

## Laparoscopic surgery for rectal prolapse and pelvic floor disorders

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### Abstract

Pelvic floor disorders are different dysfunctions of gynaecological, urinary or anorectal organs, which can present as incontinence, outlet-obstruction and organ prolapse or as a combination of these symptoms. Pelvic floor disorders affect a substantial amount of people,

predominantly women. Transabdominal procedures play a major role in the treatment of these disorders. With the development of new techniques established open procedures are now increasingly performed laparoscopically. Operation techniques consist of various rectopexies with suture, staples or meshes eventually combined with sigmoid resection. The different approaches need to be measured by their operative and functional outcome and their recurrence rates. Although these operations are performed frequently a comparison and evaluation of the different methods is difficult, as most of the used outcome measures in the available studies have not been standardised and data from randomised studies comparing these outcome measures directly are lacking. Therefore evidence based guidelines do not exist. Currently the laparoscopic approach with ventral mesh rectopexy or resection rectopexy is the two most commonly used techniques. Observational and retrospective studies show good functional results, a low rate of complications and a low recurrence rate. As high quality evidence is missing, an individualized approach is recommend for every patient considering age, individual health status and the underlying morphological and functional disorders.

**Key words:** Resection rectopexy; Pelvic floor disorders; Rectal prolapse; Laparoscopy; Mesh rectopexy; Suture rectopexy

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**Core tip:** Pelvic floor disorders are dysfunctions of the pelvic organs which affect a substantial amount of people, predominantly women. Operative treatment is often necessary and laparoscopic procedures play a major role. Many different techniques are used but their functional and operative outcome is hardly evaluated in randomised studies. In this review we summarize the present status of laparoscopic surgery for pelvic floor disorders. The different techniques are described,

compared and rated concerning their operative outcome, functional results and recurrence rates. Clinically important topics like management of complications and surgery in elderly people are highlighted.

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## INTRODUCTION

The term pelvic floor disorders summarises different dysfunctions of gynaecological, urinary or anorectal organs. These dysfunctions can present as incontinence, outlet-obstruction and organ prolapse or as a combination of these symptoms. The underlying reasons for these problems can be functional or morphological. Rectocele, enterocele and rectal intussusception are the most frequently encountered morphological manifestations and are commonly associated with a descensus of the perineum. The judgement on to what extent these anatomic disorders are clinically relevant and account for the associated bowel dysfunctions (incontinence, constipation) is difficult, as they often occur in combination and are also frequently found in healthy people<sup>[1,2]</sup>. The prevalence in women is about 25% for at least one of the above morphological pelvic floor abnormalities, somewhat questioning the clinical implications of such diagnosis *per se*.

Complete rectal prolapse is defined as protrusion of all layers of the rectum through the anal canal, full thickness rectal prolapse (FRP). A protrusion of mucosa only is called mucosa prolapse (MP). The clinical differentiation between these two can be difficult.

A common classification divides three grades: Rectal prolapse I °: inner (recto-rectal) intussusception of the rectum proximal of the anal canal; Rectal prolapse II °: inner (recto-anal) intussusception into the anal canal; Rectal prolapse III °: prolapse of the rectum beyond the anus (external prolapse).

The aetiology is unclear. Rectal prolapse is often associated with obesity, pregnancy, chronic constipation and other conditions that lead to increased abdominal pressure.

The most common anatomic varieties in patients with rectal prolapse are redundant sigmoid, diastases of the elevator ani, loss of the vertical position of the rectum and its sacral attachments and a deep cul-de-sac<sup>[3,4]</sup>.

The pathological relevance of an internal prolapse is unclear. A rectal prolapse I ° is present in 20% to 50% of healthy individuals<sup>[2,5]</sup>. On the other hand a recent study on 86 patients with internal rectal prolapse found faecal incontinence in 55% and showed incomplete

evacuation in 45% of patients<sup>[6]</sup>. The intussusceptions that are found in people without symptoms are more often only a MP, whereas patients with evacuation problems significantly more often have a full thickness prolapse<sup>[7]</sup>.

The differentiation to anal prolapse which is a protrusion of anoderm is important as the latter prolapse is generally operated *via* a perineal approach.

