# Comparison of effectiveness of vaginal and abdominal routes in treating severe uterovaginal or vault prolapse

C C M Ng, W H C Han


## ABSTRACT

**Introduction:** **This study compares the efficacy of abdominal and vaginal routes in correcting severe uterovaginal or vault prolapses by examining their primary surgical outcomes.**

**Methods:** **A retrospective study was conducted on operations performed from March 1998 to December 2001. The classifications of uterovaginal prolapse and vault prolapse were based on the Halfway system. It involved 177 women with at least grade 4 uterovaginal prolapse or grade 3 vault prolapse, and had undergone vaginal sacrospinous ligament fixation or abdominal sacrocolpopexy. The subjects were divided into two groups: 113 women who had an abdominal sacrocolpopexy and 64 women who had a vaginal sacrospinous ligament fixation. The primary surgical outcome measures was classified as cured, improved or failure according to our definition at their last follow-up.**

**Results:** **The abdominal sacrocolpopexy group had significantly greater intra-operative blood loss, operating time, haematuria, longer post-operative catheterisation and hospitalisation. Vaginal sacrospinous ligament fixation had more suture erosion. 95.6 percent of women with abdominal sacrocolpopexy were cured compared to 79.7 percent with vaginal sacrospinous ligament fixation. Five (4.4 percent) patients in the abdominal sacrocolpopexy group and six (9.4 percent) in the vaginal sacrospinous ligament fixation group defaulted their six-month follow-up with a mean follow-up of 18.1 months (range 0.9-48.1 months) and 13.2 months (range 1.1-29.1 months), respectively.**

**Conclusion:** **Abdominal sacrocolpopexy is more effective in correcting severe uterovaginal or vault prolapses but it is associated with higher intra- and post-operative morbidity compared to vaginal sacrospinous ligament fixation. Vaginal sacrospinous ligament fixation is preferred in patients with medical disorders.**


**Keywords: abdominal sacrocolpopexy, uterovaginal prolapse, vaginal sacrospinous ligament fixation, vault prolapse**

*Singapore Med J 2004 Vol 45(10):475-481*

## INTRODUCTION

About 50% of parous women are estimated to have some form of pelvic organ prolapse, with 10% to 20% requesting treatment of their symptoms[1]. It is reported that 46.2% of women aged 15 to 97 years old experience or had experienced pelvic floor dysfunction[2]. Once prolapse has occurred, spontaneous recovery is not possible. The condition tends to deteriorate in menopause as atrophy results in further weakening of the supporting tissues. Surgery can be curative for pelvic organ prolapse.

Repair of pelvic support defects can be performed abdominally or vaginally[3-9]. These range from partial[10] or total colpocleisis[11] and colpectomy[12] to the newer laparoscopic techniques[13,14] and, more recently, infracoccygeal sacropexy (posterior intravaginal slingplasty)[15,16]. The choice of surgery would depend on the patient's symptoms and severity of pelvic floor prolapse. Before surgery, one must consider the patient's age, fitness for operation, medical conditions, physical and sexual activities, previous operations and desire to retain the uterus. Women requiring pelvic floor reconstructive surgery often have more than one pelvic support defect at various vaginal sites[17].

Although there have been many studies comparing abdominal versus vaginal route for the repair of pelvic support defects[18,19], none have been conducted in Singapore. This study aims to determine whether the vaginal or abdominal route is more effective in treating severe uterovaginal or vault prolapses, with abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation as the main operations for comparison. The principles of pelvic floor reconstructive surgery are to correct pelvic support defects in order to restore normal pelvic anatomy and maintain function.

