Suture rectopexy versus ventral mesh rectopexy for complete full-thickness rectal prolapse and intussusception: systematic review and meta-analysis

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Abstract

Background: This systematic review and meta-analysis aimed to compare recurrence rates of rectal prolapse following ventral mesh rectopexy (VMR) and suture rectopexy (SR).

Methods: MEDLINE, Embase, and the Cochrane Library were searched for studies reporting on the recurrence rates of complete rectal prolapse (CRP) or intussusception (IS) after SR and VMR. Results were pooled and procedures compared; a subgroup analysis was performed comparing patients with CRP and IS who underwent VMR using biological versus synthetic meshes. A meta-analysis of studies comparing SR and VMR was undertaken. The Methodological Items for Non-Randomized Studies score, the Newcastle–Ottawa Scale, and the Cochrane Collaboration tool were used to assess the quality of studies.

Results: Twenty-two studies with 976 patients were included in the SR group and 31 studies with 1605 patients in the VMR group; among these studies, five were eligible for meta-analysis. Overall, in patients with CRP, the recurrence rate was 8.6 per cent after SR and 3.7 per cent after VMR (P < 0.001). However, in patients with IS treated using VMR, the recurrence rate was 9.7 per cent. Recurrence rates after VMR did not differ with use of biological or synthetic mesh in patients treated for CRP (4.1 versus 3.6 per cent; P = 0.789) and or IS (11.4 versus 11.0 per cent; P = 0.902). Results from the meta-analysis showed high heterogeneity, and the difference in recurrence rates between SR and VMR groups was not statistically significant (P = 0.76).

Conclusion: Although the systematic review showed a higher recurrence rate after SR than VMR for treatment of CRP, this result was not confirmed by meta-analysis. Therefore, robust RCTs comparing SR and biological VMR are required.

Introduction

Complete rectal prolapse (CRP) is defined as full-thickness protrusion of the rectal wall through the anus 1. It begins as intussusception (IS) which may or may not be symptomatic 2. It is a common condition worldwide, which can be difficult to treat successfully and causes significant psychosocial problems for the patient. The aim of treatment is to control the prolapse and relieve incontinence while preventing constipation or obstructive defaecation 3,4. Plication of the redundant bowel and/or fixation of the rectum to the sacrum was originally achieved by SR, but has evolved to the use of synthetic, non-absorbable mesh.

Recently, mesh rectopexy has been associated with a rise in expensive biological mesh has become the standard 6. SR can be performed laparoscopically or via a laparotomy. First described by Cutait 7 in 1959, SR involves mobilization and fixation of the rectum with a non-absorbable suture. The act of mobilization, suture, and fibrosis keeps the rectum fixed in position as adhesions form, attaching the rectum to the presacral fascia. Although SR is considered a good option for the cure of rectal prolapse/IS in both men and women, some reviews of this procedure noted a better overall clinical outcome in men 8. This may be due to occult sphincter defects in women, and failure to detect these defects before surgery owing to the lack of routine endoanal ultrasonography in the earlier years of prolapse surgery 9.

The mesh rectopexy operation was first described by Ripstein 10 in 1952. Again, after mobilization of the rectum, an anterior sling of synthetic material (either absorbable or non-absorbable) is placed in front of the rectum and sutured to the sacral promontory. The rationale for this is to restore the natural curve of the rectum, which reduces the effect of downward abdominal pressure. The use of a non-elastic synthetic graft provides a firm anterior fascial support even in patients with significant pelvic floor descent, returning the rectum to a normal anatomical position 11. However, there were long-term complications associated with the use of synthetic mesh for ventral mesh rectopexy (VMR) 3, so a shift to biological mesh was made.

There is little hard evidence for the use of biological mesh compared with historical techniques. This systematic review and meta-analysis aimed to identify the evidence and compare recurrence rates for SR with those of VMR for patients with CRP or IS.
Methods

Data sources and search strategy

Two literature searches were carried out using MEDLINE, Embase, and the Cochrane Library databases. No limitation on study period was set and searches were set for studies on SR and VMR—using either biological or synthetic mesh—using the following criteria: ‘(suture OR sutured) AND rectopex*’ (SR, search 1) and ‘(ventral OR anterior OR mesh) AND rectopex*’ (VMR, search 2). The reference lists from systematic reviews or meta-analyses were reviewed and relevant studies included. Titles and abstracts were screened by two reviewers, and full-text copies were subsequently obtained. Any discrepancies in screening were settled by a third reviewer.

