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ORIGINAL ARTICLE

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A new technique for dissecting the bladder laparoscopically

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Abstract To evaluate a new technique designed to facilitate bladder dissection during laparoscopic-assisted vaginal hysterectomy (LAVH). Minimal access surgery unit, James Cook University Hospital. A retrospective review of 130 LAVHs in which the bladder was dissected laparoscopically. A metal catheter was used to facilitate identification of the bladder edge, and a sponge forceps was inserted vaginally to mark the site for anterior colpotomy. Then monopolar scissors were used to open the vagina. The hysterectomy was then completed vaginally. In this series there were 14 (10.8%) recorded complications with two (1.5%) major complications (95% confidence interval 0.2–5.5%). There was one bladder trauma (0.7%; 95% confidence interval 0.02–4.2%), which was recognised immediately and repaired with laparoscopic intracorporeal knots. One patient required additional vault sutures 6 h postsurgery because of vaginal bleeding. The mean operating time was 98.7 min, and the recorded mean hospital stay was 2.7 days, with a range of 2–5 days. The recorded estimated intraoperative blood loss ranged from 75 to 300 ml, with a mean loss of 195 ml, and four patients required blood transfusion. Dissection of the bladder laparoscopically adds 5–10 min to the operative time but significantly facilitates identifying the appropriate plane. It is an easy technique to learn and teach. It is associated with minimal complications, with no increased incidence of bladder injury or dysfunction.

Keywords LAVH · Bladder trauma · Urinary injury

Introduction

Hysterectomy is the most commonly performed operation in women of reproductive age [1]. Many studies have reported lower morbidity and quicker recovery in women having vaginal hysterectomy compared with those having abdominal hysterectomy [2]. However, 70–80% [3] of hysterectomies are performed by the abdominal route, especially in cases of suspected pelvic pathology such as fibroids or malignancy or when oophorectomy is carried out [4, 5]. Laparoscopic-assisted vaginal hysterectomy (LAVH) combines operative laparoscopic techniques with vaginal hysterectomy, thereby reducing operative morbidity and recovery time compared with conventional abdominal hysterectomy.

Injury to the bladder with laparoscopy is rare, with various studies quoting a wide range of bladder trauma. Bladder injury can occur either while inserting the suprapubic trocar or during the use of electrocautery/laser near the bladder or with blunt dissection of the bladder. Saidi et al. [6] reported a 1.6% incidence of serious urinary complications after major operative laparoscopy, the majority being bladder perforations or fistulas. Women who have had caesarean sections or previous surgery or those whose bladder is not completely empty prior to surgery are more likely to sustain bladder injury during hysterectomy. Donnez et al. [7] reported four cases of bladder injury in a series of 900 laparoscopic subtotal hysterectomies; three of these four women had undergone two or three caesarean sections. Women undergoing vaginal hysterectomy are more likely to sustain a bladder injury if they have had previous caesarean section [8].

In this study we report on 130 consecutive LAVHs in which the bladder was dissected and the uterovaginal pouch then opened laparoscopically. This technique was initially designed for women who had had previous caesarean sections and in whom the bladder was adherent and difficult to identify and dissect vaginally. The technique was later adopted in all cases because it appeared to be easier and safer than the vaginal route.

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Methods

This technique was used in 130 LAVHs performed at James Cook University Hospital. The patients were

identified through the operating theatre computers, and the notes were requested and examined.

The same operating technique was used in all patients: a high-pressure entry technique (25 mmHg) using three ports in addition to the 10-mm umbilical port, with 5-mm ports inserted under direct vision in the right and left iliac fossae lateral to the deep epigastric vessels and one inserted suprapubically. Bipolar diathermy and scissors were used to secure the pedicles down to but not including the uterine vessels. Both round ligaments were secured with bipolar diathermy. The peritoneum was dissected from one round ligament to the other side. A metal catheter was then inserted in the bladder. The catheter was rotated so the tip was pointing upward, to stretch the bladder pillars (Fig. 1). The bladder was dissected with monopolar scissors with the catheter in place (Fig. 2). A sponge forceps was then inserted in the vagina into the anterior fornix and was pushed inward to stretch the vagina and mark the site for colpotomy (Fig. 3). Monopolar scissors were used to open the vagina, and the use of cutting diathermy and firing just prior to contact with the vaginal tissues helped achieve haemostasis without significant coagulation (Fig. 4). The vagina was opened in layers until the sponge forceps was reached, which was pushed inward and the blades opened widely to stretch the colpotomy site (Fig. 5).

