Complications of Laparoscopic Gynaecological Surgery - A Review

Duru Shah *Safala* Shroff

Key words : laparoscopic surgery, complications

Duru Shah

Introduction

Since its modern introduction in the early 1970s, minimally invasive surgery has revolutionized surgical diagnosis and intervention. Minimally invasive surgery, by definition, offers patients the significant benefits of faster healing and less postoperative pain. Patients can usually leave the hospital in a day or two and in most cases surgery can even be performed as an outpatient procedure. Until the late 1980s, laparoscopic surgery, one of the most common forms of minimally invasive surgery was mainly limited to gynecological procedures such as tubal ligation and the lysis of pelvic adhesions. The development of the micro-camera, however, opened the door to laparoscopic surgical procedures in a large number of specialities, including urology, general surgery, gastro enterology, chest, and orthopedics. By the year 2000, laparoscopy was expected to account for 40% of urology procedures, 50% of general surgery procedures, and 70% of gynecological procedures performed in the United States[1].

Only 15 years after the introduction of laparoscopy, this technique used either as a diagnostic tool or therapeutic method is among the most common procedure in surgery worldwide. Laparoscopic surgery presents a large number of advantages over laparotomy but no surgical procedure is entirely without risk. Though laparoscopic surgery attempts to minimize such risks, concerns about higher surgical complication rates (such as vascular and intestinal injuries as compared to conventional techniques) and anaesthetic risks still remain. Initially, the use of laparoscopic procedures was confined to laparoscopic sterilization and short diagnostic procedures and hence it was usually carried out on young and healthy females. Newer techniques have been advocated for older patients where they may have coexisting cardiac and pulmonary disease. This too has increased the morbidity associated with this surgery. However, laparoscopic surgery is not inherently dangerous for patients presenting benign gynaecological pathologies. The potential risk of complications should no longer be advanced as an argument against using laparoscopic surgery rather than laparotomy for an operation when the indication allows the choice[1].

Paper received on 19/10/02 ; accepted on 29/11/02

Correspondence :
Dr. Duru Shah

Common indications for operative laparoscopy :

- to achieve female sterilization
- for treatment of ectopic pregnancy
- to release / remove pelvic adhesions
- to surgically treat Endometriosis
- to excise or drain ovarian cysts
- to remove fibroid (benign) from the uterus
- in assisted reproductive techniques
- to facilitate hysterectomy
- for bladder neck suspensions for stress incontinence of urine
- pelvic floor repair for prolapse of uterus.

Complications

Complications in the early years of laparoscopy

Surveys of laparoscopic complications were started in Germany as early as 1949[2], in France in the 1950s[3] and in the United States in 1972 [4]. In the United Kingdom according to prospective national surveys of laparoscopic complications, major complications requiring laparotomy decreased by the end of the 1980s[5,6]. The incidence of major complications varied between 1.0/1000 and 3.1/1000 in diagnostic laparoscopies, between 0.4/1000 and 2.1/1000 in sterilization laparoscopies and between 1.4 - 4.7/1000 in operative laparoscopies.

Complications of laparoscopy in the 1990s

The American Association of Gynecologic Laparoscopists (AAGL) was founded in 1972 and since then complications have decreased from 78% in 1977 to as low as 12% in 1993. Major complications, which include injuries requiring laparotomy, decreased in sterilization laparoscopies but increased in diagnostic and operative laparoscopies including laparoscopic hysterectomies (Table I). In addition, bowel and urinary tract injuries increased from 1.6/1000 in 1985 to 4.1/1000 in 1993 [9-11].

Table I : Suveys of the American Association of Gynecologic Laparoscopists

Year	Major Complications (n/1000)			Deaths (n/100,000)		
	Diagnostic	Sterilization	Operative	Diagnostic	Sterilization	Operative
1972	6.0	6.0	-	30.0	30.0	-
1973	5.0	5.0	-	13.0	13.0	-
1974	8.5	4.2	-	-	-	-
1975	3.1	2.8	-	11.0	0.0	-
1976	5.4	2.7	-	0.0	4.0	-
1979	2.6	1.8	-	0.0	2.0	-
1982	-	1.5	-	-	-	-
1985	3.1	1.6	-	0.0	0.0	-
1988	3.1	2.1	4.7	4.8	0.0	5.4
1991	4.9	1.4	12.2	2.4	3.3	1.8
1993	5.0	1.0	15.3	0.0	4.4	6.7