Studies included were randomized and non-randomized studies using open or laparoscopic techniques that reported either symptomatic, anatomical or radiological recurrence of CRP (full-thickness) or IS as outcome measure, as it is the most standardized way of assessing the efficacy of the procedures. Studies were included only if indication and specific data were available for extraction.

Case reports, duplicates, non-English articles, and those reporting follow-up of less than 12 months were excluded. Studies that focused on robotic rectopexy were excluded owing to the novelty of the technique and absence of a SR robotic group. Other exclusion criteria were: SR in children, rectocele, volvulus or mucosal prolapse; and studies that involved posterior rectopexy, concomitant resections, sacrocolpopexy or other abdominal or pelvic procedures directly related to the prolapse or IS. Studies pertaining to VMR were excluded if they used the Ripstein procedure/sling rectopexy, Well’s procedure or the Orr–Loygue procedure, concomitant sacrocolpopexy, or any other concomitant abdominal or pelvic procedures.

Non-randomized studies were assessed for methodological quality using the Methodological Index for Non-Randomized Studies score, and RCTs were assessed independently for risk of bias using the Cochrane Collaboration tool, by two reviewers; discrepancies were discussed and resolved mutually.

Data extraction and outcome measures

The following information was extracted: study design, title, authors, publication year, study type, number of patients undergoing rectopexy, population characteristics, type of mesh used (VMR), duration of follow-up, and number of patients with recurrence of CRP or IS (primary outcome). Secondary outcomes included incontinence and constipation data, and postoperative complications reported by the studies. Secondary procedures and secondary recurrence were excluded, and partial recurrence was not considered an outcome of interest. In calculation of the complication rate, only studies that reported complications were included in the denominator.

Constipation and incontinence data varied among studies, as various scoring methods (Cleveland and Wexner scores, and Faecal Incontinence Severity Index) were reported. Data extraction for these outcomes included type of scoring system used if available, values from each scoring system, raw figures for patients with incontinence or constipation before and after operation if available, and whether the study reported a change in symptoms to be statistically significant.

Statistical analysis

Data extracted from the studies were pooled for the overall rates of recurrence and complications. The significance of recurrence and complication rates was assessed using Pearson’s $\chi^2$ test in SPSS® (IBM, Armonk, New York, USA); $P < 0.050$ was considered statistically significant. Constipation and incontinence data were considered for qualitative analysis. Randomized and non-randomized studies comparing SR and VMR were eligible for meta-analysis and statistical comparison of recurrence rates. The quality of non-randomized studies was assessed using the Newcastle–Ottawa Scale and risk of bias of randomized studies using the Cochrane Collaboration tool. Meta-analysis was performed using Review Manager 5.3 (Nordic Cochrane Centre, Copenhagen Denmark). Risk ratio was the effect measure used (with 95 per cent confidence interval) and statistical heterogeneity was assessed using the $I^2$ test. A random-effects model was to be used if heterogeneity was high ($I^2$ over 50 per cent) and a fixed-effect model if heterogeneity was low. Results were represented visually in a forest plot. $P < 0.050$ indicated statistical significance.

Results

Of 378 citations retrieved from the SR search, 22 were included in the review including 976 patients. Of 1419 citations retrieved from the VMR search, 31 studies were included in analysis reporting on 1608 patients with CRP and 399 patients with IS (Fig. 1). All studies in the SR group included patients with CRP. Data for CRP and IS were therefore compared separately. Studies and their characteristics are summarized in Tables 1 and 2.

In the VMR group, 27 of the 31 studies reported on patients with a median or mean age of more than 50 years, and in 25 studies the study population included more than 80 per cent women. Similarly, in the SR group, median or mean age exceeded 50 years in 17 of 21 studies in which age was reported, and in 25 reports women comprised more than 80 per cent of the included patients.

Follow-up and recurrences

Follow-up ranged from 12 to 74 months in the VMR group and from 12 to 162 months in the SR group; it was reported using median values in 41 studies and as a mean value in seven. Follow-up data were missing from one VMR study, although this was an update of a previous publication that reported a median follow-up of 61 months. Among patients treated for CRP, the recurrence rate was 8.8 per cent in the SR group and 3.8 per cent in the VMR group ($P < 0.001$) (Table 3). However, among 402 patients with IS treated using VMR, the recurrence rate was 9.7 per cent.

