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New procedures for uterine prolapse

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Traditionally, vaginal hysterectomy and Manchester repair were the surgical approaches to treating uterine prolapse; however, both are associated with a relatively high subsequent vaginal vault recurrence. Laparoscopic uterine suspension is a new way of maintaining uterine support. Many women are keen to keep their uterus for a variety of reasons, including maintaining reproductive capability and the belief that the uterus, cervix, or both, may play a part of their gender identity. Non-removal of the uterus may retain functional (e.g. bowel, bladder and sexual) benefits. Therefore, the concept of uterine preservation for pelvic-organ prolapse has been of interest to pelvic-floor surgeons for many decades. In this review, we provide an overview of the available evidence on treating uterine prolapse surgically. We describe techniques to support the vault during hysterectomy, and examine the evidence for uterine-sparing surgery. Comparative outcomes for vaginal, abdominal and laparoscopic routes will be made.

Introduction

Uterovaginal prolapse is a common problem affecting women of all ages. It affects 50% of parous women over 50 years of age, with a lifetime prevalence risk of 30–50%.[1] A large retrospective study of US women found that, by the age of 80 years, 11% of women have undergone surgery for urogynaecological complaints, and almost a one-third require repeat surgery.[2] This high recurrence rate has driven attempts to gain a better understanding of prolapse and the development of more robust techniques.

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For women presenting with urogynaecological problems, one size does not fit all. The surgeon's goal should be to offer a range of procedures and to individualise surgery according to needs. Treatment should be determined ultimately by the women's wishes, taking into account other relevant factors, including age, reproductive desires, medical co-morbidities and previous surgery. It is often doctor's preference, however, that influences treatment choice. Surgical methods encompass vaginal and abdominal routes, with the latter achievable by an open or laparoscopic approach. Treatment choice must take into account functional as well as anatomical problems, while minimising morbidity and maximising long-term efficacy.

Apical support for the uterus and upper vagina is provided by the cardinal and uterosacral ligaments (DeLancey level 1 support).[3] Disruption of the cardinal–uterosacral complex may result in uterine or vaginal vault prolapse. In addition to apical prolapse, they are strongly related to anterior vaginal wall descent and recurrence.[4–6] Several investigators have shown that the anterior vaginal wall is the site of failure in many recurrences.[5,7]

Historically, recurrence rate of prolapse is high after vaginal hysterectomy; therefore, the surgical option selected must result in support of the apex of the vagina.[8,9] This can entail either removal of the uterus and then effecting apical support, or effecting apical support while retaining the uterus. The two operations traditionally carried out were either vaginal hysterectomy with apical support or Manchester repair, which retained the uterus. Both methods have a relatively high recurrence rate of further symptomatic apical prolapsed, with up to 43% for vaginal hysterectomy and up to 21% after Manchester repair.[8–10]

In this review, we provide an overview of the available evidence of surgical treatment of uterine prolapse. We describe techniques to support the vault during hysterectomy, and examine the evidence for uterine-sparing surgery. Comparative outcomes for the vaginal, abdominal and laparoscopic routes will be made.

Traditional approach

Hysterectomy alone will often fail to address the underlying deficiencies in pelvic support that have led to uterovaginal prolapse.[11] Clark et al.[12] reported that the highest rates of re-operation for pelvic-floor disorders in a managed care system occurred in women undergoing surgery for apical defects (33% re-operation) or combined anterior and apical defects (15%). The risk of future vault prolapse is six-fold higher if the initial indication for hysterectomy was for prolapse compared with other indications, such as menorrhagia or pelvic pain.[8,9] This makes obvious sense, as it is likely that the original prolapse risk factors, such as connective tissue problems,[13,14] levator-muscle trauma related to child birth,[15,16] and lifestyle factors, are likely to remain, thus increasing the risk of recurrence. A range of surgical methods are used to maintain apical support. These include high uterosacral ligament suspension, McCall or Mayo culdoplasty, sacrospinous ligament suspension, iliococcygeal fixation, abdominal vault suspension and uterosacral placation.[17–20]

The Manchester repair procedure was introduced in 1888.[10] The original procedure involved amputation of the cervix, colporrhaphy, and attachment of the cervical stump to the cardinal ligaments, although several modifications have been introduced since then. Because of the complication profile and high recurrence rates, this procedure is not commonly used now.[10,21] A more recent retrospective study comparing a modified Manchester technique with vaginal hysterectomy showed no middle compartment recurrences in the modified Manchester group and 4% in the hysterectomy group at 12 months' follow up. This suggests more encouraging outcomes for the former procedure.[22] The main modification was the plication of the uterosacral ligaments by a deep suture. This is in contrast to the original Manchester procedure, where the ligaments are cut and transposed.

New techniques

Vaginal hysterectomy

Uterosacral suspension

Hysterectomy alone does not address the underlying defects of vaginal vault support[23]; hence, typically, the uterosacral ligaments are used to effect apical support at the end of the operation. The high uterosacral ligament suspension anchors the vaginal apex to the remnants of the uterosacral

ligaments at the level of the ischial spines. Proponents of this technique claim it can produce the desired effect of restoration of the native apical support structures. Shull et al.,[20] in 2000, described bilateral uterosacral ligament suspension with three suspensory non-absorbable braided sutures on each side, followed by plication of the pubocervical and rectovaginal fascia, first in the midline and then transversely by attaching it to the suspensory sutures. This can be carried out concurrently with a hysterectomy or as a treatment for post-hysterectomy vault prolapse.

