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# Editorial

After North America, followed by Europe, India is growing as the largest market for robotic surgery due to developed health care infrastructure, increasing incidence of chronic diseases and technological advancement in the region.

India is expected to show high growth rate in the robotic surgery in next few years due to Government initiatives and rise in awareness about robot-assisted minimal access surgeries.

Robotic surgery has many direct advantages to the patients as the precision is beyond the limit of human hand. In addition, rise in need for faster recovery, reduce pain and discomfort and increasing awareness about benefits of robotic surgery are expected to drive the market for robotic surgery.

Surgical robotics is a new technology that holds significant promise. Robotic surgery is often heralded as the new revolution, and it is one of the most talked about subjects in surgery today. In coming issues of World Journal of Laparoscopic Surgery (WJOLS), we are continuously going to publish articles related to robotic surgery. It is our hope that by these articles, readers will be able to make a more informed decision about robotic surgery before they jump into this new technology. Our goal in publishing the articles related to robotic surgery is to provide an objective evaluation of the robotic technology and to touch on some of the good as well as bad aspects that manufacturers of robots do not disclose.

I hope that readers will like this issue and they will give their valuable suggestions. We value your patronage and appreciate your confidence in WJOLS. Counting you among our valuable readers is something for which we are especially grateful**.**

On behalf of all of us at the team of WJOLS, I wish you a very happy new Year 2017.

**RK Mishra**
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ORIGINAL ARTICLE

# Comparative Study of Surgical Approaches for Renal Pelvic Stones in a Northern Rural Medical College

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## ABSTRACT

**Introduction:** Retroperitoneal pyelolithotomy (RPL) can be used as an alternative to open pyelolithotomy (OP) when other modalities of stone removal fail. This procedure even has potential to replace noninvasive techniques in selective subsets of patients.

**Aims and objectives:** The aim of this study was to study the efficacy, safety, and outcome of retroperitoneal laparoscopic pyelolithotomy. The study compared the advantages and complications of RPL and OP.

**Materials and methods:** This study was conducted in the Department of Surgery, Maharishi Markandeshwar Institute of Medical Science and Research, Maharishi Markandeshwar University, Ambala, from January 2012 to December 2015. A total of 280 patients of solitary renal pelvic stone were selected, out of whom 160 who underwent RPL were considered in group I and 120 patients who underwent OP were considered in group II. The patients included were of age group 12 to 80 years, with unilateral and bilateral solitary renal pelvis calculus and stone size of 10 mm to 3 cm. Patients with recurrent or residual stones after pyelolithotomy, intractable urinary tract infection, and having extrarenal pelvis and any anatomical renal abnormalities were excluded from the study.

**Results:** In this study, mean age was 37.1 and 46.66 years in groups I and II respectively. Male to female ratio was 2.33:1. Mean operative time was 75.33 ± 16.90 and 65.83 ± 12.35 minutes respectively, in groups I and II respectively ($p < 0.001$). Pyelotomy closure time and Double-J (DJ) stent insertion time were 5.2 minutes (with standard deviation [SD] of 4.3) and 9.8 (with SD of 3.7) respectively, in group I as compared with 4.2 minutes (with SD of 2.7) and 6.1 (with SD of 2.9) in group II. Mean hospital stay was less in group I at 3.76 ± 0.85 days and, in group II, it was 5.36 ± 1.96 days ($p < 0.001$). Postoperative anesthesia requirement was 2.23 ± 0.62 days (339 ± 93 mg) and 5.36 ± 0.96 days (804 ± 144 mg) in groups I and II respectively ($p < 0.001$).

**Conclusion:** The RPL is a noninvasive and cost-effective method along with minimal scar mark. It has the advantages over OP of having fewer complications, less postoperative pain, better cosmesis, and less hospital stay.

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## INTRODUCTION

Treatment options for kidney stones are possible with noninvasive or minimally invasive approach including shock wave lithotripsy, ureteroscopy, or percutaneous nephrolithotomy (PCNL). There are considerable improvements in laparoscopic surgical techniques to the point that nearly any open surgery can be performed in a minimally invasive laparoscopic fashion.[1] For patients with ectopic kidney, the results of extracorporeal shock wave lithotripsy (ESWL) are only moderately successful and PCNL is difficult. Laparoscopic pyelolithotomy (LPL) is a viable alternative in such a situation. Lithiasis in kidneys that have some type of anatomical alteration is a particularly great challenge for the urologist, due to the fact that the abnormal anatomy prevents the use of the same disintegration or extraction access routes that are utilized in normal kidney units.[2]

The reports suggest that retroperitoneal laparoscopic pyelolithotomy (RLP), having procedural similarity to open pyelolithotomy (OP), is not only nephron sparing, but also nephron reviving and, consequently, could eventually become accepted as the procedure of choice in selected groups of patients with renal calculus disease.[3] Laparoscopic pyelolithotomy is the procedure of choice in certain conditions, i.e., the size of the stone, the need for concomitant open surgery, and inaccessibility to ESWL or PCN. Other indications are relative and include failure of stone clearance via PCN, ureteroscopy, or ESWL due to difficult extraction, stone composition (i.e., cystine), or anatomy (i.e., ectopic, pelvic, or horseshoe kidney). Pyelolithotomy is also indicated in combination with pyeloplasty without increasing morbidity or decreasing the success rate.[4]

## AIMS AND OBJECTIVES

The aim of this study was to study the efficacy, safety, and outcome of RLP. The study compared the advantages and complications of retroperitoneal pyelolithotomy (RPL) done laparoscopically with classical pyelolithotomy or OP.

## MATERIALS AND METHODS

The present prospective clinical study was carried out in the Department of Surgery, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Haryana, India, from January 2012 to December 2015. The study was approved by the ethical committee of Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana. A total of 280 patients of either sex and in the age group of 12 to 80 years were taken for the study. The results were compared in both techniques.

### Patient Selection

The study was divided into two groups. Consent was taken from patients on whether they wanted to opt for open procedure or laparoscopic procedure. Group I consisted of 160 patients who underwent RLP. Group II consisted of 120 patients who underwent OP. All patients were between age group of 12 and 80 years and had unilateral and bilateral solitary pelvic stones (1–3 cm). Patients with multiple calculi, congenital or acquired anatomical abnormalities (which preclude RLP), associated bleeding diathesis, pregnancy, intractable urinary tract infection, intrarenal pelvis, and recurrent/residual stones following open surgery were excluded from the study.

Preoperatively, age, weight, height, detailed history, dietary habits, general physical examination, and previous history of surgery were noted and recorded on patient's proforma. Routine baseline investigations like hemoglobin, total leukocyte count, differential leukocyte count with platelet count, blood sugar, serum electrolytes, chest X-ray, electrocardiogram, urine routine, microscopy and urine culture and sensitivity, blood urea, and serum creatinine were done in patients. Radiological investigations done mandatorily were X-ray kidney, ureter, bladder (KUB), ultrasonography KUB, and intravenous pyelography (IVP) (Fig. 1). Additionally, plain computed tomography scan and diethylene triamine pentaacetic acid scan were done when required. All patients were given routine preoperative and postoperative antibiotics in injectable form (ceftriaxone 1 gm, amikacin 500 mg, and metrogyl 100 mL). The patient was placed in a lateral decubitus position, and the kidney bridge was elevated to flatten out the lumbar region.

The RLP was performed using the same technique as in several standard laparoscopic renal procedures. In general, three to four port placements were used.

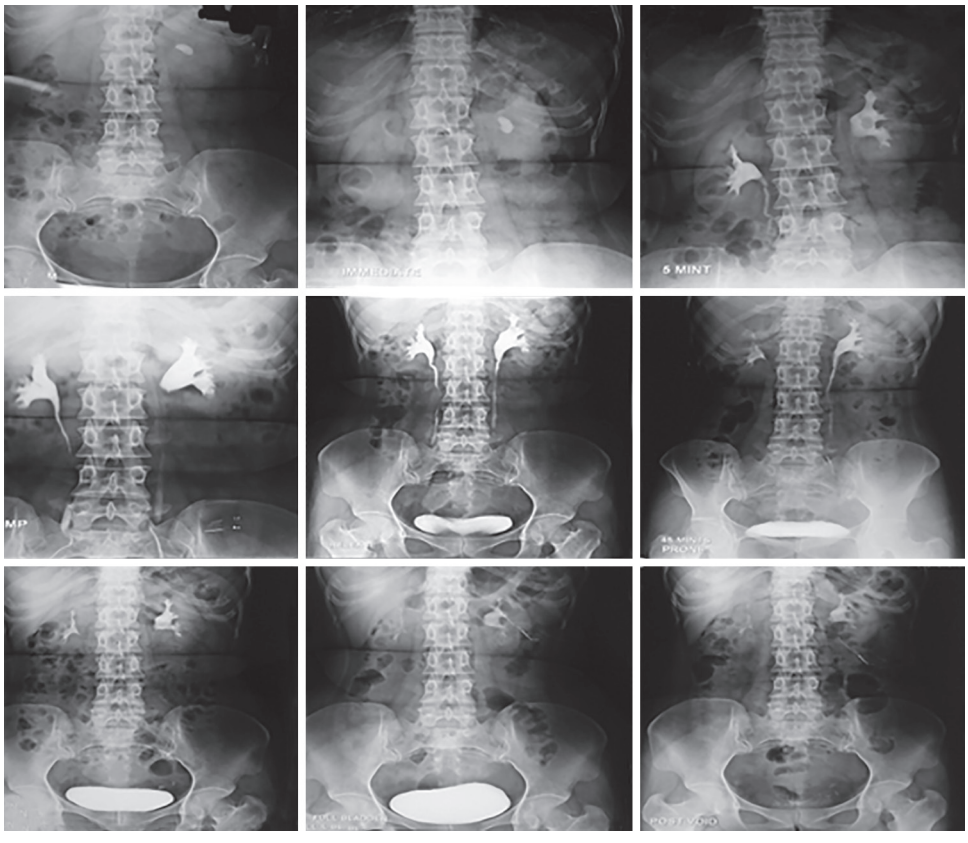


**Fig. 1:** Intravenous pyelography with a stone in pelvis of left kidney

**Fig. 2:** Landmarks for port placement for left LPL

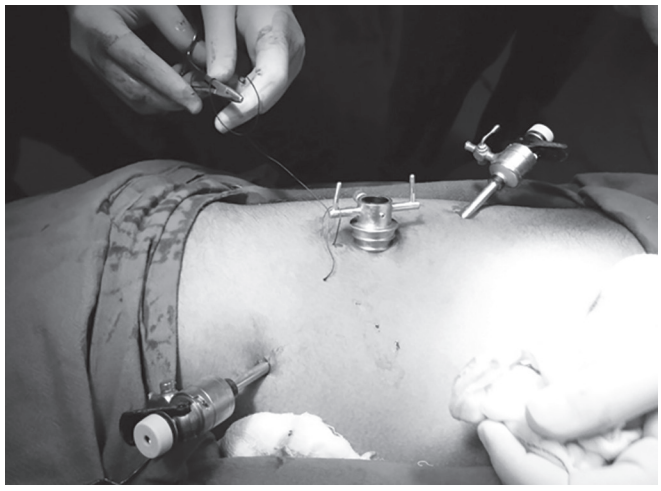

**Fig. 3:** Position of ports for performing left LPL

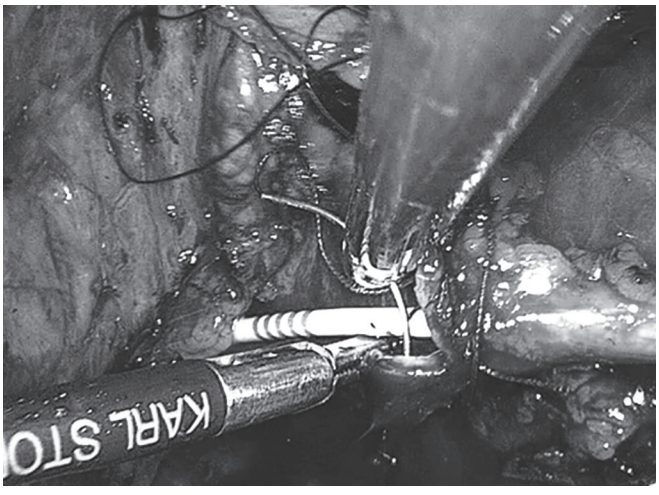

**Fig. 4:** Placement/insertion of DJ stent in renal pelvis and closure of pyelotomy being carried out laparoscopically

**Fig. 5:** Postoperative scar in a patient who underwent laparoscopic RPL at our medical center

The 1st port of size 1.5 cm was at renal fossa at the upper border of the erector spinae muscle (in the middle of the lower coastal rib and the coccyx) (Fig. 2). The balloon was inflated with water and kept inflated for 3 minutes to achieve adequate dissection and hemostasis. The 2nd port was established in the renal angle of size 5 mm (Fig. 3). The third port of 5 mm was made above the iliac crest, which was converted into an 8 mm port to insert the cold knife for pelvic incision. The renal pelvis was incised with endoscissor/cold knife.

The stone was grabbed with an endograsper or artery forcep, whichever was easier to hold the stone. The stone was pulled out of renal pelvis and kept near to the ureter. The ureteric stent was placed and the pelvis was closed with absorbable 4-0 vicryl suture (Fig. 4).

Cystoscope was inserted through the lower 5 mm port site and under evidence of cystoscope, the pelvic stone was removed through the 10 mm port incision site.

The patient was discharged on the 3rd or 4th day of surgery according to the condition of the patient. Drain was removed as soon as the drainage became minimal (<20 mL). Stiches were removed on the 10th postoperative day of the surgery (Fig. 5) X-ray KUB and ultrasound KUB were done to rule out retained stone postoperatively. All the patients were followed up for 6 months, initially at 15 days and thereafter 1 month and then at 3 and 6 months. At the end of the study, the data were collected and analyzed using appropriate statistical methods. The p-value $\leq 0.05$ was taken as the cutoff point for statistical significance.

## OBSERVATIONS AND RESULTS

The average age of patients in the RPL group was $37.1 \pm 12.29$ years and average age in the OP group was $46.66 \pm 10.39$ years. Male to female ratio was 2.33:1.

From Table 1, in group I, 112 (40%) of the cases were completed within 61 to 70 minutes and 140 cases (50%) were completed in >70 minutes. Hence, it was found that the maximum number of cases [140 (50%)] were completed in >70 minutes. Whereas in group II, similarly,

**Table 1:** Time taken for completion taken for completion of whole procedure (operative time)

| | Group I | | Group II | |
|---|---|---|---|---|
| *Time (minutes)* | *No. of patients* | *Percentage* | *No. of patients* | *Percentage* |
| 30–40 | 0 | 0 | 8 | 3.33 |
| 41–50 | 0 | 0 | 48 | 16.66 |
| 51–60 | 28 | 10 | 112 | 40 |
| 61–70 | 112 | 40 | 65 | 23.33 |
| >70 | 140 | 50 | 48 | 16.66 |

112 (40%) of the cases were completed within 51 to 60 minutes and 65 cases (23.33%) took 61 to 70 minutes; hence, most of the cases, i.e., 112 (40%), were completed within 51 to 60 minutes. Only eight cases took less than 40 minutes. The mean operative time for group I for completion of whole procedure was 75.33 ± 16.90 minutes and in group II, the mean time was 65.83 ± 12.35 minutes. Mean operative time was more in LPL group as compared with OP group, with significant difference at <0.001.

Table 2 shows perioperative and postoperative data of study population. Similarly, estimated blood loss ($p < 0.001$) and blood transfusion ($p > 0.05$, NS) needs were found to be less in LPL group as compared with OP group.

With regard to immediate complications noted in both the groups, 8 patients presented with intraoperative bleeding, 5 with stone migration, 10 with surgical emphysema, and 15 with difficulty in accessing renal pelvis; with regard to late complications, 5 patients reported with prolonged leak in group I, as compared with 8 patients of renal parenchymal injury, 8 each with bleeding and stone migration, 4 with difficulty in accessing renal pelvis, 8 with superficial wound infections and immediate complications, 4 with wound gapping, and 8 with prolonged leak in group II as shown in Table 3.

From Table 4, it is observed that total need of analgesia in terms of days (given in form of Inj diclofenac 75 mg im twice daily) was significantly less in group I as compared with group II, which were 2.23 with SD of 0.62 (339 ± 93 mg) and 5.36 with SD of 0.96 (804 ± 144 mg) respectively.

**Table 3:** Postoperative observations: Details of complications in both groups

| | *Complications* | *RPL (n = 160)* | *Open (n = 120)* | *p-value* |
|---|---|---|---|---|
| Immediate | Renal parenchymal injury | 0 | 8 | 0.150 |
| | Ureteric injury | 0 | 0 | |
| | Bleeding | 5 | 8 | 0.553 |
| | Stone migration | 5 | 8 | 0.553 |
| | Surgical emphysema | 10 | 0 | 0.150 |
| | Difficulty in accessing renal pelvis | 15 | 4 | 0.300 |
| | Fever | 0 | 0 | |
| | Superficial wound infection | 0 | 8 | |
| Late | Wound gaping | 0 | 4 | 0.150 |
| | Prolonged leak | 5 | 8 | 0.553 |
| | Lumber hernia | 0 | 0 | |

**Table 2:** Comparison of parameters between both groups

| *Procedure* | *LPL* | *Open* | *p-value* | *Exact p-value* |
|---|---|---|---|---|
| Mean Operative Time (min) | 79.33 ± 16.90 | 61.83 ± 12.35 | <0.001 | 0.0001 |
| Estimated Blood Loss (mL) | 40.7 ± 20.9 | 100.4 ± 50.8 | <0.001 | 0.0001 |
| Blood Transfusion (%) | 0 | 2 | >0.05 | 0.150 |

## DISCUSSION

Patloo et al[5] concluded that RPL for renal pelvic calculi is superior to open surgery because of the significantly reduced hospital stay, cost-effectiveness, and better cosmetic outcomes of the patients. Although the reduction in analgesia requirement and blood loss is not statistically significant, laparoscopic surgery is better than open surgery. Wang et al[6] studied the effectiveness and safety of LPL and PCNL as surgical management for solitary renal pelvic calculi larger than 2 cm. Patients managed with laparoscopy have more advantages, such as less blood loss, less postoperative pain and fever, a lower incidence of infection, and a higher stone-free rate. Sensitivity analysis indicated that all results were the same except that the stone-free rate showed no significant difference between the two groups. They concluded that LPL and PCNL were effective and safe for large renal pelvic calculi, but LPL seems to be more advantageous.