The procedure was then completed vaginally. A Wertheim's retractor was placed through to protect the bladder; the anterior uterine wall was held with Braun forceps; and the uterus was pulled anteriorly until the fundus was brought through the colpotomy. The uterine vessels were first secured with clamps and sutured with Vicryl stitches, followed by the cardinal and uterosacral ligaments.

The vagina was then closed continuously with both uterosacral ligaments tied together to support the vault. A second-look laparoscopy was done to ensure haemostasis, with the use of bipolar diathermy and suction and irrigation.

At the end of the procedure the pressure was reduced to 5 mmHg to confirm complete haemostasis, and an intraperitoneal drain was left in situ, as well as a urinary catheter until the following day.

The patients received 1.2 g intravenous Augmentin in the operating theatre as prophylaxis unless they were allergic to penicillin, in which case an alternative antibiotic was administered. They all had TED antiembolism stockings preoperatively and Flowtron systems intraoperatively for deep vein thrombosis prophylaxis. They all received Fragmin (dalteparin sodium) injections 2,500 IU subcutaneously in the theatre and for the following 5 days or until full mobilisation.

Fig. 1 Catheter marking the bladder

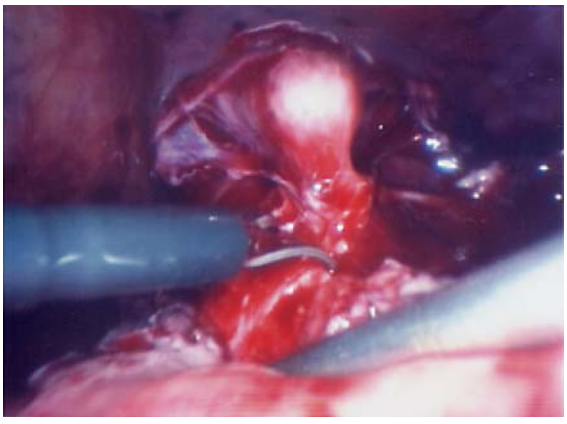

Fig. 2 Bladder dissected off the vagina

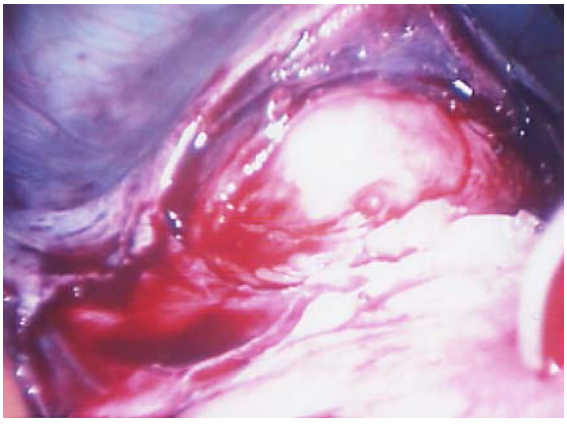

Fig. 3 Sponge forceps distending the vagina

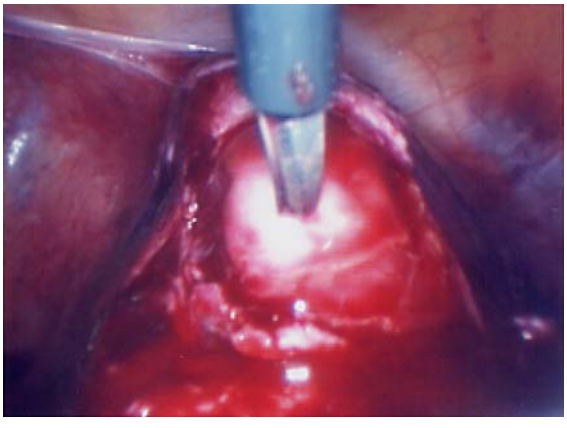

Fig. 4 Vagina opened with monopolar scissors

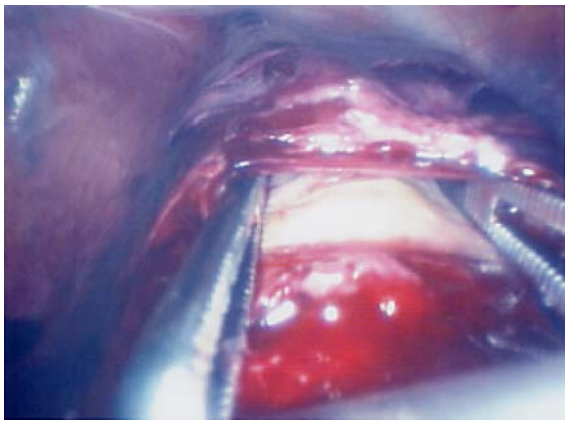

Fig. 5 Sponge forceps pushed through the vagina

Results

The mean patient age was 43 years, with a range of 28–74 years. Thirteen patients were nulliparous, and 117 were multiparous, of whom 105 had had vaginal deliveries and 12 had had caesarean sections (six patients had one, five had two, and one had three).

There were various indications for performing the hysterectomies, with more than 50% of the women undergoing them for chronic pelvic pain, as shown in Table 1.

LAVH was performed with bilateral salpingo-oophorectomy in 65 (60%) of the patients, 22 (16.9%) had the left ovary removed, 15 (11.5%) had the right ovary removed, and both ovaries were conserved in 26 patients (20%). Additional procedures were carried out with some of the hysterectomies: 20 (15.4%) patients had radical excision of stage III/VI endometriosis, three had pelvic floor repair, two underwent laparoscopic high McCall repair, and one had laparoscopic cervical myomectomy to facilitate delivery of the uterus vaginally. (See Table 2.)

