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ORIGINAL ARTICLE

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Laparoscopic hysterectomy and ureteric injury: a comparison of the initial 275 cases and the last 1,000 cases using staples

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Abstract We retrospectively analysed our first 1,275 laparoscopic hysterectomies for ureteric injuries. All patients scheduled for hysterectomy in two private gynaecological practices in Sydney and Adelaide over the past decade were offered laparoscopic hysterectomy using a linear cutter stapling device for securing uterine vascular pedicles. The stapling of the uterine vascular pedicles resulted in the injury of four ureters in the first 275 cases (1.45%), whereas in the subsequent 1,000 cases there was only one such injury (0.1%). In light of our data and the reviewed literature, we conclude regarding ureteric injury at laparoscopic hysterectomy that: in the early days it was probably more the result of surgical inexperience and technique development rather than instrument failure; in experienced hands and with a perfected technique the rate is probably no higher than for abdominal hysterectomy; in experienced hands the rate is probably similar whether stapling or bipolar diathermy is used to secure the uterine vascular pedicles.

Keywords Laparoscopy · Hysterectomy · Ureter · Stapling

Introduction

The late 1980s and early 1990s saw the initial development in advanced gynaecological endoscopic surgery. Surgical techniques, instruments and expertise developed rapidly. The linear cutter stapling device was originally a popular method of securing vascular pedicles. Nezhat et al. [1] described the first case of laparoscopic hysterectomy (LH) using the device to secure uterine vessels. But subsequently there were case reports of ureteric injuries when this device was used to perform the procedure [2, 3]. Bipolar coagulation came to be preferred as the method of choice for securing the uterine vascular pedicles endoscopically. Bipolar coagulators are generally reusable devices that gave them a cost advantage over disposable cutter-stapling devices. However, concern began to arise that collateral spread of thermal energy from bipolar diathermy could result in injury to the ureter. A recent review of ureteric injuries in pelvic laparoscopic surgery found that electrocautery was the most commonly reported technique to be associated with ureteric injuries, resulting in 50% more reported injuries than with the use of staples [4]. Cook et al. reported on the evolution of the technique of laparovaginal hysterectomy over the last 13 years in their institution [5]. Their data indicated that their ureteric injury rate more than doubled from 0.3 to 0.7% since abandoning staples in favour of bipolar diathermy to secure uterine vascular pedicles.

Fibroids are a common indication for hysterectomy with most being removed by abdominal hysterectomy [6]. We and others have successfully removed large uterine fibroid masses laparoscopically [7]. With the very large blood vessels that are found in large uterine fibroid masses, bipolar coagulation may not be suitable. Surgeons who normally use this modality may need to resort to alternative techniques such as suture ligation to secure the uterine vessels [8, 9], whereas we have found that the staples adequately secure these large vascular pedicles [7].

Materials and methods

The settings are two private gynaecological practices in Sydney and Adelaide. Terminology used is that defined by Garry et al. [10]. Both surgeons perform laparoscopic hysterectomies (LH) in which the uterine vessels are secured laparoscopically. Over the last 14 years for one of

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the authors, R.A.J., and 11 years for the other author, R.A.M., all patients for whom hysterectomy was indicated were offered laparoscopic hysterectomy. Fully informed written consent was obtained from every patient. As this review conforms to the standards established by the NHMRC for ethical quality review [11], ethics approval was not sought.

Operative procedure

With the patient in the lithotomy position, a four-port laparoscopy is performed after the pneumoperitoneum has been created with a Veress needle. One 5- to 12-mm port is inserted through the umbilicus and a 5-mm port is inserted suprapubically. Two lateral 5- to 12-mm ports are inserted lateral to the visualised inferior epigastric vessels. The anatomy is assessed and adhesions are divided. In particular, the ovaries are fully mobilised and the course of the ureters along the pelvic sidewall established.

Bladder mobilisation

Author R.A.M. performs an anterior colpotomy and mobilises the bladder vaginally at the onset of the procedure and then performs the rest of the procedure laparoscopically, whereas R.A.J. partially dissects the bladder laparoscopically, then, after securing the uterine vessels laparoscopically, completes the bladder mobilisation transvaginally, mobilises and removes the uterus, and closes the vagina.

The ovarian and uterine vessels are secured and divided, originally using the Multifire ENDO GIA 30 and more recently the Universal ENDO GIA (United States Surgical Corporation, a division of the Tyco Healthcare Group LP). This is a disposable and reloadable device that delivers two triple, staggered, linear rows of staples and simultaneously divides the tissues between the central rows of staples.

For the uterine vessels, R.A.J. inserts the ENDO GIA through the lateral ports, whereas R.A.M. inserts it through the umbilical port in a technique described a decade ago [12]. The device is opened and placed over the skeletonised uterine vessels adjacent to the cervix, after the bladder pillars have been divided. The assistant then exerts upward distraction of the uterus with the uterine manipulator, thereby ensuring that the uterine position is optimally mobilised from the ureteric canal before the device is closed. After confirming accurate placement the device is fired, thereby occluding and dividing the uterine vessels. The uterus is then dissected off the vagina using the EndoShears (United States Surgical Corporation) laparoscopic scissors and then removed per vaginam. R.A.M. sutures the vagina open with the EndoStitch (United States Surgical Corporation). Further details of the individual surgeons' techniques of LH have been described in previous publications [7, 13].