Haggag et al[7] investigated whether LPL could be used to manage large renal pelvic stones, generally considered excellent indications for PCNL. They included two groups with large renal pelvic stones 2.5 cm or greater. Group I included 40 patients treated by PNL and group II included 10 patients treated by LPL. There was a statistically significant difference between the groups regarding mean estimated blood loss (65 ± 12.25 *vs* 180 ± 20.74 mL), mean hospital stay (2.3 ± 0.64 *vs* 3.7 ± 1.4 days), rate of postoperative blood transfusion (0 *vs* 4.8%), and stone-free rate (80 *vs* 78.6%). The mean operative time

**Table 4:** Postoperative analgesia required in both groups

| | *LPL* | *Open* | *p-value* | *Exact p-value* |
|---|---|---|---|---|
| Postoperative Analgesia (days) | 2.23 ± 0.62 | 5.36 ± 0.96 | <0.001 | 0.0001 |
| Postoperative analgesia (mg) (Inj. Diclofenac 150 mg per day) | 339 ± 93 | 804 ± 144 | <0.001 | 0.0001 |

was significantly longer in group II (LPL)[13] (1 ± 22.11 *vs* 51.19 ± 24.39 minutes). They concluded PNL is the standard treatment in most cases of renal pelvic stones; LPL is another feasible surgical technique for patients with large renal pelvic stones.

Qin et al[8] assessed a retroperitoneal laparoscopic technique for treatment of complex renal stones. Seventy-five patients, including 53 men and 22 women with a mean age of 47.8 years, underwent retroperitoneal laparoscopy. They completed the procedure successfully in 73 cases, while 2 cases were converted to open surgery. The operative time was 85 to 190 minutes with a mean of 96 minutes. After the operation, seven patients experienced urinary leakage. They concluded that the procedure is safe for sparing the nephron, less bleeding, short hospitalization, and quick postoperative recovery.

Agarwal[9] compared the safety, efficacy, and outcomes of LPL with PCNL for the management of a single large (>2.0 cm) renal pelvic calculus. It included two groups: Group I included 18 patients treated by LPL and group II included 20 patients treated by PNL. The mean stone size in the LPL and PNL groups was 3.7 and 3.90 $cm^2$ respectively. There was one conversion to open surgery in the LPL group. There was no residual stone and no need of blood transfusion in the postoperative period in both groups. They concluded that retroperitoneoscopic pyelolithotomy (RPPL) was associated with longer operating time, more invasive and less cosmetics; required more analgesia; and had more blood loss as compared with PNL.

In a study conducted by Patloo et al[5] to compare RLP with OP, mean operative time was significantly less ($p < 0.001$) in the open group than in the laparoscopic group (74.83 *vs* 94.43 minutes). In a study by Yanev et al,[10] mean operative time for laparoscopic surgery was 88 minutes. In Farooq Qadri et al's study,[11] mean operative time for laparoscopic surgery was found to be 88 minutes. Leonardo et al[12] found that the mean operative time in laparoscopic surgery group patients was 85 minutes. Karami et al[13] found mean operative time of 82 minutes for laparoscopic surgery. Mean operation time was 85.48±15.11 minutes. Except for one stone migration and one conversion to open surgery, all the ureteral stones were extracted laparoscopically (94% success rate).[14] In our study, the mean duration of surgery in group I was 79 minutes (with SD of 16.90) and in group II, it was 61.83 minutes (with SD of 12.35). These results were statistically significant with approximate (approx.) difference of 18 minutes (Table 5).

In group I, pyelotomy closure time and DJ insertion time were 5.2 minutes (with SD of 4.3) and 9.8 (with SD of 4.3) respectively. In group II, pyelotomy closure time and DJ insertion time were 5.2 minutes (with SD of 4.3) and 9.8 (with SD of 4.3) respectively. It was found that pyelotomy closure time was more in group I as compared with group II, and time taken for DJ stent insertion was also more in group I as compared with group II.

**Table 5:** Comparison in mean operative time in various studies

| *Various studies* | *Mean operative time for laparoscopic procedure (min)* |
|---|---|
| Yanev et al[10] | 88 |
| Qadri et al[11] | 88 |
| Leonardo et al[12] | 85 |
| Karami et al[13] | 82 |
| Nasseh et al[14] | 85.5 |
| Qin C et al[8] | 96 |
| Patloo et al[5] | 74.83 |
| Present study | 79 ± 16.90 |

## Estimated Blood Loss

In a study conducted by Patloo et al[5] to compare RLP with OP, the mean blood loss was less in the laparoscopic group than in the open group (73 *vs* 103 mL). Qin et al[8] found average estimated blood loss in their study to be 80 mL in a study of laparoscopic retroperitoneal management of stone. Al-Hunayan et al[15] found average blood loss of 57.2 mL in their study of patients who underwent RLP. In our study, estimated blood loss was found to be 40.7 mL (with SD of 20.9 mL) in group I and 100.4 mL (with SD of 12.35 mL) in group II, and this difference of estimated blood was statistically significant. Blood transfusion was not required in any patient of group I, but required in two patients of open group (Table 6).

Goel et al[16] evaluated the role of RPPL for the management of renal pelvic calculus and its comparison with PCNL for solitary renal pelvic stone and found two conversions – one because of stone slippage and the other because of dense adhesions around the renal pelvis with conversion rate of 12.5%. Farooq Qadri et al[11] found a conversion rate of 2.4%; three patients were converted due to dense adhesion around the ureter. Agarwal[9] compared the safety, efficacy, and outcomes of laparoscopic pyelolithotomy (RPPL) with PCNL for the management of single large renal pelvic calculus (>2.0 cm). There was one conversion to open surgery in the RPPL group due to adhesions around the pelvis, and conversion rate was 5.55%. In the present study, 11 cases in the laparoscopic arm had to be converted to the open technique. Conversion rate was 6.67% (11 cases out of 160 cases

**Table 6:** Comparison of estimated blood loss in different studies

| *Studies* | *Blood loss (mL)* |
|---|---|
| Qin C et al[15] | 80 |
| Al Hunayan et al[16] | 57.2 |
| Patloo et al[5] | 73 |
| Present study | 40.7 ± 20.9 |

converted). There was failure to dissect the pelvis in both cases, and, hence, it was difficult to locate the site of calculus. Despite optimal port placement according to projected site of the calculus (from preoperative KUB X-ray and IVP), dissection was not possible and conversion was inevitable. On converting, the pelvis was found to be enveloped by peripelvic adhesions.

Chander et al[17] evaluated the role of RPPL in the management of renal calculi and found peritoneal rent in five cases, superficial wound infection in two cases, and prolonged leak in one patient. Yanev et al[10] in their study of retroperitoneal surgeries found subcutaneous emphysema in five cases (13.51%). Dongol et al[18] in their study for retroperitoneoscopic management of renal stones found three patients with peritoneal rent, two patients with port site superficial wound infection, and one patient with prolonged leak. In our study, with regard to immediate complications noted in both the groups, 8 patients presented with intraoperative bleeding, 5 with stone migration, 10 with surgical emphysema, 15 with difficulty in accessing renal pelvis; with regard to late complications, 5 patients reported with prolonged leak in group I as compared with 8 patients of renal parenchymal injury, 8 each with bleeding and stone migration, 4 with difficulty in accessing renal pelvis, 8 with superficial wound infections as immediate complication, 4 with wound gapping, and 8 with prolonged leak in group II (Table 3).

Agarwal[9] observed analgesia requirement in terms of days in a study conducted in laparoscopic group; it was 2.4 ± 0.9 days. In a study conducted by Chander et al,[17] analgesia required was 102 ± 47.7 mg of diclofenac. Haggag et al[7] found out in their study that postoperative analgesia requirement was 2.4 ± 0.9 days. In terms of postoperative analgesia requirement, it was observed that total need of analgesia in terms of days (given in form of Inj. diclofenac 75 mg im twice daily) was significantly less in group I as compared with group II, which was 2.23 (with SD of 0.62) and 5.36 (with SD of 0.96) respectively. In terms of dose of diclofenac required, it was found that significant difference was present in laparoscopic (339 ± 93 mg) and open (804 ± 144 mg) groups; analgesia required was less in the laparoscopic group.

Shamim and Iqbal[19] conducted studies in patients who underwent OP and found mean hospital stay of 5.37 days. Basiri et al,[20] in their study, found a similar hospital stay of 3.4 days in the RLP group of 30 patients. Ghanghoria et al[21] found that the mean hospital stay in the laparoscopic group was 4.4 days. Chander et al[17] evaluated the role of RPPL in the management of renal calculi and found an average hospital stay of 3.12 days. In this study, postoperative hospital stay was compared in both groups. The hospital stay in group I was 3.76 days (with SD of 1.55) and in group II, it was 5.36 days (with SD of 1.96).

## CONCLUSION

In conclusion, we would like to state that among the two approaches, namely RPL and OP, RPL is a safe, simple, and effective minimally invasive procedure with fewer complications, less postoperative pain, better cosmesis, and a lesser hospital stay period. It can provide an alternative to OP in almost all the cases.

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ORIGINAL ARTICLE

# Laparoscopic *vs* Abdominal Hysterectomy in the Management of Benign Gynecological Diseases: A Tertiary Hospital Experience in Punjab

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## ABSTRACT

**Objectives:**

- To compare laparoscopically assisted vaginal hysterectomy (LAVH) with total abdominal hysterectomy (TAH) in a retrospective analysis for the management of benign diseases.
- To evaluate average age, hospital stay, blood loss, intraoperative and postoperative complication rates, and postoperative pain management.

**Study design:**

- A retrospective case–control study in Christian Medical College and Hospital, Ludhiana, was carried out comparing LAVH) and TAH for a period of 1 year between November 2014 and October 2015.
- Sample size: A total of 124 patients (62 for LAVH and 62 for TAH).

**Results:**

- The LAVH is associated with shorter hospital stay as compared with TAH (3.3 and 5.8 days; $p < 0.001$), less amount of blood loss (176 and 420 mL; $p < 0.022$), and less number of postoperative complication rates (4.76 and 14.5%; $p = 0.061$).
- The LAVH is also associated with less number of blood transfusions. Only 8 patients required blood transfusion intra- or postoperatively following LAVH, and 25 patients for TAH.
- The operation time in LAVH is slightly longer as compared with TAH (173 *vs* 153 minutes; $p = 0.999$).
- Analgesic drug requirement to control pain was significantly less in LAVH. About 38.7% required continous opoid infusion pump following TAH, and only 6.35% following LAVH.

**Conclusion:**

- The LAVH is a safe and reliable alternative to open surgery in the management of benign gynecological diseases, with significantly reduced hospital stay and complications.


**Keywords:** Analgesia, Blood loss, Complications, Laparoscopically assisted vaginal hysterectomy, Total abdominal hysterectomy.

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## INTRODUCTION

Hysterectomy is one of the most common major operations performed in women, next only to cesarean section. In the United States, approximately 600,000 hysterectomies are performed each year. The highest rate of hysterectomy is between the ages of 40 and 49 years, with an average age of 46.1 years. Lower socioeconomic status contributes to increased hysterectomy rates.[1] In India, the mean age of a woman undergoing hysterectomy is much lower. A study conducted in Haryana state showed that the incidence of hysterectomy was 7% among married women.[2] Another study from Gujarat pointed out that 7 and 8% of rural women and 5% of urban women had already undergone hysterectomy at an average age of 37 years.[3]

There are no specific criteria that can be used to determine the route of hysterectomy.[1] The vaginal operation is preferable when there are no contraindications, as it has lower morbidity and quicker recovery. When laparoscopically assisted vaginal hysterectomy (LAVH) is done, it should be surgery should be carried out through vaginal route.[4] The abdominal approach is still being used by the majority of surgeons as the operation of choice, particularly when dealing with pelvic malignancy or for carrying out oophorectomy.[5]

The first LAVH was reported by Reich and De Caprio in 1989.[6] Since then, it has gained widespread acceptance throughout the world. Laparoscopic dissection of the parauterine tissues to the level of the uterine arteries also permits oophorectomy or dissection of adhesions under direct vision more easily than at vaginal hysterectomy (VH).[5,7]

Laparoscopy reduces the morbidity associated with laparotomy. It offers superior tissue image and anatomic view of the abdominopelvic cavity and, thus, facilitates better hemostasis and dissection. It allows the performance of adnexal surgery, ureterolysis, retroperitoneal dissection, and excision of endometriosis.[8]

Smaller incision, less postoperative pain, shorter hospital stay, and quicker return to normal activity are the main advantages of laparoscopy over laparotomy.[8]

## AIM

The aim of our study was to compare LAVH with total abdominal hysterectomy (TAH) in a retrospective analysis

for the management of benign diseases, in order to evaluate the average age of the patient, length of hospital stay, blood loss and blood transfusion, intraoperative and postoperative complication rates, and postoperative pain management.

## MATERIALS AND METHODS

A retrospective case–control study was carried out in the Department of Christian Medical College and Hospital, Ludhiana, comparing LAVH with TAH for a period of 1 year spanning from November 2014 to October 2015. Patients undergoing LAVH and TAH for benign conditions were identified. Medical records of the patients identified were then reviewed – factors examined included demographic details, indications for operation, intraoperative details, length of hospital stay, blood transfusion, and postoperative pain management and complications. A total of 124 files were reviewed, 62 for LAVH and 62 for TAH.

Data were processed and analyzed using Statistical Package for the Social Sciences (SPSS) (version 22.0). Statistical significance for differences was tested by student's t-test and $\chi^2$ test, and a p-value <0.05 was considered statistically significant.

### Exclusion Criteria

- Hysterectomy for malignant diseases
- Hysterectomy performed along with other surgical procedures like pelvic floor repair, cholecystectomy, hernia repair, etc.

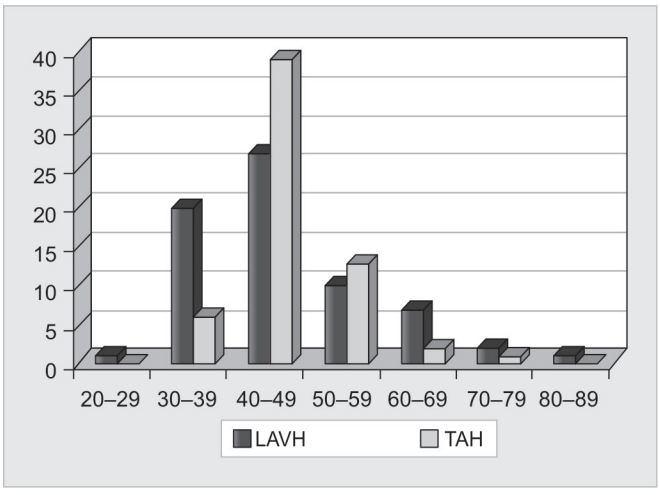
## RESULTS

Table 1 shows that the demographic characteristics, such as age, hemoglobin, and platelets levels were comparable between the two groups. The most common indications for surgery were abnormal uterine bleeding and fibroid uterus. Previous history of pelvic surgery was not significantly different between the two groups, and so did not have significant influence on the course of the study.

The average age in years of patients undergoing LAVH and TAH were 46.3 and 46.2 respectively (35–68 for LAVH and 22–89 for TAH), exactly matching the US data. The maximum number of patients in both groups fell in the age group of 40 to 49 years (Graph 1 and Table 1).

The average operating time was comparable between the two groups (LAVH was slightly longer). On an average, LAVH took 173 minutes (70–320 minutes), while for TAH, it was 153 minutes (60–300 minutes, p = 0.999).

Intraoperative complication rates (Table 2) were comparable between the two groups (LAVH 4.76% and TAH 6.45%, p = 0.275). However, postoperative complication rates (Table 3) were seen to be slightly higher in TAH as compared with LAVH (LAVH 4.76% and TAH 14.5%, p = 0.061). The common complications seen were ureteric injury, bladder injury, wound infection, and hemorrhage. One patient in the LAVH group developed vault sepsis, and there was no incidence of port site wound infection; seven patients who underwent TAH developed wound infection, including one burst abdomen.




**Graph 1:** Age distribution

**Table 1:** Demographic data of patients in both groups

| | *LAVH (n = 62)* | *TAH (n = 62)* | *p-value* |
|---|---|---|---|
| Age (years) | 46.28 ± 7.13* | 46.23 ± 11.69 | 0.51 |
| Hemoglobin | 11.20 ± 2.01* | 11.40 ± 1.66 | 0.27 |
| Platelets | 265.32 ± 10.13* | 264.98 ± 8.34 | 0.96 |
| *Previous pelvic surgery* | | | |
| Negative | 60 (96.8%)** | 58 (93.5%) | |
| Positive | 2 (3.2%)** | 4 (6.5%) | |
| *Indication for surgery* | | | |
| AUB | 31 (50%)** | 11 (17.74%) | |
| Fibroid uterus | 22 (35.48%)** | 31 (50%) | |
| PMB | 4 (6.45%)** | 3 (4.84%) | |
| Others | 5 (8.06%)** | 17 (27.42%) | |

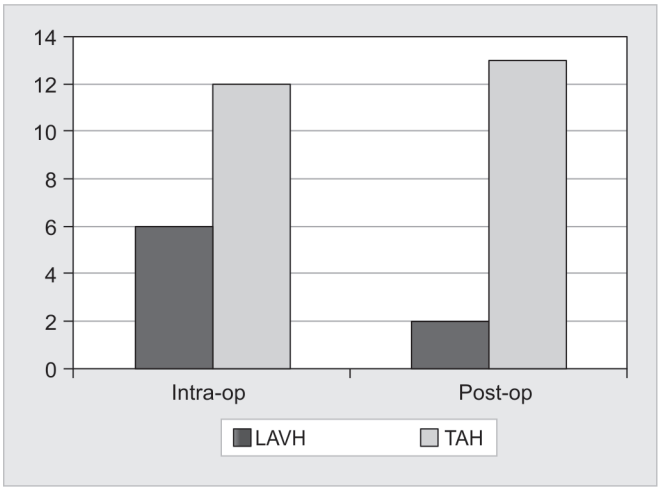
*Values are given as mean ± standard deviation; **Values are given as number with percentage in brackets; p value refers to t-test and $\chi^2$ test; AUB: Abnormal uterine bleeding; PMB: Postmenopausal bleeding

**Table 2:** Intraoperative complications

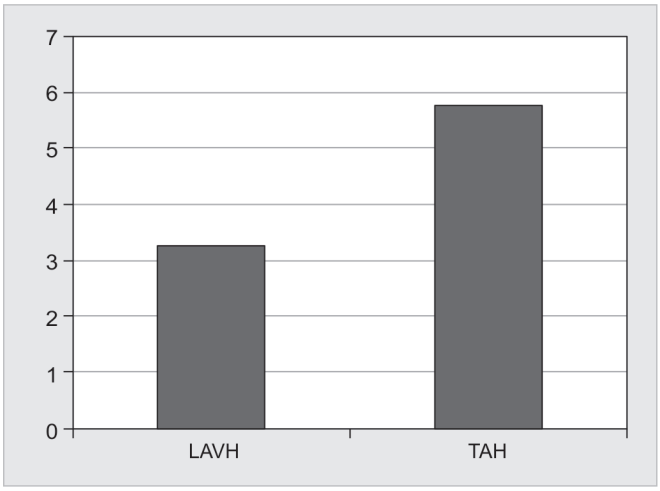
| *Intraoperative complications* | *LAVH (n = 62)* | *TAH (n = 62)* | *p-value* |
|---|---|---|---|
| Ureteric injury | 1 | 1 | 0.275 |
| Bladder injury | 0 | 2 | |
| Hemorrhage | 2 | 1 | |

**Table 3:** Postoperative complication

| *Postoperative complications* | *LAVH (n = 62)* | *TAH (n = 62)* | *p-value* |
|---|---|---|---|
| Wound infection | 1 | 7 | 0.061 |
| Chest complications | 1 | 1 | |
| Urinary complications | 1 | 1 | |




**Graph 2:** Blood transfusion




**Graph 3:** Blood loss

The average estimated blood loss was found to be more than double in TAH as compared with LAVH (100–2,300 mL for TAH and 100–1,500 mL for LAVH; $p < 0.022$) and, as such, was associated with a significantly more number of blood transfusions. Twelve patients received blood intraoperatively and 13 patients in the postoperative period. For LAVH, it was only 6 and 2 respectively (Graph 2).