The mean operating time was 98.7 min, and the mean hospital stay following LAVH was 2.7 days (range 2–5 days). The recorded estimated intraoperative blood loss ranged from 75 to 300 ml, with a mean loss of 195 ml (Table 3).

There were 14 (10.8%) recorded complications with two (1.5%) major complications: One patient required suturing of the vault 6 h after hysterectomy, and there was one bladder trauma, which was recognised immediately and repaired with laparoscopic intracorporeal knots. Cystoscopy was performed to ensure proper bladder repair and to exclude any other injuries. The patient had a bladder catheter for 7 days; at follow-up 6 months postoperatively, she was well with no residual bladder dysfunction. Two patients suffered from urinary tract infections; one settled with a course of antibiotics, but the other patient required repeated courses of antibiotics.

On follow-up of patients in the outpatient clinic, four patients complained of persistent vaginal discharge; vault granulation tissue was detected in all four patients on speculum examination. Three of them were successfully treated with silver nitrate sticks, one of whom required a repeat application of silver nitrate 6 weeks later. The fourth patient needed surgical excision of granulation tissue in the operating theatre, as her symptoms did not improve. Four patients suffered pelvic infections a few weeks following surgery; their own general practitioners adequately treated three of them. The fourth patient was readmitted. Her blood tests and ultrasound were normal; she received intravenous antibiotics for 48 h and was discharged home after 4 days with oral antibiotics. Two patients were readmitted with pelvic pain a few days following surgery. The pain was found to be due to constipation; they were both treated with laxatives and discharged home the following day.

In this series, four patients required blood transfusion. Two patients required four units because of low haemoglobin postsurgery, one patient received three units, and one patient needed two units. Table 4 summarizes all of the complications following LAVH.

