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ORIGINAL ARTICLE

Laparoscopic hysteropexy: 10 years' experience

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Abstract
Introduction and hypothesis Uterine prolapse is common and has traditionally been treated by vaginal hysterectomy. Increasingly, women are seeking uterine-preserving alternatives. Laparoscopic hysteropexy offers resuspension of the uterus using polypropylene mesh. We report on 10 years' experience with this technique.
Methods All hysteropexy procedures in our unit since 2006 were reviewed. Primary outcome was safety of hysteropexy, as assessed by intraoperative and major postoperative complications. Secondary outcomes were measures of feasibility, including operating time, length of stay, conversion to alternative procedures, change in point C, patient satisfaction, and repeat apical prolapse surgery.
Results Data were available for 507 women. Complications were rare (1.8%) with no evidence of any mesh exposure. Mean operating time was 62.5 min and median length of stay 2 nights. In 17 patients (3.4%), hysteropexy was abandoned. There was a mean change in point C of 7.9 cm and 93.8% of patients felt that their prolapse was "very much" or "much" better. Of these women, 2.8% have had repeat apical surgery.
Conclusions To our knowledge, this is the largest series to date, describing 10 years' experience with laparoscopic hysteropexy. The surgical technique appears to be safe, with low complication rates, which supports the choice of appropriately selected women to opt for uterine preservation surgery as an alternative to hysterectomy for the management of uterine prolapse.

Keywords Laparoscopic hysteropexy · Pelvic organ prolapse · Uterine preservation

Introduction

Pelvic organ prolapse is common and can have a significantly adverse impact on quality of life. More than 1 in 10 parous women will undergo surgery for pelvic floor disorders [1], and the risk of recurrence and repeat surgery is high. The most commonly performed procedure for apical prolapse remains hysterectomy with or without additional vault support, but this operation is associated with significant rates of subsequent recurrence of apical prolapse [2, 3]. As long ago as 1934, Victor Bonney highlighted the passive role of the uterus in prolapse [4], with the true culprit being the deficiency and weakness of pelvic floor ligamentous support. Hysterectomy alone does not correct the underlying pathophysiology and additional apical suspension is often necessary. Uterine preservation techniques have increased in popularity of late, in part because of the desire of patients to retain their uterus, and in part because of the quest for improved long-term outcomes. A number of techniques have been described, including vaginal, abdominal, and laparoscopic approaches, with varying outcomes [5]. Overall sample sizes are small, which means it is difficult to prove the safety and feasibility of these procedures.

The laparoscopic hysteropexy technique used in Oxford has been previously described [6], and we have published outcomes, but the population size has been small [7, 8]. We now report data from a larger cohort of patients over a 10-year period.

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Materials and methods

Patient selection

As a tertiary referral centre in Oxford, we have offered laparoscopic hysteropexy as an alternative to hysterectomy since 2006. The choice of surgery is determined by the patient, after discussion about both hysterectomy and uterine conservation. In some cases, we would recommend hysterectomy, for example, in abnormal uterine bleeding, cervical cytology or medical conditions precluding general anaesthesia or steep Trendelenburg position. In a few cases, childbearing is incomplete and hysterectomy is contraindicated. However, most of our patients can have the choice of either hysterectomy or laparoscopic hysteropexy.

Surgical technique

The surgical technique used for the "Oxford hysteropexy" has previously been described [6]. At laparoscopy, the peritoneum over the sacral promontory is incised to access a safe window of periosteum for fixation. A peritoneal-relaxing incision is then made medial to the right ureter and the utero-vesical fold opened to reflect the bladder. A type 1 polypropylene mesh (Prolene™ mesh; Ethicon, Somerville, NJ, USA) is cut in a bifurcated shape, the arms are brought through avascular windows created in the broad ligament and fixed anteriorly to the cervix with non-absorbable sutures (Ethibond Excel™; Ethicon). The peritoneum is closed over the mesh and secured with absorbable sutures (Monocryl™; Ethicon), then attached to the sacral promontory under moderate tension using a helical fastener (Protack™; United States Surgical, Tyco Healthcare, Norwalk, CT, USA).