Postoperative pain management was done either with a continuous opioid infusion pump, or with a fixed hourly dose of parenteral nonsteroidal anti-inflammatory drug and/or opioid. The number of patients requiring infusion pump following TAH was found to be 38.7%, while following LAVH, it was only 6.35%. Hence, pain was significantly less with LAVH.

The average length of hospital stay following LAVH was significantly reduced, as it is with all other laparoscopic procedures (Graph 3). In our study, we found that the average length of hospital stay was 3.3 days with LAVH, whereas following TAH, it was found to be 5.8 days ($p < 0.001$).

And finally, it is noteworthy to mention that among the LAVH group, there were only two cases of unplanned conversions to laparotomy. The first was a case of uterine vessel bleed, which could not be controlled laparoscopically. The second was a case of dense adhesion between the posterior uterine surface and bowel completely obliterating the Pouch of Douglas, which brings our conversion rate at 3.07%.

## DISCUSSION

The result of our study shows that LAVH is more comfortable and safer for the patient in terms of complications, pain, and length of hospital stay with reduced morbidity as compared with TAH, which is similar to the studies done by McCracken et al,[5] Asgari et al,[8] and Zesmin et al.[9]

It also shows that with experience and better exposure to the procedure, certain disadvantages of LAVH have been reduced. For example, studies done more than 10 years ago by Kulvanitchaiyanunt,[10] Jaturasrivilai,[11] and Carter et al[12] had consistently reported that LAVH was associated with equal amount of blood loss as compared with TAH. A study by Lowell and Kessler[13] showed that the mean blood loss and need for transfusion was higher in the LAVH group. However, in the present scenario, with better techniques, equipments, and experience, we have been able to reduce blood loss to a minimum and the need for blood transfusion with LAVH.

The same study done by Lowell and Kessler[13] showed that there was an increased risk of intraoperative complications with LAVH. However, in our study, the intraoperative complication rate was similar, and postoperative complication rate was actually higher following TAH.

Although studies done by Kongwattanakul and Khampital[14] showed comparable operating time between LAVH and TAH, in our present study, LAVH took slightly longer. We hope that in the near future, we can reduce this as well.

Since Reich and De Caprio described LAVH in 1989, the uptake of the procedure has been steadily increasing over the years and is likely to replace TAH in the management of benign diseases. Although the cost factor was not considered in our study, it is a well-known fact that laparoscopic procedures are costlier as compared with open procedures. However, the result of our study clearly shows that the benefit of LAVH outweighs the cost of the procedure. At present, we have been offering the procedure to almost all patients in our institution as the first choice for the management of benign disease, where feasible.

## CONCLUSION

The LAVH is a safe and reliable alternative to open surgery in the management of benign gynecological

diseases, with significantly reduced hospital stay and complications, and significantly less amount of pain and blood loss requiring transfusion.

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ORIGINAL ARTICLE

# Comparison of Three-port *vs* Four-port Laparoscopic Cholecystectomy in a Medical College in the Periphery

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## ABSTRACT

**Aims and objectives:** To compare three-port laparoscopic cholecystectomy (LC) with four-port LC in chronic *calculous cholecystitis* patients. We compared the feasibility of the procedure, total operative time, postoperative pain, incidence of complications, and cosmetic results.

**Materials and methods:** The present study was conducted in the Department of Surgery at Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala. Totally, 200 adult patients of cholelithiasis with chronic cholecystitis were included in the study. These cases were randomly divided into two groups (I and II) consisting of 100 cases in each group. The study was conducted for a period of 1 year from April 2014 to March 2015. Three-port LC was performed in group I patients and four-port LC was performed in group II. The cosmetic results, incidence of postoperative complications, and operative time were noted in both the groups.

The present study is being undertaken to compare the various merits and demerits of three-port LC *vs* four-port LC performed by the same surgical team in the same scenario, in terms of parameters mentioned subsequently and assess the feasibility of both the procedures in our setup in a medical college.

**Results:** Gallstone disease is found to be more common in the 4th and 5th decades. Mean age of presentation was 41 years. Three-port LC is difficult in cases of dense adhesions. There were significant differences in operative time (93.16 minutes for three-port LC and 50.66 minutes for four-port LC). There was no significant difference due to type of operation. Cosmetic appearances for both the procedures were comparable.

**Conclusion:** We concluded that both three-port and four-port cholecystectomies are equally good procedures in the hands of experienced laparoscopic surgeons. The complications, operative time, hospital stay, cosmesis, and disability days were comparable in both groups. The four-port technique should be accepted and adopted only by beginners in minimal access surgery. The operator who performs three-port LC should be prepared for placement of an additional port or conversion to open laparotomy whenever complication arises.



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**Keywords:** Cholecystectomy, Complications, Incision, Laparoscopy, Ports.

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## INTRODUCTION

The introduction of minimal access surgery for gallbladder surgery has revolutionized the treatment of gallstones. The advantages of laparoscopic procedure are lesser postoperative pain, lesser incidence of surgical site infection and shorter hospital stay.[1] Abdominal incision has been reduced to four (or more) small stab incisions. This approach significantly causes less postoperative pain, less bleeding, short hospital stay, and a good cosmetic outcome. The benefits were assessed very soon afterward: Less postoperative pain, shortened hospital stay, rapid recovery, and better cosmetic results. As the technique became a routine procedure, modifications were made in order to make it less invasive and more cosmetic.[1] Later, technical advances introduced the 5-mm laparoscope and the 5-mm clip appliers, thus decreasing the port size, and later, the newer 2- or 3-mm instruments allowed the surgeons to make smaller incisions. The use of a working channel laparoscope made it possible to use only two ports, along with transdermal sutures and needles, for an easier manipulation of the gallbladder. Natural orifice transluminal endoscopic surgery (NOTES) has been shown to offer further improvements in advantages of laparoscopic cholecystectomy (LC), i.e., decreased pain, early ambulation, and better cosmesis.[2] Gallstone disease has been known since long as far as the 5th century when Greek physician Trallianus wrote about gallstones.[3] Nowadays, LC is the gold standard for the treatment of symptomatic gallstones.

Gallstones are remarkably common, especially in female population, and are a major expensive health problem. Its prevalence has become more apparent since the introduction of ultrasonography. The incidence of cholelithiasis in the United States is reported to be 10%. In addition to these 20,000,000 people with documented cholelithiasis, another 800,000 new cases are diagnosed annually[4] and 500,000 cholecystectomies are being

performed annually.[5] The advantages of laparoscopy over conventional or classic surgery include decreased pain, improved cosmetic results, and a decreased duration of hospital stay. For this reason, LC is nowadays performed through fewer and smaller ports. In recent years, multiple studies of single-incision laparoscopic surgery (SILS) have been published. The only reported advantage of SILS over standard LC is an improved cosmetic result.[6,7] Four-port LC is most commonly used, as this method provides better anatomic views and is easier to learn.[8] This study has been undertaken to assess the feasibility of three-port LC and compare its advantages and disadvantages over the standard four-port technique.

## MATERIALS AND METHODS

A total of 260 adult patients with cholelithiasis of either sex and in the age group of 18 to 60 years, admitted to the surgical wards of the Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, from April 2014 to March 2015, were taken up for the study. From this group, 60 patients were excluded as they did not meet the inclusion criteria.

The patients were divided into group I: Three-port LC and group II: Four-port LC, as 100 in each group.

All the cases of chronic calcular cholecystitis were included in the study, and the cases diagnosed with acute cholecystitis, empyema gallbladder, perforation gallbladder, and contraindications for laparoscopic surgery were excluded from this study.

In all the cases, relevant history, general physical examination, and the routine blood and radiological investigations were done as per proforma attached, to confirm the diagnosis and assess medical fitness of the patients.

### Procedure of Laparoscopic Cholecystectomy

All the patients were given an injection of ceftriaxone 1 gm intravenously before the procedure. Patients were asked to empty the urinary bladder before moving to the operation theater. All patients were operated under general anesthesia. A nasogastric tube was inserted and stomach aspirated, in cases where stomach was distended.

The Veress needle was inserted through a stab incision in the supraumbilical region. Once the needle tip entered the free peritoneal cavity, it was connected to the pneumoinsufflator and insufflated until the pressure was raised to 10 mm Hg. The Veress needle was removed and then at the site of Veress needle puncture a 10- mm safety trocar was inserted. When the trocar reached the abdominal cavity, it was removed and a telescope was introduced through the cannula. Operating table was tilted, head end up and right side up. Then 10-mm working port in the subxiphoid (epigastric) area was inserted.

In group II patients, two 5-mm ports in the right midclavicular line subcostally and in the anterior axillary line at the level of the umbilicus were put. In patients of group I, a 5-mm port was put in the right midclavicular line. In patients of group II, the fundus of the gallbladder was grasped through the lateral port and retracted above the liver margin. In patients of group I, the gallbladder fundus was retracted toward the superolateral direction with the help of atraumatic grasper.

After port placement, posterior dissection of the Calot's triangle was started. Once posterior dissection was complete, anterior dissection of Calot's triangle was done. A large window between the cystic duct and cystic artery was made. The junction of the cystic duct and common bile duct was identified. Then two proximal and one distal LIGACLIPs were applied on the cystic duct. The cystic duct was then cut off in between the clips. Cystic artery was either coagulated with bipolar cautery or was divided between the two clips. Then, the gallbladder was removed from the liver bed using a hook dissector. The gallbladder was extracted through the subxiphoid port. Subhepatic drain was used in selected cases if postoperative bleeding or bile leakage was expected. Operative time from start of procedure (supraumbilical incision) to the closure of the wound was noted down.

Postoperative assessment included temperature, pulse, blood pressure , postoperative pain, and postoperative analgesia requirements. After surgery, postoperative complications were recorded on day 1 and after day 7. The findings noted down for the patients in the two subgroups were compared, and results were evaluated at the end of this study.

## OBSERVATIONS

In the present study, we have compared the two methods of LC, i.e., three-port LC and the standard four-port LC.

Cases were divided into two groups of 100 each randomly and were designated as groups I and II. In group I, three-port LC was performed and in group II four-port LC was performed.

Most of the patients in the present study were in the age group of 31 to 40 years (33%), ranging between 18 and 60 years, with a mean age of 39.33 years.

### Table of Age Distribution

Regarding symptoms, all the patients had pain as their chief complaint. So, pain was the single most driving force for the patient to seek treatment. Vomiting was present in only 22 to 24% of the patients, especially during acute attacks (Table 1).

**Table 1:** Symptoms

| Symptoms | Group I (no. of patients) | Group II (no. of patients) |
|---|---|---|
| Pain | 87 | 90 |
| Vomiting | 22 | 24 |
| Dyspepsia | 84 | 89 |
| Fever with jaundice | 4 | 2 |

**Table 2:** Ultrasound findings

| Ultrasound findings | Group I (100) | Group II (100) |
|---|---|---|
| Multiple stones | 63 | 40 |
| Single stone | 37 | 60 |
| Group I | | 2 |
| Group II | | 10 |

### Ultrasound Findings

In group I, 63 patients (63%) had chronic cholecystitis with multiple stones on ultrasound study and 37 patients (37%) had chronic cholecystitis with solitary stone. In group II, 40 patients (40%) had chronic cholecystitis with multiple stones on ultrasound study and 60 patients (60%) had chronic cholecystitis with solitary stone (Table 2).

Two patients (2%) in groups I and 10 patients (10%) in group II had undergone previous lower abdominal surgery.

Three patients (10%) of groups I were converted to four-port LC, and none of the patients of group II were converted to open cholecystectomy.

Mean operative time in three-port LC was 93.16 minutes and 50.66 minutes in four-port LC. This difference in time is significant as p value. The shortest period for cholecystectomy was 30 minutes, and the longest period was 150 minutes. No cholecystectomy was done within 40 minutes in group I, but in 10 patients (33%), cholecystectomy was done within 40 minutes in group II.

In 8 patients (27%) of group I, dissection of Calot's triangle was easy, and in 22 patients (73%), dissection of Calot's triangle was difficult. In 15 patients (50%) of group II, dissection of Calot's triangle was easy, and in 15 patients (50%), dissection of Calot's triangle was difficult.

Mean number of injections of analgesic (diclofenac) required in group I was 1.1 and in group II 1.0. Twenty-five patients (83%) in group I required one injection of analgesic postoperatively, and 29 patients (97%) in group II required one injection of analgesic postoperatively.

## DISCUSSION

Laparoscopic cholecystectomy is considered to be the procedure of choice for elective cholecystectomy.[9] With the increasing experience in advanced laparoscopic techniques, LC is performed by

- Four ports of entry into the abdomen (standard procedure)
- Three ports of entry into the abdomen
- Two ports of entry into the abdomen
- Single port of entry into the abdomen (SILS)
- NOTES[9]

Some surgeons observed that LC can be performed safely in the majority of cases by the three-port method. It is safe and requires conversion to four-port method in only a minority of the cases.[10] In most of the cases the fascia was not closed and no port site hernia was seen on follow-up of these was patients. Rikki et al performed 200 cases of LC in 2 years time and fascia was not closed in all of them and no port site hernia was seen in follow-up of these patients[11] with time, many refinements have been made in decreasing the port number and port size leading to evolution of the three-port LC, two-port LC, and even single-port LC. The SILS has been recently developed as an alternate approach to standard four-port LC. In this technique, a single transumbilical incision is used to either have three ports through the sheath or have an adaptor with an inbuilt three-port system. It has been shown to offer significant improvement in port-related complications, but is still not widely used due to lack of standardization of instruments and a significantly long learning curve.[11]

In the present study, we have compared the two methods of LC, i.e., three-port LC and the standard four-port LC. Cases were divided into two groups of 100 each randomly and were designated as groups I and II. In group I, three-port LC was performed, and in group II, four-port LC was performed. Most of the patients in the present study were in the age group of 31 to 40 years (33%), range between 18 and 60 years, with a mean age of 39.33 years. Regarding symptoms, all the patients had pain as their chief complaint. So, pain was the single most driving force for the patient to seek treatment. Vomiting was present in only 3% of the patients.

In the present study, there was no bleeding due to vessel injury and its incidence is low because the number of cases was less.

In the present study, there were gallbladder perforations iatrogenically with spillage of stones in 10 patients (33%) in group I and 3 patients (10%) in group II.

The complications arising from dropped gallstones in LC patients are subsequent abscesses and inflammatory masses containing gallstones or stone fragments.[12] Morishita et al[13] reported that spilled stones floating free in the peritoneal cavity may migrate to the pelvic area and become embedded there in the cul-de-sac, causing a severe reaction. Due to the subsequent inflammatory reaction, the fertility may be adversely affected in females.

Duration of operation through three-port LC was an average 31 minutes and in four-port LC was 31.3 minutes.[8]

The mean operative time of three-port LC was 33.66 minutes and for four-port LC was 33.33 minutes, and it was statistically insignificant.[9] Among the variables studied, only mean operative time was statistically significant, with the LC one-port technique showing a longer duration of the surgical procedure ($p = 0.007$).[1]

The mean operating time in the three-port group (44.00 ± 7.217 minutes) and four-port group (47.60 ± 6.633) was comparable ($p = 0.073$).[14] In our study, it was taken as time from skin incision to skin closure. Also, as the experience of the surgeons grows in both the procedures, the operative time decreases.

Drain was used in nine patients (30%) of group I and four patients (13%) of group II. On the 1st postoperative day, mean volume drained in four-port LC group was 8.66 ± 22.85 mL and in three-port LC group, this was 24.66 ± 33.80 mL.

The volume of fluid in drain was more in three-port LC group than in four-port LC group, and this difference is statistically significant ($p < 0.05$).

Drains were necessary in 20 (20%) of the three-port procedure patients, and all drains were removed by the 1st postoperative day.[8]

Assessment of pain was done by the number of doses of the analgesic required by the patients in the first 48 hours in both the groups. Analgesic used in the study was injection diclofenac. It was seen that the mean analgesic required in group I was 1.10 doses as compared with 1.03 doses in group II. Ten percent patients of both the groups required only two injections of diclofenac.

The mean analgesic requirement in four-port LC is less than that of three-port LC, but the difference is not statistically significant.

Pain scores showed differences during the recovery time, with less pain in the LC one port, but at 4 and 24 hours, there were no differences. At 5 and 8 days, patients from the LC one-port group reported more pain than the LC two-port or LC three-port groups.[1]

Postoperative pain ($p < 0.008$) and analgesic requirement ($p < 0.001$) were significantly less in the three-port group when compared with the four-port group.[14]

In the present study, patients were discharged from the hospital when they were fit and after getting their consent to go home. The mean hospital stay in three-port LC group was 3 days as compared with 4 days in the four-port LC group. Some of the patients wanted to go home after the removal of their stitches, as the cost of transportation to their villages was more than the cost of stay in the hospital. This factor was kept in mind while discharging the patients, and this led to late discharge of some of the patients. The difference in mean hospital stay in both the groups is statistically not significant.

The average hospital stay of patients was 1.1 days (1–2 days) in the three-port procedure. Length of hospital stay was similar in three-port and four-port LCs ($p = 0.312$).[8] Hospital stay was significantly less in three-port group compared with the four-port group ($p < 0.004$) owing to postoperative pain score.[14]

In the postoperative period, during hospital stay and during follow-up visits at 1 week, 1, 2, and 3 months, patients were asked for evaluation of their respective operations. Factors included were improvement in symptoms, return to normal activity, and cosmetic results. More than 77% patients in both the groups had assessed their respective procedures as good. Only 18% of the patients assessed their procedures as very good, but none complained of poor outcome after their operation.

Regarding evaluation of cosmetic results, patients in both the groups had accepted their scars as cosmetically good.

The difference in patient acceptance for the two groups is not statistically significant, so it can be said that the outcome of both the operations for the patients is similar.

Three-port LC is technically feasible, is safe, achieves good results, and is similar to those achieved with the four-port technique, with less postoperative analgesia, less assistance, and less number of scars, and so had better cosmetic appearance and was less expensive. Hence, we recommend it as a routine procedure in elective LC.[9]

The most important aspect of any surgical procedure is its safety and complications. Some surgeons have expressed concerns about the safety of the three-port technique, arguing that it may lead to a higher percentage of bile duct injuries.[15]

In our study the process of pneuoperitoneum creation in both these groups was done either by open or closed method randomly as the two methods are equally effective and feasible as evidenced in literature.[16]

## CONCLUSION

We conclude that both three-port LC and four-port LC are equally good techniques in the hands of experienced laparoscopic surgeons, with comparable operative time, pre- and postoperative complications, analgesic requirement, hospital stay, cosmesis, and disability days. The four-port technique should be accepted and adopted only by surgeons experienced in laparoscopic surgery and familiar with the three-port technique as it is more difficult to perform, particularly in patients with adhesions. The operator who performs the three-port LC should be prepared for placement of an additional port or conversion to open laparotomy whenever complication arises.