Complications in establishing pneumoperitoneum and peritoneal access

There is and should be a big focus on peritoneal access. Laparoscopic surgery has both risks associated with the specific operation undertaken and with laparoscopic access. Complications specifically associated with entry include : failure to gain access to the abdominal cavity, damage to major retroperitoneal blood vessels, damage to the gastrointestinal tract, damage to the vessels of the abdominal wall and post-laparoscopic bowel herniation through the entry scars [12]. There is nothing more damaging in laparoscopic surgery than force. Veress needle is one of the common instruments causing complications. There is no particular angle of insertion that is safe. The variations in the bifurcation of the aorta and the level of the umbilicus make the surgeon's perception a more difficult task. Reducing the force reduces the depth of insertion. One should identify the layers that one is going through, find the peritoneum and enter it. If there is a straight entry, one might go into the iliacs; if medial, then into the retroperitoneal vessels. No area is devoid of vessels. The one thing we can't predict is the superficial epigastric vessels, which come from the femoral vessels, because they are subcutaneous and different in everybody. The inferior epigastric vessel comes from the external iliac vessel, wraps around the inguinal ring and travels on the transversalis fascia, below the rectus muscles and the rectus sheath. It is identified by direct visualization. For severe complications (vessel perforation) it is impossible to prove a difference between closed and open access techniques, therefore, large outcome studies should be considered. Insertion of the first trocar with the open technique is faster as compared to the Veress needle. Randomised controlled trials comparing closed (Veress plus trocar) versus open approach have inadequate sample size to find a difference in serious complications. However, the use of either technique may have advantages in specific indications.

In the French anonymous register of laparoscopic complications, regardless of the operator, the indication for laparoscopy or the type of trocar used, some patients appeared to be particularly at risk as regards entry-related laparoscopic injuries. Seventy-two percent of the women had undergone previous abdominal surgery and 54% were overweight. In 30% of cases, safety rules for trocar insertion were not followed. Laparotomy was needed in 64% of all cases, and 90% of cases if vascular injuries to the abdominal wall were not included [13]. The incidence of incisional hernias has been between 0.1/1000[14] and 10/1000 laparoscopies[15]. In gynecological laparoscopy the most often used trocar sizes are 5,10 and 12 mm. An incidence of 2.3/1000 has been reported with 10 mm trocars and 31.0/1000 with 12mm trocars [16]. Ninety-six percent of incisional hernias have been caused by trocars of at least 10 mm in size and fascial closure is recommended whenever a 10 mm or larger trocar is used. One-fourth of hernias have been umbilical. Most hernias have occurred without peritoneal lining and have contained small or large bowel or omentum[15]. In addition, abdominal wall vessel injuries are related to laparoscopic entry at an incidence rate of 0.2-1.5/1000 laparoscopies [3,14,17].

Gas embolism and its prevention

Clinically relevant gas embolism is very rare, but if it occurs, it may be a fatal complication. Most cases of gas embolism described have been caused by

accidental vessel puncture with a Veress needle at the creation of pneumoperitoneum. Low intraabdominal pressure, low insufflation rates, as well as careful surgical technique may reduce the incidence of gas embolism. A sudden drop in end tidal CO_2 concentration and blood pressure during abdominal insufflation should be considered a sign of gas embolism.