The technique has been modified over the 10-year period; in particular, the mesh was initially not fully peritonised, a previous publication having shown that this was not necessary [9]. However, subsequent laparoscopies in 3 of our patients revealed extensive bowel adhesions to the exposed mesh; hence, our practice changed to always covering the mesh with peritoneum. Initially, we used a ProLite mesh (ProLite™; Atrium Medical Corporation, Hudson, NH, USA), cutting the "tail", extending from the cervix to the sacrum, to a width of 2–3 cm; however, we have had a few apical prolapse recurrences and in all cases the mesh had stretched; thus, a wider 5-cm mesh tail was utilised from 2011 onwards (Prolene™ mesh; Ethicon).

Assessment of prolapse

Patients are examined by a senior medical member of the Urogynaecology team in the left lateral lithotomy position with Valsalva straining. The Pelvic Organ Prolapse Quantification (POP-Q) scale was used to determine cervical position (point C) pre- and post-surgery.

Follow-up

Patients are seen at a post-operative follow-up visit, usually carried out 2–3 months post-surgery. Patients are asked to subjectively assess response to surgery using the Patient Global Impression of Improvement (PGI-I). This is a seven-scale response comparing pre- and post-operative states, 1 being "very much better" and 7 being "very much worse". They are examined and a POP-Q assessment performed as an objective assessment tool.

Data collection

This was a retrospective cohort study and as such ethics approval was not required; however, approval was obtained from the regional audit committee. Cases were identified using our theatre records (Theatre Information Management Systems or TIMS). Data were then gathered from TIMS, the British Society of Urogynaecology (BSUG) database, and patient records. Data are entered prospectively at the time of surgery onto TIMS and the BSUG database. Our unit started performing laparoscopic hysteropexy in 2006, which marked the beginning of the cohort. All women undergoing laparoscopic hysteropexy were included from this point until April 2016, thus yielding 10 years of data. This cohort includes patients previously reported on in short-term and medium-term follow-up studies and in the randomised controlled trial comparing vaginal hysterectomy with laparoscopic hysteropexy [7, 8, 10].

Information gathered included demographic data, previous urogynaecological surgery, concomitant vaginal prolapse surgery, additional procedures, intra-operative and major post-operative complications, length of procedure, seniority of the surgeon, and length of hospital stay. The position of point C was noted pre- and post-operatively. Patient satisfaction was assessed using the Patient Global Impression of Improvement (PGI-I). Data were also collected from the theatre records as to whether repeat prolapse surgery had been performed.

Analysis

The primary outcome was the safety of the procedure, as assessed by the frequency of intra-operative or major post-operative complications. Secondary outcomes included operating time, length of stay and inability to complete hysteropexy requiring the procedure to be abandoned or converted to alternative techniques. Further secondary outcomes were changed in point C, subjective assessment of surgical outcome using the Patient Global Impression of Improvement (PGI-I) scale and need for repeat apical surgery.

Descriptive statistics were used for the whole population.

Results

A total of 586 cases were identified on TIMS for the period 2006 to April 2016. When cases were looked at in more detail, 14 were found to have been incorrectly recorded as laparoscopic hysteropexy, whereas they had actually had laparoscopic sacrocolpopexy and were therefore excluded from analysis. Twelve cases were duplicates, having had their records entered twice onto the BSUG database in error, and were excluded. In 53 cases, the main medical notes were unavailable (lost or mislaid by hospital records). In these cases, an attempt was made to review electronic records and letters, but insufficient information was retrieved for robust analysis and so these were also excluded. Five hundred and seven cases were therefore used in the analysis.

Demographics and surgery

Patients had a mean age of 57.8 (range 26–87, standard deviation 12.7) and a mean BMI of 26.1 (range 17.4–41.1, standard deviation 13.5). Thirty-eight women had had previous prolapse or incontinence surgery. None of the patients had previously undergone any apical prolapse procedures.