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ORIGINAL ARTICLE

# Clipped *vs* Clipless Laparoscopic Cholecystectomy using the Ultrasonically Activated (Harmonic) Scalpel

[1]Mohammed Hamdy Abdelhady, [2]Asaad F Salama


## ABSTRACT

**Introduction:** Laparoscopic cholecystectomy (LC) is the "gold standard" in the treatment of symptomatic gallbladder lithiasis. Monopolar hook, i.e., used currently is associated with some complications, such as the risk of thermal injuries and biliary complications. The ultrasonically activated (harmonic) scalpel has been increasingly used for dissection of the gallbladder and for division of vessels and the cystic duct, because it reduces the risk of thermal injuries with encouraging results.

**Materials and methods:** In this prospective study, 60 patients with gallbladder stones were planned to do LC. Patients were randomly assigned to either group I, including 30 patients who were subjected to traditional LC using cautery and clip applier, or to group II, including 30 planned for clipless cholecystectomy using harmonic (Ethicon Endosurgery Ultracision Harmonic Scalpel, Generator 300).

**Results:** Neither minor nor major bile leaks were encountered in either groups. Similarly, no bile-duct injuries were encountered in the present study. The incidence of gallbladder perforation was less in group II. Operative time was significantly shorter in group II ($p = 0.032$). Mean hospital stay was significantly less in group II ($p = 0.046$). No statistically significant difference was found in the incidence of postoperative complications between both groups.

**Conclusion:** The harmonic shears are as safe and effective as the commonly used clip and cautery technique in achieving safe closure and division of the cystic duct in the LC. Further, it provides a superior alternative to the currently used high-frequency monopolar technology in terms of shorter operative time and lower incidence of gallbladder perforation.


**Keywords:** Clipless, Harmonic scalpel, Laparoscopic cholecystectomy.

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## INTRODUCTION

The surgical management of gallstones has been revolutionized after the advent of laparoscopic cholecystectomy (LC). Laparoscopic cholecystectomy is the optimal treatment for patients with symptomatic cholelithiasis. It has a positive impact on the postoperative quality of the patient's life as well as optimal short- and long-term results.[1]

The standard LC is commonly performed by means of specialized instruments. The electrosurgical dissector, hook, spatula, and/or scissors, using high-frequency monopolar electrocautery, have been used in most centers for dissection of gallbladder and adhesions. Metal clips were the most frequently used technique to achieve both cystic duct and artery closure. Alternative techniques for cystic duct closure have included sutures, either extracorporeal or intracorporeal knots. However, these alternatives are technically more difficult and, therefore, were used infrequently.[2]

Several reports have revealed several injuries and postoperative complications due to the current technology and technique of LC. These include deep tissue damage with possible distant tissue damage by the high-frequency electrocautery involving vascular and biliary structures in the vicinity of the cystic duct and artery, bile leakage due to slippage of the clips, and visceral and solid organ injuries due to frequent instrument exchange, which is sometimes performed without optic guidance.[3]

The ultrasonically activated (harmonic) scalpel was designed as a safe alternative to electrocautery for the hemostatic dissection of tissue and was introduced into clinical use nearly two decades ago. This innovative method of cutting tissue was based upon the coagulating and cavitational effects provided by a rapidly vibrating blade contacting various tissues.[4]

The resulting decrease in temperatures, smoke, and lateral tissue damage placed the harmonic scalpel in contrast to the effects seen with the more traditional electrocautery. In addition, the elimination of inadvertent, sometimes unrecognized, electrical arcing injuries with their potentially hazardous sequelae supported the role of the harmonic scalpel as a potentially safer instrument for tissue dissection.[5]

The replacement of scissors, dissector, and clips applicator with the harmonic scalpel gives the opportunity

to use a single instrument during the whole surgical procedure, limiting the number of passages through the trocars and consequently, reducing the possibility of causing lesions to the intraabdominal organs.[6]

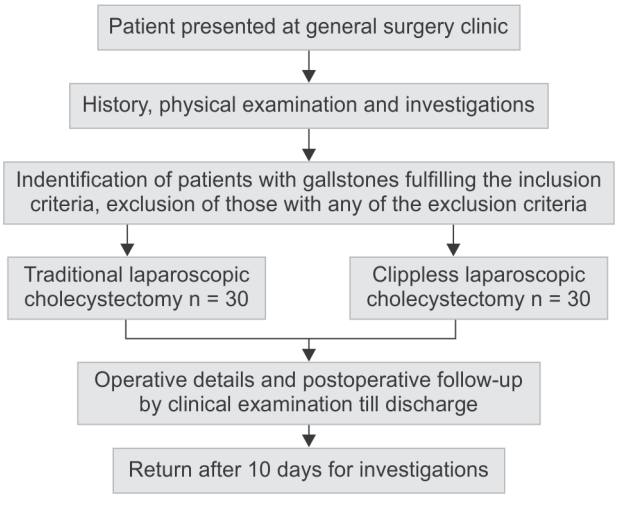
The aim of this work is to compare clipped *vs* clipless cholecystectomy using the ultrasonically activated (harmonic) scalpel as regards safety and feasibility, with the aim of developing possible nonsophisticated harmless technique and has been ethically approved.

## MATERIALS AND METHODS

In this 2 years duration of prospective randomized study, 60 patients with gallbladder stones planned to do LC were randomly assigned using the sealed-envelope technique to either group I, including 30 patients who will be subjected to traditional LC using clip applier, or be compared with group II, including 30 planned clipless cholecystectomy using harmonic (Ethicon Endosurgery Ultracision Harmonic Scalpel, Generator 300).

Patients with symptomatic gallstones disease proved by ultrasound (U/S) were the only selection criterion. Exclusion criteria include contraindication of LC, abnormal laboratory investigations, and unfavorable anatomy intraoperatively.

### Study Pathway




Preoperative assessment consisted of history taking, general and local examination. Preoperative investigations include a complete blood count, international normalized ratio, assessment of liver and renal function (ALT, total bilirubin, direct bilirubin, albumin, alkaline phosphatase, serum creatinine), and pelviabdominal U/S.

### Operative Technique

Group I performed traditional LC. The anesthetized patient was placed supine on the operating table. The pneumoperitoneum was achieved with a closed (Verres needle) method, via an infraumbilical transverse incision. The peritoneal cavity was carefully insufflated with warmed $CO_2$ to a pressure of 12 mm Hg. A 30° laparoscope was introduced via the umbilical port and the peritoneal cavity was inspected. The second 10-mm port was inserted under direct vision in the midline in the epigastrium, passing just to the right of the falciform ligament, toward the gallbladder. Two 5-mm ports were introduced, one in the right mid-clavicular and one in the right mid-axillary line, angled toward the gallbladder. Patient was placed in a steep reverse Trendelenburg position with a left down tilt. Any adhesions between the gallbladder and omentum or duodenum were divided, and the gallbladder fundus grasped and retracted toward the patient's right shoulder. A 5-mm grasper was then placed on Hartmann's pouch and, was retracted to the patient's right, opening up the porta hepatis. The anterior and posterior peritoneum over the neck of the gallbladder was then divided with a diathermy hook, and Calot's triangle was carefully dissected. Once the cystic duct and cystic artery are clearly identified, the cystic artery was clipped and divided. The cystic duct was then clipped proximally and distally and then divided. The gallbladder was carefully dissected off the gallbladder bed. Prior to the final disconnection, and using the gallbladder as a retractor, hemostasis of the gallbladder bed was secured and the positions of the clips placed on the cystic duct and the cystic artery were checked. The dissection was then completed and the gallbladder was retrieved via the epigastric port. In case of gallbladder perforation, it was retrieved in a bag, with every effort made to aspirate the bile and recover any spilt stones. The pneumoperitoneum was then released and the ports were removed. The wounds were infiltrated with local anesthetic and closed with skin clips.

Group II performed LC using harmonic ACE shears as single working instrument till skeletonization of both cystic duct and artery (Figs 1 and 2), for closure and division of both the cystic duct and artery, harmonic was set at the power level "2," which is translated into less cutting and more coagulation. First, it was ascertained that there were no microcalculi in the lumen of the cystic duct by moving the jaws of the harmonic ACE shears up and down. Second, the cystic duct was inserted between the jaws at a safe distance from common bile duct to avoid damage to this structure; then the jaws were closed until a click was heard. Third, the harmonic was activated at the power level "2," and during this phase, great care was taken to avoid stretching or rotating cystic duct but rather to keep it still until the gallbladder was detached from the cystic duct (Figs 3 and 4). Fourth, the cutting points of the cystic duct were checked for any bile leakage.

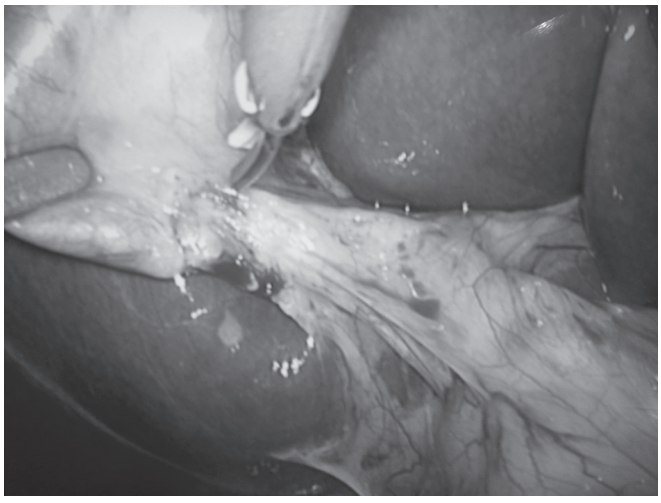


**Fig. 1:** Dissection of Calot's triangle

**Fig. 2:** Skeletonization of cystic duct and artery

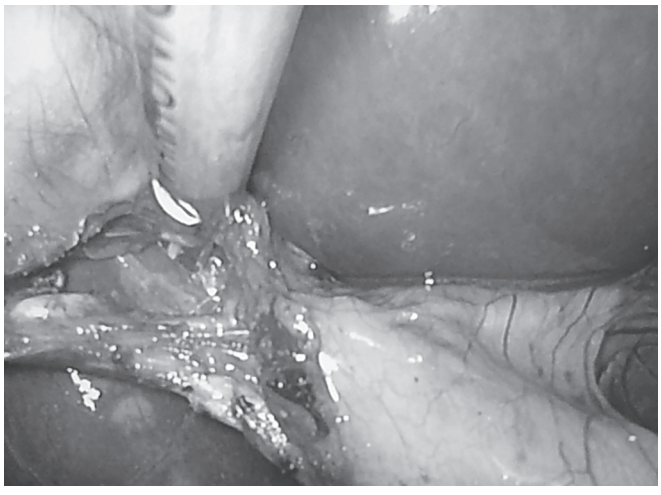


**Fig. 3:** Coagulation and cutting of cystic artery

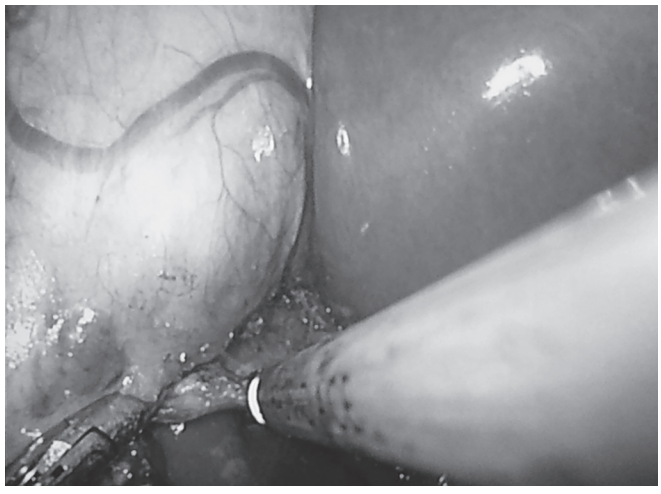


**Fig. 4:** Coagulation and cutting of cystic duct

Finally, dissection of gallbladder bed and extraction of gallbladder done.

Operative data including the operative time, intraoperative difficulties, and postoperative complications in the form of bile leak and wound infection were recorded.

The postoperative analysis included postoperative follow-up in the form of clinical examination (pulse, temperature, blood pressure, respiratory rate, and abdominal examination) till discharge and postoperative investigations in the form of full blood count, assessment of liver (ALT, total bilirubin, direct bilirubin and alkaline phosphatase), pelvi-abdominal U/S at day 10 with special attention to the presence or absence of any subhepatic collection, hospital stay. Patients were discharged once tolerating oral feeding and clinically free to return at day 10 for laboratory investigations and pelvi-abdominal U/S.

### Statistical Analysis

The statistical analysis of data was done by using Excel program for figures and Statistical Package for the Social Sciences (Inc., Chicago, IL) program, version 17. The description of the data was done in the form of mean ± SD for quantitative data and frequency and proportion for qualitative data. The analysis of the data was done to test statistical significant difference between groups. For quantitative data, Student's t-test was used to compare between two groups. Chi-square test was used for qualitative data and odds ratio for risk assessment.

## RESULTS

This study included 60 patients, 46 females (76.7%) and 14 males (23.3%) with symptomatic gallstone disease, with a mean age of 39 years (19–79 years). Following randomization, patients were assigned to either group I, including 30 patients who was subjected to traditional LC using clip applier, or be compared with group II, including 30 patients who was subjected to clipless cholecystectomy using harmonic scalpel. No statistically significant difference was found in age, sex, and associated comorbidities between both groups (Table 1).

**Table 1:** Demographic data, clinical characteristics, and associated comorbidities

| | *Overall (n = 60)* | *Group I (n = 30)* | *Group II (n = 30)* | *p-value* |
|---|---|---|---|---|
| *Age "years"* | | | | |
| Range | [19:79] | [23:58] | [19:79] | 0.81 |
| Mean ± SD | 39 ± 11.6 | 39.5 ± 10.6 | 38.8 ± 12.7 | |
| *Sex no. of patients (%)* | | | | |
| Female (%) | 46 (76.7%) | 24 (80%) | 22 (73.3%) | 0.54 |
| Male (%) | 14 (23.3%) | 6 (20%) | 8 (26.7%) | |
| *D.M.* | 17 (28.3%) | 9 (30%) | 8 (26.7%) | 0.77 |
| Hypertension | 13 (21.7%) | 6 (20%) | 7 (23.3%) | 0.75 |
| Ischemic heart disease | 4 (6.7%) | 2 (6.7%) | 2 (6.7%) | 1 |

**Table 2:** Operative data

| | *Group I* | *Group II* | *p-value* |
|---|---|---|---|
| *Operative time* | | | |
| Range | [38:115] | [28:98] | 0.032* |
| Mean | 58.6 ± 19 | 48.4 ± 16.9 | |
| *Operative time without gallbladder perforation* | | | |
| Range | [38:90] | [28:85] | 0.024* |
| Mean | 55.5 ± 14.1 | 46.6 ± 14.3 | |
| *Operative time with gallbladder perforation* | | | |
| Range | [45:115] | 98 | 0.85 |
| Mean | 86.6 ± 36.8 | 98 | |
| *Gallbladder perforation* | 3 (10%) | 1 (3.3%) | 0.31 |

The procedure was completed laparoscopically in both groups. The mean operative time in group I was significantly longer than group II with mean (58.6 *vs* 48.4 min) (p = 0.032). The incidence of gallbladder perforation is higher in group I than group II (20 *vs* 6.66%), (p = 0.31). Gallbladder perforation has been found to lengthen the operative time in both studied groups (p = 0.85) (Table 2).

Neither minor nor major bile leaks were encountered in either group. Similarly, no bile-duct injuries were encountered in the present study. Wound infection was same in groups I and II (3.3%) of no statistical significance (Table 3).

Early discharge on "day 1" occurred in 27 patients in group II (90%) *vs* 21 in group I (70%), postoperative discharge on day 2 was higher in group I than in group II [8 (26.7%) *vs* 3 (10%)], delayed discharge of more than 2 days was only for one patient in group I [1 (3.3%) (p-value = 0.13)]. The mean hospital stay in group II (1.1 ± 0.30) is less than that in group I (1.33 ± 0.54) with statistical significance (p-value = 0.046) (Table 4).

Three months after the procedure, all patients were doing well with uneventful follow-up.

**Table 3:** Postoperative complications

| | *Overall (n = 60)* | *Group I (n = 30)* | *Group II (n = 30)* | *p-value* |
|---|---|---|---|---|
| Biliary leak | 0 | 0 | 0 | |
| Wound infection | 2 (3.3%) | 1 (3.3%) | 1 (3.3%) | 1 |

**Table 4:** Hospital stay

| | *Overall (n = 60)* | *Group I (n = 30)* | *Group II (n = 30)* | *p-value* |
|---|---|---|---|---|
| 1 day | 48 (80%) | 21 (70%) | 27 (90%) | 0.13 |
| 2 days | 11 (18.3%) | 8 (26.7%) | 3 (10%) | |
| More than 2 days | 1 (1.7%) | 1 (3.3%) | 0 | |
| Mean ± SD | 1.21 ± 0.45 | 1.33 ± 0.54 | 1.1 ± 0.30 | 0.046* |

## DISCUSSION

Several studies have confirmed the effectiveness and safety of the use of the ultrasonically activated scalpel for dissection of the gallbladder, but only a few authors[3-5,7,9,10] have examined its efficacy in the closure of the cystic artery and duct. In 1999, the use of ultrasonically activated shears for both dissection and closure-division of the cystic duct and artery was first reported.[8]

In our study, the use of the harmonic shear was associated with lower incidence of gallbladder perforation, compared with traditional method. Operative time was prolonged in operations complicated by gallbladder perforation in both groups as stone spillage and bile loss leads to obstruction of laparoscopic visual field and frequent exchange in instruments.

Operative time was shorter in group II than group I. This has many potential advantages, including reducing the overall anesthetic time and increasing the number of cases that can be done on an average operative list. Similar finding was reported by Khan et al[9] and Gelmini et al.[10]

In our study, neither minor nor major bile leaks were encountered in either groups, and this could be explained partially by small number of patients in each group, although similar findings were reported by Tebala[3] and Bessa et al.[5]

In the present study, as well as in the Westervelt,[4] Tebala,[3] and Khan et al[9] studies, the harmonic shears were applied to only one site on the cystic duct where sealing and division were achieved with no bile leaks from the cystic duct stump encountered in any of the three studies. It is our belief that a double application of the harmonic shears to the cystic duct is unnecessary and may be an unsafe practice.

The greater cost of the harmonic scalpel, when compared with the cost of an electrocautery probe, has been regarded as a potential disadvantage. Although this difference is significant at the present time, however, we feel that LC, using the harmonic scalpel, is cost-effective when considering that we use fewer overall instruments and are able to carry out more procedures on an average list as a result of the shorter operative time.

The overall hospital stay in group II is less than group I, similar to the Janssen et al[11] study which reported

that the harmonic scalpel was associated with shorter operative times, fewer overnight hospital stay, and lower pain scores.