Complications from unintentional tissue burns

Monopolar electrosurgery has been used successfully in open operative procedures for over 65 years to control bleeding. In part because of this long history, it has become the most widely used surgical technique for cutting and coagulation in laparoscopic surgical procedures. In a recently published survey, 86% of surgeons reported that they employed monopolar electrosurgery in laparoscopic procedures[18]. Monopolar electrosurgery has traditionally been used primarily as a method of hemostasis during surgery. Other minimally invasive techniques such as bipolar electrosurgery, laser light surgery, and the harmonic scalpel are available for tissue dissection and the cautery of blood vessels for hemostasis. In the above referred survey, for example, only 12% of surgeons reported using bipolar electrosurgery and 2% reported using laser energy[18]. During open surgery, the surgeon operates in a relatively unrestricted space and generally has a full view of the exposed active electrode as well as the operative field and surrounding tissues. In this situation, the surgeon is usually immediately aware of an unintended burn and can apply treatment to avoid serious complications. The direct manipulation of instruments and internal tissues during open surgery allows maximum control by the surgical team, with the result that unintentional electrosurgical tissue burns are rare. During laparoscopic surgery, by contrast, the view of the surgical field is constricted. The manipulation of instruments and tissue is based on magnified images, relayed from a micro-camera connected to the laparoscope and displayed on a video monitor. The active electrode in close proximity to other instruments and to tissue may result in stray electrical current being transmitted to unseen tissue. While the laparoscope provides a detailed view of the tip of the active electrode, up to 90% of the presumably insulated part of the electrode may be beyond the surgeon's view at any one time[19]. Since the surgeon cannot directly or readily observe a burn that occurs outside the surgical field, unreliable indicators such as interference on the video monitor or loss of power to the electrode tip provide the only warning that a thermal injury may have occurred. Unaware that electrical currents may be dangerously straying, the surgeon cannot intervene to prevent injury, let alone treat such injury immediately following its causation[20-22]. Patients who suffer such unintended electrosurgical injuries can develop painful and costly complications, resulting in subsequent emergency surgery, extended hospital stays, long-term convalescence, and potentially life-threatening infection. Fecal peritonitis, resulting from the contamination of the abdominal cavity by bacteria from a bowel perforation, is the most feared complication of thermal injury, with a mortality rate estimated at 25%[23-25]. A newly available technology provides a solution to the problem of unintended tissue burns to nontargeted sites during laparoscopic monopolar electrosurgery. This technology - active electrode monitoring (AEM) - uses a combination of added electrical insulation and conductive shielding in addition to an electronic current monitoring system. The added electrical insulation and conductive shielding absorb any stray currents released through faulty insulation. Moreover, the conductive shielding is electrically connected to the return electrode of the electrosurgical unit, allowing capacitively coupled currents to flow harmlessly[20]. The Emergency Care Research Institute (ECRI), a non-profit research agency that reviews and tests medical devices, conducted a thorough study in 1995 of the potential dangers of monopolar laparoscopic electrosurgery and the safety precautions that can be taken to mitigate or eliminate these risks[23]. ECRI found this system to successfully and safely prevent stray energy leakage and tissue injury at unintended sites. After comparing this technique with other suggested protective measures such as electrode inspection and the avoidance of high electrosurgical power settings, the ECRI report concluded that active electrode monitoring offers the highest available level of protection against patient injury due to insulation failure and capacitive coupling and recommended that this system be used as the best means to promote electrosurgical safety. However most gynaecological endoscopists prefer to use the bipolar cautery in practice, but there is no published data available to compare monopolar with bipolar cautery towards minimizing unintentional tissue injury.

Gastrointestinal injuries

Bowel injuries are one of the most important complications of laparoscopic surgery because they are potentially life threatening, especially if the injury is not recognized at the time of operation. Damage to the small bowel is frequently missed and commonly lead to severe complications[26]. The injury caused by a Veress needle may be managed expectantly. Trocar perforation or sharp laceration with another instrument may be sutured by way of laparoscopy, minilaparotomy or laparotomy. Thermal injury may be sutured or may necessitate segmental resection

depending on the size of the injury[27,28]. Most thermal injuries however heal without intervention[29]. Fifty-six patients with 62 gastrointestinal injuries were reported to the register of the French Society of Gynecological Endoscopy anonymously. One-third of the complications occurred during the laparoscopic approach and 79% of cases occurred during operative laparoscopies. Diagnosis of these injuries was made during primary surgery in only 36% of cases. The small bowel was injured in 34% of cases and the large bowel in 48%. Treatment of bowel injuries was most often performed by way of laparotomy. However, almost half of the injuries diagnosed preoperatively were treated by way of laparoscopy, as against only 3% of injuries diagnosed postoperatively[31].

Urinary tract injuries

Injury to the bladder may result from a secondary trocar or from dissection of the bladder. Bladder injury recognized during laparoscopy may be sutured by way of laparoscopy or laparotomy followed by bladder drainage. Small bladder injuries not recognized during laparoscopy may be managed conservatively with a Foley catheter, whereas a larger defect would require sutures. Bladder perforation may result in vesicovaginal fistula. The incidence rate is 0.2-1/1000 laparoscopies [14,17]. Bladder injuries have even occurred at a rate of 8.4/1000 in major operative laparoscopies [31]. Bladder perforation may result in vesicovaginal fistula and incidence rates of 0.03/1000 in all laparoscopies[17] and 0.3-3.1./1000 in advanced laparoscopies have been reported [17,31]. The fistula may be repaired laparoscopically[32], vaginally[33] or abdominally[31]. Ureteral injuries occur in 0.08-0.2/1000 laparoscopies [14,17], but the incidence increases with more advanced operative laparoscopies, upto 1.2-4.2/1000 [17,31,34]. Ureteral injury rates as high as 42.9/1000 in laparoscopic hysterectomies[34] and 29.4/1000 in laparoscopic adnexectomy[31] have been reported. A small laceration of the ureter may be managed by insertion of a ureteric stent or it can be sutured even laparoscopically[35]. In most cases, laparotomy is required with one of the following procedures viz., reimplantation of the ureter into the bladder, end-to-end anastomosis of the damaged ureter, or transureteral ureterostomy[17].