Following restoration of apical support with the hysteropexy mesh, the need for concomitant vaginal surgery was assessed. Two hundred and seventy-six women (54.4%) had concomitant vaginal prolapse surgery, and 20 (3.9%) concomitant continence surgery. Fifty-one women had another procedure in addition to prolapse surgery. These data are presented in Table 1. Initially, there was a strong trend for performing additional vaginal repairs at the time of laparoscopic hysteropexy; however, practice has recently become more conservative. These numbers are demonstrated by year in Table 2. Three hundred and sixty-four procedures (71.8%) were carried out by one of three consultants, 136 (26.8%) by the resident urogynaecology subspecialty trainee, and 7 (1.4%) by a visiting fellow. The mean duration of surgery (including time for additional procedures) was 62.5 min (range 27–125, standard deviation 25.2, interquartile range 37). Consultants, as would be expected, completed the surgery in less time than trainees (mean time 56.2 min for consultants compared with 78 minutes for trainees).

The median length of stay was 2 nights (range 1–7, standard deviation 0.5, interquartile range 0).

Four hundred and thirty-seven patients (86.2%) attended a routine face-to-face follow-up appointment, usually conducted at 3 months post-surgery (range 1.5–18 months, median 3 months, interquartile range 1).

Complications

Intra-operatively, there was one bladder injury, caused by insertion of the suprapubic port. This was repaired laparoscopically and an indwelling catheter left for 10 days. A cystogram confirmed no urine leak before a successful trial without a catheter and the patient has had no ongoing sequelae.

There were three incidences of haemorrhage as a result of the surgery. One case was due to a broad ligament vessel injury, which was identified intra-operatively. The bleeding was sufficient to require laparotomy and after haemostasis had been achieved, the procedure was completed at open surgery. Two patients returned to theatre on the first day post-surgery because of suspected intra-abdominal bleeding. One of these had undergone a concomitant retropubic mid-urethral

Table 1 Concomitant surgery

	n (%)
Urogynaecological surgery	
Anterior repair	55 (10.8)
Posterior repair	201 (39.6)
Paravaginal repair	3 (0.6)
Retropubic mid-urethral sling	20 (3.9)
Other surgery	
Hysteroscopy	10 (2)
Cystoscopy	2 (0.4)
Bilateral salpingo-oophorectomy	13 (2.6)
Ovarian cystectomy	1 (0.2)
Myomectomy	1 (0.2)
Rectopexy	2 (0.4)
Insertion of Mirena® intrauterine system	14 (2.8)
Treatment to endometriosis	1 (0.2)
Trans-cervical resection of endometrium	2 (0.4)
Sterilisation	5 (0.9)

Table 2 Concomitant vaginal surgery by year

Year	Women undergoing hysteropexy, *n*	Concomitant anterior repair, *n* (%)	Concomitant posterior repair, *n* (%)
2006	8	3 (37.5)	6 (75.0)
2007	12	3 (25.0)	10 (83.3)
2008	21	4 (19.0)	17 (81.0)
2009	25	6 (24.0)	18 (72.0)
2010	42	4 (9.5)	25 (59.5)
2011	55	5 (9.1)	32 (58.2)
2012	70	6 (8.6)	34 (48.6)
2013	61	11 (18.0)	25 (41.0)
2014	122	7 (5.7)	20 (16.4)
2015	126	6 (4.8)	14 (11.1)

sling insertion. At laparoscopy, a large retropubic haematoma was found and drained, and a bleeding vessel in the retropubic space was cauterised. The other patient had a haemo-peritoneum, which was presumed to have originated from bleeding around the broad ligament; however, no obvious bleeding point was found at laparoscopy.

Three patients developed colicky abdominal pain in the months following surgery and at diagnostic laparoscopy (performed between 4 and 8 months following hysteropexy) were found to have bowel adhesions to the non-peritonised mesh, which were carefully released. These cases all occurred in 2007 and led to a change in technique so that complete peritonisation of the mesh became standard practice. There have been no cases of similar pain since complete peritonisation became routine clinical practice.

No cases of vaginal mesh exposure have been detected in this cohort.

Other major complications are summarised in Table 3. Overall, the major complication rate was 1.8% ($n = 9$).

Cases where hysteropexy was abandoned

During the period of the study, an additional 17 patients were booked for laparoscopic hysteropexy; however, at laparoscopy they were found to have anatomical anomalies (low great vessel bifurcation, pelvic kidney), which meant that safe access to the sacral promontory was not possible. Of these cases, 15 had consented to hysterectomy as an alternative and so the surgery was converted to vaginal hysterectomy. As the unit has become more confident and competent at laparoscopic surgery, this has become an infrequent event.