Several modifications of the technique described have been made with varying results. These include use of long-term absorbable and permanent sutures. The exact location of the supporting sutures differs in each of the publications.[20,24–28] Success rate varies from 87–100%, and are shown in Table 1. Some investigators have followed up their patients up to 5 years with good objective and subjective outcomes.[26,28]

The main concern, however, with high uterosacral ligament suspension is the possibility of ureteric injury, as the procedure is rarely carried out under absolute direct vision. Ureteric compromise was reported as high as 11% in one study during vaginal uterosacral ligament suspension.[29] Investigators often recommend the routine use of cystoscopy during this procedure to diagnose intra-operative ureteric compromise or injury.[28,29]

Several investigators have described the laparoscopic approach to vault suspension after vaginal hysterectomy.[30–32] Improved visualisation and magnification makes ureteric identification easier, and enhances the ability to avoid injury. It has also been suggested in cadaveric studies that the tensile strength of sutures in the uterosacral ligament placed laparoscopically are similar or even slightly greater than those placed vaginally.[33]

More recently, Rardin et al.[23] described a technique for laparoscopic uterosacral suspension after vaginal hysterectomy by using a vaginal probe to elevate the vaginal vault, thereby allowing visualisation of the uterosacral ligaments. Incisions to relax the peritoneum are made between the proximal uterosacral ligament and the ureter on each side.[23] A permanent laparoscopic suture is then doubly placed on the proximal uterosacral ligament. The suture attaches the proximal uterosacral ligament to the ipsilateral vaginal cuff. This study compared that same technique vaginally and laparoscopically, and concluded that laparoscopic uterosacral vault suspension after vaginal hysterectomy is a safe alternative to the vaginal approach. The ureteric compromise rate was 4.2% among women undergoing vaginal colpopexy, whereas none were seen in the laparoscopic group. This is consistent with other published studies on laparoscopic uterosacral vault suspension procedures.[30,32] Thus, it would seems that laparoscopic uterosacral suspension has a good safety profile and satisfactory outcome.

Sacrospinous fixation

Richter[34] and Richter and Albrigh[35] first described the sacrospinous fixation (SSF) procedure in 1968 as a transvaginal procedure for the treatment of vaginal vault prolapse. Over the past few decades, SSF has become an established operation to treat vaginal vault prolapse.[36] The operation has low perioperative morbidity, quick return to activities, and a recurrence rate of 5–15%.[37,38] The role of SSF in vault prolapse after hysterectomy is outside the scope of this review; however; it has been described as a prophylactic or a suspension procedure at the time of vaginal hysterectomy.[39,40] A retrospective study comparing SSF with modified McCall culdoplasty in 134 women showed increased operative time and blood loss in the SSF.[41] With up to 9 years follow up, the recurrence rate for vault prolapse was 8% in the

Table 1
Outcomes of high uterosacral ligament suspension.

Author	Number	Follow up (months)	Objective success (%)[b]
Shull et al., 2000[20,a]	289	14	87
Wheeler et al., 2007[24,a]	35	23	100
Karram et al., 2001[25,a]	202	36	94.5
Silva et al., 2006[26,a]	72	61	97
Jeffery et al., 2009[27]	53	15	100
Doumouctsis et al., 2011[27]	42	59	95.3

[a] Heterogeneous group of vaginal hysterectomy and post-hysterectomy vault prolapse.
[b] Pelvic organ prolapse quantification less than stage 2.

SSF group and 5% in the McCalls culdoplasty group (non-significant difference); however, more recurrent cystocele occurred in the former group.

More recently, the feasibility and safety of laparoscopic sacrospinous fixation was investigated in a heterogeneous cohort of 93 women (75 had uterine prolapse and 18 had vault prolapse). The sacrospinous ligaments were accessed through a transperitoneal approach to the retropubic space, the obturator neurovascular bundle, the Cooper's ligament, and the arcus tendinous fascia pelvic were visualised bilaterally along the pelvic sidewall. Blunt dissection was continued towards the dorsal pelvic sidewall until the ischial spine. The loose areolar tissue surrounding the ischial spine was dissected to expose the sacrospinous ligament. A 2-0 non-absorbable Ethibond Polyester suture passed through the sacrospinous ligament. For those women whose uterus was retained, the suture was passed through the cervix where uterosacral ligament accretes. At 18 months' follow up, 87 (93.5%) had been cured of their vault or uterovaginal prolapse, although, four reported bladder injures (4.3%).[42]

Sacrocolpopexy

Level one evidence supports the use of abdominal and laparoscopic sacrocolpopexy to treat vault prolapse.[43] A recent Cochrane review concluded that sacrocolpopexy was better than vaginal sacrospinous colpopexy in treating recurrent vault prolapse and caused less dyspareunia.[38,] The National Institute for Health and Clinical Excellence in the UK, however, has questioned the evidence on its use as a prophylactic procedure at the time of abdominal or laparoscopic hysterectomy. They recommend that this procedure should only be used with special arrangements for clinical governance, consent and audit or research.[44]

Several studies have shown that, when abdominal sacrocolpopexy is carried out concomitantly with hysterectomy, the mesh erosion rate was seven times higher compared with abdominal sacrocolpopexy alone.[45–47]

The increased erosion rate seems to hold true for the laparoscopic approach. In a retrospective cohort study of 188 laparoscopic sacrocolpopexies, the erosion rate was higher in women undergoing concomitant hysterectomy and laparoscopic sacrocolpopex compared with those who had laparoscopic sacrocolpopex after hysterectomy (23% *v* 5%; $P = 0.003$) or supracervical hysterectomy (23% *v* 5%; $P = 0.109$) groups.[48] A more recent retrospective study of 390 laparoscopic sacrocolpopexy showed that mesh exposure was more common when the vaginal cuff was opened (either during hysterectomy or when allowing transvaginal attachment of mesh in women who had undergone a prior hysterectomy) compared with women in whom the vaginal cuff remained closed (post-hysterectomy vault prolapse) (4.9% *v* 0.5%; relative risk 9.0; $P = 0.012$). Where concomitant hysterectomy was carried out, a higher mesh exposure rate was seen in open-cuff hysterectomy compared with supracervical hysterectomy (4.9% [9 out of 185] *v* 0% [0 out of 92]; $P = 0.032$).[49]

Most investigators suggest that, when hysterectomy is indicated, a supracervical technique should be strongly considered, as the mesh exposure rate is significantly lower.[49] The fact that mesh erosion is consistent when sacrocolpopexy is carried out with hysterectomy, regardless of the approach, is suggestive that the hysterectomy rather that the route is probably the reason for higher mesh erosions.