In a review of ureteral injuries in the 1980s, none were diagnosed intraoperatively. Endometriosis was the indication for the laparoscopic procedure in 39% of cases and adhesions in 31% of the cases. Thirty-three percent of patients underwent transverse ureteroureterostomy, 25% end to-end anastomosis, 25% ureteral stenting, 8% ureteroneocystostomy and 8% ileal interposition (interposition of a loop of ileum between the ureter and the bladder). In the follow-up period, 58% of the patients had an uncomplicated recovery. Seventeen percent underwent nephrectomy (two patients) 8% (one patient) ureteral dilatation, 8% (one patient) had hydronephrosis with chronic infection and 8% (one patient) had a loss of renal function but did not undergo nephrectomy[36].

Major vascular injuries

The most dangerous complications of laparoscopy are injuries to the aorta, vena cava, iliac vessels and mesenteric vessels. The incidence of major vascular injury has been reported to be 0.2 – 1./0/1000 laparoscopies[14,17]. The risk is almost the same in diagnostic (0.2.1000) as in operative laparoscopy (0.3/1000)[17]. Twenty-one major vascular injuries to 17 patients have been reported to the complication register of The French Society of Gynecological Endoscopy (24% external iliac vessels, 24% vena cava, 19% aorta, 19% common iliac vessels, 10% mesenteric vessels and 4% unspecified). Seventy-seven percent occurred during the setting up phase of laparoscopy and 33% during the operative procedure. The injury was repaired by way of laparotomy in 94% of cases and 12% died[37].

Other injuries

Carbon dioxide insufflation may cause potential complications by elevation of blood carbon dioxide level and elevation of intra-abdominal pressure. These changes may cause increase in blood pressure and cardiac output but decrease in venous return from the lower part of the body by vena caval compression leading to deep venous thrombosis. Vagal stimulation from peritoneal manipulation may produce severe bradycardia. Other rare complications such as brachial plexus, peroneal and saphenous nerve paresis, gas embolism, and subcutaneous and preperitoneal emphysema have been reported during laparoscopy [15].

Postoperative aspects

Nausea and vomiting are particularly troublesome after laparoscopic surgery; over 50% of patients require antiemetics. Therefore prophylactic antiemetics may be given routinely. Pain following laparoscopic surgery consists of early transient vague abdominal and shoulder discomfort due to peritoneal irritation by residual carbon dioxide. Patients can also experience deep seated pain related to trauma at the surgical site. Pain from the puncture wounds of the trocars is generally mild because the wounds are small and are produced without the cutting of muscle fibres.

Anaesthesia management

Anaesthetic management of patients undergoing laparoscopic surgery must accommodate surgical requirements and allow for physiological changes during surgery. Monitoring devices are available for the early detection of complications. Recovery from anaesthesia should be rapid with minimal residual effects. The possibility of the procedures being converted to open laparotomy needs to be considered. The major problems during laparoscopic surgery are related to the cardiopulmonary effect of pneumoperitoneum, systemic carbon dioxide absorption, extraperitoneal gas insufflation, venous gas embolism, unintentional injuries to intra-abdominal structures and patient positioning. An appraisal of the potential problems is essential for optimal anaesthetic care of patients undergoing laparoscopic surgery. Appropriate anaesthetic techniques and monitoring facilitate surgery and allow early detection and reduction of complications. The need for rapid recovery and a short hospital stay impose additional demands on the anaesthetist for skilful practice. Most of the gynecologic laparoscopy is simple and brief, with minimal gas insufflation. In these cases, respiratory compromise is limited, and spontaneous ventilation appears acceptable. Such procedures therefore can be performed with the patient under local or regional anesthesia. As more procedures are conducted on an outpatient basis, the choice of maintenance agent is likely to be reduced to shorter-acting drugs such as sevoflurane, desflurane and infusions of propofol. As more prolonged operations have become possible, these normally require general anesthesia, controlled ventilation, and tracheal intubation[38].

Laparoscopic Hysterectomy

This procedure is the most popular laparoscopic gynaecological surgery and hence needs a special mention. Many series of this surgery by skilled gynecologists have been reported. Four meta-analyses of these studies from 1989 to 1995 have been carried out[39,40,43,44]. According to the results, the mean major complication rate was 3%-4%[39,42], the mean total complication rate was 11.6% - 15.6%[39,40] and the mortality rate was 0-6/100,000[39,43]. A total complication rate of as low as 5.8% has been reported by two experts in total laparoscopic hysterectomy[44]. A nationwide membership survey by the AAGL in 1995 evaluated complications of laparoscopic hysterectomies when 49% of the uterine vessels were secured vaginally. The overall complication rate was 6% but the response rate to the questionnaires was only 18%[43].