Trends in surgery

As our unit became more comfortable with laparoscopic hysteropexy and as general practitioners and patients became more familiar with the concept, numbers opting for uterine preservation increased dramatically, with a concurrent drop in the numbers of vaginal hysterectomies being performed for prolapse, as shown in Figure 1.

Table 3 Complications

	n (%)
Major complications	
Pulmonary embolus	2 (0.4)
Bladder injury	1 (0.2)
Haemorrhage	3 (0.6)
Adhesions to mesh	3 (0.6)
Minor complications	
Urinary tract infection	6 (1.2)
Perineal infection (concomitant posterior repair)	16 (3.2)
Voiding difficulty post-surgery	11 (2.2)

Notable events

Patients are advised to defer prolapse surgery until their family is complete, and that there are limited data on the safety of pregnancy following hysteropexy; however, of this cohort, 6 patients have subsequently conceived. Delivery was by caesarean section as the hysteropexy mesh encircles the cervix preventing dilatation. All pregnancies resulted in live births with no significant complications.

Two patients subsequently underwent hysterectomy owing to menorrhagia; this was performed with no major difficulties by laparoscopic assisted vaginal hysterectomy.

Two patients in this cohort have subsequently been diagnosed with early-stage endometrial cancer (diagnosed 3 and 18 months post-prolapse surgery) and have gone on to have surgical treatment. One patient was diagnosed with squamous cell cervical cancer 2 years following her prolapse surgery and needed a radical hysterectomy; this required excision of the mesh, but was completed without complications.

Patient satisfaction and outcome

Patient Global Impression of Improvement (PGI-I) data were available for 404 patients. Three hundred and seventy-nine (93.8%) described their prolapse as "very much" or "much" better. Six patients (1.5%) felt that there was no change in prolapse symptoms. None of the women described their prolapse as worse.

Of the 507 women, 66 (13%) did not attend for their follow-up visit and a further 61 were either not examined because of patient request or the data were not adequately recorded. Three hundred and eighty patients had both pre-operative and post-operative POP-Q point C assessments documented and were included in the analysis.

The objective measurements of point C pre- and post-operatively are shown in Table 4. A paired *t* test showed that the difference between pre-operative and post-operative scores was significant ($p < 0.001$), with a mean change in point C of 7.9 cm.

Repeat surgery

Fourteen women (2.8%) have required repeat apical surgery, which took place a median of 12 months (range 6–84) following the original surgery. These women were assessed with repeat laparoscopy, there were no cases of mesh avulsion from the cervix or sacrum, but the mesh had stretched and was loose. Ten women were treated with plication of the mesh using non-absorbable suture material (Ethibond Excel™ or Prolene™, Ethicon, Somerville, NJ, USA). In three cases an

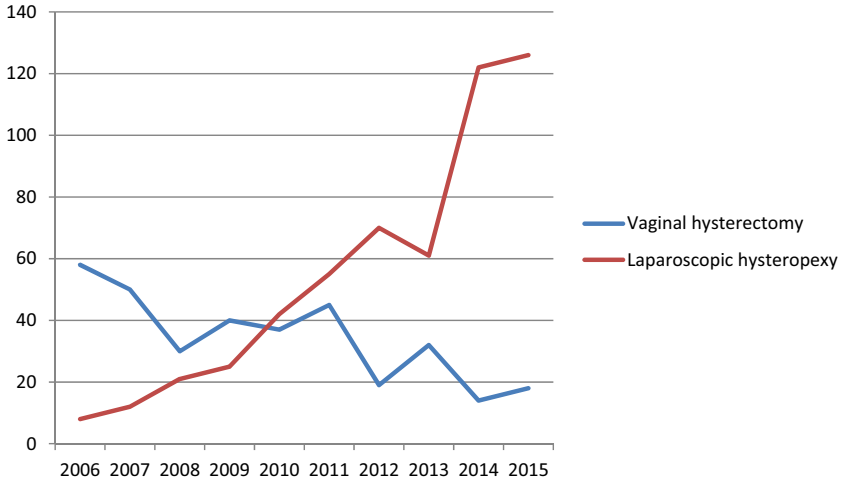

Fig. 1 Numbers of vaginal hysterectomy and laparoscopic hysteropexy performed in Oxford by year

elongated cervix was felt to be contributing to symptoms of prolapse and so cervical amputation was performed, with or without plication. Two women underwent two repeat apical procedures —both had initially undergone plication, but subsequently had vaginal hysterectomy with sacrospinous fixation owing to ongoing uterine prolapse, meaning 0.4% of women required vaginal hysterectomy following hysteropexy. Thirty-six women (7.1%) have required further vaginal wall repair.