Uterine suspension surgery

Many women are keen to keep their uterus. For premenopausal women, there may be a strong desire to maintain reproductive capability. For others, the uterus and or cervix may play a part of their gender identity, sexual function, self-worth, or general psychological wellbeing.[50]

Other women may question the need to remove an organ that has no pathological disease. Therefore, the concept of uterine preservation during uterovaginal prolapse surgery warrants re-evaluation.

Vaginal approach

Uterosacral suspension and plication

Many variations of the original Manchester repair exist, which has already been described. Petros[51] introduced posterior intravaginal slingplasty (IVS) in 2001, which is a minimally invasive, transperineal

procedure using the IVS Tunneller (Tyco Healthcare, USA), providing level I support by making neo-uterosacral ligaments using mesh.[51,52]

Few studies have used the IVS in uterine-sparing surgery. Despite some good reported success rates, mesh erosion rates of up to 21% have been reported.[51–56] The nature of the tape might play an important role. Farnsworth[52] first had an erosion rate of 10% with nylon tape; however, after he started using polypropylene mesh, the erosion rate dropped to 0%.

Sacrospinous suspension

Richardson et al.[13] were the first to describe sacrospinous hysteropexy in 1989 in young women.[13] The technique involves unilateral attachment of the cervix to the right sacrospinous ligament. The technique was deemed successful in five women. The rationale for developing the sacrospinous hysteropexy was that hysterectomy would be unnecessary if sacrospinous ligament fixation alone adequately replaced the uterus in its normal anatomical, position, restoring vaginal support. Sutures placed in the sacrospinous ligament can be achieved with free suturing, but the procedure is facilitated by reusable ligature carriers, such as the miyazaki hook, Deschamps needle ligature carrier or the CapioTM suture-capturing device.[21]

Maher et al.[57] reported the first comparative study between vaginal hysterectomy and sacrospinous hysteropexy in 2001. No significant differences were reported in objective and subjective outcomes at 26 months' follow up. Similar results have been reported by other investigators.[58,59] The uterine conservation group had significantly less blood loss, shorter operating time, and fewer complications after surgery.

The first randomised-controlled trial comparing vaginal hysterectomy and sacrospinous hysteropexy assessed 66 women with stage 2 or more uterine descent. The primary outcome was recovery time. The women who underwent sacrospinous hysteropexy were associated with earlier recovery (43 days versus 66 days; $P = 0.02$), but no differences were found in quality of life or functional outcomes between the two procedure groups at 1-year follow up.[60] Contrary to earlier studies, the investigators concluded that the vaginal hysterectomy group experienced fewer high-grade and low-grade prolapse recurrences than the sacrospinous hysteropexy group. Uterine prolapse recurred in 7% of women in the sacrospinous hysteropexy group compared with the one (3%) in the vaginal hysterectomy group. One of the conclusions drawn was that the number of women who had or had not experienced recurrent uterine prolapse was too small to make statistical sub-analysis; however, they also observed that all women with preoperative stage 4 uterine prolapse had a recurrent uterine prolapse. Because the primary outcome of this study was return to work, the investigators' conclusion of objective anatomical outcomes need to be interpreted with caution. The only other randomised-controlled trial focused on comparing sexual function between sacrospinous hysteropexy and vaginal hysterectomy. Frequency of orgasm decreased after vaginal hysterectomy and sacrospinous hysteropexy; however, no significant difference was found between the two groups in postoperative sexual function.[61]

Gamble et al.[62] introduced polypropylene mesh with bilateral anterior sacrospinous hysteropexy using allograft reinforcement to treat stage II uterine prolapse. After 1 year follow up, the risk of uterine prolapse, cystocele and rectocele recurrences were 2.6%, 4% and 4.3%, respectively.[62] A subsequent study using anterior sacrospinous mesh hysteropexy and posterior fascial plication by Feiner et al.[63] showed an objective success rate of 87% in the anterior compartment and 75% at all compartments at 12 months' follow up.[63]

Vaginal meshes

Vaginal mesh kits involve the implantation without suture of a synthetic mesh in the vesicovaginal and rectovaginal spaces.[64–66] Several vaginal mesh kits are available, with recurrence rates for uterine preservation varying from 3–11% over 24 months (Table 2).

Takahashi et al.[64] treated 310 women with pelvic-organ prolapse (POP). The uterus was preserved in 102 women using tension-free vaginal mesh, which involves the implantation without suture of a synthetic mesh in areas of vesicovaginal and rectovaginal dissection spaces. The investigators reported that five patients experienced recurrent uterine prolapse, and underwent vaginal hysterectomy

Table 2
Outcomes of uterine sparing vaginal mesh surgery.

Study	Number	Follow up (months)	Objective success[a] (%)	Mesh erosion (%)
Takahashi et al., 2010[64]	102	12	94	Not applicable
McDermott et al., 2011[67]	24	10.5	92	13
Huang et al., 2012[68]	67	19.6	89.5	11.9
Chu et al., 2012[69]	52	8.9	96	3.8
Cho et al., 2012[70]	68	24	97.1	1.5

[a] Pelvic organ prolapse quantification less than stage 2.