Twenty-one studies of VMR reported the use of synthetic mesh, whereas the use of biological mesh was reported in seven (Table 4). The remaining VMR studies either did not report the type of mesh used, or used both types and did not specify which mesh was used in patients who had recurrence. Synthetic mesh was used in 1362 patients with CRP across 17 studies, of whom 49 (3.6 per cent) had a recurrence, and in 209 patients with IS across four studies, of whom 23 (11.0 per cent) developed recurrence. Biological mesh was used in 97 patients with CRP across five studies, of whom four (4.1 per cent) had a recurrence, and in 140 patients with IS across two studies, of whom 16 (11.4 per cent) developed recurrence. There was no significant difference in recurrence rates between synthetic or biological mesh for CRP ($P = 0.789$) or IS ($P = 0.902$),
Constipation and incontinence

In the VMR group, 27 studies reported data on incontinence and 21 found a statistically significant improvement after surgery (Table 5). In the SR group, 17 studies reported data on incontinence, eight of which found a statistically significant improvement after operation. One study in the VMR group and five in the SR group did not report statistical significance testing, but suggested an improvement in incontinence. No studies reported an overall worsening of incontinence.

In the VMR group, 24 studies reported data on constipation and 14 found a statistically significant improvement after operation (Table 5). In the SR group, 14 studies reported data on constipation, two of which found a statistically significant post-operative improvement. Nine further studies did not report statistical significance testing, but suggested an improvement in constipation. One study showed a significant worsening of constipation after SR.

Of five studies that compared SR and VMR, three reported a comparison of incontinence and constipation (Table 6). Regarding incontinence, two studies found no statistical difference between VMR and SR, although one reported a significant difference favouring VMR. With respect to constipation, two studies reported a statistical difference between VMR and SR, both favouring VMR; however, one of these studies included...
some patients who had concurrent sigmoid resection with SR. The third study did not perform significance testing on constipation data, but reported a similar worsening after VMR and SR.

**Complications**

Twelve studies in the SR group reported complications, including 616 patients with 54 complications overall (8.8 per cent) (Table 7). Twenty-two VMR studies reported complications including 1232 patients and 97 complications overall (7.9 per cent) (Table 7). Of the randomized studies, 7.4 per cent had complications after VMR and were therefore eligible for meta-analysis (Table 8). Of the randomized studies, risk of bias assessed using the Cochrane Collaboration tool was considered to be low in one and unclear in the other. Of the three non-randomized studies, one was considered to be of fair quality (4 of 7) and the other two of high quality (7 of 7 and 6 of 7) (Tables S1 and S2).

Length of follow-up varied between the studies ranging from 12 to 84 months. The method of assessing recurrence of CRP was robust in all five studies, which reported the use of clinical examination with or without questionnaires, endoscopy or defaecography.

Across the five studies, 269 patients had SR, of whom 26 had a recurrence (9.7 per cent) and 215 had VMR, of whom 16 developed recurrence (7.4 per cent). Statistical heterogeneity was high (I² = 73 per cent) and the difference in recurrence rates was not statistically significant (P = 0.66, 3 d.f.) (Fig. 2).

**Discussion**

The concept of fixing the rectum to the sacrum has been a mainstay in the treatment of rectal prolapse for 35 years. The original Orr–Loygue procedure, which involves fully mobilizing the rectum circumferentially down to the levator ani muscle, and fixing an anterior and posterior mesh from the sacrum to the anterolateral rectal wall, has been modified over the years. The D’Hoore modified method performed laparoscopically demands only that Denonvilliers fascia is dissected around the anterior rectal wall and a single mesh is sutured to the anterior aspect of the distal rectum. Owing to possible complications of neurological damage, posterior dissection is avoided in the modified procedure and is limited only to clear the sacral promontory sufficiently for mesh fixation to the periosteum.
When considering synthetic mesh as a material for rectal fixation, the tensile strength of most synthetic materials usually exceeds the physiological demand. This excess tensile strength can lead to an increased local inflammatory response and loss of elasticity of the mesh. On the other hand, biological meshes are made from human, bovine or porcine tissue that has been