Discussion

Increasingly, when considering treatment for POP, women are requesting uterine conservation, preferring a more conservative approach with reconstructive pelvic floor surgery rather than hysterectomy, which they may perceive to be a more invasive option.

Table 4 Outcomes of hysteropexy: point C

	POP-Q point C (cm)	
Pre-operative	Mean	1.1
	Median	0
	Range	10 to −4
	Standard deviation	2.9
	Interquartile range	2.8
Post-operative	Mean	−6.9
	Median	−7
	Range	0 to −10
	Standard deviation	1.2
	Interquartile range	1
Change	Mean	7.9*
	Median	7
	Range	1 to 18
	Standard deviation	2.9
	Interquartile range	3

POP-Q Pelvic Organ Prolapse Questionnaire

*Paired *t* test $p < 0.001$

The hysteropexy technique used in our unit is a modification of that described at open surgery using Teflon mesh by Leron and Stanton [11]. Cutner et al describe a laparoscopic sling suspension procedure, with favourable short-term outcome data [12]. We have previously reported medium-term follow-up (mean 2.1 years) for a group of 140 women [8]. Kupelian et al, who use an identical operative technique, have reported their medium-term (mean 2.6 years) follow-up data for 110 women [13]. Both of these studies reported high satisfaction rates and objective anatomical success in the apical compartment. A randomised controlled trial compared laparoscopic hysteropexy with vaginal hysterectomy, and showed a trend toward higher rates of repeat apical surgery at 1 year in the vaginal hysterectomy group, although numbers were small and statistical significance was not reached [10].

Uterine-conserving surgery is popular with patients; in our own unit, it is chosen in preference to hysterectomy by most patients. However, although intellectually appealing, there are few data available to allow informed decision-making. Our patients are all informed, before making a decision regarding surgical preference, that hysterectomy is the prevalent operation within the urogynaecology community for uterine prolapse, and that hysteropexy is a newer technique with no proven efficacy and limited safety data [14].They are also informed about the known complications with prolapse surgery and polypropylene mesh implants.

The main reason why we offer laparoscopic hysteropexy is our belief that hysterectomy outcomes are suboptimal. Our standard approach to vault suspension at the time of vaginal hysterectomy is to attach the vaginal cuff to the uterosacral ligament complex, or to perform concomitant sacrospinous ligament fixation in the case of procidentia. However, the senior author's subjective experience (17 years in tertiary urogynaecology consultant practice) is that apical prolapse

recurrence is high. We see many patients, both from our own unit and elsewhere, presenting with vault eversion, or cystocele/rectocele with poor apical support, post-hysterectomy. The literature supports this opinion: vault prolapse has been reported at a rate of 11.6% following hysterectomy for prolapse [15]. Subsequent repeat surgical options are limited, mesh either needs to be placed next to the vagina (sacrocolpopexy or transvaginal mesh), with the known mesh extrusion rates this entails, or repeat conventional native tissue repair is performed. All urogynaecologists are familiar with the compromised vaginal calibre and function that repeated vaginal surgery frequently causes.

We believe that these data will help informed discussion between patients and clinicians. It is the largest cohort reported to date, and describes a 10-year experience with this laparoscopic hysteropexy technique.

Overall, numbers of patients undergoing prolapse surgery in our unit have approximately doubled in the last 10 years. This reflects growth within our department. There has also been a change in the workload of the surrounding district general hospitals and an increase in national referrals, as women increasingly seek reconstructive surgery rather than hysterectomy.