A rectocele is a protrusion of the rectum into the vagina. An enterocele/sigmoidocele is a prolapse of the peritoneal sack between rectum and vagina with herniation of small bowel respectively sigmoid. The clinical relevance of these anatomical varieties is also unclear. It is thought that larger rectoceles can lead to outlet obstruction with incomplete emptying. Defecographies showed an incidence of up to 93% in healthy women. Enteroceles can be found in up to 20% of healthy woman<sup>[2,5]</sup>.

A prospective evaluation of 100 patients with obstructive defecation syndrome (ODS) found a combination of rectocele and MP in 54% of patients<sup>[8]</sup>. Dvorkin *et al.*<sup>[7]</sup> tried to define certain predictive symptoms in 896 patients with evacuation disorders. They used an evacuation proctography and found 125 patients with rectal intussusception, 100 patients with rectocele and 152 patients with both pathologies. Anal pain and sensation of prolapse were predictive for the subsequent finding of an isolated intussusception rather than a rectocele.

In a systematic review on laparoscopic ventral rectopexy (LVR) for ODS all patients had a rectocele, 90% had an intussusception and 51% had an enterocele<sup>[9]</sup>.

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## OPERATION PROCEDURES

Multiple operations have been described for the therapy of pelvic floor disorders. In the following section techniques and results of operations as far as they are performed laparoscopically are explained and rated (Tables 1 and 2).

The aim of the operation generally is to correct the morphologic alteration and thereby treat the symptoms of the patient, *e.g.*, improve incontinence or constipation and incomplete emptying, depending on what major symptoms the patient is suffering from. This can be achieved by three ways: (1) fixation of the rectum (rectopexy); (2) resection or plication of redundant bowel; and (3) mobilisation of the rectum. Most operations combine the two principles of rectal mobilisation and rectopexy, some operations add bowel resection.

The approach can be transanal/perineal or trans-abdominal. Abdominal operations seem to result in lower recurrence rates, but there are no randomised controlled trials substantiating this<sup>[10,11]</sup>. Perineal procedures avoid laparotomy/laparoscopy and therefore may have a lower operative risk and morbidity. They may therefore be more suitable for older or high-risk

**Table 1** Abdominal procedures for pelvic floor disorders

Type of procedure	Operation technique
Suture rectopexy (Sudeck)	Complete rectal mobilisation to level of levators Suture of rectum to presacral fascia
Anterior sling rectopexy (Ripstein)	Complete rectal mobilisation to level of levators circular wrapping of mesh around rectum and attachment to the promontory
Lateral mesh rectopexy (Orr-Loygue)	Anterior + posterior complete rectal mobilisation fixation by two lateral mesh strips to promontory
Ventral mesh rectopexy (D'Hoore)	Strictly anterior rectal dissection to level of levators Fixation of mesh strip on distal rectum and to promontory
Posterior mesh rectopexy (Wells)	Complete rectal mobilisation to level of levators Semicircular mesh around rectum posterior, fixation to promontory
Resection rectopexy (Frykman-Goldberg)	Complete rectal mobilisation to level of levators sigmoid resection and suture fixation of rectum to promontory
Rectal mobilisation without rectopexy	Complete rectal mobilisation to level of levators no fixation

**Table 2** Outcome of laparoscopic procedures for pelvic floor disorders

	Minor compl.	Major compl.	Mortality	Conversion	Incontinence	Constipation	Recurrence
LSR	0%-16%	2%-11%	0%	0%-5%	48%-82% (+)	11% (-)-70% (+)	2%-20%
LMR	0%-5%	0%-3%	0%	0%-5%	76%-92% (+)	38% (-)-36% (+)	1.3%-6%
LVR	0%-36%	0%-5%	0%-0.4%	0%-7.4%	70%-90% (+)	60%-80% (+)	0%-14%
LRR	11%-21%	0%-4%	0%-0.8%	0%-6%	62%-94% (+)	53%-80% (+)	0%-11%

Data from studies that report data of laparoscopic rectopexy. Incontinence/constipation: Improvement (+), worsening (-); Minor compl.: Dindo I - II; Major compl.: Dindo III-IV. LSR: Lap. suture rectopexy; LMR: Lap. mesh rectopexy (Wells, Orr-Loygue); LVR: Lap. ventral rectopexy; LRR: Lap. resection rectopexy.

patients with a relevant co-morbidity, although again there are no adequately powered RCTs to back these recommendations up.