## CONCLUSION

The harmonic scalpel is as safe and effective as the commonly used clip and cautery technique in achieving safe closure and division of the cystic duct in the LC. Further, it provides a superior alternative to the currently used high-frequency monopolar technology in terms of shorter operative time and lower incidence of gallbladder perforation.

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10.5005/jp-journals-10033-1296

ORIGINAL ARTICLE

# Laparoscopic Appendectomy as a Standard of Care for Both Complicated and Uncomplicated Appendicitis in South Africa, Is It Safe? Single Center Experience

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## ABSTRACT

**Aim:** The aim of this descriptive analytical study was to describe the outcomes of using laparoscopic appendectomy (LA) as the standard of care for both complicated and uncomplicated cases of acute appendicitis in South Africa.

**Background:** Laparoscopic appendectomy has been widely accepted as safe when performed in uncomplicated cases of acute appendicitis. However, acceptance of this procedure as the standard of care has been surrounded by controversies, with the main concern been around the safety of this procedure in complicated cases of appendicitis. Currently, there is no consensus in published literature regarding the use of LA as the standard of care in both complicated and uncomplicated appendicitis.

**Materials and methods:** A retrospective analysis of all patients who were diagnosed with acute appendicitis at Dr George Mukhari Academic Hospital over a 3-year period was reviewed. Data were retrieved from our departmental database and analyzed using descriptive statistics.

**Results:** A total of 746 patients were reviewed and 576 were included in the study. All these patients were offered LA. The mean age was 26.37, with 66% of our patients been males. Complicated cases formed 38% of our total study population. Laparoscopic appendectomy was performed in both complicated and uncomplicated cases of appendicitis with a success rate of 96%. Intraoperative complication rate and the relook rate was 0.5 and 7% respectively, with an overall mortality of 1.7%.

**Conclusion:** The positive outcome found in this study when LA was used in both complicated and uncomplicated cases of acute appendicitis suggests that this approach is possible in carefully selected patients and with appropriate basic laparoscopic skills.

**Clinical significance:** Complicated appendicitis is not a contraindication to laparoscopy.


**Keywords:** Appendicitis, Complicated appendicitis, Laparoscopic appendectomy, Uncomplicated appendicitis.

**How to cite this article:** Mosai F, Koto ZM. Laparoscopic Appendectomy as a Standard of Care for Both Complicated and Uncomplicated Appendicitis in South Africa, Is It Safe? Single Center Experience. World J Lap Surg 2017;10(1):22-25.

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## INTRODUCTION

Laparoscopic appendectomy (LA), initially described by Semm in 1983, has increasingly gained favor in the past decade in management of selected cases of acute appendicitis.[1] The benefits of LA as a minimal access surgery include less postoperative pain, shorter hospital stay, early return to work, and better cosmesis.[2-4] These benefits have made this approach attractive. However, despite all these benefits, LA has not been wildly accepted as a standard of care for management of all cases.[5] This is due to dispute regarding its advantage compared with open surgery.[1,6-9]

The controversies around high procedure-related complication rate and conversion rate associated with LA when used in complicated cases of appendicitis have led to some authors questioning the safety of this procedure, especially in complicated cases.[10-12] Most acute appendicitis cases present after hours are often managed by residents. This has also been quoted in the literature as a potentially contributing factor to high complication rate due to lack of skill.[13] Currently, there is no general consensus regarding the safety and feasibility of using LA in complicated cases of appendicitis.

Contrary to what has been practiced and reported in the literature, LA was introduced as the standard of care at Dr George Mukhari Academic Hospital (DGMAH) for both complicated and uncomplicated cases of appendicitis in 2011. Most of the cases at this facility present after hours and are managed by residents on site. The DGMAH is a tertiary teaching hospital with a bed capacity of 1,500, situated in Gauteng province. The hospital takes referrals from at least three provinces namely Gauteng, Northwest, and Limpopo provinces.

A departmental database was used to store all the information of patients managed with LA and it is updated and checked for accuracy during our weekly morbidity and mortality meetings.

All patients who presented with a preoperative assessment of acute appendicitis, in all age groups were offered LA, hence, were considered for the study.

The uncertainty about the safety of using LA as a standard of care in the management of both complicated and uncomplicated cases of appendicitis needs clarification. The outcomes of this study will suggest if LA as the standard of care for both complicated and uncomplicated cases of acute appendicitis can be safely practiced.

## MATERIALS AND METHODS

A retrospective analysis of a prospectively collected data on patients who were offered LA from June 2012 to October 2015 at DGMAH was done. A database from the Department of General Surgery at Sefako Makgatho Health Sciences University (SMU) was used to retrieve all the data used in this study. An ethics clearance was obtained from SMU in accordance with Helsinki declaration.

A diagnosis of appendicitis was made based on the clinical and/or special investigations. The Alvarado score (Appendix 1) of 7 or more was considered diagnostic, and imaging (ultrasound or CT scan) was done to confirm the diagnosis if the Alvarado score was 4 to 6. Also, all patients with an Alvarado score of 3 or less were managed nonoperatively, hence excluded from the study.

### Inclusion Criteria

All patients with a preoperative diagnosis of acute appendicitis and were performed an emergency LA were included in the study.

### Exclusion Criteria

Laparoscopic appendectomy for incidental appendectomies and interval appendectomies.

### Data Collected

All data concerning patients' demographics, such as age, sex were collected. The intraoperative findings, such as four quadrant pus, appendicular abscess, and appendicular mass as well as procedure-related complications were documented. The outcomes, such as relooks, postoperative complications (see paragraph below) as well as mortality were recorded.

Complicated appendicitis was defined as a ruptured appendicitis with either localized pus, four-quadrant pus, or appendix mass.

Uncomplicated appendicitis was defined as an inflamed appendix.

Procedure-related complications was defined as iatrogenic bowel injury, appendicular artery bleed (>500 mL), port-side bleed (>100 mL)

Postoperative complications were defined as intraabdominal collections, port-site sepsis, and port-site hernia.

Poor visibility was defined as intraoperative bowel distension which precludes adequate visualization of intraabdominal contents.

Successful LA was defined as a patient who underwent LA without conversion.

### Statistical Analysis

Means (±SD) are presented for continuous variables and frequencies (%) are presented for categorical variables. All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC).

## RESULTS

A total of 746 records were reviewed and 576 met the inclusion criteria and hence were included in the analysis (Flow Chart 1); 170 patients were excluded due to insufficient data, managed nonoperatively, operated as elective case (i.e. interval appendectomy) and incidental appendectomy. There were 221 complicated cases of acute appendicitis with majority been four-quadrant pus, as indicated in Flow Chart 1. The complicated cases were subdivided based on intraoperative findings.

The age distribution ranges from pediatric population to geriatric population with majority of the patients above age 21 years as indicated in Table 1. Males contributed 66% of the study population (Table 1).

Among 576 patients who were offered LA, the procedure was successful in 552 (Table 2). The conversion rate was higher in the four-quadrant pus subgroup.

A total of 43 patients were taken for a relook laparoscopy and more than half were from the four-quadrant

**Flow Chart 1:** Analysis

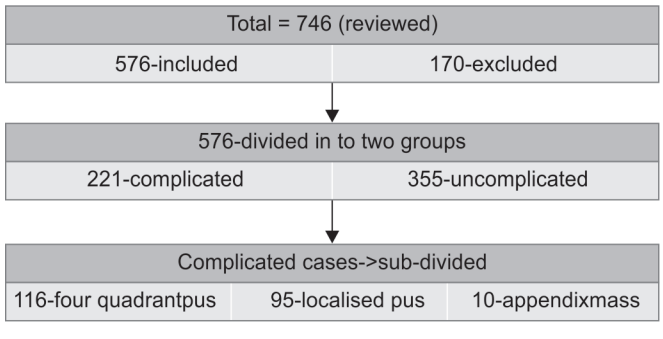


**Table 1:** Demographics

| *Variable* | *Obs.* | *Mean* | *Std. dev.* | *Min* | *Max* |
|---|---|---|---|---|---|
| Age | 576 | 26.37153 | 12.76357 | 4 | 82 |
| | *Male* | | *Female* | | |
| *Age in years* | *n* | *%* | *n* | *%* | *Total* |
| 0–13 | 50 | 68.49 | 23 | 31.51 | 73 |
| 14–21 | 113 | 64.94 | 61 | 35.06 | 174 |
| 22–82 | 217 | 66.04 | 112 | 33.96 | 329 |
| Total | 380 | 66.02 | 196 | 33.98 | 576 |

pus subgroup. The most frequent intraoperative finding in this subgroup was pelvic collection.

The complications were divided into two major categories namely intraoperative and postoperative complications. Intraoperative complication rate was 0.5% and majority were from the four-quadrant pus subgroup and all were iatrogenic bowel injuries. Postoperative complication rate was 5% and majority were from the four-quadrant subgroup and the commonest complication was pelvic collections.

The most common cause of morbidity was pneumonia. Mortality was grouped according to the subgroups, which indicated high mortality rate being among the four-quadrant pus subgroup and significant cause was systemic sepsis.

**Table 2:** Results

| | *Total % (n)* | *Subgroup* | *Indications* |
|---|---|---|---|
| Outcomes | | | |
| Successful LA | 96% (552) | | |
| converted | 4% (24) | u (5) | Poor visibility (4) |
| | | | Hypoxia (1) |
| | | am (0) | |
| | | aa (3) | Poor visibility (3) |
| | | 4qp (16) | Poor visibility (7) |
| | | | Hemodynamic instability (7) |
| | | | Iatrogenic bowel injury (2) |
| Relooks | | | Findings |
| Total | 7% (43) | u (6) | Port-site bleed (1) |
| | | | Port-site hernia (1) |
| | | | Negative finding (4) |
| | | am (0) | |
| | | aa (8) | Pelvic collection (2) |
| | | | Port-site sepsis (1) |
| | | | Negative finding (5) |
| | | 4qp (29) | Pelvic collection (22) |
| | | | Subphrenic collections (3) |
| | | | Port-site sepsis (2) |
| | | | Liver abscess (1) |
| | | | SBO (1) |
| Complications | | | Nature |
| Intraoperative | 0.5% (3) | 4qp (2) | IBI (2) |
| | | u (1) | Port-site bleedings |
| | 5% (29) | u (2) | Port-site hernia (1) |
| Postoperative | | | Port-site bleed (1) |
| | | aa (3) | Pelvic collection (2) |
| | | | Port-site sepsis (1) |
| | | 4qp (24) | Pelvic collection (22) |
| | | | Port-site sepsis (2) |
| Morbidity and mortality | | | Cause |
| Morbidity | 2% (12) | | Pneumonia (4) |
| | | | Adhesive bowel obstruction (3) |
| | | | DVT (3) |
| | | | ARDS (2) |
| | 1.7% (10) | u (2) | Port-site bleed (1) |
| | | | Hypoxia (1) |
| Mortality | | aa (1) | Pneumonia (1) |
| | | 4qp (7) | Systemic sepsis (4) |
| | | | ARDS (2) |
| | | | Liver abscess (1) |

LA: Laparoscopic appendectomy; U: Uncomplicated appendix; aa: Appendicular abscess; am: Appendicular mass; 4qp: four-quadrant pus; DVT: Deep vein thrombosis; ARDS: Acute respiratory distress syndrome; IBI: Iatrogenic bowel injury; SBO: Adhesive small bowel obstruction

## DISCUSSION

The results of this study demonstrate positive outcome in using LA as the standard of care for both complicated and uncomplicated cases of acute appendicitis.

The four-quadrant pus subgroup contributed a significant proportion to the conversion rate of 4%. This rate is, however, not higher than what is generally reported in the literature.[14] The main indication for conversion was noted to be poor visibility due to bowel distension. Majority of this patients presents with abdominal distension which can be picked up on clinical examination in the preoperative assessment. These suggest that careful preoperative assessment could select this subgroup of patients and hence offer them an open surgery from the start.

The relook rate of 7% is slightly lower than reported in the literature.[15] Our main indication was intraabdominal collection, documented on imaging or suspected on clinical examination. In many cases this collection was deemed amenable to percutaneous drainage, but due to lack of intervention radiology services at our center, all these patients were taken back for a relook laparoscopy. Intraoperative findings at relook were mainly serous fluid instead of pus; this could possibly be the residual fluid from the peritoneal lavage at the index operation. However, a separate study would be needed to establish if peritoneal lavage contribute to intraabdominal collections.

Intraoperative complicated rate of 0.5% where majority of cases were from the four-quadrant pus subgroup, all those patients had iatrogenic bowel injury. The main contributing factor was poor visibility due to bowel distension. These complications can be avoided in the future by doing open surgery for patients with bowel distension. However, the complication was not higher than what is reported in other studies.[16]

Postoperative complication rate of 5% was mainly coming from the four-quadrant pus subgroup with majority been pelvic collection. As discussed earlier, we do not have sufficient information to suggestive whether peritoneal lavage was a contributing factor or not. Although Tate reported a postoperative intraabdominal collection of 1.4%, significantly lower than in our study, in the same paper the subanalysis showed that the rate was as high as 7.5% when the appendix was complicated.[17]

The main cause of morbidity was ventilator-associated pneumonia and deep vein thrombosis (DVT). These were patients who were admitted to intensive care unit (ICU). Also, improvement in ICU care and appropriate use of venous thromboembolism are measures we should improve on.

Mortality was 1.7%, which is higher than reported by other researchers.[18] Majority of the causes were nonprocedure-related causes. Systemic sepsis and acute respiratory distress syndrome (ARDS) contributed to a significant proportion to mortality. Both of the causes were found in the four-quadrant pus subgroup. Majority of these patients were delayed presentation and often came in septic shock and needed postoperative care in ICU. Many of them were ventilated for more than a week. Therefore, delayed presentation, septic shock, and prolong ICU stay seem to be a major contributing factors to mortality.

The results of this study seem to be comparable to previous studies and the negative outcome seen in the four-quadrant pus subgroup seem to be due to patients' factors and not procedure-related.

## CONCLUSION

The positive outcome found in this study when LA was used in both complicated and uncomplicated cases of acute appendicitis suggests that this approach is possible in carefully selected patients and with appropriate basic laparoscopic skills.

However, we recognize the limitations of our study: Retrospective study, with a small study population size. Therefore, more studies with large population size are needed to establish the role of LA as the standard of care in both complicated and uncomplicated cases of appendicitis (Appendix 1).[19]

**Appendix 1:** Alvarado score

| *Variables* | *Clinical features* | *Score* |
|---|---|---|
| Symptoms | Migratory RIF pain | 1 |
| | Anorexia | 1 |
| | Nausea and vomiting | 1 |
| Signs | Tenderness (RIF) | 2 |
| | Rebound tenderness | 1 |
| | Elevated temperature | 1 |
| Laboratory | Leukocytosis | 2 |
| | Shift to left (neutrophils) | 1 |
| Total score | | 10 |
| Score | Significance | Plan |
| ≤ 3 | Appendicitis unlikely | Observation |
| 4–6 | Appendicitis likely | Imaging (U/S or CT) |
| 7–10 | Appendicitis highly likely | |

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ORIGINAL ARTICLE

# Can Intraperitoneal Tramadol decrease Pain in Patients undergoing Laparoscopic Cholecystectomy in Postoperative Period? A Randomized Controlled Trial

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## ABSTRACT

**Aim:** To evaluate analgesic effect of intraperitoneal tramadol in patients undergoing laparoscopic cholecystectomy.

**Settings and design:** Prospective, double blind, randomized study.

**Materials and methods:** Hundred patients undergoing laparoscopic cholecystectomy were randomized into two groups, I and II, of 50 each: Group I received intraperitoneal tramadol 100 mg (diluted in 20 mL of distilled water) immediately after induction of pneumoperitoneum and just before removal of trocars. Similarly, group II received 20 mL of intraperitoneal normal saline. All patients had a standard anesthetic. Rescue analgesia was with diclofenac sodium. Postoperatively, visual analog scale, 1 and 24 hours diclofenac consumption, postoperative hospital course, and adverse effects were recorded.

**Statistical analysis:** Student's t-test and Epi Info statistical software were used for statistical analysis.

**Results:** Pain intensity is significantly less in group I than in group II in first 4 hours, while requirement of analgesic postoperatively is significantly less in group I than in group II in first 8 hours except at 30 and 60 minutes. Better control of blood pressure and respiratory rate was seen in group I in first 4 hours. There was no significant difference between two groups regarding postoperative hospital course and incidence of adverse effect.

**Conclusion:** Intraperitoneally, tramadol provides superior postoperative analgesia in the early postoperative period after laparoscopic cholecystectomy compared with normal saline in patients undergoing laparoscopic cholecystectomy.


**Keywords:** Intraperitoneal tramadol, Laparoscopic cholecystectomy, Pain, Visual analog scale score.

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## INTRODUCTION

Laparoscopic cholecystectomy has become the treatment of choice for gallbladder stone disease[1] as it offers many advantages compared with the open cholecystectomy, the major being shorter duration of hospital stay and early convalescence,[2] but some patients still experience considerable pain in postoperative period. The site of most severe pain is in the right upper quadrant and port site during first 24 hours,[3] which can be due to traumatic traction on the nerves; release of inflammatory molecules; trauma to the abdominal wall; maintenance of high abdominal pressure; and irritation of the phrenic nerve.[4,5] While laparotomy results mainly in parietal pain, laparoscopy has a visceral component, a somatic component and shoulder pain secondary to diaphragmatic irritation.[6] In laparoscopic cholecystectomy, visceral pain predominates in first 24 hours, whereas shoulder pain, less on the 1st day, increases and becomes significant on the following days.[7] The degree of pain after laparoscopic procedure is influenced by factors, such as the volume of residual gas, the type, temperature of gas used for pneumoperitoneum, and the pressure created by pneumoperitoneum.[8] The peritoneal origin of the pain suggests that analgesia delivered locally to the peritoneal cavity may be of benefit postoperatively.[9] While some studies show that intraperitoneal instillation of drugs for pain relief is more effective if used before creation of pneumoperitoneum,[10] others suggest it to be more effective at the end of the surgery.[11] So, considering these facts the present study was undertaken to evaluate analgesic effect of intraperitoneal tramadol in patients undergoing laparoscopic cholecystectomy.

## MATERIALS AND METHODS

After approval from Ethical Committee, the study was conducted on 100 patients scheduled for elective laparoscopic cholecystectomy under a standardized general anesthesia technique after informed consent. Uncooperative and unwilling patients; those with a history of anaphylaxis to opioids, drug abuse, narcotic use, or previous

abdominal surgery; American Society for Anesthesiologists grade III, IV, V or any other significant comorbidity; and those needing conversion to open cholecystectomy were excluded from the study.

After preoxygenation with 100% oxygen for 3 minutes, induction of anesthesia was achieved with thiopentone sodium (2.5%) 4 to 6 mg/kg intravenous (IV) slowly (till the abolition of eye lash reflex) along with injection fentanyl 1.5 µg/kg IV. Intubation with an appropriate-sized endotracheal cuffed tube, i.e., facilitated by neuromuscular blocker suxamethonium 1.5 mg/kg IV.