Initially, rates of concomitant vaginal surgery, in particular, posterior repair, were high, as reported in the medium-term follow-up [8]. The authors' practice has changed over time, with a more conservative approach to vaginal surgery now adopted. The senior author had previously offered vaginal hysterectomy with concomitant cystocele and/or rectocele repair to most patients, and initially continued to recommend concurrent vaginal repair. Practice changed with growing confidence in hysteropexy outcome; as the years passed, our experience suggested that apical support might frequently be sufficient to cure vaginal wall symptoms. Further POP-Q research data are required to measure this. The data from Kupelian et al. suggests that apical prolapse plays a dominant role in symptomatology, supporting a restrictive role for concomitant repair of modest vaginal wall prolapse [13]. By limiting vaginal surgery, we would expect to see lower rates of complications such as vaginal wall infection and dyspareunia.

Critics of laparoscopic surgery raise concerns about prolonged operative time compared with open or vaginal surgery. The mean operating time in our unit was 62.5 min (including concomitant procedures) with operating times as expected being shorter for consultants than trainees. One interesting pattern emerging from these data that is not formally reported is the learning curve for this type of surgery: 10 years on, the senior authors would typically complete a straightforward hysteropexy in less than 45 min, suggesting that fears about patient safety with prolonged surgery might be unfounded. Laparoscopic surgery affords a magnified view and better access into the deep pelvis compared with open surgery. In the one case in this cohort in which the patient had to be opened owing to heavy bleeding, the surgeon (senior author) struggled to effect peritonisation of the mesh behind the uterus as access to the Pouch of Douglas was awkward and restricted compared with the laparoscopic approach.

One of the many advantages of laparoscopic surgery is quicker patient recovery and shorter length of hospital stay, with the attendant risk reduction for patients and higher turnover for hospitals. The median length of stay for our patients was two nights. We are moving toward earlier discharge with early mobilisation, avoidance of indwelling catheters, and management of patient expectation.

When advocating a newer, less evidence-based technique to patients, it is vital to be satisfied that the approach is safe. The low overall major complication rate in this cohort (1.8%) offers this reassurance to clinicians and patients. It is well documented that the use of vaginal mesh has a rate of graft complications of up to 10% [16] whereas the abdominal approach appears to confer a lower risk [17]. With laparoscopic hysteropexy the mesh lies at the level of the internal os, well away from the vagina. It is therefore unsurprising that there were no reports of vaginal graft complications in this population. These are valuable data supporting the safety of laparoscopic mesh implants in the current climate of mesh controversy.

One concern frequently raised by patients when hysteropexy is explained to them is whether they will develop back pain or problems as a result of fixation to the sacral promontory. There have been case reports in the literature of lumbosacral spondylodiscitis following similar prolapse surgery [18]. In this cohort, we did not encounter any such cases, and it seems to be a rare sequela of promontory fixation. We have tried to minimise the potential risk by reducing the number of helical fasteners (Protack™) used in fixation. We used up to six tacks when commencing this surgery 10 years ago; we now usually only use two staples and suspect one alone would suffice.

The main contraindication to laparoscopic prolapse surgery is being unfit for general anaesthesia and the ventilatory challenges associated with pneumoperitoneum and the Trendelenburg position, for example, in the context of significant respiratory compromise. In this case, a vaginal hysterectomy with regional anaesthetic would be a safer approach. In some circumstances a laparoscopic hysteropexy is planned; however, unexpected anatomical anomalies mean that it is not safe to proceed. These include a low aortic or venous bifurcation or the presence of a pelvic kidney. This occurred in 17 cases during the study period, and thus is not a frequent occurrence; however, it is an important consideration. The possibility of hysteropexy not being feasible is discussed with our patients before surgery and if appropriate, consent is taken for hysterectomy as an alternative procedure if access to the sacral promontory is not safe. As laparoscopic skills and confidence develop, the "difficult sacral promontory" has become an infrequent event.

Some consider obesity to be a contraindication to non-urgent laparoscopic surgery; however, in our experience, once pneumoperitoneum is established, surgery is often straightforward. Fat deposition around the sacrum can make this dissection more challenging, but this is variable, with some slim patients having more fat deposition then their obese counterparts. Airway management and ventilatory support is more challenging in the obese, particularly in the context of steep Trendelenburg. However, there are significant advantages for recovery and laparoscopic surgery in the obese is safe, provided that appropriate anaesthetic and surgical precautions are taken [19].