Virtually all abdominal procedures that were originally described *via* laparotomy can also be performed laparoscopically. The laparoscopic management of rectal prolapse was first introduced in 1992 and consisted of a suture-less rectopexy with staples without bowel resection. In the meantime, besides the conventional laparoscopic approach, there are new reports of a robotic-assisted approach with the da-Vinci system<sup>[12,13]</sup>. The transabdominal operations differ mainly in the extent of rectal mobilisation, the method of rectal fixation and the additional sigmoid resection.

## RECTOPEXY

The fixation of the rectum to the sacrum is supposed to restore the physiological position of the rectum and thereby also correct the descensus of the pelvic floor. The fixation can be achieved by simple stitching, stapling or by meshes.

### SUTURE RECTOPEXY (SUDECK)

This method was first described by Sudeck in 1922. The operation includes a complete mobilisation of the rectum down to the level of the levators. The rectum is then attached to the promontory by suture or staples. The dorsal mobilisation induces fibrosis which helps to fixate and hold the rectum in place<sup>[14]</sup>.

In the literature this technique was used mostly to treat full rectal-prolapse in some cases combined with outlet obstruction or occasionally for outlet obstruction alone. Morbidity rates of 0% to 16% and no mortality were reported<sup>[15-18]</sup>. Conversion rates were between 0% and 5%. Most reports showed an improvement of incontinence, while constipation was mostly unchanged or even slightly worsened. Recurrence rates were between 2% and 9%<sup>[19]</sup>. A study which performed a longer follow-up found a recurrence rate of 20% ten years after laparoscopic suture rectopexy<sup>[17]</sup>.

### RECTOPEXY WITH MESH OR GRAFT

A mesh or graft is used to achieve a broader fixation and induce more fibrosis. Used materials include fascia lata, synthetic meshes and bio-meshes<sup>[20]</sup>. The mesh can be placed anteriorly, posteriorly, laterally or around the rectum.

### ANTERIOR MESH RECTOPEXY (RIPSTEIN SLING RECTOPEXY)

Ripstein<sup>[21]</sup> described this operative technique in 1952. After complete mobilisation of the rectum a graft constructed out of the fascia lata was wrapped around the rectum and sutured to the promontory. Later instead of a fascia lata graft, synthetic meshes are used.

There is only one case report on this procedure using a laparoscopic approach which found a good clinical outcome (no morbidity, no recurrence)<sup>[22]</sup>.

## LATERAL MESH RECTOPEXY (ORR-LOYGUE)

In this procedure the rectum is completely mobilised anteriorly and posteriorly. Two mesh strips are sutured laterally to the rectum on both sides. The mesh strips are then sutured under tension to the promontory<sup>[23]</sup>.

Several studies examined this technique with a laparoscopic approach. Lechaux *et al.*<sup>[24]</sup> performed 35 laparoscopic Orr-Loygue rectopexies. They reported a surgical morbidity of 5% and no mortality. Incontinence improved in 27% of patients, constipation improved in 19%, but worsened in 27%. The recurrence rate was 6% after a follow-up of 36 mo. A study on 73 patients with an Orr-Loygue procedure with limited lateral dissection found an improvement of incontinence in 90% and of constipation in 60% of patients<sup>[25]</sup>.

## POSTERIOR MESH RECTOPEXY (WELLS)

After a complete mobilisation of the rectum a mesh is placed around the posterior circumference of the rectum (2/3) and then fixed to the promontory. The ventral third of the rectal circumference is spared to avoid fibrosis and stenosis by shrinking of the mesh.

A prospective study examined the Wells' procedure in 77 patients with FRP. It observed no major post-operative complications. Incontinence improved in 89% of patients, constipation improved in 36%<sup>[26]</sup>. Recurrent prolapse occurred in one patient (1.3%). Older studies evaluating laparoscopic posterior mesh rectopexy found similar results, but with a worsening of constipation in 20%-30% of patients, which might be caused by injury of autonomic nerves during posterior dissection<sup>[27]</sup>.