Anesthesia was maintained using controlled ventilation with isoflurane (0.5–1.5%) and nitrous oxide ($N_2O$) 66% + oxygen ($O_2$) 33% using Bain's circuit. Neuromuscular blockade achieved with atracurium besylate. All patients were given injection metoclopramide 0.5 mg/kg IV intraoperatively at the end of procedure. Patients were randomly allocated in double-blind manner using computer-generated random numbers to one of the two groups comprising 50 patients each and use of coded syringe which is prepared by anesthesiologist not involved in study. Patients with group I labeled syringe (Study group) received intraperitoneal tramadol 100 mg (diluted in 20 mL of distilled water) while patients with group II coded syringe (Control group) received 20 mL of intraperitoneal normal saline. In both groups, 10 mL of the study drug was injected into the hepatodiaphragmatic space, 5 mL into the area of the gallbladder and 5 mL was injected into the space between the liver and the kidney under direct vision by the surgeon immediately after induction of pneumoperitoneum and just before removal of trocars, so in both groups a total of 40 mL drug was instilled. Postoperatively, patient was extubated and shifted to recovery room where observations were made, recorded, and analyzed, such as postoperative pain scores at 0, 15, 30, and 60 minutes; 4, 8, 12, 24, and 24 hours; cumulative 1 and 24 hours analgesic consumption, postoperative hospital course [monitoring of heart rate (HR), blood pressure (BP), respiratory rate (RR), $SPO_2$, temperature at 0, 4, 8, 16, and 24 hours, and incidence of adverse effect (nausea, vomiting, shoulder pain, itching, shivering) at 0, 4, 8, 16, and 24 hours].

Intensity of pain was measured by visual analog scale (VAS).[12] Patients showing a VAS ≥ 3 or patients who request for analgesia were administered a supplemental dose of an analgesic (diclofenac sodium; 3 mL, 75 mg). Results were reported as mean ± SD. The sample size has been calculated based on the study,[13] where mean pain score of the normal saline (3.9 ± 2.7) has been consulted. The sample size per group has been calculated to be 50 with 5% level of significance. The 20% reduction in pain at 0 minute has been assumed to be significant reduction. This sample size will maintain at least 89% power of the study. Data was collected and analyzed using Student's t-test. Epi Info statistical software was used for all analyses.

## RESULTS

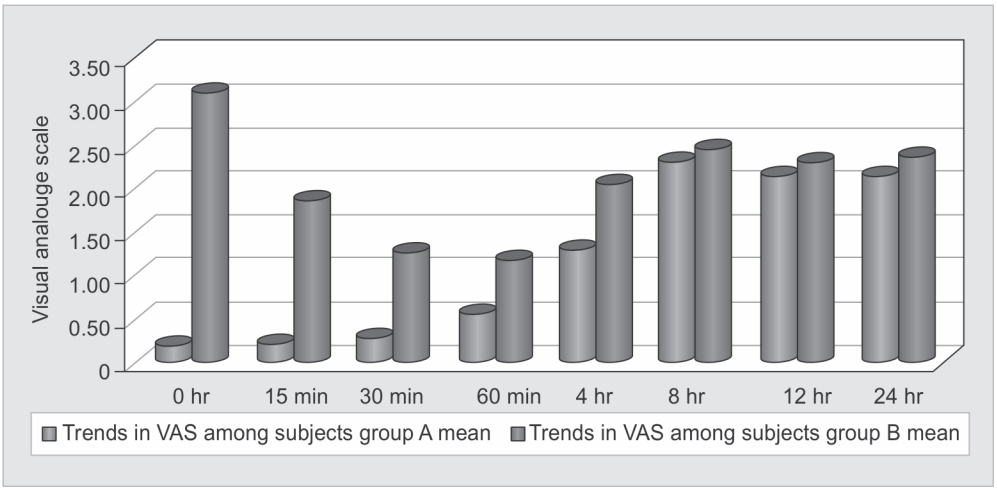
For this study, 100 patients were recruited. There were no significant differences between two groups according to age, sex, and body weight (Table 1).

The mean intensity of postoperative pain was significantly lower in group I than in group II ($p < 0.05$) at 0 hour, 15, 30 minutes, 1 hour, 4 hours after the operation. There was no statistical difference between the two groups thereafter (Graph 1).

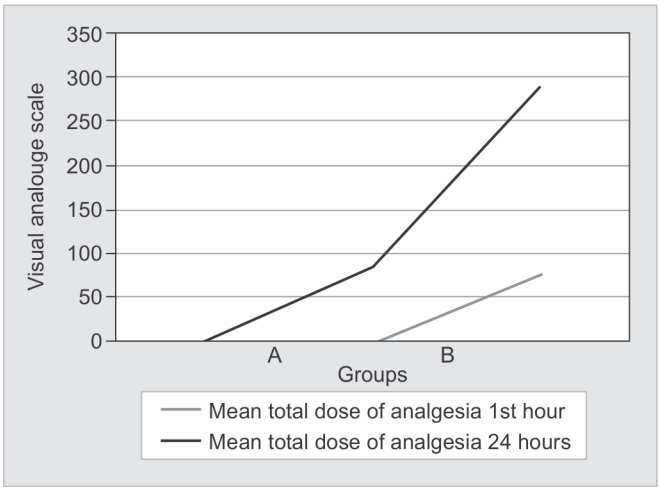
**Table 1:** Data from 100 patients who received IP saline (group II), tramadol (group I), during laparoscopic surgery

| *Parameter* | *Group I* | *Group II* |
|---|---|---|
| Age (years) | 39.20 ± 11.53 | 42.04 ± 13.14 |
| Sex ratio (F:M) | 34:16 | 34:16 |
| Body weight (kg) | 68.98 ± 11.96 | 69.72 ± 11.39 |

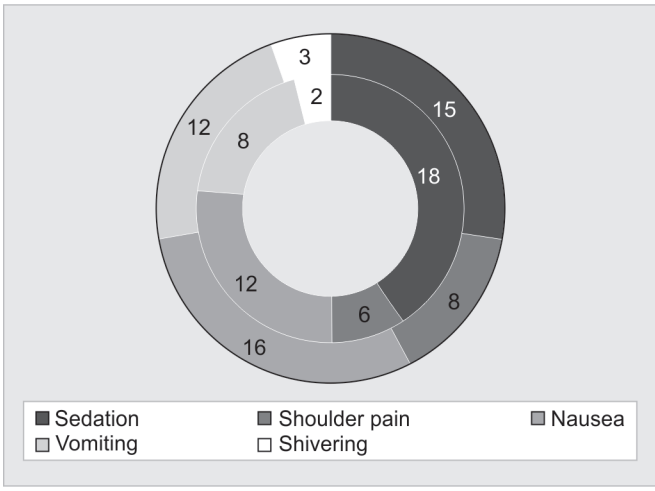
Values are mean ± SD. *p < 0.05 was considered statistically significant




**Graph 1:** Trends in VAS among subjects




**Graph 2:** Cumulative requirement of analgesic




**Graph 3:** Trends in incidence of adverse effects

**Table 2:** Trends in systolic BP

| Time | Group I | | Group II | | |
|---|---|---|---|---|---|
| (hours) | Mean | SD | Mean | SD | p-value |
| 0 | 131.44 | 16.54 | 146.08 | 18.02 | 0.0001 |
| 4 | 125.00 | 11.86 | 132.16 | 11.84 | 0.003 |
| 8 | 124.44 | 10.93 | 124.52 | 10.03 | 0.970 |
| 16 | 121.48 | 9.96 | 125.24 | 11.71 | 0.087 |
| 24 | 122.44 | 8.83 | 124.28 | 11.49 | 0.371 |

SD: Standard deviation

**Table 3:** Trends in RR

| Time | Group I | | Group II | | |
|---|---|---|---|---|---|
| (hours) | Mean | SD | Mean | SD | p-value |
| 0 | 21.56 | 1.42 | 22.88 | 1.35 | 0.0001 |
| 4 | 20.88 | 1.15 | 21.84 | 1.06 | 0.0001 |
| 8 | 21.12 | 1.67 | 21.64 | 1.05 | 0.065 |
| 16 | 20.48 | 1.49 | 20.56 | 1.28 | 0.774 |
| 24 | 20.24 | 1.70 | 20.32 | 1.58 | 0.808 |

SD: Standard deviation

The supplementary mean dose of rescue analgesic (diclofenac sodium, 3 mL, 75 mg) in first hour and 24 hours were significantly higher in group II, being 76.47 ± 10.39 mg and 213 ± 41.11 mg as compared to group I of 0 and 84 ± 59.92 mg respectively (Graph 2).

There is no significant difference between mean HR, $SPO_2$, temperature between the two groups at any point of time during our study. Mean systolic BP (Table 2) and RR (Table 3) were lower in group I than in group II at all time intervals, but the difference is significant statistically at 0 and 4 hours attributed to better pain control in early postoperative period.

There was no significant difference in the incidence of shoulder pain, nausea, vomiting sedation, itching, and shivering in the two groups (Graph 3). No patient experienced muscle rigidity.

## DISCUSSION

In our study we showed that intraperitoneal administration of tramadol resulted in much lower postoperative pain scores, cumulative postoperative analgesic consumption without significant increase in incidence of adverse effect or adverse hemodynamic changes in patients undergoing laparoscopic cholecystectomy.

In our study, the mean VAS scores in group I were significantly low in first 4 hours postoperatively than in group II due to the effect of Tramadol given intraperitoneally. The maximum mean VAS score was observed at 8th hour (2.32 ± 0.96 cm). Administration of rescue analgesic thereafter leads to downward trend in subsequent pain scores. The results are consistent with findings of Golubovic et al[14] who showed this significant reduction for first 6 hours.

Our study also showed significant reduction in cumulative postoperative analgesic requirement in group I than in group II in first and 24 hours, which is consistent with study done by Golubovic et al,[14,15] who demonstrated that intraperitoneal administration of tramadol had valuable implication in reducing VAS score/pain in patients undergoing laparoscopic cholecystectomy.

Peripheral antinociceptive effect of opioids occurs due to interaction of opioids with opioid receptor located on peripheral intact perineurium that prevent entry of hydrophilic opioid molecule, such as morphine while lipophilic opioids, such as tramadol, buprenorphine can diffuse across the intact perineural barrier, which results in better analgesia on intraperitoneal administration. Secondly, as duration of action of parenterally administered tramadol is 6 to 8 hours, so this explains low VAS scores and less need for rescue analgesic in early postoperative period.[16]

Mean systolic BP and RR were lower in group I than in group II at all time intervals but the difference is significant statistically at 0 and 4 hours attributed to better pain control in early postoperative period. As there was no differences in the incidence of adverse effect, so

tramadol can be used safely at doses as in our study intraperitoneally, which can be correlated with study done by Akinci et al.[13]

## CONCLUSION

Intraperitoneal tramadol significantly reduces pain scores in early postoperative period (4 hours in our study), and requirement of rescue analgesic for first 8 hours without significantly increasing incidence of adverse effect or hemodynamic complications. So, it can be safely introduced for control of postoperative pain in patients undergoing laparoscopic cholecystectomy.

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ORIGINAL ARTICLE

# Obesity-related Metabolic Comorbidities Remission in Postbariatric Surgery Patients

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## ABSTRACT

**Introduction:** Obesity-related diseases (ORD) are associated with a decrease in the quality of life and life expectancy of patients. The remission of these pathologies after bariatric surgery is not the same in all patients.

**Objectives:** To evaluate the remission of the principal ORD in patients who underwent bariatric surgery.

**Materials and methods:** Retrospective analysis of patients with morbid obesity and ORD (hypertension, diabetes mellitus, dyslipidemia or obstructive sleep apnea and hypoapnea syndrome) who received bariatric surgery between January 2014 and January 2016. Patients had two surgical options: Laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB). Follow-up was performed after 1, 6, and 12 months per the first year after surgery, recording data, such as percentage of excess weight lost (%EWL), percentage of total body weight lost, and partial or total ORD remission.

**Results:** Out of a total of 23 patients, 52% (12) were females and the average age was 44 ± 13 years, 17 (74%) received LSG and 6 (26%) LRYGB. The average initial body mass index was 43 ± 4.3 kg/m², the %EWL at 1, 6, and 12 months was 35.4 ± 15.2, 62.5 ± 17.5, and 79.1 ± 20.2 respectively. Comorbidities remission was found in 95.6% of patients (22), partial resolution in 32%, and complete in 68%. A total of 52.1% of remissions were reported in the first month postsurgery.

**Conclusion:** Bariatric surgery has proved to be the most effective method for reducing and sustaining weight loss in the long-term and comorbidities remission. A decrease of 50% of EWL has a positive impact in terms of discontinuing medications and normalizing the patient's biochemical profile.


**Keywords:** Bariatric surgery, Gastric bypass, Laparoscopic Roux-en-Y, Laparoscopic sleeve gastrectomy, Obesity, Obesity-related disease, Remission.

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## INTRODUCTION

Obesity is a pandemic that affects 1.7 billion people.[1] Obesity is closely related to metabolic disease, which is defined as the presence of hypertension, type II diabetes, and hyperlipidemia, increased risk of cardiovascular disease, osteoarticular symptoms, and obstructive sleep apnea and hypopnea syndrome (OSAHS); all these obesity-related diseases (ORD) result in a decrease in patients' life expectancy of up to 10 to 20 years.[1-4]

In Colombia in 2014, 51% of the population were overweight or morbidly obese and one out of every two Colombians is now suffering as a consequence of this excess body weight. In June 2015, 10% of the Colombian population had diabetes and obesity, and 25% of the population had hypertension.[5]

Research has shown that a decrease in body weight of 10 kg can lead to improvements in the effects of comorbid conditions associated with obesity.[6] It is for this reason that bariatric surgery has proved to be an effective treatment with long-term results in terms of improving and resolving the problems associated with comorbid conditions in individuals with obesity. This surgery positively impacts on life expectancy. A decrease of 10% of a patient's excess weight, therefore, has an impact on the quality of life of the patient.[6]

In a cohort study, bariatric surgery decreased excess weight by 67.1%, with a significant reduction in the relative risk of cardiovascular disease, in the risk of endocrine, respiratory, and infectious problems, and in cancer related to obesity and psychiatric care. Additionally, bariatric surgery reduced the risk of mortality by 89% and produced a 71.6% improvement in quality of life.[6]

It is also well known that ORD has negative economic impacts within the health system.[4] From 2 to 8% of insurance costs are due to the management of ORD.[4] There is also a huge annual cost in terms of medications prescribed for controlling the effects of ORD.[7]

It has been demonstrated, in numerous articles, that both the laparoscopic sleeve gastrectomy (LSG) and

laparoscopic Roux-en-Y gastric bypass (LRYGB) are equally effective in the management of obesity, for the resolution of comorbidities, or in terms of influencing the course of the chronicity of diseases.[8]

The impact of bariatric surgery on the health system is significant because once a patient's excess body weight is removed, between 97 and 98% of their comorbidities are resolved. This translates into fewer medical visits, decreased or absent need for medications, and fewer complications from chronic diseases, which means a decrease of up to 50% in the demands on the health insurance system.[4]

In the USA, in 2008, 9.1% of the health care budget was allocated to the management of comorbidities in patients with morbid obesity. The discrimination individuals with obesity experience is also significant, in terms of accessing employment.[9] Hawkins et al[10] showed that after a bariatric surgery, 32% of patients managed to find a job or improved their current employment conditions.

## MATERIALS AND METHODS

After approval by the Institutional Review Board (IRB) and in accordance with requirements for submission of the International Committee of Medical Journal Editors, this study was performed. Data of all patients with documented ORD who were admitted in the institution with a body mass index (BMI) of 35 to 50 kg/m², according to the American Society for Metabolic Bariatric Surgery (ASMBS) guide, were prospectively collected. All the patients were assessed and managed by a multidisciplinary group for clinical obesity, and according to their comorbidities, food habits, and their risk of regaining weight, the patients were evaluated by a board of specialists and the best procedure was chosen for each patient. The surgical alternatives were LSG and LRYGB; the choice of one or the other was made using the criterion of the surgeon and board. Data were collected as patient's follow-up, including initial BMI, the patient's ideal weight, and the comorbidities associated with obesity, such as hypertension, type I and II diabetes, hyperlipidemia, OSAHS, and osteomuscular diseases.

The surgical techniques used were the following: *LSG*: In the French position, using a 5 trocar technique, two 12 mm umbilical and left paraumbilical, and three 5 mm right paraumbilical, left low costal border, and subxiphoid; traction of the left hepatic lobe; with an ultrasonic scalpel, the major curve was released until the left crura and 6 cm from the pylorus to the antrum. A 36 F bougie was used for calibration, and the tubulization was initiated with 5 cartridges 60 mm Echelon Johnson and Johnson staples, first green and the rest blue. The staple line was subsequently reinforced with PDS 2/0 and all of them underwent an air leak test. Finally, closure of the ports of 12 mm with endoclose needle and prolene 1/0 was performed. No drains were left routinely.

*LRYGB:* In the French position, technique with five trocars, three 12 mm: Umbilical and bilateral paraumbilical and 2 of 5 mm: Left costal margin and subxiphoid. The first step is to create the gastric pouch, below the third gastric vessel, and the space dissection was performed with an ultrasonic scalpel and the back face of the stomach was dissected and the first cartridge of 45 mm blue was fired; it subsequently passed the 36 F bougie and two shots were performed with 45 mm blue cartridge. The transverse colon was lifted to identify the Treitz ligament and, at 70 cm, the first jejunostomy was performed with a white cartridge of 45 mm for biliopancreatic limb. Next, the 120 cm was measured for the alimentary limb and the Roux-in-Y laterolateral was performed with a 45 mm cartridge with a distal closure with vicryl 3/0. In all patients, the meso was closed with vicryl 3/0 to avoid internal hernias. Last step, laterolateral gastrojejunal anastomosis with a 45 mm blue cartridge, an air test leak was performed and closing the 12 mm ports with endoclose needle and 1/0 prolene; no drain left.

Routinely we did not order barium studies. Discharge was given 1 day after the procedure and patients began hypoglucid half portion clear liquids per day 4; then they turned to liquid diet.

In order to classify each patient according to their comorbidity, and to attempt to achieve the remission of these comorbidities, the following definitions were used:

- Arterial hypertension was defined as systolic pressure > 140 and/or diastolic pressure > 90, or the use of antihypertensive agents.
- Diabetes is diagnosed with a fasting glycemia > 126 mg/dL, > 200 mg/dL 2 hours after a glucose load, or the use of hypoglycemic agents/insulin.
- Hyperlipidemia is defined as a lipid profile of high-density lipoproteins (HDL) < 40 mg/dL for men and < 50 mg/dL in women and/or triglycerides > 150 and/or low-density lipoproteins (LDL) > 100 mg/dL, or the use of medications to decrease lipids.
- The diagnosis of OSAHS was based on repeated episodes of occlusion of the respiratory tract, greater during sleep, or whilst the patient is awake and a high rate of apnea/hypopnea evidenced in the polysomnogram or if a continuous positive airway pressure (CPAP) was needed whilst the patient was asleep.[6,11]

The criteria for remission are the following:

- Diabetes, according to the American Diabetes Association definition, which defines partial remission as a fasting glycemia < 126 and glycosylated Hb < 7 for 1 year without medication, complete remission as a

glycemia < 100, and glycosylated Hb < 6.5 for a year without medication.[8]

- In hypertension, remission refers to the nonuse of medication and normal levels of pressure or a decrease in the amount/frequency of use of antihypertensive agents.[12]
- In sleep apnea, no use of CPAP.
- Hyperlipidemia in the absence of medication and normal lipid profile values. Another form of definition for the comorbidities was according to the available descriptions in their prior medical histories.