**Urogynaecological Unit**
**KK Women's and Children's Hospital**
**Level 6,**
**Women's Tower**
**100 Bukit Timah Road**
**Singapore 229899**

C C M Ng, FRANZCOG, MMed
Registrar

W H C Han, MRCOG, MMed, MRACOG
Senior Consultant and Head

**Correspondence to:**
Dr Christopher Ng Chee Mun
Tel: (65) 6293 4044
Fax: (65) 6298 6343
Email: drchrisng@hotmail.com

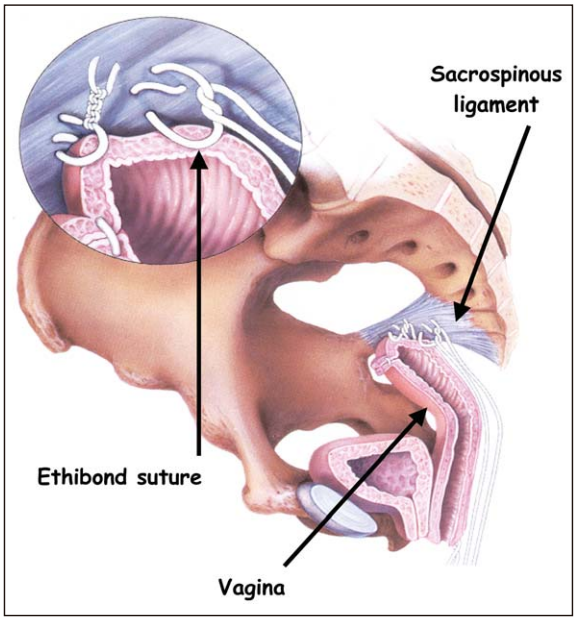


**Fig. 1** Sketch shows vaginal sacrospinous ligament fixation.

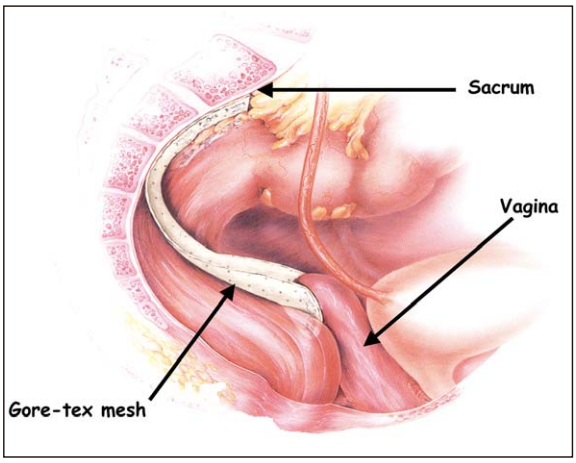


**Fig. 2** Sketch shows abdominal sacrocolpopexy.

## METHODS

This was a retrospective comparative study based on operations performed from March 1998 to December 2001. The data was reviewed on 1 November 2002. The classification of uterovaginal prolapse and vault prolapse was based on the Halfway system[17]. The inclusion criteria were that the subjects must have at least a grade 4 uterovaginal prolapse or grade 3 vault prolapse, and had undergone vaginal sacrospinous ligament fixation or abdominal sacrocolpopexy during the study period. The diagnosis was made with the woman in the supine and Sim's position while performing a Valsalva manoeuvre at maximum strain in the outpatient clinic, as well as intraoperatively under anaesthesia.

In vaginal sacrospinous ligament fixation (Fig. 1), a vertical incision was made in the posterior vaginal wall to expose the recto-vaginal space. The right ischial spine was palpated and exposed by blunt dissection, allowing the sacrospinous ligament to be palpated. Two Ethibond 1 sutures (Ethibond Excel W969; Johnson & Johnson, St-Stevens-Woluwe, Belgium) made of braided non-absorbable polyester were used in vaginal sacrospinous ligament fixation to secure the apex of the vaginal vault, excluding the vaginal epithelium, to the right sacrospinous ligament. This was facilitated using a Miya hook ligature carrier. Care was taken to avoid damage to the sacral plexus and sciatic nerve (located above the superior border of the sacrospinous ligament), as well as the pudendal vessels and nerves. The sacrospinous sutures were then tied like a pulley to bring the vaginal vault up to the sacrospinous ligament.