## VENTRAL MESH RECTOPEXY (D'HOORE)

In 2004 D'Hoore *et al.*<sup>[28]</sup> published the results of a novel, autonomic nerve-sparing rectopexy technique. The dissection in this operation is strictly ventral in the rectovaginal space down to the pelvic floor. A lateral or dorsal mobilisation is not performed. The rectum is attached to the sacrum by a mesh which is sutured to the anterior side of the rectum. The ventral dissection and position of the mesh has several advantages: (1) a supra-anal rectocele can be corrected; (2) the rectovaginal septum is reinforced which prevents an anterior recto-rectal intussusception which may be one of the relevant mechanisms to a full rectal prolapse; and (3) a colpopexy is performed. The avoidance of any lateral or posterior mobilisation preserves the autonomic nerves<sup>[29]</sup>.

Although LVR is a comparably new method it was rapidly adopted and up to now, more than 30 retro- and prospective series have reported outcome and postoperative function. Two systematic reviews have summarized the data.

Indications for the procedures were intussusception

as well as overt rectal prolapse, rectocele, ODS and vaginal vault prolapse.

The rate for minor complications was 0% to 36%, major complications were observed in 0% to 5%. Reported typical but infrequent complications were erosions of the bowel or the vagina caused by the mesh or a dislocation of the mesh in about 4% of patients. Two studies reported the rare event of a lumbosacral discitis at the site of the proximal mesh fixation in 3 patients<sup>[30,31]</sup>.

The conversion rate ranged from 0% to 7.4%. In most cases the conversions had to be made due to pelvic or abdominal adhesions after prior surgery.

Recurrence rates in the literature range from 0% to 15%, with most studies reporting recurrences in less than 5% of patients after a follow-up of a minimum of two years.

The median hospital stay ranged from 1 to 7.1 d. One study showed that a same day discharge was possible in selected patients and that more than 90% of patients could be discharged the day after surgery with the same long term outcome<sup>[32]</sup>.

Fifty percent to 93% of patients operated with LVR suffered from constipation pre-operatively, between 44% and 93% of patients had faecal incontinence. Bowel function improved significantly in all studies with improvement rates from 70% to 90% for incontinence and 60% to 80% for constipation. Seven percent to 27% complained of persisting constipation and 0% to 18% of persisting incontinence. A new onset of constipation was found in 2% to 7% of patients<sup>[9,28,33]</sup>. Sexual function also showed significant improvement postoperatively<sup>[34,35]</sup>.

Despite the good results, the rapid adoption and distribution of this new method without any high level evidence has to be seen critically<sup>[36]</sup>.

## RESECTION RECTOPEXY (FRYKMAN-GOLDBERG)

A sigmoid resection is combined with a rectopexy, mostly a sutured rectopexy. The resection results in the following morphologic changes: (1) an area of fibrosis develops around the anastomosis and the sacrum which leads to a rectal fixation to the sacrum; and (2) the colon lies in a straighter course which avoids torsion and sigmoidocele<sup>[37]</sup>.

Especially in patients with an elongated sigmoid and slow-transit constipation it is postulated that constipation improves through the resection of redundant colon. A recent study, however, could not confirm an improvement in abnormal colonic transit time in patients after resection rectopexy<sup>[38]</sup>.

Furthermore it must be considered that a removal of a part of the colon can alter bowel function independently from the underlying pelvic floor disorder. A recent study reported impaired bowel function and quality of life after sigmoid resection for diverticulitis<sup>[39,40]</sup>. Resection

of the sigmoid and creation of an anastomosis can contribute to perioperative morbidity (leakage, stenosis, ureter lesion).

Indications for resection rectopexy in the available studies were intussusception, external rectal prolapse, rectocele and ODS.

In studies for laparoscopic resection rectopexy (LRR) a minor complication rate between 11% and 21% and a major complication rate between 0% and 4% were observed. Anastomotic leakages occurred very rarely (< 1%). Only an older study from 1998 reported a leakage rate of 3.3%<sup>[41]</sup>. A low mortality rate between 0% and 0.3% was observed.

The conversion rate for LRR ranges from 0% to 6%. The reasons for conversion were mainly adhesions<sup>[42-45]</sup>.

The recurrence rates ranged from 0% to 11% after a follow-up of a minimum of 4 years. The median hospital stay ranged from 4 to 9.7 d.

