in vivo *28*: 263-266 (2014)

Feasibility and Perioperative Morbidity of Minilaparoscopic Hysterectomy

SEBASTIAN BERLIT[1], BENJAMIN TUSCHY[1], JOACHIM BRADE[2], MARC SÜTTERLIN[1] and AMADEUS HORNEMANN[1]

[1]*Department of Obstetrics and Gynaecology, University Medical Centre Mannheim, and* [2]*Department of Medical Statistics and Biomathematics, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany*

Abstract. *Aim: To analyze the feasibility and perioperative morbidity of minilaparoscopy compared to conventional laparoscopy (CL) in patients undergoing laparoscopic hysterectomy. Patients and Methods: Between 04/2012 and 04/2013, 31 patients were prospectively enrolled to undergo hysterectomy via minilaparoscopy with 3.5-mm instruments. A cohort of 108 matched patients who underwent hysterectomy via CL performed by the same surgeon between 08/2011 and 12/2012 served as the control group. Results: There were no statistically significant differences concerning duration of surgery, overall hospital stay and perioperative haemoglobin drop between groups. However, in the study group, the registered blood loss via suction tube was higher (p-value=0.0216) and in two women, intraoperative complications occurred in the form of thermal damage of the ureter via bipolar coagulation. Conclusion: Hysterectomy via minilaparoscopy is a feasible laparoscopic approach. Nevertheless, the use of minilaparoscopy should be considered carefully as the reduced diameter of the instruments might impede certain surgical procedures, such as vessel sealing.*

Laparoscopy has become state-of-the art for many diagnostic and therapeutic surgeries in various specialties. Known advantages of this minimally-invasive surgical approach are reduced patient morbidity, shorter hospitalisation, fewer postoperative complications and better cosmetic results. These advantageous developments due to initiation of endoscopic procedures have undergone a further refinement by the introduction of instruments with a diameter of only 3.5 mm, allowing the so-called minilaparoscopy.

Correspondence to: Sebastian Berlit, MD, University Medical Center Mannheim; Theodor-Kutzer-Ufer 1–3, 68167 Mannheim, Germany. Tel: +49 6213832286, Fax: +49 6213835074, e-mail: sebastian.berlit@umm.de

Key Words: Laparoscopic hysterectomy, minilaparoscopy, surgical outcome.

The use of minilaparoscopy has increasingly been investigated in the field of general surgery, while gynaecological investigations concerning feasibility of this novel approach are still lacking. Minilaparoscopy, although increasingly performed in the gynaecological setting, is still a matter of ongoing debate due to the lack of unbiased investigations justifying its use in routine surgery. In general surgery, some beneficial aspects of minilaparoscopy overcoming conventional laparoscopy (CL) have been found. A meta-analysis found that a needlescopic approach reduces incisional pain compared to CL, also yielding better cosmetic results (1). Additionally, due to smaller incisions by using 3.5-mm instruments, it is assumed that the risk for short- and long-term incisional complications, such as wound infection and trocar-site herniation, is reduced. Only two cases of incisional hernia after minilaparoscopy have been so far reported (2, 3). Furthermore, diagnostic minilaparoscopy can be performed in an office setting with local anaesthesia and has proven, in various investigations, to be comparable to CL with general anaesthesia, minimizing costs, avoiding risks of general anaesthesia and enabling conscious pain mapping (4). In some cases, even therapeutic minilaparoscopy can be performed under local anaesthesia as described by Almeida *et al.* (5). While the advantages of minilaparoscopy intuitively make sense, concerns regarding its feasibility using 3.5-mm instruments still lack scientific recognition. Minimization of instrument diameter is due to technical limitations accompanied by a compromised quality of optical visualization, an increased flexibility of the laparoscope, and smaller surfaces of graspers, scissors and electrocautery instruments.

The aim of our study was to analyze the feasibility and perioperative morbidity comparing minilaparoscopy with CL in patients undergoing laparoscopic hysterectomy.

Patients and Methods

Between 04/2012 and 04/2013, 31 patients underwent hysterectomy *via* minilaparoscopy with 3.5-mm instruments and a 5-mm 30˚ optic (Richard Wolf® GmbH, Knittlingen, Germany).

Table I. *Parameters matching between study and control groups.*

	Number of patients analysed		Mean±SD		*p*-Value	
Parameter	Study group	Control group	Study group	Control group	*t*-Test	*U*-Test
Age (years)	31	108	47.19±5.06	47.93±7.74	0.6205	0.7494
BMI (kg/m^2)	31	103	25.45±4.34	27.17±5.91	0.1364	0.2533
Uterine weight (g)	31	108	224.42±227.05	234.48±254.79	0.8431	0.5320

SD: Standard deviation; BMI: body-mass index.

