cause of hysterocele, while the other changes (lengthening of utero-sacral ligaments, round and pubo-cervical ligaments etc.) are

secondary to the traction by the prolapsed uterus.[14] Shortening the round ligaments during the L-POPs operation is directed to correct the uterine retroversion. The L-POPs can be successfully performed in hysterectomized patients too. Finally, in the event of a big preoperative rectocele, or a rectocele residual to L-POPs, a STARR procedure can be added.

Laparoscopy has all the theoretic benefits to be considered the ideal approach to the pelvic floor for its minimal invasivity, the good exposition of the pelvis and the optimal cosmetic impact. On the other hand, up to now laparoscopic techniques for corrective pelvic floor surgery, showed many limitations and none offered a single-stage correction of total pelvic prolapse.

In 1967 Kapandji described a Colpo-Isthmo-Cystopexy, with transverse sub-peritoneal strips from the anterior superior iliac spines to the vagina, associated with Douglassectomy and reconstruction of the round ligaments. The limits were the 4-hour operative time and the excessive anterior shifting of the vagina, resulting in the widening of the recto-vaginal space, which is a well-known open door for the onset of an enterocele.[15]

The Laparoscopic Colpo-Sacropexy (LCS) is technically difficult, requires high operative skills and is not infrequently complicated by bladder injury (5%).[16] Even if the reported global success rate of LCS is very high, this operation cannot correct an associated symptomatic rectal prolapse, and can even worsen the defecatory function due to partial occlusion and stiffness of the Douglas pouch caused by the mesh.[16] In case of concomitant rectal prolapse the association of a rectopexy to LCS is technically feasible, nevertheless it is well known that a rectopexy without resection could worsen an ODS, independently from the technique used.[17]

Laparoscopic Lateral Suspension (LLS) , in which the mesh, fixed to the dissected anterior and posterior vaginal wall, is laterally suspended to the abdominal wall, posterior to the

anterior superior iliac spine, is effective for repairing the vaginal wall prolapse, as well than the traditional sacrocolpopexy, with lower complication rate, particularly regarding vascular or nerve lesions. However the limits of this procedure are almost the same than LCS, as it cannot correct an associated rectocele and can accelerate the onset of an enterocele and a rectal prolapse.[18] Furthermore, a 3.8% rate of mesh erosion after LLS was reported.[19]

The recent technique of Laparoscopic Vaginal Suspension and Rectopexy, which consists in the fixation of three strips of polypropylene mesh to the posterior vaginal vault (or the vaginal apex) and bilaterally to the sacral promontory, associated with a rectopexy, is considered indicated in patients with full-thickness rectal prolapse and fecal incontinence but not in patients with ODS.[20]

The Laparoscopic Ventral Mesh Rectopexy (LVR), which is at reason very popular because of the good results achieved in the cure of ODS and enterocele, is devised for treating internal and external rectal prolapse and enterocele but does not entail the correction of a concomitant 3rd/4th grade POP and/or cystocele. According to the proposing author, about one in three patients will not benefit from surgery and careful selection of indications is mandatory. [21,22]

In our series, LPOPs was very effective in correcting the associated 3rd, or 4th degree genital prolapse, ODS, and SUI with no mortality, low morbidity and only 2/61 patients showing persistent urinary symptoms. We did not observe any erosion of the mesh in vagina or rectum. Finally, the 19 patients (< 5 %) presenting recurrent ODS one year after L-POPs were successfully submitted to a STARR.

There is common agreement that the difficulty in managing patients with associated pelvic floor diseases with the very large number of one, two or more stage surgical approaches described in Literature, prompt for the creation of pelvic surgery units, involving skilled specialists dedicated to diagnosis and treatment of these conditions. However, in our country only very few pelvic Units have been created, due to the lack of training, funding,

and regulations. A formal specialization in pelvic surgery does not exist in Italy and policy and funding of this issue among the country's 20 Regions are not homogeneous.

The laparoscopic surgery of the pelvic floor requires specific surgical skills. Pucher *et al* reported a learning curve from 25 to 30 cases based on operative time and length of stay, with 3.2% of morbidity for laparoscopic ventral mesh rectopexy.[23] In our hand 15 to 20 cases were sufficient for L-POPs, considering our previous experience of colorectal surgeons with training in laparoscopy and the more than 100 operations performed with general urologists and gynecologists.

The collection of such a large series of patients with rigorous surgical indications in a single center during a limited time frame was determined by the fact that our Unit is a referral center in Italy with more than 50 % of our patients living in other Regions of the country.

However, our study had some limitations, and namely: it is a non-randomized, unicentric experience, without a control group, and follow-up was limited, Longo score has yet not been validated and the assessments have been unblinded which cause a potential bias. On the other hand, the series is very large and the operation, as well as the pre and postoperative controls, were standardized with few drop–outs.

CONCLUSIONS

In our series The L-POPs operation proved to be a safe and effective cure of multiorgan pelvic prolapse, followed by significant improvement of anal/rectal and uro-gynecologycal symptoms and radiological parameters in the medium period. Multicentric randomized studies comparing L-POPs with an appropriate control group and longer follow-up are now needed to assess the real effectiveness of this promising technique.