| Reference     | Study type | No. of patients | Age (years)* | % women | Follow-up method                                                                 | Duration of follow-up (months)* | Type of mesh | MINORS score | Cochrane Collaboration tool score |
|---------------|------------|-----------------|--------------|---------|---------------------------------------------------------------------------------|---------------------------------|--------------|--------------|----------------------------------|
| Albayati et al. | Retrospective | 9               | 42           | 57      | Questionnaire and telephone call                                                | 22                              | Biological   | 8 of 16      | –                                |
| Benoist et al.  | Retrospective | 14              | 40           | 64.7†   | Clinical examination and telephone call                                          | 18                              | Synthetic    | 7 of 16      | –                                |
| Bjerke and Mynster | Prospective    | 65              | 0            | 72      | Clinic consultation and telephone call                                           | 19                              | Synthetic    | 11 of 16     | –                                |
| Boons et al.    | Prospective   | 13              | 0            | 64.7†   | Clinical examination and telephone call                                          | 29                              | Biological   | 11 of 16     | –                                |
| Byrne et al.    | Prospective   | 126             | 0            | 56.2†   | Telephone interview and contacted GP                                            | 60                              | Synthetic    | 10 of 16     | –                                |
| Chandra et al.  | Prospective   | 15              | 0            | 50      | Examination and long-term telephone consultation                                | 22                              | Synthetic    | 10 of 16     | –                                |
| Collinson et al. | Prospective  | 0               | 75           | 58      | Consultation and examination                                                    | 18†                             | Synthetic    | 11 of 16     | –                                |
| Consten et al.  | Retrospective | 242             | 0            | 55.8†   | Examination                                                                      | 74                              | Synthetic    | 12 of 16     | –                                |
| D’Hoore and Penninckx | Prospective | 109             | 0            | F: 50   | Interview, endoscopy, and examination                                           | 20                              | Biological or synthetic | 13 of 16     | –                                |
| Emile et al.    | RCT          | 25              | 0            | 59.7†   | Questionnaire and outpatient clinic                                             | 12                              | Synthetic    | 10 of 16     | –                                |
| Faucheron et al. | Prospective  | 175             | 0            | 58†     | Examination                                                                      | 74                              | Synthetic    | 12 of 16     | –                                |
| Franceschilli et al. | Prospective | 0               | 98           | 63†     | Interview, endoscopy, and examination                                           | 20                              | Synthetic    | 13 of 16     | –                                |
| Gleditsch et al. | Prospective  | 22              | 0            | 72      | Questionnaire and outpatient clinic                                             | 29                              | Biological   | 10 of 16     | –                                |
| Gosselink et al. | Prospective  | 41              | 50           | CRP: 63 | Questionnaire and outpatient clinic                                             | 12                              | Synthetic    | 10 of 16     | –                                |
| Hidaka et al.   | RCT          | 34              | 0            | 56.5    | Clinical examination                                                            | 72                              | n.a.         | 18 of 24     | –                                |
| Hiltunen and Matikainen | Prospective | 54              | 0            | 53†     | Outpatient clinic                                                                | 36                              | Synthetic    | 9 of 16      | –                                |
| Lechaux et al.  | Prospective  | 35              | 0            | 53      | Clinical review and postal questionnaire                                      | 36                              | Synthetic    | 9 of 16      | –                                |
| Luglio et al.   | RCT          | 20              | 0            | 68      | Questionnaire, endoscopy and defaecography                                     | 12                              | n.a.         | 5 unclear    | 2 low risk                      |
| Madbouly and Youssef | Prospective | 41              | 0            | 55†     | Clinical review and postal questionnaire                                      | 46†                             | n.a.         | 18 of 24     | –                                |
| Maggiori et al. | Prospective  | 20              | 0            | 64†     | Examination or telephone consultation                                           | 42                              | Synthetic    | 10 of 16     | –                                |
| Mantoo et al.   | Prospective  | 23              | 0            | 62†     | Examination                                                                      | 16                              | Synthetic    | 19 of 24     | –                                |
| Mehmood et al.  | Prospective  | 34              | 0            | 59      | Examination                                                                      | 12                              | Biological   | 17 of 24     | –                                |
| Ogilvie et al.  | Prospective  | 33              | 0            | 72.3†   | Clinic/examination Questionnaire                                                | 16                              | Mostly synthetic | 9 of 16     | –                                |
| Owais et al.    | Prospective  | 18              | 0            | 34.5    | Outpatient clinic, examination and questionnaire                                | 22†                             | Synthetic    | 9 of 16      | –                                |
| Portier et al.  | Prospective  | 40              | 0            | 60.6†   | Examination in outpatient clinic or telephone interview                         | 43                              | Synthetic    | 16 of 24     | –                                |
| Raftopoulos et al. | Prospective | 125             | 0            | 53      | Examination in outpatient clinic or telephone interview                         | 43                              | Synthetic    | 16 of 24     | –                                |
| Randall et al.  | Prospective  | 190             | 0            | 69      | Questionnaires and proctography                                                 | 29                              | Synthetic    | 11 of 16     | –                                |
| Tsunoda et al.  | Prospective  | 58              | 0            | 80      | Outpatient clinic, telephone interview mail questionnaire, and examination      | 49                              | Synthetic    | 9 of 16      | –                                |
| Tsunoda et al.  | Retrospective | 58              | 0            | 80      | Outpatient clinic, telephone interview mail questionnaire, and examination      | 49                              | Synthetic    | 10 of 16     | –                                |
| Wahed et al.    | Prospective  | 27              | 0            | 62      | Examination in outpatient clinic or telephone interview                         | 12                              | Biological   | 11 of 16     | –                                |