Table II. *Primary outcome parameters for the study and control groups.*

	Number of patients analysed		Mean±SD		*p*-Value	
Parameter	Study group	Control group	Study group	Control group	*t*-Test	*U*-test
Duration of hospital stay (days)	31	108	2.32±0.75	2.30±0.55	0.8300	0.9078
Hemoglobin drop (g/dl)	27	61	1.32±0.74	1.20±0.85	0.5152	0.3945
Duration of surgery (minutes)	31	108	104.10±44.0	106.17±37.46	0.7949	0.4554

SD: Standard deviation.

A cohort of 108 matched patients who underwent hysterectomy *via* CL performed by the same surgeon between 08/2011 and 12/2012 served as the control group. The data of both groups were documented prospectively. The performing surgeon has over 10 years' experience of laparoscopic surgery, so that a potential bias due to a learning curve throughout the study period was unlike. The two cohorts were matched according to the parameters listed in Table I [age, body mass index (BMI), uterine weight]. For CL, 5 mm instruments and a 10 mm 30˚ optic (Karl Storz® GmbH, Tuttlingen, Germany or BBraun® Aesculap, Tuttlingen, Germany) were used. Intraoperative pressure was 15 mmHg maximum in both groups and all surgeries were performed under general anaesthesia.

In the case of laparoscopic supracervical hysterectomy (LASH) a 10-mm and 12.5-mm electric morcellator (Karl Storz® GmbH, Tuttlingen, Germany) was used in the study and control groups, respectively. The size of the morcellator chosen depended on the size of the uterus. Laparoscopic sacrocolpopexy was performed with a 5-mm ProTack™ fixation device (Covidien®, Mansfield, MA, USA) for both collectives. Demographic parameters such as age, BMI and previous laparotomy were collected before surgery. Indications for surgery, intra- and postoperative complications, duration of surgery, haemoglobin reduction and overall duration of hospital stay were evaluated. The uterine weight was extracted from pathological records. Blood loss was measured *via* a suction tube.

The study was approved by Ethics Committee II of the Medical Faculty Mannheim, Heidelberg University (2012-400M-MA). The study is listed in the German Clinical Trials Register (DRKS00003635).

All data were recorded in an Excel datasheet and transferred into the SAS® environment (Statistical Analysis System, Release 9.2; SAS® System, Cary, NC, USA) for statistical analysis. Data are presented as the mean±standard deviation. Comparisons between study and control groups were accomplished using univariate tests. A *p*-value below 0.05 was considered statistically significant.

Results

Concerning patient characteristics, there were no statistically significant differences by comparing both groups with respect to age, BMI (see Table I), smoking history (*p*-value=0.4723) or previous vaginal and abdominal deliveries (*p*-value=0.1332). Patients of the control group had undergone prior abdominal surgery significantly more often compared to the study group (*p*-value=0.0282). Intraperitoneal adhesions were observed in 7 (22.6%) patients of the study and 42 (38.9%) of the control group (*p*-value=0.094). Primary outcome parameters are depicted in Table II and showed no statistically significant differences by comparing both groups. Indications for hysterectomy and type of surgery performed were not statistically significant different (Tables III and IV). Registered blood loss on the other hand was significantly higher (*p*-value=0.022) in the study group compared to women undergoing CL. Intraoperative complications occurred only in the minilaparoscopy group: In two women with massive intraperitoneal adhesions, the ureter was thermally-damaged by bipolar coagulation. In both cases, inserting a ureteral double-J stent for six weeks was sufficient. Urological follow-up revealed no abnormal findings.

Discussion

Reviewing existing literature comparing minilaparoscopy and CL reveals conflicting results regarding their relative advantages. Whereas some investigations state that

Table III. *Indications for surgery for the study and control groups.*

Indication for surgery, n (%)	Study group n=31	Control group n=108	*p*-Value+
Uterine fibroids	17 (54.83)	64 (59.26)	0.1028
Bleeding disorder	11 (35.48)	24 (22.22)	
Postmenopausal bleeding	1 (3.23)	2 (1.85)	
Prolapse of the uterus	1 (3.23)	6 (19.35)	
Other	1 (3.23)	12 (42.58)	

+Chi-squared test.

Table IV. *Type of surgery performed for study and control groups.*

Type of surgery, n (%)	Study group n=31	Control group n=108	*p*-Value+
LASH	20 (64.52)	64 (59.26)	0.9263
LASH with bilateral salpingo-oophorectomy	1 (3.23)	3 (2.78)	
TLH	8 (25.81)	28 (25.93)	
TLH with bilateral salpingo-oophorectomy	1 (3.23)	8 (25.81)	
LASH with sacrocolpopexy	1 (3.23)	5 (4.63)	

LASH: Laparoscopic supracervical hysterectomy, TLH: total laparoscopic hysterectomy. +Chi-squared test.