One concern with uterine-preserving prolapse surgery is the risk of missing a malignancy of the uterus or cervix. Hysterectomy obtains a specimen for histology and occult cancer has been reported, although the risk of an asymptomatic woman being diagnosed with coincidental endometrial carcinoma at the time of vaginal hysterectomy is thought to be less than 1% [20, 21]. In this cohort, two women who were asymptomatic at the time of prolapse surgery subsequently presented with endometrial cancer. Treatment was not compromised by the mesh implant. Our current practice is to ask all women contemplating hysteropexy about any abnormal bleeding and to assess with hysteroscopy if there is any concern. One patient was diagnosed with cervical cancer approximately 2 years following prolapse surgery. This highlights the need for patient selection, ensuring that the smear history is up to date and normal before surgery, and for patient counselling, to ensure that patients are aware that they should carry on with the smear programme following surgery.

We are aware of six post-operative pregnancies in our population, all resulting in live births. Delivery by caesarean section is mandatory owing to the placement of the mesh, which encircles the cervix, precluding dilatation. All women assessed in the clinic for treatment of prolapse are asked about their desire for childbearing and where possible advised to complete parturition before surgery. Women contemplating pregnancy are counselled about the limited data on pregnancy outcome and the effect on treatment that a pregnancy may have. If they do become pregnant, they are asked to contact our team to arrange a multidisciplinary approach to antenatal care and delivery. There is theoretical concern that the mesh that encircles the uterine arteries may result in abnormal placental function and growth restriction. We therefore perform uterine artery Doppler measurements and serial growth scans in these patients. All pregnancies have resulted in normal birthweight babies with no evidence of blood flow compromise [Jefferis et al., submitted for publication]. At follow-up post-delivery, there was no change in apical support; however, two women had developed new cystocele. These numbers are of course too small to draw significant conclusions about either safety or prolapse outcome following pregnancy.

We include data on prolapse outcome, assessed subjectively by the PGI-I score, and objectively by change in point C. Satisfaction was high, with 93.8% of women being "very much" or "much better". Objectively, point C was elevated by a mean of 7.9 cm. However, these measures were assessed relatively early following surgery (median follow-up time 3 months) and so although encouraging, do not give a robust assessment of surgical outcome. In addition, only 380 of the 507 women had both pre- and post-operative point C measurements recorded, which limits interpretation of these data.

Rates of repeat apical surgery in this cohort were low (2.8%) over the 10-year period. This study can only assess repeat surgery within our trust. It is theoretically possible that we could have missed patients who may have had repeat surgery elsewhere. However, we consider it unlikely that significant numbers of repeat surgeries will have been omitted; our unit is the only tertiary urogynaecology centre within the region: cases of repeat prolapse and apical vaginal prolapse are sent to us for treatment. It is extremely unlikely that other surrounding units will have performed repeat apical prolapse surgery on patients post-hysteropexy. We do, however, acknowledge that repeat surgery does not necessarily reflect rates of recurrent prolapse, patients with recurrent apical prolapse may have been managed conservatively.

One limitation of this study is the potential to have missed some late post-operative complications. As a tertiary centre, we operate on women from a wide geographical area and it is possible that they may have presented locally with complications, or indeed may have been managed by another specialty. However, this would have been detected at the follow-up visit in most cases; thus, hopefully minimising the risk of missing key data, although we acknowledge that a significant number of women (13%) did not attend a follow-up appointment.

This cohort study describes our experience over the past decade and adds to existing data supporting the feasibility and safety of laparoscopic hysteropexy. Transvaginal mesh procedures previously developed in an effort to improve prolapse repair outcomes have had significant mesh complications, these have been widely reported. Complications only became apparent some years after initial device implantation. It is consequently vital that any new operation is rigorously evaluated and audited, safety being of paramount importance. Our primary outcome measure in this study is safety, and data published over a 10-year period, in a large cohort of women, suggest that hysteropexy might be a safe procedure. Complication rates are low, and importantly mesh complication rates are minimal. This differs markedly from the vaginal mesh implant experience with which we are all familiar. More data are needed assessing both the objective and the subjective outcomes of hysteropexy to further guide clinicians and patients as to the most efficacious mode of surgery.

Compliance with ethical standards

Conflicts of interest None.

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