*Values are median unless indicated otherwise; values are †mean. CRP, complete rectal prolapse; IS, intussusception; MINORS, Methodological Index for Non-Randomized Studies; n.a., not available.
decellularized to leave a collagen matrix for native tissue to infiltrate. The characteristics of each material are unique and depend on the tissue source, the method used to remove the cells, and the method of sterilization. However, it is in terms of the safety profile that biological mesh has become superior to synthetic mesh.

Anecdotally, the complication rate associated with biological mesh appears to be lower than that for synthetic mesh, probably related to its lower tensile strength, but its cost for VMR remains a problem. Before the development of VMR, simple sutures were used for rectopexy. Historically, there have been numerous subtle variations of this technique, but the general consensus was to use two or three non-absorbable sutures for fixation of the rectum to the sacrum.

This review aimed to compare recurrence rates following CRP and IS. However, the SR group did not include any patients with IS and so a subgroup analysis was performed in the VMR group. The recurrence rate was higher after SR than VMR in patients treated for CRP, whereas the subgroup analysis of patients who underwent VMR showed higher rates in patients with IS than those with CRP.

Given that biological VMR is the current standard treatment for CRP and IS, it is important to note that, of the seven studies (237 patients) that reported the use of biological mesh, the recurrence rate was similar to that of SR (recurrence rate of IS and CRP combined 8.4 per cent after VMR versus 8.8 per cent for CRP after SR) (Tables 3 and 4). The small number of studies reporting recurrence following biological VMR highlights the need for further research. Comparison of the two groups using meta-analysis showed no statistical difference in recurrence of CRP between synthetic VMR and SR.

It appears that constipation and incontinence improved more after VMR. However, poor consistency of reporting, variation in methods of measuring constipation and incontinence across studies, and varying interpretation of these methods made comparison of studies challenging in this study and reduces the reliability of these results.

Few studies reported postoperative complications and, although complication rates were similar after both procedures, heterogeneity between studies will have had a considerable impact. Surgical-site infection was by far the most common postoperative complication after SR.

This review has highlighted that the recurrence rates and safety of SR and VMR are comparable; however, a robust RCT in this field is highly advocated.

Disclosure. The authors declare no conflict of interest.

Supplementary material

Supplementary material is available at BJS Open online.