Table V. *Previous abdominal surgeries for study and control groups.*

Previous surgery, n (%)	Study group n=31	Control group n=108	*p*-Value+
None	19 (61.29)	37 (34.26)	0.0282
Laparoscopy	5 (16.13)	39 (36.11)	
Transverse laparotomy	6 (19.35)	31 (28.70)	
Longitudinal laparotomy	1 (3.23)	1 (0.93)	

+Chi-squared test.

minilaparoscopy results in less postoperative pain than CL, others failed to show significant advantages concerning postoperative pain, time of hospitalisation and patient morbidity (6-14). As already stated above, a recent meta-analysis of investigations in the field of general surgery found that a needlescopic approach reduces incisional pain compared to CL and yields better cosmetic results due to an almost scar-less healing (1). In a small randomised trial, Ghezzi *et al*. analyzed postoperative pain in patients undergoing hysterectomy *via* minilaparoscopy compared to CL and found no differences concerning the rate of postoperative pain or duration of hospitalisation (15). Concerning the length of hospitalisation, the authors argued that this parameter is not a surrogate measure of functional recovery as it is largely determined by local discharge planning policy, women´s expectations and motivation, as well as by the cultural background (15). Furthermore, cosmetic results after minilaparoscopy are an important issue known to influence quality of life and, as stated above, represent one of the known advantages of minilaparoscopy due to almost scar-less healing of incisions (11, 12, 16). A further advantage of minilaparoscopy is that a small incision with minilaparoscopy instruments implies less trauma to affected tissues, lowering the risk of harming surrounding structures. The smaller diameter of instruments also allows smoother abdominal access. Particularly in the case of intra-abdominal adhesions, these characteristics appear to be advantageous.

In general, minimising the diameter of laparoscopic instruments obviously does not eliminate intraoperative complications, *e.g.* concerning intestinal or vascular damage. In our investigation, intraoperative complications only occurred in the minilaparoscopy group. However, these complications cannot be attributed to minilaparoscopy itself. In our Department, ureteral damage in laparoscopic hysterectomy, including the above stated cases, occurred in 1.56% of patients from 01/2011 until 06/2013. In general, we found bipolar coagulation in minilaparoscopy to be a major drawback of this laparoscopic approach, as the small size of the grasper reduces its functionality. Hence, haemostasis *via* bipolar coagulation is especially more demanding compared to CL. The postoperative decrease of haemoglobin showed no significant differences comparing both groups, but the registered blood loss did.

Ghezzi *et al*. described resolution, clarity and light-carrying capacity to be satisfactory compared to CL when performing hysterectomy in patients *via* minilaparoscopy (15). This addresses the main concerns of various early investigations regarding minilaparoscopy that questioned its benefits due to a limited view and instrumental impairments because of diminished instrumental diameters (16). As a result of technological advances, many of the same endoscopic tools are available for minilaparoscopy when compared to 5- or 10-mm devices, such as rinsing systems and electrocautery devices. Nevertheless, surfaces of graspers and scissors are considerably diminished, which might logically impair handling of greater ablative material and bleeding. Another restraint concerning needlescopic procedures is the intrinsic inability to extirpate surgical tissue at the end of an ablative procedure, so that in some minilaparoscopic procedures at least one larger port for specimen retrieval is required (17). This argument is justified, although in the case of total laparoscopic hysterectomy, the extirpated uterus is usually retrieved *via* the vagina. Further compromise was noted by Ghezzi *et al*., who described that in obese patients, instruments for minilaparoscopy tend to bend more compared

to conventional laparoscopic tools (15). In our opinion, in cases of obesity or greater ablative procedures, surgeons should generally bear in mind that an increased manipulation of laparoscopic tools, when performing minilaparoscopy, might lead to a widening of incisions, so that in these cases, indication for minilaparoscopy should be considered restrictively. Furthermore, in these cases, the diminished diameter of instruments, potentially impairing surgery, should be kept in mind.

Conclusion

Hysterectomy *via* minilaparoscopy is a feasible laparoscopic approach. Nevertheless, the use of minilaparoscopy should be considered carefully, as the reduced diameter of the instruments might impede certain surgical procedures, such as vessel sealing. We believe that minilaparoscopy is a serious alternative for diagnostic or small ablative procedures, but as yet, not for demanding laparoscopic procedures.