In abdominal sacrocolpopexy (Fig. 2), eight Ethibond 1 sutures (6 to secure the upper two-thirds of the posterior vaginal wall, excluding the vaginal epithelium, to the Gore-tex mesh and 2 to secure this mesh to the sacrum) and one Gore-tex mesh (Gore Creative Technologies Worldwide, Flagstaff, Arizona, USA) made of polytetrafluoroethylene were used. The peritoneum over the sacrum was opened and a tunnel was created on both ends to let the Gore-tex mesh through. The peritoneum was then closed to reduce the risk of adhesion and intestinal obstruction. Concomitant enterocoele repairs were not performed.

All patients in the study were counselled on the risks and benefits of vaginal sacrospinous ligament fixation and abdominal sacrocolpopexy. They were allowed to decide which operation they preferred to undergo. The patients were divided into two groups: vaginal sacrospinous ligament fixation and abdominal sacrocolpopexy. Any significant coexisting cystocoeles and rectocoeles were repaired at the time of surgery. Genuine stress incontinence (frank or occult) and detrusor instability were diagnosed by standard urodynamic studies (dual channel subtraction cystometry, erect stress test, uroflowmetry and urinalysis). Burch colposuspension or tension-free vaginal tapes (TVT) were the surgical treatments of choice for genuine stress incontinence. Detrusor instability, if persistent, was treated with anti-cholinergic medication pre- and postoperatively.

The surgery, along with the pre- and postoperative assessments, were performed or supervised by the same urogynaecologist to reduce inter-operator errors in the study. Postoperatively, patients were reviewed at one month, six months and yearly thereafter. The follow-up examination was carried out with

**Table I. Characteristics of patients (n=177).**

| Characteristic | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) |
|---|---|---|
| Mean age (years) | 60 | 63.1 |
| Mean weight (kg) | 57.4 | 55.3 |
| Mean height (cm) | 152.7 | 151.1 |
| Mean BMI (kg/m$^2$) | 24.6 | 24.1 |
| Mean number of children | 4 | 3 |
| Previous forceps / vacuum delivery | 4 (3.5%) | 4 (6.3%) |
| Menopausal women | 92 (81.4%) | 56 (87.5%) |
| On HRT | 7 (6.2%) | 6 (9.4%) |
| Grade 4 uterovaginal prolapse (%) | 78 (69%) | 37 (57.8%) |
| Grade 3 or 4 vault prolapse (%) | 35 (31%) | 27 (42.1%) |
| Cystocoele: None | 7 (6.2%) | 5 (7.8%) |
| Grade 1 | 7 (6.2%) | 14 (21.9%) |
| Grade 2 | 7 (6.2%) | 4 (6.3%) |
| Grade 3 | 19 (16.8%) | 19 (29.7%) |
| Grade 4 | 73 (64.6%) | 22 (34.4%) |
| Rectocoele: None | 34 (30.1%) | 8 (12.5%) |
| Grade 1 | 33 (29.2%) | 9 (14.1%) |
| Grade 2 | 25 (22.1%) | 33 (51.6%) |
| Grade 3 | 13 (11.5%) | 10 (15.6%) |
| Grade 4 | 8 (7.1%) | 4 (6.3%) |
| With GSI | 24 (21.2%) | 12 (18.8%) |
| With occult GSI | 3 (2.7%) | 0 (0%) |
| Women with DI | 12 (10.6%) | 5 (7.8%) |

BMI: body mass index; DI: detrusor instability; GSI: genuine stress incontinence; HRT: hormone replacement therapy; UV: uterovaginal

the woman in the supine and Sim's position whilst performing a maximum Valsalva strain manoeuvre. All subjects were reassessed at six months with a filling and voiding cystometry to exclude genuine stress incontinence and detrusor instability. Defaulters or those lost to follow-up were treated as having defaulted on their scheduled postoperative visits at the time of data collection.