| Table 3 Recurrences according to surgical approach |
|--------------------------------------------------|
| Reference | No. of patients | No. of recurrences (%) |
|-----------|----------------|------------------------|
| Suture rectopexy | 976 | 86 (8.8) |
| Benoist et al.15 | 16 | 0 (0) |
| Blatchford et al.16 | 42 | 1 (2) |
| Briel et al.13 | 24 | 0 (0) |
| Bruch et al.17 | 32 | 0 (0) |
| Chaudhry et al.18 | 36 | 1 (3) |
| De Oliveira et al.19 | 16 | 2 (13) |
| Foppa et al.20 | 172 | 30 (17.4) |
| Gleditsch et al.21 | 49 | 15 (31) |
| Heal et al.22 | 25 | 0 (0) |
| Hidaka et al.23 | 30 | 7 (23) |
| Kellokumpu et al.24 | 16 | 2 (13) |
| Kessler et al.25 | 28 | 2 (7) |
| Khanna et al.26 | 65 | 0 (0) |
| Liyanage et al.27 | 70 | 5 (7) |
| Luglio et al.28 | 11 | 3 (27) |
| McKee et al.29 | 8 | 0 (0) |
| Novell et al.30 | 32 | 1 (3) |
| Raffopoulos et al.31 | 163 | 1 (0.6) |
| Sahoo et al.32 | 32 | 0 (0) |
| Senapi et al.33 | 35 | 9 (26) |
| Wilson et al.34 | 59 | 6 (10) |
| Yasukawa et al.35 | 15 | 1 (7) |
| Ventral mesh rectopexy | 1608 | 61 (3.8) |
| Albayati et al.36 | 9 | 1 (11) |
| Benoist et al.37 | 14 | 0 (0) |
| Bjerke and Mynster38 | 40 | 2 (5) |
| Boons et al.39 | 65 | 1 (2) |
| Brunner et al.40 | 13 | 1 (8) |
| Byrne et al.41 | 126 | 5 (4.0) |
| Chandra et al.42 | 15 | 0 (0) |
| Consten et al.43 | 242 | 13 (5.4) |
| D’Hoore and Penninckx44 | 109 | 4 (3.7) |
| Emile et al.45 | 25 | 2 (8) |
| Faucheron et al.46 | 175 | 2 (1.1) |
| Gleditsch et al.47 | 22 | 3 (14) |
| Gosselin et al.48 | 41 | 1 (2) |
| Hidaka et al.49 | 34 | 3 (9) |
| Hiltunen and Matikainen50 | 54 | 1 (2) |
| Lechaux et al.51 | 35 | 1 (3) |
| Luglio et al.52 | 20 | 1 (5) |
| Madbouly and Youssef53 | 41 | 1 (2) |
| Maggiori et al.54 | 20 | 0 (0) |
| Mantoo et al.55 | 23 | 2 (9) |
| Mehmoed et al.56 | 34 | 0 (0) |
| Ogilvie et al.57 | 33 | 5 (15) |
| Owais et al.58 | 18 | 0 (0) |
| Raffopoulos et al.59 | 125 | 9 (7.2) |
| Randall et al.60 | 190 | 1 (0.5) |
| Tsunoda et al.61 | 58 | 1 (2) |
| Wahed et al.62 | 27 | 1 (4) |
| Recurrence of intussusception | 399 | 39 (9.8) |
| Albayati et al.35 | 42 | 2 (5) |
| Collinson et al.43 | 75 | 4 (5) |
| Franceschilli et al.44 | 98 | 14 (14.3) |
| Gosselin et al.45 | 50 | 3 (6) |
| Owais et al.55 | 50 | 0 (0) |
| Porter et al.56 | 40 | 1 (3) |
| Tsunoda et al.58 | 44 | 15 (34) |

Values in parentheses are percentages. P < 0.001, suture rectopexy versus ventral mesh rectopexy for complete rectal prolapse (Pearson’s χ² test).
Table 4 Comparison between biological and synthetic mesh for mesh rectopexy

| Type of mesh          | No. of studies | Recurrence  |
|-----------------------|----------------|-------------|
|                       | CRP | IS  | CRP   | IS   | Total  |
| Biological            | 5   | 2   | 4 of 97 (4) | 16 of 140 (11.4) | 20 of 237 (8.4) |
| Synthetic             | 17  | 4   | 49 of 1362 (3.6) | 23 of 209 (11.0) | 72 of 1571 (4.6) |

P 0.789, *P* 0.902

Values in parentheses are percentages. CRP, complete rectal prolapse; IS, intussusception. *Pearson’s χ² test.