Table II Complications of laparoscopic hysterectomy

Study	Cases	Complications				
		Total	Major	Urinary tract	Intestinal	Vascular
Review: Munro et al. 1995 [39]	2975	11.6%	3.0%	1.5%	0.2%	1.0%
Review : Garry et al. 1995 [40]	3189	15.6%	?	1.4%	0.5%	1.3%
Review : Harris et al. 1995 [41]	2412	?	?	1.6%	0.2%	0.4%
Review : Meikle et al. 1997 [42]	3112	?	4.0%	2.1%	0.4%	0.8%
Series : Liu and Reich 1994[44]	518	5.8%	3.3%	1.4%	1.2%	0.6%
AAGL : Hulka et al. 1997[43]	14.91	6.0%	?	1.5%	0.5%	3.5%
Adelaide : O'Shea et al. 1996 [45]	760	17.0%	7.7%	2.5%	?	3.0%

All laparoscopic hysterectomies in one region in Australia were analyzed to identify the true incidence of complications among gynecologists with different experience during the learning phase and the total complication rate was 17%[45] (Table II).

Bladder and ureters are easily damaged during laparoscopic hysterectomy and urinary tract injury has been the most common complication with an incidence rate of 1.4-2.5%. Ureteral injuries have been reported to occur in 0.3% of cases in meta-analyses [39,40,43,44]. Most of the ureteral injuries have occurred when securing uterine vessels laparoscopically. Damage to the bladder is more common than that to the ureter because the bladder must always be dissected from the anterior surface of the uterus. Bowel injuries may occur during adhesiolysis or electrocoagulation and are highly correlated with the difficulty of the operation. The average incidences of bowel injuries in four meta-analyses were 0.2-0.5% [39,40,42]. Two main types of vascular structure are at risk during laparoscopic hysterectomy: those lying in the abdominal wall and those lying retroperitoneally in the pelvic side wall and posterior abdominal wall. The injuries may occur during the entry phase of laparoscopy or during the procedure with instrument or diathermy[46]. The incidences vary considerably depending on what kind of bleeding complications are counted. The risk was 0.4-1.3% in meta-analyses [39,40,

and 3.0-3.5% in AAGL and Adelaide surveys [43,45].

Learning Curve

In Belgium, a group of eight gynecological laparoscopic surgeons from six centers started a register on laparoscopic hysterectomy in June 1991 to study first experiences of laparoscopic hysterectomy (the Belcohyst register)[47]. Every surgeon had great experience in endoscopic surgery before performing the first procedures. Altogether, 413 hysterectomies were carried out; about two-thirds were LAVH, one-third LH and only a few were TLH. The mean operating time among all the cases was 118 min and during the first year of registration the operating time decreased with increasing experience. In the first 30 cases, operating time decreased sharply in one center from 200 min to 100 min and leveled after 40 cases to 80 min. The operating time did not drop further because at the same time uterine weight went up slightly. Major complications and conversions to abdominal hysterectomy continued to occur at the same rates throughout the study[47]. Another study was carried out in Australia to determine learning curves for laparoscopic hysterectomy for a trainee and for an experienced gynecologist. The investigators wanted to see how many procedures are needed to achieve an acceptable level of performance. Over a 12 month period 21 women were operated on by the trainee and 33 by the experienced surgeon. The average operating time for the trainee was 145 min, decreasing from 180 min to 105 min by the end of the period. After 16 completed procedures, the operating time was 105 min and it was considered by supervising staff that the trainee had achieved sufficient competence. As expected, the average operating time for the experienced surgeon was shorter (99 min), decreasing from 145 min to 80 min within the first year. A plateau was reached after 10 cases. No correlation was found in either group between operating time and uterine weight, patient weight or previous abdominal surgery and no difference in complications were seen between the trainee's patients and those of the experienced surgeon[48].

Clinical outcome between conventional and laparoscopic hysterectomy

After the report of the first laparoscopic hysterectomy[49] many observational reports of personal experience or results from specialized centers were published. Later on some comparative studies on clinical outcome between different hysterectomy techniques were reported and there have been 11 randomized controlled studies in which laparoscopic and abdominal or vaginal hysterectomy have been compared[50-58] data on clinical outcome from small personal and comparative series, and different techniques included. No studies have given compared all three techniques simultaneously in a prospective manner, so assessment is dependent on reports comparing only two techniques and on review articles[59]. Munro and Deprest[39] analyzed all reported studies from 1989 to 1994. A total of 2975 laparoscopic hysterectomies were recorded, with 314 reported in the context of a comparative study[39]. Meikle et al[41] reviewed published literature on laparoscopic hysterectomy from 1989 to September 1995. Cases identified included 3112 laparoscopic, 1618 abdominal and 690 vaginal hysterectomies. The studies were from eight countries, but more than half of them were from the United States of America.