The primary surgical outcome was classified as cured, improved or failure according to our definition at the last follow-up. The surgery was considered cured in women who were asymptomatic with no or grade 1 vault prolapse. An improved outcome applied to women who remained asymptomatic with a grade 2 vault. Surgery was considered a failure in women who may have been symptomatic or have grade 3 or 4 vault prolapse.

Data was analysed using Fisher's exact and chi-square tests. A value of $p<0.05$ was considered statistically significant. Continuous data was analysed using standard t-test (for normal distribution) and Mann-Whitney U test (for non-normal distribution or where $N<20$).

## RESULTS

The characteristics of the 177 subjects are shown in Table I. 113 patients had undergone abdominal sacrocolpopexy and 64 had a vaginal sacrospinous ligament fixation. The main characteristics between the two groups were generally very similar except for their mean ages, whereby women in the vaginal sacrospinous ligament fixation group were significantly older (Table I). The additional operations performed in each group are illustrated in Table II. As the number of women with only abdominal sacrocolpopexy or vaginal sacrospinous ligament fixation was small, they were classified with the rest of the patients who had other operations in addition to abdominal sacrocolpopexy or vaginal sacrospinous ligament fixation in the data analysis.

**Table II. Additional operations performed on patients (n=177).**

| Operation | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) |
|---|---|---|
| Anterior repair | 0 (0%) | 44 (68.8%) |
| Posterior repair | 8 (7.1%) | 52 (81.3%) |
| Paravaginal cystocoele repair | 81 (71.7%) | 0 (0%) |
| Total abdominal hysterectomy | 78 (69%) | 0 (0%) |
| Vaginal hysterectomy | 0 (0%) | 38 (59.4%) |
| Burch colposuspension | 27 (23.9%) | 0 (0%) |
| Tension free vaginal tape | 1 (0.9%)* | 12 (18.8%) |
| Abdominal sacrocolpopexy or vaginal sacrospinous ligament fixation alone | 7 (6.2%) | 3 (4.7%) |

* Patient did not have Burch colposuspension because of inability to enter the space of Retzius as a result of dense adhesions from a previous surgery.

**Table III. Intraoperative outcomes in patients (n=177).**

| Outcome | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) | P value |
|---|---|---|---|
| Mean blood loss (range) | [a]557ml (50 to 2700ml) | [b]239ml (5 to 700ml) | #<0.001 |
| Require blood transfusion | 13 (11.5%) | 2 (3.1%) | **0.089 |
| Tissue injury | [c]1 (0.9%) | [d]1 (1.6%) | **1 |
| Mean operating time (range) | 133min (32 to 227min) | 78min (28 to 156min) | @<0.001 |

\# Mann-Whitney U test
** Fisher's exact test
@ t-test
[a] n=51 (62 women with no data)
[b] n=18 (46 women with no data)
[c] Injury to bladder
[d] Injury to rectal mucosa

The intraoperative outcomes encountered in abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation are summarised in Table III. The significant blood loss reported in abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation was the result of the concomitant operations performed (abdominal and vaginal hysterectomy, paravesical vessel haemorrhage in Burch colposuspension/paravaginal cystocoele repair). There were no injuries to the pudendal vessels and nerves in the vaginal sacrospinous group, which could have led to excessive bleeding. There was only one case of significant bleeding from the presacral vessels in the abdominal sacrocolpopexy group. In order to arrest the bleeding and to secure haemostasis, two suckers to improve vision of the bleeding vessels followed by unipolar diathermy, bone wax and bipolar diathermy were employed.

There were an equal number of intraoperative injuries, but to different tissues in both groups of operations (Table III). There were no injuries to the middle rectal artery, sigmoid colon or ureters. Perhaps because of the technically more difficult nature of abdominal sacrocolpopexy compared to vaginal sacrospinous ligament fixation, abdominal sacrocolpopexy was associated with a significantly longer mean operating time ($p<0.001$). This translates into greater patient exposure to anaesthetic and surgical risks.