LRR improved incontinence in 62% to 94% of patients and constipation in 53% to 80% of patients with rectal prolapse<sup>[44,45]</sup>.

LRR was performed for ODS in one study. Sixty percent of patients showed a rectocele, 60% had a rectal prolapse I°-III° and 50% had sigmoidocele. In 40% of patients the incontinence and the constipation ceased, in further 40% the symptoms improved irrespective of the underlying morphologic pathology<sup>[46]</sup>.

## ROLE OF ABDOMINAL PROCEDURES AND LAPAROSCOPY

Concerning the large number of different operative methods and the poor evidence it does not surprise that evidence based guidelines for treatment do not exist for pelvic floor disorders.

A recent survey asked 391 surgeons over 50 countries for their preferred method for the treatment of rectal prolapse. It revealed that 60% of surgeons would treat healthy patients with an external prolapse with a laparoscopic abdominal procedure, 20% would chose an abdominal method *via* laparotomy and only 20% favoured a perineal approach. For internal prolapse still 40% of the surgeons preferred laparoscopy. While in Europe LVR is the most popular treatment for external prolapse, surgeons in North America favour LRR<sup>[47]</sup>.

An expert consensus paper published in 2013 explicitly recommends a laparoscopic or robotic approach for ventral rectopexy<sup>[48]</sup>.

## LEARNING CURVE OF LAPAROSCOPIC RECTOPEXY

The learning curve for laparoscopic colorectal surgery has been found to be around 150 to 200 cases for achieving a constant level of proficiency<sup>[49,50]</sup>. This also seems to apply to laparoscopic rectopexy. One large single-surgeon series found a proficiency level of 54 patients for operation time and about 100 patients for

clinical and functional outcome parameters even for an experienced colorectal surgeon<sup>[51]</sup>. This adds to the difficulties in evaluating different procedures, as in most studies the experience of the surgeon was not defined.

## COMPARISON OF LAPAROSCOPIC AND OPEN PROCEDURES

Evidence from randomised studies that compared laparoscopic with open rectopexy is rare. A Cochrane systematic review from 2008 found that the laparoscopic approach resulted in fewer postoperative complications and a shorter hospital stay compared to the open approach. But these findings are based on only two randomised studies comprising altogether 60 patients. Both studies used a ventral mesh fixation without resection<sup>[52-54]</sup> (Table 3).

Postoperative major complications were only cardiorespiratory and occurred only in the group with an open operation. A faster recovery (return to solid diet) and a reduced requirement for morphine were found for the laparoscopic group, which altogether resulted in a shorter hospital stay. But no difference was found for functional parameters (incontinence, constipation, rectal capacity, anal squeeze pressure) and recurrence rates.

Two case controlled studies compared open and laparoscopic surgery for rectal prolapse. Kairaluoma *et al*<sup>[55]</sup> used different procedures in 106 patients (LRR, suture rectopexy, Wells rectopexy). A longer operation time (170 min vs 100.5 min) but a shorter hospital stay (5 d vs 7 d) was found for laparoscopy. Functional outcome, recurrence rates and complications did not differ between case- and control-group. Kariv *et al*<sup>[56]</sup> found similar results. In this study also different techniques were applied. One third of patients in each group had resection rectopexy respectively suture rectopexy respectively mesh rectopexy (predominantly Ripstein anterior rectopexy for open surgery, Well's procedure in laparoscopic surgery). Incontinence and constipation improved in all patients, with a significant higher improvement in the laparoscopic group (74% vs 54%). A likely explanation for this finding was the much more frequent use of the Ripstein procedure in the open surgery group where the circular anterior mesh placement can result in a stenosis which obviously in turn contributes to the occurrence of constipation<sup>[57]</sup>. For this reason a circular mesh placement is now considered obsolete by most authors.

de Hoog *et al*<sup>[58]</sup> compared open rectal prolapse surgery to a conventional laparoscopic and a robot-assisted approach in a prospective non-randomised setting. Half of the patients were operated with the Wells procedure, the other half with a ventral rectopexy. While the functional outcome (incontinence, constipation) improved significantly in all three groups, the recurrence rates during a 2-year follow-up were significantly increased in the robot-assisted (20%) and the conventional laparoscopic group (27%) vs 2% in