Table 1 Indications for laparoscopic-assisted vaginal hysterectomy

Number of patients	Indication
57 (44%)	Chronic pelvic pain plus other causes
24 (18%)	Heavy or irregular periods (failed other treatment modalities)
21 (16%)	Chronic pelvic pain
10 (7.7%)	Uterovaginal prolapse
9 (6.9%)	Postmenopausal bleeding (after exclusion of endometrial pathology)
7 (5.4%)	Heavy or irregular periods plus other causes
2 (1.5%)	Dyspareunia

Table 2 Additional procedures performed with laparoscopic-assisted vaginal hysterectomy

Additional procedure	Number (%)
Bilateral salpingo-oophorectomy	65 (60)
Left salpingo-oophorectomy	22 (16.9)
Right salpingo-oophorectomy	15 (11.5)
Radical excision of endometriosis	20 (15.4)
Laparoscopic high McCall repair	2 (1.5)
Pelvic floor repair	3 (2.3)
Laparoscopic cervical myomectomy	1 (0.7)

Table 3 Operative details

	Range	Mean
Hospital stay	2–5 days	2.7 days
Operating time	45–240 min	98.7 min
Estimated blood loss	75–300 ml	195 ml
Haemoglobin difference	0–7.7 g/dl	1.83 g%
Uterine weight	39–350 g	148 g

Discussion

It is difficult to detect the incidence of bladder injury with laparoscopic surgery in general and in LAVH specifically,

Table 4 Complications following laparoscopic-assisted vaginal hysterectomy

Case	Complications
1	Returned to operating theatre within 6 h; required suturing of vault
2	Bladder trauma detected intraoperatively and sutured laparoscopically
3	Urinary tract infection; required course of antibiotics
4	Urinary tract infection; required repeated courses of antibiotics
5	Vault granulation tissue treated with silver nitrate
6	Vault granulation tissue treated with silver nitrate
7	Vault granulation tissue treated with silver nitrate two times, 6 weeks apart
8	Vault granulation tissue treated with silver nitrate, followed by excision in operating theatre a few weeks later; histology confirmed granulation tissue
9	Recurrent pelvic infections treated with antibiotics
10	Recurrent pelvic infections treated with antibiotics
11	Recurrent pelvic infections treated with antibiotics
12	Recurrent pelvic infections treated with antibiotics but needed hospital admission and ultrasound examinations to exclude other pathology
13	Readmission with pain due to constipation
14	Readmission with pain due to constipation

with various studies quoting a wide range. Gilmour et al. [9] reported that with major gynaecological surgery the incidence of bladder injury varied from 0.2–19.5 per 1,000 with an overall frequency of 2.6 per 1,000, based on a Medline search for all reports between 1996 and 1998. They found a higher incidence of bladder injury when routine cystoscopy was performed, with a range from 0 to 29.2 and overall frequency of 10.4 per 1,000. The authors commented that only 51.6% of bladder injuries were identified and managed intraoperatively. Ostrzenski et al. [10] reported the overall incidence of bladder injury during laparoscopic procedures to range from 0.02% to 8.3% of cases. These injuries most frequently occurred during LAVH. Sharp electrosurgical dissection was the leading instrument causing injury. An intraoperative diagnosis of bladder injury was made in 53.24% of all bladder injury cases, with the bladder dome being the most commonly injured structure. Less than half (29.87%) of the bladder injuries were corrected laparoscopically.

In our series we report one bladder trauma [0.7%; 95% confidence interval (CI) 0.02–4.2%] occurring when the catheter was pushed into the bladder wall and thus perforated through. The injury was identified immediately (100%) and successfully repaired laparoscopically (100%) with no residual permanent bladder dysfunction. The use of a metal catheter to stretch the bladder helps in identifying the boundaries of the bladder and its pillars, which significantly facilitates recognising where to dissect and release the bladder, especially in patients with extensive scarring. The dissection should be carried out until one is satisfied that the bladder has been completely freed off the vagina, and the use of sponge forceps to stretch the vaginal wall clearly marks the site for colpotomy.

Further larger studies are needed to obtain more accurate estimates of bladder trauma. We have calculated various CIs based on sample size: 260, 95% CI 0.09–2.8%; 390, 95% CI 0.16–2.2%; 520, 95% CI 0.21–2.0%; 650, 95% CI 0.25–1.8%.

Cystoscopy was not performed routinely unless bladder injury was suspected. Indigo carmine was injected intravenously a few minutes prior to cystoscopy in cases of suspected ureteric injury, with the dye being visualised flowing from ureteric orifices during cystoscopy. Some authors recommend the routine use of cystoscopy with hysterectomy because of the high incidence of undetected bladder injury. Vakili et al. [11] recently reported a 4.8% incidence of urinary injury during hysterectomy, whether abdominal, vaginal, or laparoscopic, and therefore concluded that routine cystoscopy should be considered.