(Table 2).[64] Kato et al.[65] and Caquant et al.[66] have published their experiences with vaginal mesh, but only reported perioperative complications and did not include separate outcomes for cases where the uterus was preserved.[65,66] A more recent study compared outcomes using Gynecare Prolift® with or without hysterectomy. Apical support at 12 months was significantly higher in the group that had undergone hysterectomy and also received the total Prolift® at 12 months.[67] Postoperative mesh erosion, prolapse symptoms, surgical satisfaction, sexual activity and dyspareunia rates did not significantly differ between groups.

Over the past few years, concern has mounted over the use of vaginal meshes. Between 2005 and 2007, over 1000 adverse events were reported to the US Food and Drug administration (FDA) for surgical-mesh devices used to repair POP and stress urinary incontinence. Since then, the FDA received 2874 additional reports of complications associated with surgical mesh devices used to repair POP and stress urinary incontinence, with 1503 reports associated with POP repairs and 1371 associated with stress urinary incontinence epairs. The most frequent complications reported to the FDA for surgical mesh devices for POP repair include mesh erosion through the vagina (also called 'exposure', 'extrusion' or 'protrusion'), pain, infection, bleeding, pain during sexual intercourse, organ perforation, and urinary problems.[71]

The FDA issued a safety communication entitled *Update on serious complications associated with transvaginal placement of surgical mesh for pelvic organ prolapse*. In this report, based on evaluation of adverse event reports and assessment of the scientific literature, the FDA found no conclusive evidence that using transvaginally placed mesh in POP repair improved clinical outcomes any more than traditional POP repair, and may expose women to greater risk. In particular, transvaginal meshes are associated with serious adverse events, including vaginal mesh erosion, a complication that can require multiple surgeries to repair and may result in continued sequelae (e.g. pain) even after mesh removal. Performance data that fail to demonstrate improved clinical benefit over traditional non-mesh repair compound concerns about adverse events, particularly for transvaginal apical and posterior repair. Although published data suggest a possible anatomic benefit to anterior repair with mesh augmentation, this anatomic benefit may not result in superior clinical outcomes, and the associated risk of adverse events should be considered. One of the FDA recommendations to clinicians from this document was that mesh placed abdominally for POP repair may result in lower rates of mesh complications compared with transvaginal POP surgery with mesh.[72,73]

In a further update on 4 Jan 2012, the FDA announced that it was considering reclassifying surgical mesh used for transvaginal repair of POP be reclassified from Class II to Class III.[74] Reclassification would ensure that the FDA could require appropriately designed clinical trials (i.e. with a control arm of women undergoing POP repair using traditional technique without mesh).

Owing to increasing numbers of adverse events and patient concerns being reported, the Medicines and Healthcare products Regulatory Agency in the UK has launched an investigation to improve the understand of the use of these devices and the complications associated with them. The MHRA held a workshop in March 2012, which included representatives of the Royal College of Obstetricians and Gynaecologists, the British Association of Urological Surgeons, the British Society of Urogynaecology, The National Institute for Health and Clinical Excellence, the University of Aberdeen Health Services Research Unit, and representatives of some manufacturers of these devices, to consider how to make this a safer procedure. The MHRA commissioned an independent review of all current and up-to-date evidence on the use and potential problems associated with vaginal tapes and mesh for stress urinary incontinence and POP. Work continues on this, and a final report is expected soon.[75]

Abdominal approach

Abdominal hysteropexy was first described in 1957.[76] A variety of anchoring structures, including the ileo-pectineal ligament[77] and the vaginal-abdominal retropubic uterine suspension, have been used; most commonly, however, the sacral promontory is the point of attachment. A number of studies have reported satisfactory results for sacrohysteropexy or sacrocervicopexy with uterine preservation. The failure rate was (0–21.9%) in various studies; however, the numbers were small (the largest study included 41 participants).[78–86] Variations in the operating technique, mesh size, shape and attachment sites make comparison difficult. In a comparison study of sacrocolpopexy after hysterectomy and hysterocolposacropexy with uterus preservation, Costantini et al.[81] reported no significant difference in functional outcomes, including subjective and objective outcomes, as well as patient satisfaction. In a series of 30 women by Barranger et al.,[84] a polyester fibre mesh was used to suspend the uterus. After a mean of 45 months, two failures were reported. The investigators concluded that abdominal sacrohysteropexy is effective and safe in the treatment of uterovaginal prolapse, with excellent long-term results and without a time-dependent decrease in efficacy.

Roovers et al.[87] compared the outcomes of abdominal sacrohysteropexy and vaginal hysterectomy with combined vault fixation to the uterosacral-cardinal ligament complex in a randomised-controlled trial. At 1 year after surgery, only 5% of women in both groups had a stage II or more vault prolapse (vaginal group) or uterine prolapse (abdominal group). A stage II or more cystocele was present in 39% of the vaginal group and 36% of the abdominal group, and a stage II or more rectocele was present in 15% of the vaginal group and 5% of the abdominal group. Women who underwent abdominal sacrohysteropexy also reported more discomfort caused by overactive bladder symptoms. The operating time, however, was shorter in the abdominal group, possibly because the procedure was less invasive as the uterus was preserved in the abdominal group and removed in the vaginal group. Although the anatomical results of the initial surgery were similar, women who had undergone abdominal surgery presented themselves more often with persisting or recurring prolapse symptoms compared with women who had undergone vaginal surgery. Within the first year after prolapse surgery, repeated prolapse surgery was more often planned or carried out in the abdominal group (nine out of 41 women) compared with the vaginal group (one out of 41 women).[87] The indication for surgery in the abdominal group was cystocele in five women and recurrence of uterine prolapse in four others. The explanation for the differences in the reoperation rate given by the investigators was that it is likely to be operator dependant as the women in the abdominal group visited doctors post-operatively more regularly than the vaginal group. This indicates that the recurrence or persistence of symptoms of pelvic-floor dysfunction rather than the presence of anatomical abnormalities determines whether the woman will undergo repeated prolapse surgery. Moiety et al.[88] in 2010 contradicted the earlier randomised-controlled trial results, and concluded that abdominal sacrohysteropexy is a safe, efficient surgical technique for the treatment of uterine prolapse in women who desire to preserve the uterus. The objective and subjective success rates at were 93.93 and 81.8%, respectively at 6 months.