The postoperative complications encountered in abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation are shown in Table IV. A significantly greater percentage of women who underwent abdominal sacrocolpopexy developed postoperative pyrexia compared to women in the sacrospinous group but interestingly enough, this was not associated with a statistically significant increase in the number of postoperative wound infections or urinary tract infections. This may be because patients in the study received prophylactic antibiotics both peri- and postoperatively as part of the treatment protocol.

Postoperative haematuria in the abdominal sacrocolpopexy group was a result of the bladder being pushed medially in order to perform a Burch

**Table IV. Postoperative complications in patients (n=177).**

| Complication | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) | p value |
|---|---|---|---|
| Pyrexia (>37.5°C) | 59 (52.2%) | 18 (28.1%) | **0.003 |
| Wound infection | 6 (5.3%) | 0 (0%) | **0.088 |
| Urinary tract infection | 12 (10.6%) | 7 (10.9%) | **1 |
| Haematuria | 29 (25.7%) | 3 (4.7%) | **<0.001 |
| Mean urinary catheter duration (range) | 4 days (1 to 60 days) | 3 days (1 to 56 days) | #<0.001 |
| Mesh/Suture erosion | [a]1 (0.9%) | [b]5 (7.8%) | **0.024 |
| Mean hospital stay (range) | 6 days (2 to 28 days) | 4 days (2 to 14 days) | #<0.001 |
| De novo genuine stress incontinence | 4 (3.5%) | 0 (0%) | **0.298 |
| De novo detrusor instability | 6 (5.3%) | 3 (4.7%) | **1 |

# Mann-Whitney U test

** Fisher's exact test

[a] Mesh erosion

[b] Suture erosion

**Table V. Postoperative outcomes in patients (n=177) at the last follow-up.**

| Outcome | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n = 64) | p value |
|---|---|---|---|
| Cured (%) | 108 (95.6%) | 51 (79.7%) | |
| Improved (%) | 3 (2.7%) | 2 (3.1%) | [a]<0.001 |
| Failure (%) | 2 (1.8%) | 11 (17.2%) | |
| Mean of follow-up (range) | 18.1 months (0.9 to 48.1 months) | 13.2 months (1.1 to 29.1 months) | NA |
| Median interval to prolapse (95% confidence interval) | [a]16.5 months (12.5 to 20.5 months) | [a]25.1 months (19.3 to 30.9 months) | [b]0.017 |

[a] Fisher's exact test

[b] Kaplan-Meier survival analysis

NA: Non-applicable

colposuspension or paravaginal cystocoele repair. Postoperative haematuria in vaginal sacrospinous ligament fixation patients was a result of concomitant surgery (TVT and vaginal hysterectomy). These complications may have resulted from the fact that the patients received additional operations on top of abdominal sacrocolpopexy (Table II), and may not be as a direct result of abdominal sacrocolpopexy per se.

Ethibond sutures were used in both vaginal sacrospinous ligament fixation and abdominal sacrocolpopexy operations, with additional Gore-tex mesh in the case of abdominal sacrocolpopexy. Significantly more women who had vaginal sacrospinous ligament fixation developed suture erosion compared to women with abdominal sacrocolpopexy (p=0.024).

Overall, women who underwent abdominal sacrocolpopexy had significantly longer hospital stays than those who had vaginal sacrospinous ligament fixation; this finding concurred with that of other studies[19,20]. This was not unexpected as more women in the abdominal sacrocolpopexy group had postoperative pyrexia, wound infection, haematuria and longer catheterisation (Table IV). These women also had abdominal scars that may have been associated with more postoperative pain, although this parameter was not assessed in the study.