References

1 Sajid MS, Khan MA, Ray K, Cheek E and Baig MK: Needlescopic *versus* laparoscopic cholecystectomy: a meta-analysis. ANZ J Surg *79(6)*: 437-442, 2009. Epub 2009/07/02.

2 Yee DS and Duel BP: Omental herniation through a 3-mm umbilical trocar site. J Endourol *20(2)*: 133-134, 2006. Epub 2006/03/03.

3 Bergemann JL, Hibbert ML, Harkins G, Narvaez J and Asato A: Omental herniation through a 3-mm umbilical trocar site: unmasking a hidden umbilical hernia. J Laparoendosc Adv Surg Tech A *11(3)*: 171-173, 2001. Epub 2001/07/10.

4 Tu FF and Advincula AP: Miniaturizing the laparoscope: current applications of micro- and minilaparoscopy. Int J Gynaecol Obstet *100(1)*: 94-98, 2008. Epub 2007/10/30.

5 Almeida OD Jr., Val-Gallas JM and Browning JL: A protocol for conscious sedation in microlaparoscopy. J Am Assoc Gynecol Laparosc *4(5)*: 591-594, 1997. Epub 1997/11/01.

6 Bisgaard T, Klarskov B, Trap R, Kehlet H and Rosenberg J: Microlaparoscopic *vs*. conventional laparoscopic cholecystectomy: a prospective randomized double-blind trial. Surgical endoscopy *16(3)*: 458-464, 2002. Epub 2002/04/03.

7 Bisgaard T, Klarskov B, Trap R, Kehlet H and Rosenberg J: Pain after microlaparoscopic cholecystectomy. A randomized double-blind controlled study. Surg Endosc *14(4)*: 340-344, 2000. Epub 2000/05/03.

8 Novitsky YW, Kercher KW, Czerniach DR, Kaban GK, Khera S, Gallagher-Dorval KA *et al*: Advantages of mini-laparoscopic *vs*. conventional laparoscopic cholecystectomy: results of a prospective randomized trial. Arch Surg *140(12)*: 1178-1183, 2005. Epub 2005/12/21.

9 Huang MT, Wang W, Wei PL, Chen RJ and Lee WJ: Minilaparoscopic and laparoscopic cholecystectomy: a comparative study. Arch Surg *138(9)*: 1017-1023, 2003. Epub 2003/09/10.

10 Huang MT, Wei PL, Wu CC, Lai IR, Chen RJ and Lee WJ: Needlescopic, laparoscopic, and open appendectomy: a comparative study. Surg Laparosc Endosc Percutan Tech *11(5)*: 306-312, 2001. Epub 2001/10/23.

11 Alponat A, Cubukcu A, Gonullu N, Canturk Z and Ozbay O: Is minisite cholecystectomy less traumatic? Prospective randomized study comparing minisite and conventional laparoscopic cholecystectomies. World J Surg *26(12)*: 1437-1440, 2002. Epub 2002/09/26.

12 Cheah WK, Lenzi JE, So JB, Kum CK and Goh PM: Randomized trial of needlescopic *versus* laparoscopic cholecystectomy. Br J Surg *88(1)*: 45-47, 2001. Epub 2001/01/03.

13 Lau DH, Yau KK, Chung CC, Leung FC, Tai YP and Li MK: Comparison of needlescopic appendectomy *versus* conventional laparoscopic appendectomy: a randomized controlled trial. Surg Laparosc Endosc Percutan Tech *15(2)*: 75-79, 2005. Epub 2005/04/12.

14 Ghezzi F, Cromi A, Siesto G, Boni L, Uccella S, Bergamini V *et al*: Needlescopic hysterectomy: incorporation of 3-mm instruments in total laparoscopic hysterectomy. Surg Endosc *22(10)*: 2153-2157, 2008. Epub 2008/07/16.

15 Ghezzi F, Cromi A, Siesto G, Uccella S, Boni L, Serati M *et al*: Minilaparoscopic *versus* conventional laparoscopic hysterectomy: results of a randomized trial. J Minim Invasive Gynecol *18(4)*: 455-461, 2011. Epub 2011/06/07.

16 Schwenk W, Neudecker J, Mall J, Bohm B and Muller JM: Prospective randomized blinded trial of pulmonary function, pain, and cosmetic results after laparoscopic *vs*. microlaparoscopic cholecystectomy. Surg Endosc *14(4)*: 345-348, 2000. Epub 2000/05/03.

17 Gagner M and Garcia-Ruiz A: Technical aspects of minimally invasive abdominal surgery performed with needlescopic instruments. Surg Laparosc Endosc *8(3)*: 171-179, 1998. Epub 1998/07/02.

Received November 23, 2013
Revised January 17, 2014
Accepted January 20, 2014