**Table 3** Comparative rectopexy studies (open *vs* laparoscopic, different procedures)

Study	Procedure	Patients	Results
Sajid (2009)	LR	330	No difference in Mort, Morb, Inc, Cons, recurrence shorter hospital stay for LR
Meta-analysis (12 studies)	OR	358	Shorter operation times for OR
different procedures			
Cadeddu (2012)	LR	192	No difference in Mort, Morb, Inc, Cons, recurrence
Meta-analysis (8 studies)	OR	275	
different procedures			
Senapeti (2013)	SR	38	No difference in morbidity, recurrence and functional outcome
Randomised	RR	40	
Forminje (2014)	LVR	40	More minor complications in LRR
Retrospective	LRR	28	No difference in major complications, recurrence and functional outcome
Sahoo (2014)	LPR	38	No differences in morbidity, recurrence and functional outcome
Retrospective	LSR	32	
Lechoux (2004)	LRR	13	Significant more patients with worsening of constipation in the LMR-group (26% <i>vs</i> 8%)
Prospective	LMR	35	No differences in morbidity and improvement of continence
Madbouly (2002)	LRR	12	No difference in complications and functional outcome
Prospective	LPR	12	

Data from studies that compare open *vs* laparoscopic rectopexies or studies that compare different procedures. Mort: Mortality; Morb: Morbidity; Inc: Faecal incontinence; Cons: Constipation; LR: Laparoscopic rectopexy; OR: Open rectopexy; SR: Suture rectopexy; RR: Resection rectopexy; LPR: Laparoscopic posterior mesh rectopexy; HS: Hospital stay; OT: Operation time.

the open group. However, there was an imbalance in patient distribution, with more young patients in the laparoscopic group. In these patients a vaginopexy was generally not performed, which proved to be a protective factor in regard to recurrence on multi-variate analysis.

In a recent meta-analysis, 12 comparative studies comprising 688 patients (330 with laparoscopic rectopexy) were analysed<sup>[59]</sup>. A drawback of this meta-analysis was that only one study was randomised and that several different procedures (resection, non-resection) were used even within studies. Nevertheless a significant shorter hospital stay was found for the laparoscopic group, while no differences between the open and laparoscopic approach were found for complication rates, postoperative functional outcome, recurrence rates and mortality. A meta-analysis from 2012 showed the same results<sup>[60]</sup>.

As a conclusion: the laparoscopic approach for rectal prolapse is equivalent to the open approach in terms of functional and clinical outcome. The recurrences rates do not seem to differ, although single studies suggest higher recurrence rates after laparoscopic surgery. Advantages are a shorter hospital stay. It has to be remarked that the evidence is based on only two randomised and a few prospective and comparative case-controlled studies with significant heterogeneity in patient characteristics and in applied surgical procedures, making a relevant selection bias very probably.

## COMPARISON OF DIFFERENT LAPAROSCOPIC PROCEDURES

Studies comparing the different operation techniques are rare. One randomised trial compared suture rectopexy (38 patients) with resection rectopexy (40 patients). After a median follow-up of 36 mo fewer

recurrences were seen in patients with resection (13%) compared to patients with suture rectopexy (26%), but the difference was not statistically significant. Functional results were not different expect that the use of laxatives was more common at all time points in the suture rectopexy group. This suggests that resection has a positive effect on constipation<sup>[11]</sup>.

Formijnje Jonkers *et al*<sup>[45]</sup> compared 40 patients with LVR to 28 patients with LRR for full rectal prolapse in a retrospective cohort study. Patients with LRR suffered from significantly more complications (32% *vs* 7.5%), but these were mainly minor complications (wound infections, pneumonia), the rate of major complications was not different. Both groups showed a significant improvement in faecal incontinence (LVR 40% *vs* LRR 57%) and constipation (LVR 36% *vs* LRR 32%). In this study no recurrences were observed in a median follow-up period of 4 years.

Laparoscopic posterior rectopexy was compared to suture rectopexy retrospectively by Sahoo *et al*<sup>[61]</sup> in 70 patients. Suture rectopexy had a shorter operation time (100 min *vs* 120 min). The improvement of constipation (suture rectopexy 61% *vs* mesh rectopexy 47%) and incontinence (SR 90% *vs* MR 80%) was not different.