After abdominal sacrocolpopexy, four women developed an incisional hernia, one had a unilateral deep vein thrombosis in the lower leg and one had subacute intestinal obstruction. Two women in the abdominal sacrocolpopexy group and one woman in the vaginal sacrospinous ligament fixation group had a wound breakdown. In women who underwent abdominal sacrocolpopexy, an acute myocardial infarct occurred postoperatively in one woman while another developed congestive heart failure. Both abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation groups had one woman each developing a pelvic haematoma postoperatively. Hence,

**Table VIA. Postoperative outcomes (n=177) assuming all patients lost to follow-up were considered cured.**

| Outcome | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) | p value |
|---|---|---|---|
| Cured (%) | 110 (97.3%) | 51 (79.7%) | |
| Improved (%) | 1 (0.9%) | 2 (3.1%) | [a]<0.001 |
| Failure (%) | 2 (1.8%) | 11 (17.2%) | |

[a] Fisher's exact test

**Table VIB. Postoperative outcomes (n=177) assuming all patients lost to follow-up were considered failures.**

| Outcome | Abdominal sacrocolpopexy (n=113) | Vaginal sacrospinous ligament fixation (n=64) | p value |
|---|---|---|---|
| Cured (%) | 57 (50.4%) | 35 (54.7%) | |
| Improved (%) | 1 (0.9%) | 2 (3.1%) | [a]0.385 |
| Failure (%) | 55 (48.7%) | 27 (42.2%) | |

[a] Fisher's exact test

it would appear that abdominal sacrocolpopexy was associated with more postoperative complications than vaginal sacrospinous ligament fixation.

Genuine stress incontinence and detrusor instability are not common complications of abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation. The incidence of de novo genuine stress incontinence and detrusor instability was not statistically significant between the two groups. The postoperative findings are summarised in Table V. All patients attended the initial one-month postoperative review, with only five (4.4%) patients in the abdominal sacrocolpopexy group and six (9.4%) patients in the vaginal sacrospinous ligament fixation group defaulting on their six-month follow-up. There were, however, 53 (46.9%) women and 16 (25%) women who defaulted on their subsequent follow-up at the time of review in the abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation groups, respectively. This was a rather high proportion of women lost to follow-up, especially in the former, and attempts to contact them were unsuccessful. The higher number of patients lost to follow-up in the abdominal sacrocolpopexy group could be due to their longer follow-up. The follow-up period for pelvic floor reconstructive surgeries should be at least five years as the failure rate is directly proportional to the length of follow-up. The data will be reviewed at five years to obtain a clearer representation of the success rates.

Overall, 95.6% of women who underwent abdominal sacrocolpopexy were cured of their prolapse compared to 79.7% of women in the vaginal sacrospinous ligament fixation group at their last follow-up. 53.1% and 75% of patients in the two groups, respectively, were still on follow-up at the time of data review. These results may be biased as we do not know the outcome of those who were lost to follow-up. Abdominal sacrocolpopexy appears to be more effective in treating or preventing vault prolapse compared to vaginal sacrospinous ligament fixation ($p<0.001$). Table VIA and VIB summarises the postoperative findings if we assume that all patients lost to follow-up were considered either as cured or as failures. Abdominal sacrocolpopexy would then appear to be more effective in the former ($p<0.001$) and not effective in the latter assumption ($p=0.385$).

## DISCUSSION

There are several newer treatments in addition to abdominal sacrocolpopexy and vaginal sacrospinous ligament fixation in the management of severe uterovaginal or vault prolapses. Recent interest has focused on less invasive methods, including laparoscopic pelvic floor repair and laparoscopic sacrocolpopexy[21]. The laparoscopic (sacrocolpopexy and sacrospinous ligament fixation) route is said to offer superior vision and a less traumatic access compared with the traditional abdominal and vaginal routes. Proponents of laparoscopic surgery claim better assessment, more precise and correct anatomical repair, usage of strong and acceptable material as a substitute for weak tissues, faster recovery and excellent anatomical and functional results[13]. Lee et al[22] reported a 91.6% cure rate over a mean follow-up period of 2.2 years for laparoscopic sacrospinous ligament fixation. The cure rates reported with laparoscopic sacrocolpopexy are equally

encouraging, with several authors reporting rates of between 94% and 100% based on a follow-up period of three to 40 months[23-25].

