

ORIGINAL RESEARCH

Complications and difficulties faced during laparoscopic tubal ligation using single-puncture technique in scarred abdomen

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This study was carried out in Dr. MK Shah Medical College and SMS Multispeciality Hospital, a tertiary care medical center, catering to Lower middle class and middle-class communities.

Objective: To evaluate the difficulties faced during laparoscopic tubal ligation and complications that occurred during or after laparoscopic tubal ligation in the scarred abdomen using the single-puncture technique and its outcome.

Methodology: A prospective study was carried out in tertiary care medical center in the periphery of the metropolitan area from 1st January 2022 to 30th September 2023. Consent of the ethical committee of the hospital and written consent of the patient were taken. All patients with a history of previous pelvic/abdominal surgery undergoing laparoscopic tubal ligation with a fallopian ring were included in the study and any difficulties faced or complications that occurred were noted. Patients undergoing the concomitant procedure (MTP/D&E/Check curette) with Lap TL were also included.

Results: A total of 41 patients were included in the study. 46.3% patients were in the age group of 25–30 years. There was only a marginal difference of around 3% between the age group of >30 years. The majority of patients were up to G3 (85.4%). Patients accepted laparoscopic tubal ligation if they had more than 2 children. Preoperative assessment should be done thoroughly by senior faculty. Fixed mobility is an ominous sign to take patients for Lap TL. Normally these findings are the same in patients with 3 scars on the abdomen and having a history of closure of the abdomen in single layer. 80% of patients undergoing Lap TL had a history of previous 2 CS. 12.5% of patients had a history of previous 3 Lower Segment Cesarean Section (LSCS). 1 out of 41 pt had operative h/o 2 LSCS + open appendectomy. 1 pt had operative h/o 2 LSCS + 3 Lap surgeries for surgical pathology. 1 pt had an exclusive history of open appendectomy. The majority of patients, 78.1%, had interval Lap TL. 17.1% had concurrent Lap TL with suction & evacuation. 4.8% had Lap TL following the 2nd trimester MTP. In 75.6% of patients, there was no difficulty in applying fallopian ring. 19.5% of patients who had peritubal adhesions were taken care of while doing single-puncture Lap TL. Complications were comparable with those of non-scarred abdomen undergoing Lap TL.

Conclusion: Lap TL in a patient with a scar on the abdomen is a preferable method rather than Laparotomy. Junior gynecologists should take the help of senior gynecologists conversant with doing Lap TL in patients with scarred abdomen. Complications are comparable with those of Lap TL in non-scarred abdomen. The abdomen should be closed in layers. It should be standard protocol for all gynecologist practicing universally. Scar/scars on the abdomen is not a contraindication of Lap TL.

Keywords: laparoscopic tubal ligation, scarred abdomen, single-puncture technique

Abbreviations and Acronyms

LSCS, Segment Caesarean Section; Lap TL, Laparoscopic tubal ligation; BMI, body mass index; MTP, medical termination of pregnancy; FTND, full-term normal delivery; WHO, world health organization; S.TSH: serum thyroid stimulating hormone; S.creat, serum creatinine; CBC, complete blood count; SGPT, serum glutamic pyruvic transaminase; ECG, electrocardiography.

1. Introduction and review of literature

India is leading so far as the terminal method of family planning (Sterilization) is concerned. Even in the terminal method of sterilization, female sterilization is the preferred method of choice. Most of the sterilizations, 70%, are female sterilizations (1). There are varied reasons, but the major reason is social. The percentage of women undergoing LSCS has increased dramatically in last 20–25 years from 8–10 to 25–30%. This itself has created problems with the scarred abdomen and its inherent complication while subjecting patients to laparoscopic sterilization. In India, over 4.1 million female sterilization procedures are done annually (HMIS 2013–14). There are various methods of female sterilization. But the laparoscopic method scores over all other methods due to shorter hospital stays, good chances of reverting fertility if required, and more and more patients demanding the laparoscopic method (2, 3, 4).

Insertion of Trocar and canula till the procedure of inserting the trocar and canula is a blind procedure as we do not follow open method of insertion of Trocar and canula in Lap TL. So, safety and the least complication in laparoscopic sterilization is the primary goal. Even after inserting the laparoscope, there may be adhesions to the surrounding uterus and fallopian tube, creating difficulties in applying fallopian ring. Keeping these things in mind, an attempt has been made in this study to find out the feasibility of doing laparoscopic TL in patients with a history of previous surgeries like LSCS, appendectomy, gynaecologic surgery, and laparotomy with the least complication and to circumvent difficulty if any.

2. Methodology

A prospective study was carried out in a tertiary care medical center in the periphery of metropolitan area from 1st January 2022 to 30th September 2023. Consent of the ethical committee of the hospital and written consent of the patient was taken.