Laparoscopic approach

Laparoscopic surgery is open surgery carried out through small incisions, with the benefits of improved visualisation of pelvic anatomy, shorter hospitalisation, less postoperative pain, and a quicker return to normal activities. With correct surgical expertise, there is no reason why differences should occur in efficacy between the open and laparoscopic approach for the same procedure. For the management of vault prolapse, a recent randomised-controlled trial[43] comparing open and laparoscopic sacrocolpopexy has shown clinical equivalence. Improvements were observed in blood loss, haemoglobin and shorter length of stay in the laparoscopic group compared with the abdominal group; however, no difference was observed in the rate of return to normal activities. The increased surgical skills required for laparoscopic surgery has led some to suggest robotic surgery as an alternative. Only one randomised-controlled trial has compared laparoscopic and robotic sacrocolpopexy. It found longer operating times, more pain and increased costs in the robotic group.[89]

Laparoscopic hysteropexy

Four types of laparoscopic suspension procedure have been described: suspension of the uterus to the round ligaments, anterior abdominal wall, uterosacral ligaments and sacral promontory.

Round ligament suspension

Laparoscopic ventrosuspension involves suturing the round ligament to the rectus sheath, and is associated with a poor success rate, with one case study of nine women reporting recurrence of prolapse in eight women within 3 months.[90] A later paper by Shalev et al.[91] reported no failure rates in a group of 36 women undergoing laparoscopic ventrosuspension, although the concept of suspension of the uterus by the round ligaments seems anatomically misguided, and has rarely been proposed.[91] Anatomically, the round ligament does not provide any level of support according to DeLancey 3 level support theory.[3]

Anterior abdominal wall suspension

Chen et al.[92] describe laparoscopic uterine suspension to the anterior abdominal wall as the attachment of the uterus to the anterior abdominal wall using mesh.[92] They report an objective cure rate at 1 year of 100%; however, all the 22 women reported postoperative dragging pain at the puncture ports where the mesh was fixed to the abdominal wall. Although the reported success is 100%, it is not surprising that all the women who underwent this procedure reported dragging pain.

Uterosacral ligament suspension

Laparoscopic uterosacral plication was first described in 1997[93] and involved placing three purse string sutures. The sutures were passed from the left uterosacral ligament, through the posterior vaginal wall and cervix, the right uterosacral ligament, the peritoneum of the rectosigmoid gutters, the serosa of the rectosigmoid, and then back to the left uterosacral. In this small case study of seven women, no recurrence of prolapse was reported at 9 and 17 months' follow up.

Laparoscopic suture hysteropexy with closure of the pouch of Douglas (Moschcowitz culdoplasty) and plication and re-attachment of the uterosacral ligaments to the cervix was reported by Maher et al.,[94] with an objective success rate of 79% in 43 women after mean follow up of 12 months. Women also underwent concomitant anti-incontinence and prolapse procedures, as appropriate. One recurrent difficulty in objectively assessing the efficacy of a single procedure is that, for prolapse surgery, often combination procedures will be required that will undoubtedly compound the perceived subjective and objective outcome measures. Nonetheless, the investigators isolated some details for the hysteropexy component alone. The mean operating time for the laparoscopic suture hysteropexy alone was 42 mins (range 22–121), and the mean blood loss was less than 50 ml (range10–1000). Ureteric kinkings occurred in two women.[94] Laparoscopic uterosacral suspension runs the risk of ureteric kinking, although this risk can be significantly reduced by a peritoneal-releasing incision to deflect the ureter laterally. The investigators also reported subsequent cervical elongation being a notable feature at subsequent follow up.

Diwan et al.[95] retrospectively compared laparoscopic uterosacral suspension with vaginal hysterectomy and vault suspension procedure. Laparoscopic suturing was carried out using a permanent suture, and taking one or two full purchases through the uterosacral ligament at the level of the ischial spine. This is thought to be a particularly strong part of the ligament able to resist a force greater than 17 kg.[96] The suture was then passed through the uterosacral ligament at its point of insertion into the lower uterine segment. This suspension suture was repeated twice on both uterosacrals. The investigators found that this technique led to less blood loss and significantly shorter hospitalisation than those women undergoing 'gold standard' vaginal hysterectomy and vault suspension. Similar anatomical efficacy was found between the two techniques and, after 40 weeks, significantly greater improvement was found in apical support (as measured by point D in the laparoscopic group, and point C in the vaginal hysterectomy group) in the laparoscopic group. In the

abstract, the investigators mention that three women in the vaginal hysterectomy group required further surgery for apical prolapse and no operations were required in the laparoscopic group. As a postscript, it subsequently mentioned that one woman in the laparoscopic group returned with apical prolapse after 3 years and, in total, five apical prolapse recurrences were reported in the vaginal group.[95]