Laparoscopic procedures require a high degree of skill and extensive specialised training. The learning curve takes a longer time and there have been suggestions that the surgeon should perform at least 50 cases in order to be proficient. As a result, only a minority of surgeons achieve competence in these methods. Petros[15] first described infracoccygeal sacropexy (posterior intravaginal slingplasty) as a minimally invasive procedure for the treatment of vault prolapse. Farnsworth[16] recently reported a cure rate of 91% over a mean follow-up period of 12 months and suggested that infracoccygeal sacropexy had similar efficacy to more established surgical techniques, but with lower surgical morbidity, less patient discomfort, a short learning curve and the skills needed to perform it were those of any competent pelvic surgeon.

It should be remembered that it can be difficult to draw direct comparisons between our data with that of other studies as there may be differences in patient classification, definition of cure and failure, as well as operator skills and techniques. Nevertheless, our study concurred with others[26] in suggesting that the abdominal route (sacrocolpopexy) was associated with a lower incidence of recurrent vault prolapse than the vaginal route (sacrospinous ligament fixation) in the treatment of severe uterovaginal or vaginal vault prolapses. However, in order to obtain a realistic comparison between the abdominal and vaginal routes with the newer treatment methods described above, a prospective randomised controlled trial would have to be conducted.

In conclusion, abdominal sacrocolpopexy is associated with significantly greater intraoperative blood loss and operating time, along with significantly more patients with postoperative pyrexia, haematuria, longer postoperative urinary catheterisation and hospitalisation. In contrast, significantly more women with vaginal sacrospinous ligament fixation developed suture erosion. Despite the increased intra- and postoperative morbidity, abdominal sacrocolpopexy is a more effective operation in treating severe uterovaginal or vault prolapses with a higher probability of achieving cure and a lower probability of recurrence when compared to vaginal sacrospinous ligament fixation. Although more vault recurrences occur with vaginal sacrospinous ligament fixation, they take place significantly later than with abdominal sacrocolpopexy. The vaginal route may be preferable in women with medical disorders as it is associated with lower intra- and postoperative morbidity.