A postsurgical control was performed after 1 week, then 1st, 3rd, 6th, and 12th month postoperative, with the following data being taken: Percentage of weight lost compared with the total body weight, the %EWL and whether or not there was any remission in any of the comorbidities. The categorical variables were represented with numeric proportions and with medium and standard deviations.

## RESULTS

The records of 136 patients who received bariatric surgery were included between January 2014 and January 2016; the patients who did not suffer comorbidities associated with obesity and who did not complete 1-year follow-up were excluded. Twenty-three patients with comorbidities, as documented in their medical records, were included (Flow Chart 1).

The patients' mean age was 44 ± 13 years; 52% (12) were women; 17 (74%) received their bariatric surgery via LSG and 6 (26%) via LRYGB; 16 (69.5%) patients suffered from hypertension; 9 (39%) patients had OSAHS; 11 (48%) patients had hyperlipidemia; 5 (22%) had other comorbidities, such as osteoarthritis; and hyperuricemia in 2 (9%) patients (Table 1). The average initial BMI was 43 ± 4.3 kg/m². No mortality or associated complications were documented for the procedure in this group of patients. The remission rate was 95.6% (22) of patients and was partial and complete in 32 and 68% of patients respectively.

**Flow Chart 1:** Flow diagram

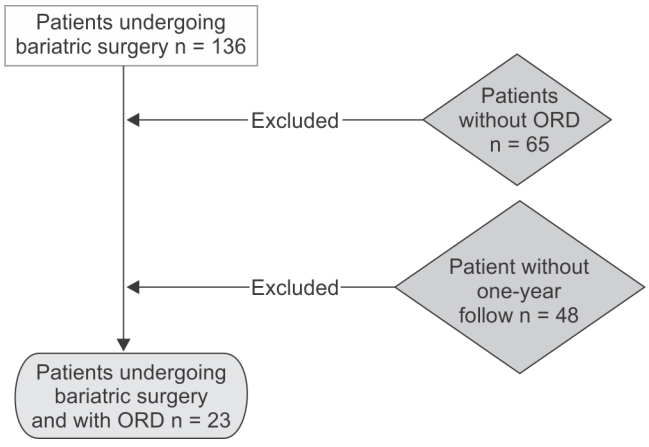


**Table 1:** Characteristics of baseline patients

| | *Patients n = 23* |
|---|---|
| Age, average ± | 44 ± 13 |
| Gender, n (%) | |
| Male | 11 (48) |
| Female | 12 (52) |
| Comorbidities n (%) | |
| Hypertension | 16 (69.5) |
| OSAHS | 9 (39.1) |
| Hyperlipidemia | 11 (48) |
| Diabetes mellitus | 5 (22) |
| Others | 2 (9) |
| Presurgical BMI (%), average ± | 42.9 ± 4.3 |
| Type of procedure, n (%) | |
| Sleeve | 17 (74) |
| Bypass | 6 (26) |
| Rate of complications | 0 (0) |
| Total length of hospital stay, median (IQR) | 3 [1–6] |
| Mortality | 0 (0) |
| Comorbidities remission, n (%) | 22 (95.6) |
| Partial remission | 7 (32) |
| Complete remission | 15 (68) |

OSAHS: Obstructive sleep apnea/hypopnea syndrome

The %EWL at 1, 6, and 12 months was 35.4 ± 15.2, 62.5 ± 17.5, and 79.1 ± 20.2 respectively. With a weight loss of 14.4 ± 5.3% and comorbidities remission in 52.1% of patients, whether partial or complete, in the 1st month (Table 2).

Partial or total ORD remissions are summarized in Table 3.

## DISCUSSION

Bariatric surgery is the most effective procedure for the management of morbid obesity and the total or partial resolution of its associated metabolic comorbidities. Both

**Table 2:** Follow-up time and weight loss percentage

| | *1 month* | *6 months* | *1 year* |
|---|---|---|---|
| Weight lost (kg), average ± SD | 17.3 ± 8.6 | 30.4 ± 10.8 | 38 ± 14.2 |
| Excess weight loss (%EWL) | 35.4 ± 15.2 | 62.5 ± 17.5 | 79.1 ± 20.2 |
| Weight loss percentage (%), average ± SD | 14.4 ± 5.3 | 25 ± 6.6 | 31.6 ± 7.9 |
| Comorbidities remission, n (%) | 12 (52.1) | 9 (39.1) | 1 (4.3) |

SD: Standard deviation

**Table 3:** Partial or total remission per comorbidity

| *Comorbidities remission* | *Partial remission n = 7* | *Total remission n = 15* |
|---|---|---|
| Hypertension, n = 16 | 7 (44) | 9 (56) |
| OSAHS, n = 9 | 5 (55.5) | 4 (44.4) |
| Hyperlipidemia, n = 10 | 4 (40) | 6 (60) |
| Diabetes mellitus, n = 5 | 3 (60) | 2 (40) |

OSAHS: Obstructive sleep apnea/hypopnea syndrome

procedures proved equally effective in the resolution of comorbidities and the weight loss.[13]

This change, both in weight and comorbidities, directly impacts mortality, with a decrease between 29 and 40% and with improvements in terms of life expectancy.[14] We know that obesity accounts for between 2 and 7% of the overall health costs of a country, which can translate, in the USA, into 100 billions of dollars each year. Bariatric surgery is a cost-effective method to decrease the costs related to the management of obesity.[15,16]

A factor that affects patient outcome is the different processes of authorization of the insurers. Flanagan et al[17] performed a study comparing the mortality of patients whose insurers, after being approved by the multidisciplinary group, either approved or denied the procedure. The study showed that the mortality of the control group was 6% compared with the study group, favoring bariatric surgery for the resolution of the patients' comorbidities and increasing their life expectancy.

This same analysis was done in Europe; in France, there was a decline of 5% in terms of the overall cost for the patients operated on during the first 2 years of postbariatric surgery, which has a positive impact on the reduction of their medical expenses and the number of medical visits.[18]

As to whether there were any differences in the metabolic impact and the type of surgery for weight reduction, Zhang et al[11] showed that both have a positive impact on weight reduction and improving the patient's comorbidities. The results obtained for the two different types of surgeries were not very different from one another, although it is known that the sleeve type of surgery is considered a better option for the management of diabetes; it has been shown that there are particular benefits in terms of the resolution of type II diabetes with this type of surgery.[19] This type of surgery has also been shown to produce improvement in the patients' total cholesterol and their LDL, although the sleeve type of surgery improves the patients' triglycerides and increases their levels of HDL.[19,20]

Hepatic steatosis is a disease frequently found in patients with morbid obesity and is one of the main causes of chronic liver disease, such as steatohepatitis, chronic inflammation, cirrhosis, and eventually hepatocellular carcinoma. Hepatic steatosis makes up part of the metabolic diseases that are related to insulin resistance. Currently, the use of ultrasonography has facilitated the early diagnosis of this pathology, but it is clear that a decrease of 50% EWL leads to the resolution of this pathology.[21]

In a meta-analysis, Buchwald showed that remission of hypertension is not dependent on the type of procedure, but rather that the number of antihypertensive drugs a patient was taking before or around the time of the surgery defines a patient's total or partial remission.[22-24] A Swedish study showed more benefits with the bypass, although it is worth mentioning that this study did not include the gastric sleeve.[13]

Bariatric surgery has proved to be the most effective treatment in management of metabolic syndrome.[25] A decrease of more than 50% of the patient's excess weight has a significant impact on the resolution of this pathology and the type of surgery undertaken does not affect this result; in our cohort, there was a loss of 30% of the patient's excess weight in the 1st month, leading to a significant improvement of their metabolic syndrome. During the year of the patients' follow-up, a resolution of their metabolic symptoms was found in 92% of patients.[21,22] The inability of patients to attend their follow-up appointments was one of the difficulties of this study; monitoring and follow-up of patients for 1 year or more is hampered by insurers.

In terms of pharmacoeconomics, this indicates that there is a decrease of up to 82% of the costs associated with the management and treatment of comorbidities secondary to obesity, in relation to the overall cost of the surgery; this is small with regards to the social impact this brings to the patient.[16]

## CONCLUSION

Bariatric surgery is an excellent tool for the management of metabolic disease, as our study showed a resolution of up to 92% and a weight decrease of more than 70%, which is consistent with previously published studies. The impact of these results on the patient is translated into an improvement in the quality of their daily lives (such as their working conditions). It also produces a positive impact in terms of reduction in the use of health services, both medication usage and medical visits. This translates to savings of millions of pesos in health care costs. It is very important to bear in mind that a change of habits, in patients, is fundamental in order to achieve these results and to keep their weight down in the long-term.

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REVIEW ARTICLE

# Laparoscopic Cerclage in Pregnant and Nonpregnant Uterus: Emerging Need to change Conventional Management Approach

**Oluwole E Ayegbusi**


## ABSTRACT

Cervical incompetence/insufficiency occurs in 0.1 to 1% of all pregnancies, and, traditionally, management involves transvaginal cervical cerclage. In some situations, however, such as in extremely short cervix following cone biopsy, congenital absent cervix, and in cases where transvaginal cerclage fails or is technically impossible, transabdominal approach via laparotomy is usually done. Recent data suggest that these methods should be reviewed in light of the advantages seen in the developments of minimal access surgical techniques.

This article, therefore, compares both approaches (conventional and laparoscopy) and, in particular, discusses the use of laparoscopy in the management of cervical incompetence/insufficiency both in pregnant and nonpregnant uterus.


**Keywords:** Cerclage, Cervical insufficiency, Laparoscopy.

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## INTRODUCTION

The joy of motherhood is to be able to achieve spontaneous pregnancy and, most importantly, carry such pregnancy to term and deliver a healthy baby. One of the factors that prevents such expected natural cycle is frequent midtrimester miscarriages, which sometimes is due to cervical insufficiency.

It is seen in almost 1% of all pregnancies, with a high recurrence rate of 30%, and mainly results in abortion or premature delivery in the second and third trimester respectively.[1-3]

Cervical incompetence/insufficiency can be described as the inability to endure a pregnancy till term due to a functional or structural defect of the cervix.[1-3] Most of the affected women have a classic history of acute, painless cervical dilatation followed by premature rupture or prolapse of the membranes[4] without any warning signs, such as low abdominal discomfort. This can be very traumatic to most women, with majority usually saying, "Doctor, how do I know is coming."

Various surgical techniques and approaches have been used to prolong pregnancy and improve perinatal outcome. The surgical treatment, cervical cerclage, was first described in 1955 by Lash and Lash and later by Shirodkar.[4-6] Most cerclage operations for cervical incompetence are performed transvaginally[1] and are usually done around 14 weeks.

The current most frequently used and most simple technique of transvaginal cerclage, a purse string suture around the body of the cervix, was described in 1957 by McDonald.[1,6,7]

Cerclage can be performed both in the pregnant and the nonpregnant state. In some conditions, such as an extremely short, deformed, or absent cervix, the vaginal approach does not allow placement of the cerclage, and, hence, transabdominal cerclage via laparotomy is usually employed. The first transabdominal cerclage by laparotomy was reported in 1965 by Benson et al[1,5,8]; subsequently, transabdominal cerclage by laparotomy has since been done for cases that cannot be performed via transvaginal approach with improved outcomes.

The following are some of the indications for transabdominal cerclage: Congenitally short or absent cervix, extensively amputated cervix, marked scarring of the cervix, deeply notched multiple cervical defects, penetrating lacerations of the fornix, subacute cervicitis, wide or extensive cervical conization, cervicovaginal fistulas, and one or more previous transvaginal cerclage failures.[1,4] The contraindications for transabdominal cerclage are bulging membranes, ruptured membranes, intrauterine infections, vaginal blood loss, intrauterine fetal death, labor, and life-threatening maternal condition. The obvious disadvantage of this approach is that a laparotomy is required for the placement of the band and for delivery[1]; this could be done twice with attending complications. It was these realities and others that led to the first successful cases of laparoscopic transabdominal cerclage, which were published in 1998.[9,10] Evidence now abounds in recent years with successful reports about treating cervical insufficiency

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with cerclage placed via laparoscopy both in pregnant and nonpregnant phases.[5, 11-13]

The objectives of this review are to:

- Ascertain the advantages of laparoscopic cerclage over conventional laparotomy cerclage;
- Review the safety of laparoscopic cerclage over conventional laparotomy cerclage;
- Briefly describe the procedure of laparoscopic transabdominal cerclage.

## MATERIALS AND METHODS

Searches in the literature on laparoscopic cervical cerclage were conducted via PubMed, Google Scholar, EMBASE, Medline, and Cochrane library database. No language restriction was applied to the searches.

### Procedure of Laparoscopic Cerclage

Laparoscopic transabdominal cerclage is commonly performed in a nonpregnant state.

#### *Preparation*

Under general anesthesia, the patient is placed in dorsal lithotomy position. After inserting a Foley catheter in the urinary bladder and a uterine manipulator (for patients that are not pregnant), a subumbilical incision for the laparoscope is made by using the closed Verres technique. Two more trocars at the right and left lower abdominal quadrants are placed, after insufflating with appropriate $CO_2$ gas.

*Step 1*: Development of the paravesical and vesicouterine spaces.

For the nonpregnant uterus, a solution with vasopressin (VasopressineR 20 Units/1 mL, American Regent Inc., Shirly, New York, diluted in 50 cc 0.9% NaCl) is injected under the peritoneum of the uterovesical reflection and lateral of the lower uterus. This facilitates the bloodless separation of the bladder from the cervix.

*Step 2*: Creation of windows in the broad ligament

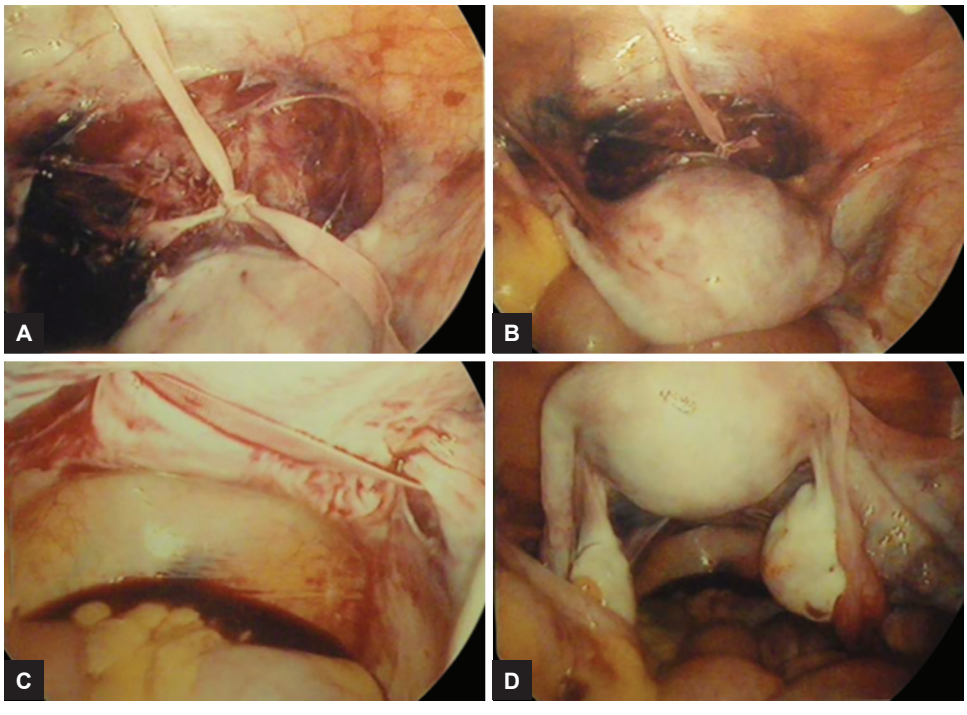
Subsequently, branches of the uterine artery and vein are identified, so that the cardinal ligament can be perforated from anterior to posterior by a straight atraumatic clamp in an avascular area on the median side of the uterine vessels on both sites. The instrument is guided in such a way that the perforation at the posterior side is medially located from the uterosacral ligament.

*Step 3*: Placement of suture material through the broad ligament windows.

A polyester tape (5 mm width MersileneR, Ethicon, Johnson and Johnson), the needles removed, is passed into the pelvis and pulled through the holes with both free ends of the tape at the anterior side. Because the windows are medially located from the uterosacral ligament on both sides and a small purchase of cervical tissue is taken, there is no need for further anchoring of the suture on the uterus. Therefore, the needles are redundant and can be removed.

*Step 4*: Securing the cerclage by knots

Finally, three knots are made in the tape at the anterior side of the uterus resulting in a tension-free loop around the cervix above the insertion of the uterosacral ligament (Figs 1A to D).




**Figs 1A to D:** The cerclage can be seen passing on the posterior side of the cervix, medially of the uterosacral ligaments with the knot on the anterior side

## RESULTS

All the cases of patients available within the limit of the search engines that underwent laparoscopic cerclage between 2008 and 2015 were reviewed. This in total involves pregnant and nonpregnant patients – of 403 patients of various indications, 88 (21.8%) were pregnant when the procedure was done, while 315 (78.2%) were not pregnant.

The results are shown in Table 1.[15-25] The number of patients that were treated each year ranges from 1 to 101, with majority of the cases done before pregnancy, and, in all, reveals very minimal intraoperative complications which were seen in only three cases – 2009, 2013, and 2014, with intraoperative complications of 10.7, 4.5, and 1.6% respectively; others did not record any form of complications. There were no severe complications like infection, severe hemorrhage, and injury of peripheral organs.

The mean gestational ages at delivery were grossly normal, ranging between 35 and 38 weeks except for only one of the cases that was reported by Murray et al, in 2011, with the delivery at 28 weeks. It was only one case, and the cerclage was done before pregnancy.

The survival rate at birth ranges between 75 and 100%.

All the surgeries were successful without assistance or converting to laparotomy.

## DISCUSSION

Cervical incompetence has been traditionally treated with transvaginal cerclage over the years, and this has been the treatment of choice for the last 50 years.[3,14]

In the majority of patients in whom cervical cerclage is indicated, it can be achieved through transvaginal procedure. In this case, the suture can be removed at 37 weeks, and a vaginal delivery can be aimed for, if there is no contraindication to vaginal delivery.

The transabdominal approach of cerclage in general (laparotomy and laparoscopy) is essential for adequate therapy in a selected population of women. This includes those individuals in whom a satisfactory transvaginal cerclage is not technically feasible – a congenital short or absent cervix, an extensively amputated cervix, marked scarring of the cervix, and multiple deep cervical defects, and also a previously failed vaginal cerclage has been regarded as a good indication for transabdominal cerclage.