Table 5 Constipation and incontinence reported in included studies

| Method of measurement       | Statistically significant improvement | Method of measurement       | Statistically significant improvement |
|-----------------------------|--------------------------------------|-----------------------------|--------------------------------------|
| Incontinence                |                                       | Constipation                |                                       |

(continued)
## Table 5 (continued)

| Reference | Incontinence | Constipation |
|-----------|--------------|--------------|
|           | Method of measurement | Statistically significant improvement | Method of measurement | Statistically significant improvement |
| Consten et al. [42] (CRP) | Browning and Parks | Yes, but includes patients with IS/symptomatic rectocele not included in recurrence data | Rome II criteria | n.s. but 50 of 82 improved |
| D’Hoore and Penninckx [43] (CRP) | n.a. | n.a. | n.a. | n.a. |
| Emile et al. [44] (CRP) | Wexner score | Yes | Wexner score | n.s. but large improvement in Wexner score |
| Faucheron et al. [45] (CRP) | FISI | Yes | Wexner score | Yes |
| Franceschilli et al. [46] (IS) | FISI | Yes | Wexner score | Yes |
| Gleditsch et al. [47] (CRP) | FISI | Yes | Wexner score | Yes |
| Gosselink et al. [48] (IS) | FISI | Yes | Wexner score | Yes |
| Hidaka et al. [49] (IS) | FISI | Yes | Wexner score | Yes |
| Hiltunen and Matikainen [50] (CRP) | Raw figures | Yes | Wexner score | n.s. |
| Lechaux et al. [51] (CRP) | Wexner score | No | Wexner score | n.s. |
| Lurgio et al. [52] (CRP) | Wexner score | n.s. | Wexner score | n.s. |
| Maggiori et al. [53] (CRP) | Wexner score | Yes | Wexner score | Yes |
| Mantoo et al. [54] (CRP) | Wexner score | Unclear | Rome II criteria | n.s. but 13 of 18 improved |
| Mehmed et al. [55] (CRP) | FISI | Yes | Wexner score | Yes |
| Ogilvie et al. [56] (CRP) | CCIS | n.s. but large improvement in mean CCIS scores | Wexner score | n.s. |
| Owais et al. [57] (IS and CRP) | CCIS | Yes | ODS score | Yes |
| Portier et al. [58] (IS) | CCIS | Yes | Raw figures | n.s. but 13 of 20 improved |
| Raftopoulos et al. [59] | n.a. | n.a. | n.a. | n.a. |
| Randall et al. [60] (CRP) | CCIS | Yes | CSS | Yes |
| Tsunoda et al. [61] (IS) | FISI | Yes | CSS | Yes |
| Tsunoda et al. [62] (CRP) | Wexner score | Yes | Wexner score | Yes |

CRP, complete rectal prolapse; n.s., not stated; n.a., not available; CCIS, Cleveland Clinic Incontinence Score; CCIS, Cleveland Clinic Constipation Score; PAC-QOL, Patient Assessment of Constipation Quality of Life questionnaire; PAC-SYM, Patient Assessment of Constipation Symptom score; IS, intussusception; FISI, Faecal Incontinence Severity Index; ODS, obstructive defaecation syndrome; CSS, Constipation Scoring System.

## Table 6 Constipation and incontinence in comparative studies

| Reference | Incontinence | Constipation |
|-----------|--------------|--------------|
|           | Method of measurement | Results | Method of measurement | Results |
| Benoist et al. [15] | Raw figures | No significant difference | Raw figures | n.s., but similar worsening in constipation following VMR and SR |
| Hidaka et al. [23] | CCIS | No significant difference | ODS score, CCCS, PAC-QOL, PAC-SYM | VMR statistically better than SR in all parameters |
| Lurgio et al. [27] | Wexner score | VMR statistically better than SR | Wexner score, Rome III criteria | VMR statistically better than SR, however, some patients who had resection rectopexy were included in SR group |

n.s., Not stated; VMR, ventral mesh rectopexy; SR, suture rectopexy; CCIS, Cleveland Clinic incontinence Score; CCCS, Cleveland Clinic Constipation Score; PAC-QOL, Patient Assessment of Constipation Quality of Life questionnaire; PAC-SYM, Patient Assessment of Constipation Symptom score.
Table 7 Summary of complications by procedure