## REFERENCES


1. Beck RP. Pelvic relaxational prolapse. In: Kase NG, Weingold AB, eds. Principles and Practice of Clinical Gynaecology. New York: John Wiley and Sons, 1983:677-85.
2. MacLennan AH, Taylor AW, Wilson DH, Wilson D. The prevalence of pelvic floor disorders and their relationship to gender, age, parity and mode of delivery. Br J Obstet Gynaecol 2000; 107:1460-70.
3. Lane FE. Repair of post-hysterectomy vaginal vault prolapse. Obstet Gynecol 1962; 20:72-7.
4. Grundsell H, Larsson G. Operative management of vaginal vault prolapse following hysterectomy. Br J Obstet Gynaecol 1984; 91:808-11.
5. Maloney JC, Dunton CJ, Smith K. Repair of vaginal vault prolapse with abdominal sacropexy. J Reprod Med 1990; 35:6-10.
6. Snyder TE, Krantz KE. Abdominal-retroperitoneal sacral colpopexy for the correction of vaginal prolapse. Obstet Gynecol 1991; 77:944-9.
7. Timmons MC, Addison WA, Addison SB, Cavenar MG. Abdominal sacral colpopexy in 163 women with post-hysterectomy vaginal vault prolapse and enterocele. Evolution of operative techniques. J Reprod Med 1992; 37:323-7.
8. Richter K, Albrich W. Long-term results following fixation of the vagina on the sacrospinal ligament by the vaginal route (vaginaefixatio sacrospinalis vaginalis). Am J Obstet Gynecol 1981; 141:811-6.
9. Morley GW, DeLancey JO. Sacrospinous ligament fixation for eversion of the vagina. Am J Obstet Gynecol 1988; 158:872-81.
10. Ubachs JM, van Sante TJ, Schellekens LA. Partial colpocleisis by a modification of LeFort's operation. Obstet Gynecol 1973; 42:415-20.
11. Von Pechmann WS, Mutone M, Fyffe J, Hale DS. Total colpocleisis with high levator plication for the treatment of advanced pelvic organ prolapse. Am J Ostet Gynaecol 2003; 189:121-6.
12. Morley GW. Treatment of uterine and vaginal prolapse. Clin Obstet Gynecol 1996; 39:959-69.
13. Wattiez A, Mashiach R, Donoso M. Laparoscopic repair of vaginal vault prolapse. Curr Opin Obstet Gynecol 2003; 15:315-9.
14. Miklos JR, Moore RD, Kohli N. Laparoscopic surgery for pelvic support defects. Curr Opin Obstet Gynecol 2002; 14:387-95.
15. Petros PE. New ambulatory surgical methods using an anatomical classification of urinary dysfunction improve stress, urge and abnormal emptying. Int Urogynecol J Pelvic Floor Dysfunct 1997; 8:270-7.
16. Farnsworth BN. Posterior intravaginal slingplasty (infracoccygeal sacropexy) for severe post-hysterectomy vaginal vault prolapse – a preliminary report on efficacy and safety. Int Urogynecol J Pelvic Floor Dysfunct 2002; 13:4-8.
17. Baden WF, Walker T. Fundamentals, symptoms, and classification. In: Baden WF, Walker T, eds. Surgical Repair of Vaginal Defects. Philadelphia: Lippincott Williams & Wilkins, 1992; 9-23.
18. Carey MP, Dwyer PL. Genital prolapse: vaginal versus abdominal route of repair. Curr Opin Obstet Gynecol 2001; 13:499-505.
19. Benson TJ, Lucente V, McClellan E. Vaginal versus abdominal reconstructive surgery for the treatment of pelvic support defects: a prospective randomized study with long-term outcome evaluation. Am J Obstet Gynecol 1996; 175: 418-22.
20. Brown WE, Hoffman MS, Bouis PJ, Ingram JM, Hopes SL. Management of vaginal vault prolapse: retrospective comparison of abdominal versus vaginal approach. J Fla Med Assoc 1989; 76:249-52.
21. Paraiso MF, Falcone T, Walters MD. Laparoscopic surgery for enterocele, vaginal apex prolapse and rectocele. Int Urogynecol J Pelvic Floor Dysfunct 1999;10: 223-9.
22. Lee CL, Wang CJ, Yen CF, Soong YK. Laparoscopic extraperitoneal sacrospinous suspension for vaginal vault prolapse. Changgeng Yi Xue Za Zhi 2000; 23: 87-91.
23. Nezhat CH, Nezhat F, Nezhat C. Laparoscopic sacral colpopexy for vaginal vault prolapse. Obstet Gynecol 1994; 84:885-8.
24. Ross JW. Apical vault repair, the cornerstone of pelvic vault reconstruction. Int Urogynecol J Pelvic Floor Dysfunct 1997; 8:146-52.
25. Cosson M, Bogaert E, Narducci F, Querleu D, Crepin G. laparoscopic sacral colpopexy: short-term results and complications in 83 patients [French]. J Gynecol Obstet Biol Reprod (Paris) 2000; 29:746-50.
26. Sze EH, Kohli N, Miklos JR, Roat T, Karram MM. A retrospective comparison of abdominal sacrocolpopexy with Burch colposuspension versus sacrospinous fixation with transvaginal needle suspension for the management of vaginal vault prolapse and coexisting stress incontinence. Int Urogynecol J Pelvic Floor Dysfunct 1999; 10:390-3.