Operating time

In all comparative studies the shortest operating time was in vaginal hysterectomy and the longest in laparoscopic hysterectomy [39,42]. The operating time was negatively correlated with the experience of the surgeon and positively correlated with uterine weight [47]. In these studies it was concluded that laparoscopic procedures took significantly longer to perform than traditional hysterectomies.

Operative blood loss

There was significantly less blood loss in laparoscopic compared with traditional hysterectomies in six out of ten randomized studies.

Postoperative pain

In Meikle et al's[42] review, abdominally operated women needed more pain medication than laparoscopically operated women and a slight increase of pain medication use or no difference was seen between laparoscopic and vaginal hysterectomy

Hospital stay

In all randomized trials the hospital stay was significantly shorter after laparoscopic compared with abdominal hysterectomy and similar to that after vaginal hysterectomy.

Convalescence time

In the review of observational and comparative studies by Meikle et al[42] the time to return to work was always less for laparoscopic compared with abdominal hysterectomy (two to six weeks for LH and five to nine weeks for TAH), but no difference was seen between laparoscopic and vaginal hysterectomy.

Tissue trauma

Statistically, the highest values were associated with

abdominal hysterectomy followed by laparoscopic and vaginal hysterectomy suggesting the greatest tissue damage after abdominal hysterectomy[18].

Conclusion

In general laparoscopic surgical techniques allow excellent diagnostic inspection of abdominal and pelvic organs and facilitate operative correction of gynaecological disorders without the necessity for large abdominal incisions, prolonged hospitalization and protracted recuperation. However, the procedure is surgically demanding and introduces specific risks unique to laparoscopic surgery that are not present during the performance of conventional procedures. Subgroup analysis according to the indication and seriousness of the surgery can prepare the untrained gynaecologist in a systematic manner. Minor procedures such as sterilisation techniques are included in most residency programs. Major procedures, which include laparoscopic adhesiolysis, adnexal surgeries, hysterectomy etc, need more training and experience. Advanced procedures, which include complicated cases of malignancy, pelvic lymphadenectomy etc are best left to experts in the field. Hence, while improved training and credentialing can help ameliorate complications relating to improper techniques, workshop experiences can teach knowledge and skills necessary for safe and effective laparoscopic surgery. All the same it must be emphasized that vaginal surgery wherever possible should always be preferred to laparoscopic surgery because of its many advantages.

References

1. Wetter P.A. Trends Study. Presented at Society of Laparo endoscopic Surgeons Annual Meeting; June 10-11, 1994; *Seattle* WA.
2. Chapron C, Fauconnier A, Goffinet F et al. Laparoscopic surgery is not inherently dangerous for patients presenting with benign gynaecologic pathology. Results of a meta-analysis. *Hum Reprod* 2002; 17:1331–42.
3. Lehmann-Willenbrock E, Riedel H-H, Mecke H, et al. Pelviscopy – Laparoscopy and its complications in Germany 1949-1988. *J Reprod Med* 1992; 37:671–7.
4. Mintz M. Risks and prophylaxiss in laparoscopy: a survey of 100 000 cases. *J Reprod Med* 1977; 18:269–71.
5. Phillips J, Hulka B, Hulka J et al. Laparoscopic procedures : The American Association of Gynecologic Laparoscopists' membership survey for 1975. *J Reprod Med* 1977; 18:227–32.
6. Phillips JM, Hulka JF, Peterson HB. American Association of Gynecologic Laparoscopists 1978 membership survey. *J Reprod Med* 1981; 26:3–4
7. Chamberlain G. Gynaecological laparoscopy. *Ann Royal Coll Surg* 1980;62:1–3.
8. Hulka JF, Peterson HB, Phillips JM. American Association of Gynecologic Laparoscopists 1988 membership survey on laparoscopic sterilization. *J Reprod Med* 1990;35:581–6.
9. Hulka J, Peterson HB, Phillips JM. Operative Laparoscopy: American Association of Gynecologic Laparoscopists 1993 membership survey. *J Am Assoc Gynecol Laparosc* 1995; 2:15–6.
10. Peterson HB, Hulka JF, Phillips JM. American Association of Gynecologic Laparoscopists Membership survey on operative laparoscopy. *Reprod Med* 1990; 35:35–9.
11. Levy BS, Hulka JF, Peterson HB et al. Operative laparoscopy: American Association of Gynecologic Laparoscopists 1993 membership survey. *J Am Assoc Laparosc* 1994; 1:301–6.
12. Garry R. Complications of laparoscopic entry. *Gynaecol Endosc* 1997; 6:319–29.
13. Marret H, Harchaoui Y, Chapron C et al. Iroca injuries during laparoscopic gynaecological surgery. Report from the French Society of Gynaecological Laparoscopy. *Gynaecol Endosc* 1998; 7:235–41.
14. Jansen FW, Kapiteyn K, Trimbos-Kemper T et al. Complications of laparoscopy: a prospective multicentre observational study. *Br J Obstet Gynaecol* 1997; 104:595–600.
15. Li TC, Saravelos H, Richmond M et al. Complications of laparoscopic pelvic surgery: recognition, management and prevention. *Hum Reprod* 1997; 3:505–15.
16. Kadar N, Reich H, Liu CY et al. Incisional hernia after major laparoscopic gynecologic procedure. *Am J Obstet Gynecol* 1993; 168:1493–5.
17. Chapron C, Querleu D, Bruhat M A et al. Surgical complications of diagnostic and operative gynaecological laparoscopy: a series of 2990 cases. *Hum Reprod* 1998; 13:867–72.
18. Tucker RD. Laparoscopic electrosurgical injuries: Survey results and their implications. *Surgical Laparoscopy & Endoscopy* 1993; 3:311–7.
19. Odell RC. Electrosurgery in laparoscopy. Infertility and Reproductive Medicine. *Clinics North America*, 1993;4:289–301.
20. Vancaillie TG. Electrosurgery at laparoscopy: Guidelines to avoid complications. *Gynaecologic Endoscopy* 1994; 3:143–50.