The choice of transabdominal cerclage now depends on so many factors: The expertise and availability of technical knowhow, the institutional norms, evident cumulative fetal survival rate, ranging from 75 to 100%, favorable gestational age at delivery, and the current and consistent successful transabdominal laparoscopic cerclage that has been reported over the last three decades,

**Table 1:** Results of laparoscopic cervical cerclage done between 2009 and 2015

| *Cerclage by laparoscopy* | *Patient no.* | *Time of surgery* | *Pregnant no.* | *Intraoperative complication rate (%)* | Average gestational age *at birth* | *Survival rate at birth (%)* |
|---|---|---|---|---|---|---|
| Liddell and Lo[15] | 11 | Before pregnancy | 10 | 0 | ND | 100 |
| Whittle et al[16] | 65 | 34 before pregnancy<br>31 during pregnancy | 67 | 10.7 | 35.8 | 80 |
| Fechner et al[17] | 1 | During pregnancy | 1 | 0 | 37 | 100 |
| Carter et al[18] | 12 | 7 before pregnancy<br>5 during pregnancy | 12 | 0 | ND | 75 |
| Pereira et al[19] | 1 | Before pregnancy | 2 | 0 | 38 | 100 |
| Palacio et al[20] | 2 | Before pregnancy | ND | 0 | ND | ND |
| Murray et al[21] | 1 | Before pregnancy | 1 | ND | 28 | 100 |
| DaCosta et al[22] | 3 | Before pregnancy | 2 | 0 | 37 | 100 |
| Riiskjaer et al[12] | 52 | Before pregnancy | 45 | 0 | 37.4 | 83.3 |
| El-Nashar et al[23] | 4 | During pregnancy | 4 | ND | 37.3 | 100 |
| Salmeen and Parer[24] | 66 | Before pregnancy | 36 | 4.5 | 37.2 | 90 |
| Ades et al[25] | 64 | 61 before pregnancy<br>3 during pregnancy | 35 | 1.6 | 35.8 | 95.8 |
| Shin et al[3] | 1 | During pregnancy | 1 | 0 | 35 | 100 |
| Luo et al[11] | 19 | Before pregnancy | 15 | 0 | 38.4 | 90 |
| Chen et al[4] | 101 | 58 before pregnancy<br>43 during pregnancy | 93 | 0 | 38.2 | 95 |

ND: No data

with minimal complications. There is an increasing need to start giving consideration to transabdominal laparoscopic cerclage.

The laparoscopic approach has further advantages of obviating the need for a laparotomy, reducing the abdominal wall trauma and the recovery time, with short hospital stay, avoiding repeated laparotomy, and indirectly reducing *de novo* postoperative adhesion formation; this aspect cannot be overemphasized, which most obstetricians detest.

Finally, laparoscopic procedures, especially gasless ones,[1] appear to be safe for both the mother and fetus. The procedure also avoids the risk of ascending lower genital tract infections, which are occasionally seen in transvaginal cerclage and could result in abortions or preterm delivery as the case may be.

## CONCLUSION

In patients that are indicated, laparoscopic approach to cervical cerclage placement is an effective and safe adjunct to the treatment of cervical insufficiency, as evident by the obstetric outcomes. Also, laparoscopic cerclage may also be a superior method in terms of surgical outcomes, as suggested by several studies.

However, there is still need for more studies and, especially, considering fetal outcomes of laparoscopic cerclage and laparotomy cerclage with transvaginal cerclage, there is a need to do more in terms of increasing expertise in order to reduce complications to the barest minimum. It may be advisable to consider laparoscopic transabdominal cerclage before pregnancy, i.e., as an interval procedure.

Apart from those stated above, the following questions may, therefore, need answers in future studies:

- Should cerclage placed via laparoscopy be done before or after pregnancy?
- Will there be an effect on fertilization if laparoscopic cerclage is done before pregnancy?

## ACKNOWLEDGMENT

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CASE REPORT

# Laparoscopic Management of Stomach Sleeve Obstruction after Sleeve Gastrectomy

[1]Sanjay Patolia, [2]Ibrahim Hazza


## ABSTRACT

**Introduction:** Stomach sleeve obstruction can occur after sleeve gastrectomy (SG). It results in absolute intolerance to liquid and food intake. The obstruction of sleeve may be because of stomach torsion, twisting, kinking, folding, adhesions, and stenosis/narrowing.

We present a case report of two patients with absolute intolerance to liquid intake because of sleeve obstruction. The reason for obstruction was folding, twisting, and partial torsion of the stomach sleeve after SG.

**Case/technique description:** Two patients with absolute intolerance to liquid intake were received on day 5 and on day 12 after undergoing primary laparoscopic SG.

The endoscopy findings were similar in both the cases. It was not possible to reach pylorus without great difficulty and high level of maneuverability.

The laparoscopic findings were twisting and partial torsion due to laxity of the sleeve. Gastropexy was done in both the cases. The recovery in terms of excellent tolerance for liquid intake was immediate and that too without recurrence.

**Discussion:** The distal passage for food and liquid in the lumen of the sleeve should remain very smooth. The lumen can accept arrival of the Ryle's tube or gastric calibration tube up to antrum without any great assistance. This will not be possible in case of improper architecture of the crafted sleeve. The design of the sleeve may be improper from the beginning or it may mutate because of abnormal adhesion at any time during postoperative course. Symptoms and endoscopic findings are diagnostic of the problem. Laparoscopic correction of the architecture of the sleeve by doing adhesiolysis and gastropexy is successful.


**Keywords:** Gastric sleeve kinking, Gastric sleeve obstruction, Gastric sleeve twisting, Gastric torsion, Gastric volvulus, Gastropexy, Sleeve gastrectomy.

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## INTRODUCTION

Sleeve gastrectomy (SG) has earned huge popularity as an effective, safe, reproducible, fast, and easy bariatric procedure.

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However, it is also associated with few complications, such as leak, bleeding, reflux, and food intolerance.[1,7]

Stomach is stabilized at two fixed points, the cardia and pylorus. It is further held in position by the gastrophrenic, splenic, colic, and hepatic ligaments.

In case of SG, the stomach is to be mobilized completely by dividing all the structures supporting stability of the stomach. The dissection makes the stomach sleeve free. This will make it susceptible for twist, torsion, folding, or kinking, resulting in obstruction of the lumen.[1] Intractable vomiting, nausea, and absolute intolerance to liquid and food intake are because of obstruction of the sleeve. Gastric torsion is the terminology used for the case operated for stomach surgery, whereas gastric volvulus is used in the case of nonoperated stomach. Gastric torsion can be organoaxial (completely along the long axis) and mesenteroaxial (partial along the horizontal axis).[1]

The architecture (morphology) of the sleeve is a very critical aspect in the development of sleeve obstruction. The proper techniques of dissection and stapling are very important technical issues to craft the sleeve with perfect architecture, which gives almost vomiting-free postoperative recovery.[2]

The established treatment for obstructed sleeve is to convert it into gastric bypass, but adhesiolysis and meaningful gastropexy can be successful correction.[3]

## CASE REPORTS

### Case 1

A 26-year-old female with body mass index (BMI) 37 underwent SG and was discharged on the 3rd postoperative day. She presented with severe liquid intolerance and intractable vomiting on the 5th postoperative day. Upper gastrointestinal (GI) endoscopy revealed relative obstruction of the sleeve.

### Endoscopy Finding

The endoscope was not possible to reach pylorus without great difficulty and high level of maneuverability (Fig. 1).

### Laparoscopic Findings

The upper two-thirds of the gastric sleeve was twisted at the level of incisura angularis (Fig. 2). It was possible

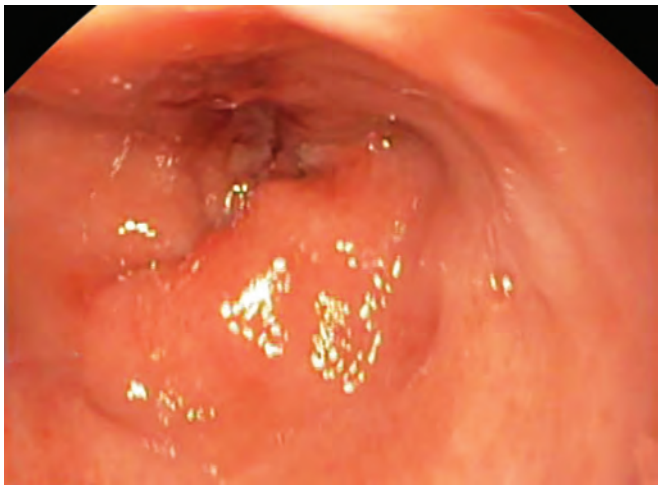

**Fig. 1:** Obstruction of sleeve lumen

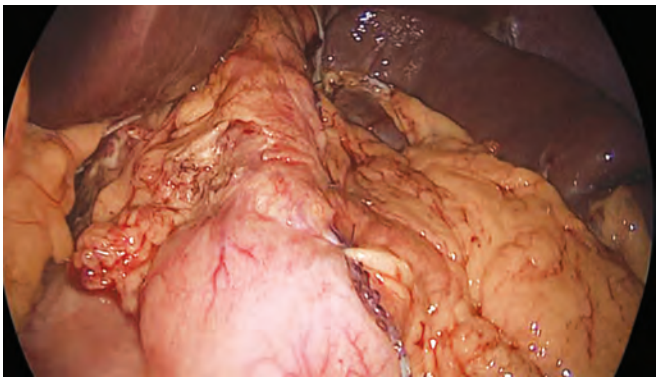

**Fig. 3:** Sleeve after gastropexy

to negotiate with a gastric calibration tube (GCT) after assisting with grasper from inside.

### Detail of Gastropexy

The gastric sleeve was mobilized and checked for the level and reason of obstruction with the help of a GCT. The stomach sleeve was fixed with posterior structures – pancreatic capsule and mesocolon – by taking

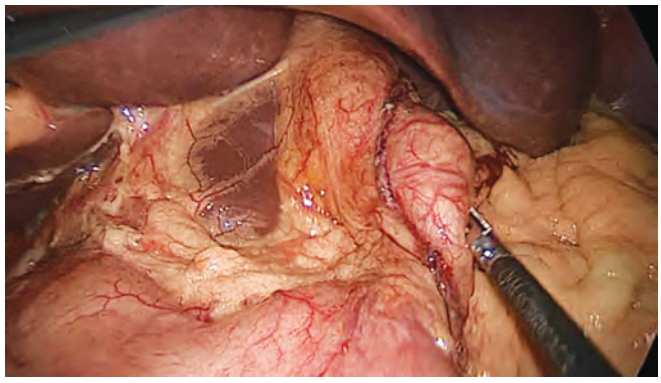

**Fig. 2:** Twisting (Clockwise) of sleeve at incisure angularis

intermittent stitches using 3–0 Vicryl. The gastropexy helped to correct the twisting of the sleeve (Fig. 3). The correction of obstruction of the lumen was confirmed by easy passage of GCT.

## RESULT

The pateint could tolerate clear liquids without any episode of vomiting or retrosternal discomfort during immediate postoperative period. The patient immediately improved and was discharged after 2 days. During follow-up (1 year), the patient remained asymptomatic.

### Case 2

A 27-year-old female with BMI 40.5 underwent SG and was discharged on the 3rd postoperative day. She presented with severe liquid intolerance and intractable vomiting on the 12th postoperative day. Upper GI endoscopy revealed relative obstruction of the sleeve.

### Endoscopic Findings

It was not possible to negotiate with the endoscope beyond incisura angularis (Fig. 4).

**Fig. 4:** Obstruction of the sleeve lumen

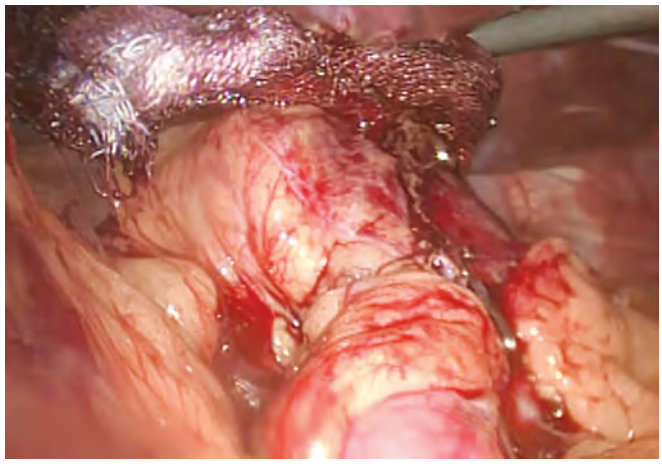

**Fig. 5:** Twisting of upper sleeve (clockwise) and mid part (anticlockwise)

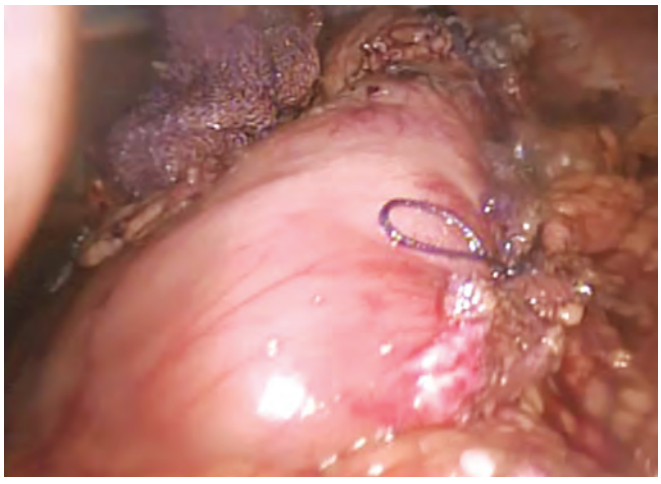

**Fig. 6:** After gastropexy

### Laparoscopic Findings

The sleeve was obstructed at two levels. There was clockwise rotation of upper one-third of the sleeve and anticlockwise rotation of lower one-third at the level of the incisura angularis (Fig. 5). It was not possible to negotiate the GCT without great assistance with grasper from inside.

### Details of Gastropexy

The gastric sleeve was mobilized and checked for the level and reason of obstruction with the help of GCT. The stomach sleeve was fixed with left crush to correct for upper clockwise rotation. The lower sleeve was fixed with posterior structure (pancreatic capsule and mesocolon) by taking intermittent stitches using 3–0 Vicryl. The gastropexy helped to correct the twisting of the sleeve at the level of incisura angularis (Fig. 6). The correction of obstruction of lumen was confirmed by easy passage of GCT.

## RESULT

The patient could tolerate clear liquids without any episode of vomiting or retrosternal discomfort during immediate postoperative period. Patient immediately improved and was discharged after 2 days. During follow-up (4th month), patient remained asymptomatic.

## DISCUSSION

The stomach is fixed proximally at the cardia and distally by posterior fixation of antrum, pylorus, and duodenum. Along with these two fixation points, the gastrophrenic, gastrosplenic, gastrocolic, and gastrohepatic ligaments fix the stomach in place.[4] In case of SG, the stomach is dissected free all around. The free stomach is vulnerable for twisting, torsion, kinking, or folding, resulting in a gastric sleeve obstruction.[5]

The architectural abnormality of the crafted stomach tube after SG may result in absolute intolerance for liquid and food intake due to obstruction of the lumen.[4]

Making the stomach free is a mandatory part of the surgery; thus, it cannot be avoided, but crafting the stomach sleeve with proper architecture can be focused and undertaken to avoid obstruction.

Tips to create sleeve with proper shape:

- Drop the idea of performing SG when there is large hiatus hernia and select gastric bypass.
- Do not overdissect posterior to antrum toward pylorus because the free antrum can rotate anticlockwise very easily resulting in obstruction at the level of incisura angularis.
- The angle on the staple line between the 1st and 2nd cartridge firing should be wide because a narrow angle will not create a smooth distal passage.
- Take extra care not to create narrowing of lumen at the level of incisura angularis. This situation can arise if stapling is done without using GCT or too much traction on the stomach wall is applied at the time of stapling.
- Do not overstretch the stomach wall at the time of stapling because it can give rise to narrowing of the lumen and zigzag on staple line.
- Take anterior and posterior wall in the stapling jaw equally. It helps to keep staple line away from the anterior surface of the sleeve. The staple line on the anterior surface will form dense adhesion with the undersurface of the left lobe of liver. Along with weight loss, left lobe of liver shrinks and pulls adherent staple line resulting in torsion/kinking of the sleeve.
- Staple line is to be covered by omentum always to avoid adhesion formation between left lobe of liver and staple line.
- Omentopexy involving staple line 5 cm above and 5 cm below the incisura angularis will be the best way to prevent twisting of the sleeve.
- Confirm the proper shape of the sleeve by easy passage of GCT into the antrum. If it is not up to satisfaction, perform gastropexy in such a way that it allows easy passage of GCT into the antrum.

Symptoms and endoscopy are the best tools to diagnose not only the obstruction of sleeve, but also the reason for it.

The early presentation of obstruction is mainly due to twisting, folding, corkscrewing, or partial torsion involving the lower segment of the sleeve. The other causes for vomiting, such as leak or hematoma should be ruled out.

The late presentation is mainly because of abnormal adhesion resulting in torsion and kinking.

The stenosis/narrowing of the lumen at the level of the incisura angularis can be suspected if stapling has been done without using GCT or overstretching of the stomach wall.

Endoscopy is the best diagnostic tool, but a clear picture of obstruction may not be visualized. The diagnosis of obstruction can be considered when it is done

by an experienced and exposed endoscopist. When it is extremely difficult and requires high level of maneuverability to reach the pylorus, it is indicative of twisting or partial torsion. The spiral appearance of the mucosal fold indicates total torsion of the sleeve.

After failure of conservative treatment, focus should be on surgical correction of the architecture of the sleeve.

Tips to perform result-oriented gastropexy.

- Careful adhesiolysis of sleeve, making it free all around.
- Pass GCT Fr 36 gently and observe the levels of holdup.
- Try to correct the architecture of the sleeve by holding/pressing it with the help of graspers. Request to push GCT repeatedly, and it should reach up to the antrum without holdup in between. This confirms proper correction and also gives idea of the places for the fixation stitches during gastropexy.[5-7]
- *Gastropexy*: Attempt gastropexy by taking intermittent stitches involving posterior fixed structures like left crush, pancreatic capsule, and mesocolon.
  - Involve anterior wall in the fixation in case of torsion and posterior wall in the fixation in case of folding/twisting for effective gastropexy.
- Gastropexy should be aimed at easy passage of GCT into the antrum. To achieve this, canceling and retaking of fixation stitches should be attempted.

If gastropexy attempts fail to achieve easy passage of GCT into antrum, consider the case for conversion into gastric bypass.

## CONCLUSION

Mobilization of stomach by removing all its natural supports creates a situation where the stomach sleeve can easily get into twisting or partial torsion during early postoperative period and folding, kinking, or torsion due to adhesion at any time in the postoperative period.

Nonjudicious overdissection, improper technique of stapling, and nonvigilance are responsible for improper final architecture of the sleeve. This will create problem of intolerance for liquid intake.

The obstructive symptoms along with signs of dehydration, hypovolemic shock, oliguria, nutritional deficiency, and endoscopy are the most effective tools to diagnose the situation of obstructed sleeve.

Laparoscopic adhesiolysis and gastropexy are effective corrections. Conversion to gastric bypass can be avoided if gastropexy is possible to be performed meaningfully.

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