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LEGENDS

Video 1 shows the steps of LPOP-s technique, using a polypropylene mesh, knitted in double thread , with pore size 0.7mm

Video 2 shows a dynamic pelvigraphy in a patient with ODS and genital prolapse

Table

Table 4. Operative data in 384 patients submitted to L-POPs operation: values expressed as mean (SD) for operating time, hospital stay, VAS scale and n (%) for complications

Operating time (min)	82.5 (5.9)
Hospital stay (days)	3.0 (0.6)
VAS scale	3.6 (2.4)
Complications	11 (2.9)

Table

Table 5. Pre and postoperative (12 months) SF36 Health Survey questionnaire in patients submitted to L-POPs operation: values expressed as mean(SD)

Finding	Preoperative n =384	Postoperative n=368	P*
Limitations: physical activities	15.2 (1.5)	19.6 (1.8)	<0.01
Limitations: social activities for physical or emotional problems	5.7 (0.8)	6.6 (1.0))	<0.01
Limitations: usual role activities for physical problems	5.3 (0.7)	6.4(0.7)	<0.01
Body pain	4.5 (0.6)	3.3 (0.7)	<0.01
General mental health	6.7 (0.9)	4.8 (0.8)	<0.01
Limitations: usual role activities for emotional problems	4.1 (0.4)	5.0 (0.7)	<0.01
Vitality	33.8 (3.3)	31.4 (2.9)	<0.01
General health perceptions	12.8 (1.4)	11.2 (1.1)	<0.01
Total	80.5 (77-84)	84 (82-90)	<0.01

Table

Table 6. Overall Patient Satisfaction at 12 months in 368 patients submitted to L-POPs operation: values expressed as number of pts (%).

	12 months
Excellent	**115 (31.3)**
Good	**172 (46.7)**
Fairly good	**57 (15.5)**
Poor	**24 (6.5)**

Table

Table 1. Longo ODS Score

Parameter	Description	**Score**	Description	**Score**	Description	**Score**	Description	**Score**	Description	**Score**
Defecation - Frequency	1-2- def./1-2 days	**0**	2 def ./week or 3 def. or attempts/day	**1**	1 def ./week or 4 def. or attempts/day	**2**	< 1 def./week or >4 def. or attempts/day	**3**		
Straining - Intesity	No or light straining	**0**	moderate	**1**	intensive	**2**				
Straining - duration			Short time	**1**	Prolonged or many times	**2**				
Feeling of incomplete evacuation	never	**0**	≤ 1/ week	**1**	2 / week	**2**	> 2 / week	**3**		
Recto-perineal discompfort	never	**0**	≤ 1/ week	**1**	2 / week	**2**	> 2 / week	**3**		
Activity reduction	never	**0**	< 25% of activity	**2**	25-50% of activity	**4**	> 50% of activity	**6**		
Laxatives	never	**0**	< 25% of defecations	**1**	25 - 50% of defecations	**3**	>50% of defecations	**5**	Always	**7**
Enemas		**0**		**1**		**3**		**5**		**7**
Digitation		**0**		**1**		**3**		**5**		**7**

Table

Table 2. Pre and postoperative (12 months) clinical data, fecal continence score and ODS score after L-POPs operation: n (%) for symptoms and mean (SD) for scores

Symptom/score	Pre-operative n=384	Post-operative n= 368	P*
Rectal Dyschezia	295 (76.8)	18 (4.9)	<0.0001
Tenesmus	269 (70.0)	17 (4.6)	<0.0001
Rectal Bleeding	155 (40.4)	2(0.5)	<0.0001
Continence score	0.4(0.3)	0.4 (0.2)	1.00
Renzi ODS score [8]	17.5 (2.1)	2.3 (0.5)	<0.0001
Longo ODS score [7]	32.4 (4.3)	5.1 (0.7)	<0.0001
Dyspareunia	130 (33.8)	9 (2.4)	<0.0001
Vaginal discomfort	211 (54.9)	19 (5.2)	<0.0001
SUI	62 (16.1)	2 (0.5)	<0.0001

* McNemar test for evaluation of symptoms and 2-sample t-test for scores were used

Table

Table 3. Pre and post-operative defecography data in patients submitted to L-POPs operation: values expressed as mean (SD)

Finding	**Preoperative** n=384	**Postoperative** n=368
Intussusception thickness (mm)		
Anterior	**5.4 (0.9)**	**3.3 (0.5)**
Posterior	**4.9 (0.7)**	**3.1(0.3)**
Point of take off (mm) :		
Anterior	**59.7 (10.9)**	**42.6 (8.4)**
Posterior	**60.8 (11.8)**	**45.9 (7.7)**
Intussusception descent (mm)		
Anterior	**25.2 (6.8)**	**16.8 (4.8)**
Posterior	**28.7(6.3)**	**17.3 (5.0)**
Rectocele depth (cm)	**4.0 (0.4)**	**2.1 (0.3)**

Wilcoxon test was used: all parameters significantly improved after operation ($p<0.001$)

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