1. Saye WB, Miller W, Hertzmann P. Electrosurgery thermal injury: Myth or misconception? *Surgical Laparoscopy & Endoscopy. 1991;1:223 - 8.*
2. Deziel DJ. Avoiding laparoscopic complications. *International Surg. 1994;79:361 - 4.*
3. Focus on laparoscopy. *Health Devices. 1995;24:3 - 38.*
4. Wolfe BM, Gardiner BN, Leary BF et al. Endoscopic cholecystectomy: An analysis of complications. *Archives of Surgery. 1991;126:1192 - 8.*
5. Berry SM, Ose KJ, Bell R H et al. Thermal injury of the posterior duodenum during laparoscopic cholecystectomy. *Surgical Endoscopy. 1994;8:197-200.*
6. Garry R. The Achilles heel of minimal access surgery. *Gynaecol Endosc 1994;3:201 - 2.*
7. Nezhat C, Nezhat F, Ambroze W et al. Laparoscopic repair of small bowel and colon. *Surg Endosc 1993;7:88 - 9*
8. Hill D, Lolatgis N, Maher P et al. Does suspected large bowel perforation at laparoscopy always require large incision laparotomy? *Gynaecol Endosc 1998;7:43 - 5.*
9. Joshi GP – Complications of Laparoscopy. *Anesthesiol Clin North America 2001; 19 : 89 - 105*
10. Chapron C, Pierre F, Harchaoui Y et al. Gastrointestinal injuries during gynaecological laparoscopy. *Hum Reprod 1999; 14:333 - 7.*
11. Saidi MH, Vancaillie TG, White AJ et al. Complications of major operative laparoscopy: a review of 452 cases. *J Reprod Med 1996; 41:471 - 6.*
12. Nezhat C, Nezhat F, Nezhat C et al. Laparoscopic repair of a vesicovaginal fistula: a case report. *Obstet Gynecol 1994;83:899 - 901.*
13. Labasky RF, Leach GE. Prevention and management of urovaginal fistulas. *Clin Obstet Gynecol 1990;33:382 - 91.*
14. Tamussino KF, Lang PEJ, Breinl E. Ureteral complications with operative gynecologic laparoscopy. *Am J Obstet Gynecol 1998; 178:967 - 70.*
15. Nezhat C. Nezhat F. Laparoscopic repair of ureter resected during operative laparoscopy. *Obstet Gynecol 1992;80:543 - 4*
16. Grainger DA, Soderstrom RM, Schiff SF et al. Ureteral injuries at laparoscopy: insight into diagnosis, management, and prevention. *Obstet Gynecol 1990; 75:839 - 43.*
17. Chapron CM, Pierre F, Lacroix S et al. Major vascular injuries during gynecologic laparoscopy. *J Am Coll Surg 1997; 185:461 - 2.*
38. Smith I, Anesthesia for laparoscopy with emphasis on outpatient laparoscopy. *Anesthesiol Clin North America – 2001; 19 : 21 - 41.*
39. Munro MG, Deprest J. Laparoscopic hysterectomy: Does it work? : A bicontinental review of the literature and clinical commentary. *Clin Obstet Gynecol 1995;2:401 - 25.*
40. Garry R, Phillips G. How safe is the laparoscopic approach to hysterectomy? *Gynaecol Endosc 1995;4:77 - 9.*
41. Harris WJ, Daniell JF. Early complications of laparoscopic hysterectomy. *Obstet Gynecol Surv 1996;51:559 - 67.*
42. Meikle SF, Nugent EW, Orleans M. Complications and recovery from laparoscopy – assisted vaginal hysterectomy with abdominal and vaginal hysterectomy. *Obstet Gynecol 1997;89:304 - 11.*
43. Hulka JF, Levy BS, Parker WH et al. Laparoscopic-assisted vaginal hysterectomy: American Association of Gynecologists' 1995 membership survey. *J Am Assoc Gynecol Laparos 1997; 4: 167 – 71.*
44. Liu CY, Reich H. Complications of total laparoscopic hysterectomy in 518 cases. *Gynaecol Endosc 1994; 3:203 - 8.*
45. O'Shea RT, Petrucco O. Adelaide laparoscopic hysterectomy audit (1991-1994): complications in the real world. *Gynaecol Endosc 1996; 5: 261 - 3.*
46. Phipps JH. Avoidance of complications of laparoscopic hysterectomy. *Baill Clin Obstet Gynecol 1995;9:729 - 48.*
47. Deprest JA, Cusumano PG. Donnez J et al. 1992 results of the Belcohyst register on laparoscopic hysterectomy. In: Cusumano PG, Deprest JA, eds. Advanced gynecologic laparoscopy: a practical guide. 1st ed. London: *The Parthenon Publishing Group 1996; 85 – 98.*
48. Rosen DMB, Cario GM, Carlton MA et al. an assessment of the learning curve for laparoscopic and total laparoscopic hysterectomy. *Gynaecol Endosc 1998; 7: 289 – 93.*
49. Reich H, DiCaprio J, McGlynn F. laparoscopic hysterectomy. *J Gynecol Surg 1989; 5: 213 – 6.*
50. Nezhat C, Nezhat F, Gordon S et al. Laparoscopic versus abdominal hysterectomy. *J Reprod Med 1992; 37: 247 – 50.*
51. Summitt RL, Stovall TG, Lipscomb GH et al. Randomized comparison of laparoscopy assisted vaginal hysterectomy with standard vaginal hysterectomy in an outpatient setting. *Obstet Gynecol 1992; 80: 895 – 901.*
52. Phipps JH, Nayak JS. Comparison of laparoscopy