|                          | Suture rectopexy (n = 616) | Mesh rectopexy (n = 1232) |
|--------------------------|-----------------------------|----------------------------|
| Atelectasis              | 0 (0)                       | 1 (0.1)                    |
| Atrial fibrillation      | 1 (0.2)                     | 0 (0)                      |
| Bladder injury           | 0 (0)                       | 1 (0.1)                    |
| Bleeding from port site  | 1 (0.2)                     | 0 (0)                      |
| Deep vein thrombosis     | 4 (0.6)                     | 0 (0)                      |
| Enteroctaneous fistula   | 0 (0)                       | 0 (0)                      |
| Faecal impaction         | 0 (0)                       | 1 (0.1)                    |
| Fluid overload           | 0 (0)                       | 1 (0.1)                    |
| Haematoma                | 1 (0.2)                     | 10 (0.8)                   |
| Hypertension             | 1 (0.2)                     | 0 (0)                      |
| Incisional/port-site hernia | 3 (0.5)               | 7 (0.6)                    |
| Infective diarrhoea      | 2 (0.3)                     | 0 (0)                      |
| Intestinal obstruction   | 4 (0.6)                     | 2 (0.2)                    |
| Lumbar discitis          | 0 (0)                       | 1 (0.1)                    |
| Myocardial infarction    | 0 (0)                       | 1 (0.1)                    |
| Non-specific bleeding    | 1 (0.2)                     | 1 (0.1)                    |
| Non-specific infection   | 0 (0)                       | 2 (0.2)                    |
| Pain                     | 0 (0)                       | 6 (0.5)                    |
| Pelvic abscess           | 2 (0.3)                     | 0 (0)                      |
| Pelvic collection        | 1 (0.2)                     | 0 (0)                      |
| Perforated bowel         | 2 (0.3)                     | 3 (0.2)                    |
| Peritonitis              | 1 (0.2)                     | 0 (0)                      |
| Pneumonia                | 3 (0.5)                     | 3 (0.2)                    |
| Presacral vein injury    | 2 (0.3)                     | 0 (0)                      |
| Prolonged ileus          | 1 (0.2)                     | 12 (1.0)                   |
| Pulmonary oedema         | 0 (0)                       | 0 (0)                      |
| Respiratory failure      | 0 (0)                       | 0 (0)                      |
| Retrograde ejaculation   | 0 (0)                       | 0 (0)                      |
| Sphincterismus          | 0 (0)                       | 0 (0)                      |
| Subcutaneous emphysema   | 1 (0.2)                     | 3 (0.2)                    |
| Surgical-site infection  | 12 (1.9)                    | 5 (0.4)                    |
| Upper gastrointestinal bleed | 0 (0)               | 0 (0)                      |
| Ureteric injury          | 2 (0.3)                     | 1 (0.1)                    |
| Urinary incontinence     | 0 (0)                       | 2 (0.2)                    |
| Urinary retention        | 6 (1.0)                     | 4 (0.3)                    |
| Urinary tract infection  | 3 (0.5)                     | 29 (2.4)                   |
| Wound abscess            | 0 (0)                       | 1 (0.1)                    |
| Total                    | 54 (8.8)                    | 97 (7.9)                   |

Values in parentheses are percentages. *P = 0.509 versus suture rectopexy (Pearson’s χ² test).

Table 8 Characteristics of studies included in meta-analysis

| Reference       | Study design                             | No. of patients | Comparators | Inclusion criteria | Exclusion criteria | Method of measuring recurrence | Outcome measures | Duration of follow-up (months) |
|-----------------|----------------------------------------|-----------------|-------------|--------------------|--------------------|-------------------------------|------------------|-------------------------------|
| Benoist et al.  | Retrospective, observational            | 16              | 14          | VMR versus SR with and without sigmoid resection | Patients who had surgery for full-thickness rectal prolapse | Clinical examination or long-term telephone interview | Complications, constipation, incontinence, recurrence | SR: 24 VMR: 26 |
| Gleditsch et al. | Retrospective, observational            | 49              | 22          | Laparoscopic posterior SR versus VMR | Patients who had surgery for external rectal prolapse | Clinical examination and endoscopy | Complications, recurrence | SR: 84 VMR: 29 |
| Hidaka et al.   | RCT (2006–2014)                         | 30              | 34          | Laparoscopic posterior SR versus VMR | Patients with rectal prolapse | Clinical examination and questionnaires | CCCS, CCIS, ODS score, PAC-QOL, PAC-SYM, prolapse recurrence, mesh | 72 |

(continued)
A Mantel–Haenszel random-effects model was used for meta-analysis. Risk ratios are shown with 95 per cent confidence intervals.

Fig. 2 Forest plot of recurrence after suture rectopexy versus ventral mesh rectopexy for complete rectal prolapse
A Mantel–Haenszel random-effects model was used for meta-analysis. Risk ratios are shown with 95 per cent confidence intervals.

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