Sacral promontory suspension

More recent techniques use the sacral promontory as an anchor point for mesh or suture fixation. Krause et al.[97] reported a case study of 81 women who underwent laparoscopic suture hysteropexy to the sacral promontory. The median age was 44 years, and monofilamentous non-absorbable sutures were used. The sutures were placed into the supravaginal part of the posterior cervix at the level of the insertions of uterosacral ligaments and continued along the right uterosacral ligament to the sacral promontory where a bite was taken of the longitudinal ligament. The suture was then run back along the right uterosacral ligament towards the cervix. The suture was then tied approximating the cervix towards the sacral promontory. At 20-month follow up of 57 women, 9% had objective success (grade 1 or less cervical descent), although 12% of women reported symptomatic prolapse. One of the merits cited of this technique is that peritoneal dissection is minimal, with the suggested benefit of minimal neuronal damage; however, one woman presented with bowel obstruction secondary to bowel entrapment in a suture bridge, which necessitated bowel resection. This risk may have lessened by opening the peritoneum and subsequently burying the suture. Two hundred and forty-seven concomitant surgeries were carried out for prolapse or incontinence in the women. Again, the performance of other procedures at the time of uterine suspension makes it difficult to assess the outcome of the uterine suspension procedure in isolation. This group had also previously reported a hysteropexy technique that did not involve fixation to the sacral promontory, but only plication of the uterosacral ligaments, and was associated with worse outcomes.[94] It seems reasonable to conclude that, in terms of surgical technique, providing two robust points of fixation (cervix and promontory) is the superior approach.

Rosenblatt et al.[98] used synthetic mesh to attach the distal uterosacral ligaments and posterior endopelvic fascia to the anterior longitudinal ligament of the sacral promontory. Seracchioli et al.[99] retrospectively reviewed 15 women who had undergone laparoscopic sacrohysteropexy (along with other laparoscopic procedures to correct coexistent vaginal wall prolapse where appropriate). A Y-shaped polypropylene mesh was flapped around the cervix anteriorly and posteriorly, via a small hole created in the right broad ligament and attached to the anterior ligament of the sacrum. After a minimum of 2 years' follow up, no recurrence of apical prolapsed took place.

In our unit, we have introduced a new surgical technique of laparoscopic uterine sling suspension.[100] The purpose of the technique is to re-create the level 1 support structure (uterosacral ligament) that has failed to account for the uterine prolapse. Mersilene tape is used to suspend the uterus to the sacral promontory bilaterally. The procedure has been registered with the National Institute of Health and Clinical Excellence as a new interventional procedure, and was approved by the new procedures clinical governance committee of our hospital. The National Institute of Health and Clinical Excellence recommends that mesh uterine suspension sling, including hysteropexy, should only be carried out by surgeons specialising in the management of POP, and that this procedure should only be used with special arrangements for clinical governance, consent and audit or research.[101]

Laparoscopic uterine sling suspension is carried out under general anaesthesia with the woman supine in semi-lithotomy. After skin preparation, draping and catheterisation, a uterine manipulator is inserted to mobilise the uterus adequately. A pneumoperitoneum is created, and four laparoscopic ports are placed; 11-mm umbilical and suprapubic ports and two 5-mm lateral ports at the level of the umbilicus. The ovaries are temporarily suspended to the anterior abdominal wall, with a prolene suture to allow improved visualisation and access to the pelvis without the need for an assistant to retract.[102] The peritoneum over the sacral promontory is then incised. A rectal sizer is placed to deflect the rectum away from the side of the promontory that has been dissected. The ureters are identified bilaterally, and a peritoneal relaxing incision is made medial to the ureters to retract them away from the operative site safely. A tunnel is made by blunt dissection underneath the peritoneum from the sacral

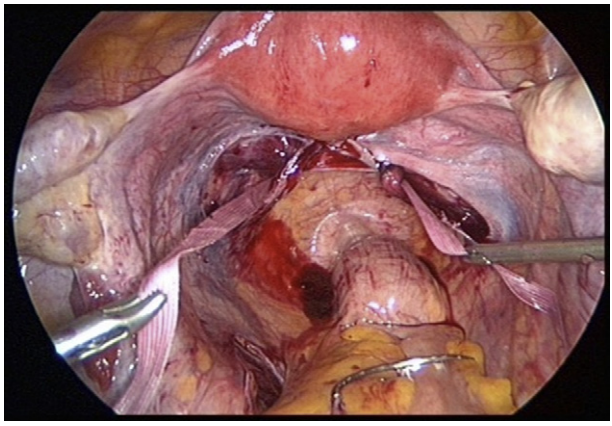

Fig. 1. Laparoscopic uterine sling, the tape is passed through the uterosacral ligaments and maintained lateral to the ligaments.

promontory to the insertion of the uterosacral ligament complex into the cervix on either side. A 5-mm mersilene tape on a 48-mm round-bodied needle (Ethicon Inc, Somerville, NJ, USA) is placed through the cervix taking a double bite of the cervix at the isthmic-cervical junction. The tape is passed through the uterosacral ligaments and maintained lateral to the ligaments so as to prevent bowel constriction (Fig. 1) The tape is then passed under the peritoneal tunnel on either side and is tacked bilaterally to the sacral promontory using 5 mm helical screws (Protack™, Covidean, Mansfield MA) to elevate the uterus (Fig. 2). As the vagina is unopened, and the mesh is inserted above the level of posterior fornix, the likelihood erosion is reduced. The mesh is lateralised by passing it through the uterosacral ligaments and buried beneath the peritoneum so the risk of bowel complication is also likely to be low. At the end of the procedure, the sling resembles newly created uterosacral ligaments. Gas is expelled, and ports withdrawn under vision.