assisted vaginal hysterectomy and bilateral salpingo-ophorectomy with conventional abdominal hysterectomy and bilateral salpingo-ophorectomy. *Br J Obstet Gynecol 1993; 100: 698 – 700.*

53. Raju KS, Auld BJ. A randomized prospective study of laparoscopic vaginal hysterectomy versus abdominal hysterectomy each with bilateral salpingo-ophorectomy. *Br J Obstet Gynecol 1994; 101: 1068 – 71.*
54. Richardson RE, Bournas N, Magos AL. Is laparoscopic hysterectomy a waste of time? *Lancet 1995; 345: 36 – 41.*
55. Langebrekke A, Eraker R, Nesheim BI et al. Abdominal hysterectomy should not be considered a primary method for uterine removal. A prospective randomized study of 100 patients referred to hysterectomy. *Acta Obstet Gynecol Scand 1996; 75: 404 - 7.*
56. Olsson JH, Ellstrom M, Hahlin M. A randomized trial comparing laparoscopic and abdominal hysterectomy. *Br J Obstet Gynecol 1996; 103: 345 – 50.*
57. Summitt RL, Stovall TG, Steege JF et al. A multicenter randomized comparison of laparoscopically assisted vaginal hysterectomy and abdominal hysterectomy in abdominal hysterectomy candidates. *Obstet Gynecol 1998; 92: 321 – 6.*
58. Falcone T, Paraiso MFR, Mascha E. Prospective randomized clinical trial of laparoscopically assisted vaginal hysterectomy versus total abdominal hysterectomy. *Am J Obstet Gynecol 1999; 180: 955 – 62.*
59. Marana R, Busacca M, Zupi E et al. Laparoscopically assisted vaginal hysterectomies. *Gynecol Endosc 1998; 7: 243 9.*
60. Holub Z, Jabor A, Fischlova D et al. Assessment of tissue damage associated with laparoscopic and conventional hysterectomies. *Gynecol Endosc 1998; 7: 243 – 9.*