A comparison between LRR and LR without resection in 67 patients with FRP revealed that more patients with resection improved in incontinence while constipation improved similarly in both groups.

In a multi-centre randomised trial, Karas *et al*<sup>[62]</sup> evaluated, if a sole rectal mobilisation without rectopexy was equal to a posterior mesh rectopexy. Two hundred and forty-five patients were randomised. In case of constipation sigmoid resection was added. The degree of rectal mobilisation (posterior or 360°) was up to the surgeon's decision.

After a 5-year follow-up the recurrence rate in the group without rectopexy was significantly higher than in

the group with rectopexy (8.6% vs 1.5%,  $P = 0.003$ ). This was despite the fact that sigmoid resection was significantly more often performed in the group without rectopexy<sup>[62]</sup>.

Madbouly *et al*<sup>[63]</sup> compared LRR with laparoscopic posterior rectopexy in 35 patients with rectal prolapse. The choice of operation depended on the symptoms: patients with constipation or normal bowel habits underwent LRR, patients with incontinence LPR. Constipation was improved in 90% of patients after LRR and incontinence was improved in 80% after LPR. This emphasizes the need to consider the underlying symptoms besides the morphologic alterations in the choice of procedure.

Raftopoulos *et al*<sup>[64]</sup> conducted a retrospective multi-centre pooled data-analysis on 645 patients with rectal prolapse in order to determine the impact of the surgical approach and the method of rectopexy on recurrence rates (464 open, 179 laparoscopic operations). Used techniques were LPR, LRR, LSR or mobilisation only. They found recurrent rates from 20%-30% after a ten-year follow up irrespective of what operation method was used. A limitation of the study was the heterogeneity of the data with a variation of recurrence rates between the centres from 0% to 85%.

The limited data allows only modest conclusions: (1) rectopexy and resection rectopexy show equivalent functional outcome with a slight advantage of resection rectopexy in the improvement of constipation; (2) resection rectopexy leads to an increase of minor complications; (3) rectopexy should be performed in any case, as recurrence rates are higher if only rectal mobilisation is performed; and (4) recurrence rates do not differ between the procedures and reach 20% when a long term follow-up (about 10 years) is conducted.

## LAPAROSCOPIC RECTOPEXY IN ELDERLY PATIENTS

It is thought that the group of elderly patients especially profits from laparoscopic surgery. A recent systematic review showed significant advantages in short term outcome in laparoscopic colorectal surgery for elderly people<sup>[65]</sup>. As the incidence of rectal prolapse and pelvic floor disorders increases with age it is important to know if laparoscopic procedures are safe for this group of patients and if they offer a good alternative to perineal procedures.

For ventral rectopexy a recent French study evaluated 4303 patients from a national database. Patients aged more than 70 years were compared to patients younger than 70 years. Elderly patients had more minor complications (urinary, wound complications) and a longer hospital stay, but major complication rate and mortality were not different<sup>[66]</sup>. Another study used a modified laparoscopic Orr-Loygue technique in 46 elderly patients (median age 83 years) with rectal prolapse. A significant cardiac morbidity was

observed. Two patients died of cardiac arrest. Two patients were re-operated for recurrent prolapse after 2 mo. The reasons for the recurrences were mesh dislocations. Faecal incontinence improved significantly (Wexner-Score decreased from 19 to 5 points after one year). Constipation did not improve. Most patients were satisfied with the operation, but there was no association seen between satisfaction and functional result<sup>[67]</sup>.

A German study from 2012 studied the outcome of LRR in elderly patients (> 75 years). The complication rate was slightly increased compared to the younger population. Incontinence and constipation improved in half of the patients irrespectively of age<sup>[68]</sup>.

Dryberg used a laparoscopic dorsal mesh rectopexy in 81 older patients with FRP<sup>[69]</sup>. A remarkable major complication rate of 14.8% was reported. Port site hernias with consecutive ileus and postoperative haemorrhage each occurred in 5% of patients. Thirteen point five percent of recurrences were observed at a median follow-up of 2 years.