Harkki-Siren et al. [12] reported an overall complication rate of 4 per 1,000 gynaecological laparoscopic procedures but a rate of major complications of 10.1 per 1,000 with operative laparoscopies; 19% of the major complications in this series were ureteric injuries, and 46% were intestinal injuries. They found that 75% of all complications were associated with LAVH and commented that many of these may be due to technique, as the uterine vessels were coagulated and cut laparoscopically 86% of the time, and attempts to secure the uterine vessels with diathermy or staples may result in significantly more ureteric injuries [13].

In our series we report no bowel injuries despite the high incidence of pelvic pathology, mainly endometriosis. There were no ureteric injuries as the laparoscopic dissection stopped above the uterine vessels and the procedure was then completed vaginally.

A recent systematic review and metaanalysis of randomised controlled trials comparing abdominal, vaginal, and laparoscopic hysterectomy was published by Johnson et al. [14]. They reported a significant increase in urinary tract injury for laparoscopic compared with abdominal hysterectomy (odds ratio 2.61; 95% CI 1.22–5.60); there was no significant difference when comparing laparoscopic versus vaginal or laparoscopic hysterectomy versus LAVH.

In this series we opted for laparoscopic-assisted rather than vaginal hysterectomies because about 88% of patients had either one or both ovaries removed due to either

pathology or patient preference; we felt more confident removing the ovaries laparoscopically rather than vaginally. There were 10 (7.7%) patients with uterovaginal prolapse in whom the vaginal route would have been feasible, but most of them complained of pelvic pain, and it was decided that the laparoscopic route would ensure clearing the pelvis of any pathology. In addition, some of the patients requested removal of the ovaries, and therefore the laparoscopic route was adopted.

Visco et al. [15] studied rates of conversion to laparotomy in a large population-based administrative database to determine whether conversion decreased with increasing surgeon experience with LAVH. Of the total cases, 2,998 (80%) represented the first 20 LAVHs for the surgeon. Overall, there was a 12.1% surgical complication rate. Damage to the urinary tract was reported in 2.6% of LAVHs. Injury to the gastrointestinal tract, including direct injury and obstruction, was reported in 1.7% of procedures. The overall rate of conversion to laparotomy was 21%; the conversion rate significantly decreased with increasing surgeon experience. Ferrari et al. [16] reported a 27% rate of conversion to laparotomy in women undergoing LAVH. In six patients in our series, the procedure was converted to laparotomy either because of haemorrhage or difficulty due to extensive adhesions or uterine size. The overall conversion rate (4.6%) is much smaller than that reported in other studies.

In this study the incidence of urinary tract infection was 1.4%, which is much lower than that reported in prospective studies. This is most probably due to underreporting in a retrospective study, even though all the patients were routinely tested after the urinary catheter was removed and were followed up in the outpatient department.

The "eVALuate" study published by Garry et al. [17] comparing laparoscopic with abdominal hysterectomy and laparoscopic with vaginal hysterectomy reported 2.1% bladder injury in laparoscopic hysterectomy, whereas with abdominal hysterectomy the incidence was 1%. On comparison of laparoscopic and vaginal hysterectomy, the bladder injuries reported were 0.9% and 1.2%, respectively. The incidence of bladder injury in our series was slightly lower (0.7%), but as stated earlier, the main advantage of the described technique is the ease of identifying and dissecting the bladder. However, this was a retrospective case control series, so various complications may be underreported.

Conclusion

This was a retrospective study reporting the various complications with a new technique of dissecting the bladder, whether performing LAVH or a total laparoscopic hysterectomy. Dissection of the bladder laparoscopically adds 5–10 min to the operating time. The use of a metal catheter helps to identify the bladder margins, and by stretching of the bladder pillars, the planes are easily recognised. The use of sponge forceps vaginally clearly marks the vagina and thus the site for colpotomy. It is an easy technique to learn and adopt, especially in patients who have had previous caesarean section. The incidence of bladder injury is low, similar to other reported studies, but the main advantage is facilitating bladder dissection when there are significant adhesions. The technique is associated with low incidence of bladder injury and with no increased incidence of bladder dysfunction.

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