Over a study period of 1 year, we have seen significant improvements in the apical and anterior components of the POP-Q prolapse quantification system.[103] Concomitant anterior compartment surgery was carried out in five out of 10 women. Improvements were also seen in vaginal, sexual and quality-of-life scores as measured by the ICIQ (The International Consultation on Incontinence Questionnaire) vaginal symptom questionnaire.[104]

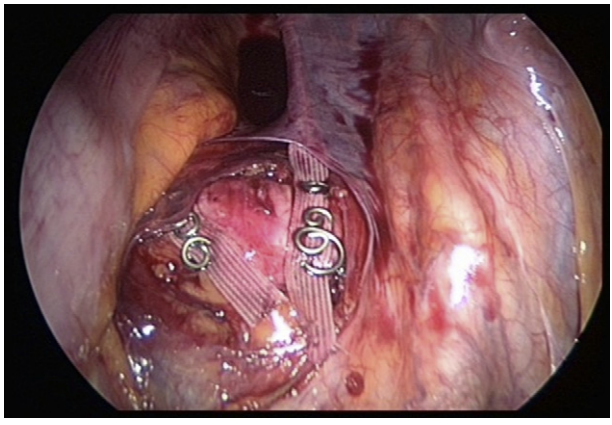

Fig. 2. Laparoscopic uterine sling, the tape is passed under the peritoneal tunnel on either side and is tacked bilaterally to the sacral promontory using 5 mm helical screws.

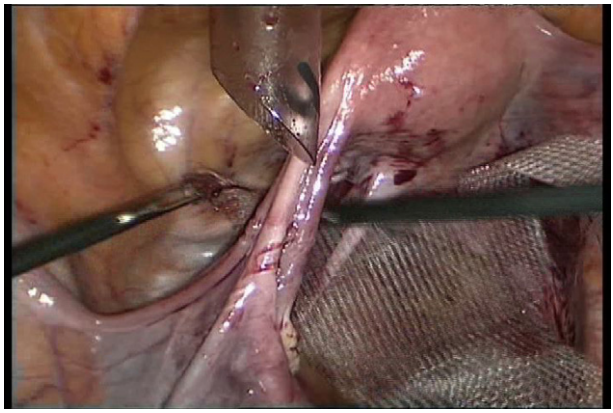

Fig. 3. Laparoscopic mesh hysteropexy, two windows are created laterally in the broad ligament through which the arms of the bifurcated mesh are passed.

Aside from the initial entry into the abdomen, all surgical steps are undertaken under direct vision, minimising the risks of inadvertent ureteric or bowel damage. No significant peri- or postoperative complications were reported.

The particular advantages of this procedure are that should the woman require a hysterectomy in the future, the tape can be easily cut when dividing the uterosacral pedicles. Intuitively, the more mesh material that is used to cover a large surface area of the uterus, the more difficult a subsequent procedure may be. In addition, the interruption to the blood supply to the uterus using our Mersilene tape procedure is minimal. This is particularly pertinent if a woman is keen on future pregnancies. Two women have been pregnant and had their babies delivered by caesarean section.

In 2010, Price et al.[105] published a new technique of laparoscopic uterine suspension using a bifurcated polypropylene mesh. The technique involves dissection of the uterovesical fold with inferior reflection of the bladder to expose the cervix anteriorly. Two windows are created laterally in the broad ligament through which the arms of the bifurcated mesh are passed (Fig. 3). These are sewn together on to the cervix anteriorly, and the mesh is then anchored onto the sacral promontory using helical fasteners (Fig. 4). The investigators published a prospective observational study of 51 women who had significant uterine descent of at least grade 2 (cervix at the level of the hymen) as defined by

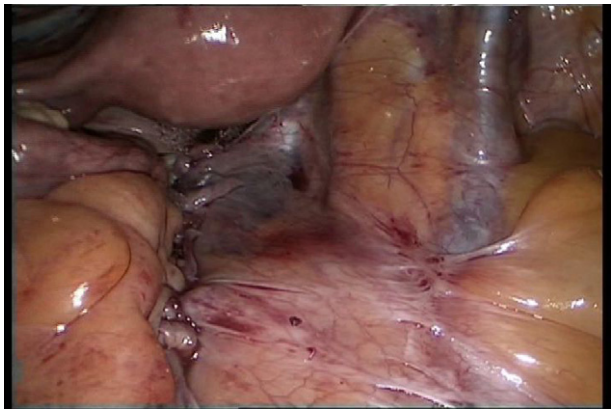

Fig. 4. Laparoscopic mesh hysteropexy, almost complete peritonization of the mesh is achieved.

the Baden–Walker system. Success was defined as the absence of uterine prolapse (Grade 1 or less), and was achieved in 50 (98%) women at 3 months' follow up. The median change in the C measurement of the POP-Q system was −9 cm. The mean duration of the procedure was 50 mins.[105] A subsequent study with a similar number of women who underwent sacrohysteropexy (47 abdominally and eight laparoscopically) showed consistent results with no uterine prolapse recurrence at 60 months' follow up.[106] The investigators found that voiding dysfunction resolved in 93% of participants. The likely explanation for this finding is that suspending the uterus will also elevate the bladder and thereby have a positive effect on urinary voiding.

Ingber et al.[107] reported one case of laparoscopic single site surgery using a 3 cm wide strip of polypropylene mesh along the posterior vaginal wall and cervicouterine junction, and suturing the proximal end to the anterior longitudinal ligament overlying the scaral promontory. At 6-months' follow up; the woman had excellent anatomic support with no evidence of recurrence.