## TYPICAL COMPLICATIONS AND THEIR MANAGEMENT

A study in a tertiary referral centre analysed the typical complications after mesh rectopexy: Mesh fistulation or erosion of the rectum, vagina or the bladder, recto-vaginal fistula, early symptomatic recurrence, rectal stricture and chronic pelvic pain were observed. In this study all complications could be managed laparoscopically<sup>[70]</sup>.

The reasons for early recurrence were in all 27 cases an inadequate technique during the prior operation (only limited or no ventral dissection, no sutures in the recto-vaginal space, detachment or incorrect position of the staples, wrong placement of the mesh to the lateral instead the anterior rectal wall with development of an enterocele). These cases were treated by placement of a new mesh and fixation with staples and sutures. Recto-vaginal fistulas were treated with removal of the mesh and abdominal or transvaginal fistula repair. Rectal injuries and strictures were operated by anterior resection and a placement of a bio-mesh. In all patients with rectal strictures the mesh had been stapled to the mid-sacrum rather than to the promontory. Erosions of the vagina or the bladder were managed by mesh removal, defect repair and insertion of a bio-mesh. All women with this complication were postmenopausal and had previous hysterectomy. In patients that complained about chronic pain unresponsive to pain medication, the mesh showed an excessive inflammation. A replacement of the mesh by a teflon-coated mesh improved symptoms. After revisional surgery, quality of life and bowel function improved significantly.

Two case reports describe a mesh fistulation in the rectum<sup>[71,72]</sup>. Typical symptoms were recurrent fever, pelvic pain and rectal bleeding. Diagnosis was made

by flexible sigmoidoscopy. In one case therapy was anterior rectum resection, in the other case the mesh was extracted laparoscopically and a loop-ileostomy was performed.

Tranchart *et al*<sup>[73]</sup> observed 6 rectal mesh migrations after 312 laparoscopic ventral mesh rectopexies (1.9%). The median time interval between surgery and onset of symptoms was 53 mo (range 4 to 124 mo). The treatment was transanal partial mesh resection, in one case where a recto-cutaneous fistula was present, a deviating colostomy was added. A recurrent mesh migration was again treated with partial mesh resection. After a median follow-up of 40 mo all patients were free of complaints and showed no recurrent mesh, migration.

As a rare but serious complication lumbosacral discitis at the site of rectal fixation was observed after ventral rectopexy and resection rectopexy. Only four cases are reported in literature. Patients presented typically 1 to 3 mo after the initial operation with severe lower back pain, fever and malaise. An magnetic resonance imaging revealed the diagnosis. A contrast enema was helpful to rule out a rectal fistula. Broad spectrum iv-antibiotics covering colonic flora are the treatment of first choice. In some cases, antibiotic treatment was not sufficient, and removal of mesh or suture material was necessary, in one case with a deviating colostomy<sup>[31,74,75]</sup>. A gynaecological review found 26 cases of discitis after sacrocolpopexy or rectopexy in a 50-year period<sup>[76]</sup>. Although this complication is rare it should always be considered in patients complaining of persisting back pain after any type of rectopexy.

## FINANCIAL CONSIDERATIONS

An Australian study from 2004 conducted a cost-effectiveness analysis for posterior mesh rectopexy in a randomised setting. When costs for theatre time, staff, laparoscopic equipment and hospital stay were included, the laparoscopic operation was less costly than the open operation. The shorter hospital stay in the laparoscopic group accounted for this saving<sup>[77]</sup>.

## ASSESSMENT OF DIFFERENT APPROACHES

The evaluation of the different operation techniques is difficult, as the quality of available studies is low and outcome parameters are not defined consistently.

Regarding complications and conversion rates all laparoscopic procedures provide similar good results with each having their typical complications (anastomotic leakage, mesh complications). Recurrence rates for all methods are below 10% within a follow-up of up to 5 years but studies that extended follow-up to 10 years found recurrence rates of up to 20%.

LRR and LVR improve both constipation and faecal incontinence in a similar degree, but randomised studies

are missing. LSR and LPR have about the same effect on incontinence, but they tend to have a lesser effect on constipation, in some studies these operations even worsened constipation in a relevant number of patients.

As high quality evidence is missing, an individualized approach is recommend for every patient considering age, individual health status and the underlying morphological and functional disorders. Moreover, as most operations actually show acceptable results, the choice of procedure also depends on the experience and learning curve of the surgeon.

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