Results

We can now add our last 5 years of experience with an extra 550 cases to our previous reported series [14–17], giving a combined series of 1,275 cases of LH using the stapling device to secure the uterine vascular pedicles. The stapling of the uterine vascular pedicles with the device resulted in the injury of four ureters in the first 275 patients (1.45%). Two injuries occurred at the pelvic brim when securing the ovarian vessels, the infundibulopelvic fold (R.A.J.) and two injuries occurred deep in the pelvis when securing the uterine vessels (R.A.M.). In the subsequent 1,000 cases there was only one ureteric injury associated with the device (0.1%). This latter case of ureteric injury was in a complicated patient with multiple risks of two previous classical (mid-line) Caesarean section deliveries, multiple uterine fibroids and congenitally abnormal ureters in the form of a bilateral duplex collecting system. In this case there was a "difficult" fibroid on the right side and the right upper ectopic ureter was injured with the stapling device when securing the uterine vessels (R.A.M.).

There was one other ureteric injury in this later series of 1,000. In this case the ureter was injured by the sharp tip of a 5-mm trochar on insertion. All the ureters injured were successfully reimplanted into the bladder at coincident or subsequent surgery. There were no other significant injuries caused by the stapling device in this series.

Our combined rate of abdominal hysterectomy (AH; both conversions and elective) over the last 6 years was 2.7% (15 out of 557).

Discussion

Laparovaginal hysterectomy has its main advantages over abdominal hysterectomy in the short term, with faster patient recovery and a quicker return to normal activity [18]. LH, where the uterine vessels are secured endoscopically [10], can allow for more difficult cases to be performed endoscopically [7, 19]. There are those cases in which vaginal access is too inadequate to permit safe vaginal hysterectomy. This situation may pertain to nulliparous patients, to those who have only had Caesarean section deliveries, to patients with severe endometriosis with obliteration of the pouch of Douglas and/or adherent ovaries, or indeed patients with large uterine fibroid masses. Under these clinical circumstances a surgeon who performs only laparoscopically assisted vaginal hysterectomies (LAVH; in which the uterine vessels are secured vaginally [10]) may have to revert to an open operation, but with LH these potential AHs can mostly be performed endoscopically.

The recent Cochrane Review [20] on the different surgical approaches to hysterectomy for benign gynaecological diseases compares ureteric injuries from LH and AH, with the Review citing four published trials [21–25].

The Review found that the ureteric injury rate was higher with LH than AH (10 out of 796 vs. 1 out of 512) with OR of 3.83 (0.94, 15.57) [20].

Langebrekke et al. [21] reported two ureteric injuries in the LH arm in one hospital where the staff had had little training in LH prior to their trial. This prompted the authors to recommend: "a need for thorough training prior to embarking on such a technically advanced operation method." Perino et al. [22] had one ureteric injury in the LH arm of their trial using bipolar diathermy.

In the trial by Lumsden et al. [23], 76 of the 95 patients in the LH arm had the "uterine arteries divided using the Endo GIA disposable stapling device" and yet the Review [20] classified the LHs in this trial as "non-categorisable". The Review [20] makes important errors with regard to ureteric injuries in this trial by quoting two ureteric injuries in the LH arm and one in the AH arm (see Fig. 27 in [20]), whereas in fact there were no ureteric injuries after LH and two after AH. Of the two *urinary tract* injuries in the LH arm (see Table 3 in [23]), one was in fact a cystotomy and not a ureteric injury. The other ureteric injury was in a patient who, despite being randomised to the LH arm, "opted to have an AH after randomization but prior to being admitted for operation [23]." These corrections would give a cumulative relative risk of ureteric injury of LH compared with AH in these four trials [21–25] of 2.5.

Garry et al. [24] had five ureteric injuries in the LH arm of the abdominal trial, but "in this trial most of the procedures were of the LAVH type." [25]. Thus, most of the patients who were entered into the abdominal trial (rather than the vaginal trial) and then randomised to the LH arm, subsequently had laparoscopically assisted vaginal hysterectomies, fully justifying the classification of these LHs as "non-categorisable" [20] and indicating that the surgeons involved had little experience of LH. Garry et al. found that: "The method used to secure the blood vessel pedicles did appear to influence the rate of complications with the lowest risk apparently associated with securing vascular pedicles with diathermy or staples rather than sutures [25]."

Makinen et al. [26] in a review of 10,110 hysterectomies in Finland found that ureteric injuries at laparoscopic hysterectomy were 4.4 times more common with surgeons who had performed 30 procedures or fewer than with surgeons who had performed more than 30 (incidence: 2.2 vs. 0.5%). Wattiez et al. [27] had significantly more renal tract injuries in their first 695 laparoscopic hysterectomies than in the subsequent 952, with ureteric injuries falling by almost two-thirds from 0.58 to 0.21%. These results along with those from the trials [21–25] and our data would indicate that surgical inexperience and technique development are major factors in ureteric injury at LH.

Our series of LHs using the cutter stapling device to secure the uterine vessel pedicles reports only one ureteric injury as a result of this technique in the last 1,000 cases. Our overall ureteric injury rate for the last 1,000 cases was 0.20% and that of Wattiez et al. of 0.21% in their latter 952 cases compared favourably with the reported rates in AH of 0.24% from western Sydney [28], 0.20 and 0.40% from Finland [26, 29], and 0.39% overall for all the AHs performed in the above reported trials [21–25].

In conclusion, we suggest that in experienced hands and with a perfected technique the ureteric injury rate is no higher for LH than for AH, even with more difficult cases and with low conversion rates to AH [7, 19].

None of the above trials [21–25] implicates staples as a cause of ureteric injury at LH. The ureteric injury rate in the latter 952 cases of the French series [27], in which bipolar diathermy was used, was virtually the same as in our latter 1,000 cases with staples, leading us to conclude that the ureteric injury rate at LH in experienced hands using staples to secure the uterine vessels is similar to that when bipolar diathermy is used.

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