Robotic hysteropexy

The da Vinci™ robotic system has been used successfully in treating women with POP. Pulliam et al.[108] compared operating-room experiences with laparoscopic and robotic-assisted approaches to minimally invasive apical sacropexies. Complications, conversions, estimated blood loss and hospital stay were low and similar between groups, but set-up time was longer for the robotic-assisted approach. The investigators also concluded that robotic learning curve is short for surgeons who have experience with laparoscopic sacrocolpopexy.[108] The only randomised-controlled trial that compared laparoscopic with robotic sacrocolpopexy was published in 2011.[89] The investigators concluded that robotic-assisted sacrocolpopexy results in a longer operating time than with laparoscopic surgery. This included the anaesthesia time, total time in the operating room, total sacrocolpopexy time, and total suturing time; all were significantly longer in the robotic group. Participants in the robotic group also had significantly higher pain at rest and with activity from weeks 3–5 after surgery, and required longer use of non-steroidal anti-inflammatory drugs and increased pain and cost compared with the conventional laparoscopic approach.[89]

Vitobello et al.[109] reported two cases of robotic hysteropromontopexy for uterine prolapse. No intra- or postoperative complications were reported. The follow up at 6 and 18 months showed good anatomical and functional results.

New challenges

The decision to treat women with uterine prolapse must consider the woman's preferences, the surgeon's experience, extent of prolapse, previous treatment of prolapse and functional and anatomical symptoms and outcomes. The challenge is to balancing all these factors, and this may be difficult when grade 1 evidence is lacking.

In principle, our decision to treat women with uterine prolapse who opt for surgical intervention largely depends on whether they have completed their families. Owing to the paucity of evidence on effects of uterine prolapse surgery on pregnancy and vice versa, we would advocate that a woman has completed her family before embarking on POP surgery.

In our practice at University College London Hospital, UK, we offer a whole range of options to treat uterine prolapse. Over the past 3 years, we have used the hysteropexy technique described by Price et al.[105] for women presenting with chiefly central prolapse, who are keen on preserving their uterus and have completed their families. For women presenting with symptomatic central compartment but not completed their families, we reserve the option of the laparoscopic uterine sling.[100] This technique is less likely to affect future pregnancy outcomes as the Mersilene tape is attached to the cervicouterine junction posteriorly rather than encircling the cervix with mesh, which potentially can affect the interruption of the blood supply to the gravid uterus.

We offer hysterectomy to those women who present with uterine prolapse but not keen on uterine preservation, or if they have a history of abnormal cervical smears or multiple fibroids. We routinely offer the laparoscopic approach unless contraindicated, as we believe that the enhanced visualisation and magnification makes laparoscopic vault suspension after the hysterectomy safer and more

effective. Furthermore, as others have shown, the risk of ureteric compromise is diminished when uterosacral ligament suspension is carried out.[18] The National Institute of Health and Clinical Excellence has reviewed the evidence on the safety and efficacy of laparoscopic techniques for hysterectomy, and concluded that adequate evidence exists for their use, provided that normal arrangements are in place for consent, audit and clinical governance.[110] This is further supported by a systematic review[111] that showed no significant difference between vaginal and laparoscopic hysterectomy in the need for unintended laparotomy. Also, comparing laparoscopic and vaginal hysterectomy, the meta-analysis found no significant difference for urinary tract injury, bowel injury or vascular injury. In our practice, we still have a place for offering vaginal hysterectomy if patients are not keen on uterine preservation and who have contraindications to laparoscopic surgery, such as cardiopulmonary compromise; this would make prolonged Trendelenburg position challenging.

Conclusion

The potential advantages and disadvantages of vaginal, abdominal, and laparoscopic approaches for the repair of prolapse will vary, depending on the patient and the skill of the surgeon. Laparoscopic uterine suspension is a new way of maintaining uterine support for those women, specifically requesting uterine conservation and surgical management of uterine prolapse. For many women, uterine conservation is an absolute necessity to retain future reproductive potential. For others, it remains a matter of personal choice. Newer techniques are being introduced that respond to patients' desires for such conservative surgery, and their desire for minimally invasive techniques.

Evaluation of new procedures is complex. Before widespread implementation, it is imperative that new procedures are subject to scrutiny, with a proven safety profile and evidence of clinical effectiveness. Any new procedure will need to achieve similar anatomical outcomes to vaginal hysterectomy (the current gold standard operation). The advantage of a hysteropexy, especially carried out laparoscopically, is the reduction in morbidity, and a quicker return to normal activities. It may be that standard teaching in the surgical approach to uterovaginal prolapse is turned on its head, and that uterine preservation becomes the preferred choice. Such a change in practice would mirror that which occurred when minimally invasive slings replaced colposuspension as the commonly used primary treatment for urodynamic stress incontinence.

Practice points

- Pelvic organ prolapse is estimated to affect nearly one-half of all women over the age of 50 years, and can affect quality of life negatively.
- Traditionally, vaginal hysterectomy and Manchester were the two operations to treat uterine prolapse; however, both are associated with a relatively high recurrence rate.
- The risk of future vault prolapse is six-fold higher if the initial indication for hysterectomy was for prolapse compared with other indications, such as menorrhagia or pelvic pain.
- Many women are keen to keep their uterus. For premenopausal women, there may be a strong desire to maintain reproductive capability. For others, the uterus and or cervix may play a part of their gender identity, sexual function, self-worth, or general psychological wellbeing.
- Vaginal, abdominal and laparoscopic techniques have been described for uterine suspension; however, no clear evidence favours any one route.
- Laparoscopic uterine suspension techniques seem promising. Advantages are improved visualisation of pelvic anatomy, shorter hospitalisation, less postoperative pain, and a quicker return to normal activities.
- Consensus is growing that uterine suspension is a reasonable alternative to hysterectomy. It may be that standard teaching in the surgical approach to uterovaginal prolapse is turned on its head, and that uterine preservation becomes the preferred choice.

Research agenda

- Compare new techniques, such as laparoscopic uterine suspension procedures with the traditional 'gold standard', which is vaginal hysterectomy.
- Assess functional outcomes after laparoscopic uterine suspension procedures.
- Investigate long-term outcomes after uterine suspension procedure for pelvic-organ prolapse.

Conflict of interest

None declared.

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