The study included all 41 patients for single-puncture laparoscopic tubal ligation as per inclusion and exclusion

criteria. A detailed history of the patients was recorded with special reference to age, parity, menstrual, obstetric history, any medical history, and past surgical history. All the necessary preoperative investigations were done (CBC with blood grouping, serology, S TSH, SGPT, S creat, ECG). The patients were taken for Lap TL under short general anesthesia or under sedation and local anesthesia. Single-puncture Lap TL was performed as per standard technique with one modification of keeping the incision supraumbilical in all these patients to avoid injury to vital structures adherent to the anterior abdominal wall at scar site (incision away from previous scar).

2.1. Inclusion criteria

1. The patient should be married and should have at least one child whose age is above 1 year.
2. Female clients should be above the age of 22 years and below the age of 49 years.
3. Routine investigations like hemoglobin (Hemoglobin should be ≥ 8 gm/dl) and urine examination for albumin and sugar were done.
4. All patients, irrespective of the number of scars on the abdomen, were included for Lap TL after screening. None of the patients had more than 3 scars on the abdomen. Almost all scars were scars of CS.

2.2. Exclusion criteria

1. Puerperal period
2. Current and any history of ischemic heart disease
3. Uncontrolled diabetes mellitus
4. Diaphragmatic hernia
5. Active skin infection near the surgical site
6. Multiple risk factors for arterial and cardiac complications

3. Observation

3.1 Demographic data

3.1.1. Age

The majority of patients (19, 46.3%) were in the age group of 25–30 years. There is only a marginal difference of around 3% between the age group of >30 years. This is because of our tradition of early marriage and peak reproductive age between 20–30 years (Table 1).

3.1.2. Religion

All (100%) the patients were Hindus. Our hospital caters to Muslim Patients also, but the percentage of Muslim patients is less in our hospital, and acceptance of sterilization is very low in the Muslim community as their religious doctrine of Islam does not support permanent methods of female contraception (5, 6). The percentage of the Christian community is negligible in our hospital, practically nil.

3.2 Pre-OP assessment

3.2.1. Gravida/parity status of patients

The majority of patients are up to G3 (85.4%). None of the patients accepted laparoscopic tubal ligation if they were having less than 2 children (Table 2).

Acceptance of tubal ligation is highest when the number of children is two or more (78%). This is in variations of figure available before 2 decades where patients used to accept when the number of living children was 3. More and more couples are opting for small family norms and terminal methods of contraception. As the nuclear family concept is prevalent, more and more people are going for a decreased number of children (Table 3).

3.2.2. BMI

We are catering to lower and middle socioeconomic classes of patients in whom obesity is very low. Hence 75.6% are within the normal BMI range (Table 4).

TABLE 1 | Age -1451624575-1451624575distribution of patients.

AGE	20–25 years	25–30 years	> 30 years
NO OF PATIENTS	4	19	18
PERCENTAGE	9.8%	46.3%	43.9%

TABLE 2 | Gravida status of patients.

Gravida	No of patients	Percentage
G2	18	43.9%
G3	17	41.5%
> / = G4	6	14.6%

TABLE 3 | Parity status of patients.

Parity	No of patients	Percentage
1	0	0%
2	32	78%
3	8	19.5%
4	1	2.4%

3.2.3. Mobility of uterus

2 (4.8%) patients had restricted mobility of the uterus and 1(2.4%) patient had fixed mobility. Patient with restricted mobility was included in the study and we had a lot of difficulties in carrying out laparoscopic TL. The senior person had not evaluated this patient pre-operatively (Tables 5 and 6).

3.2.4. Visibility of cervix

Only in 1 patient (2.4%), the cervix could not be visualized, and the same patient had an immobile uterus; hence, there was difficulty in doing Lap TL in that patient. Non-visualization of cervix and fixed uterus is a deadly combination for carrying out Lap TL (Table 7).

3.3 Operative history

The major scar in our patient naturally is LSCS. 80% of patients undergoing Lap TL had a history of previous 2 CS. 5(12.5%) patients had a history of previous 3 LSCS. The total number of surgeries is higher because of duplication of different surgeries in the same patient.

TABLE 4 | BMI status of patients.

BMI	<18.5 underweight	18.5–24.9 normal	>25 overweight	> 30 obese
No of patients	3	31	6	1
Percentage	7.3%	75.6%	14.6%	2.4%

TABLE 5 | Mobility of uterus.

Mobility of uterus	Freely mobile	Restricted mobility	Fixed
No of patients	38	2	1
Percentage	92.6%	4.8%	2.4%

TABLE 6 | Comparison between no. of CS and mobility of uterus.

	Freely mobile	Restricted mobility	TOTAL
Prev 1 CS	3 (7.5%)	0 (0%)	3 (7.5%)
Prev > / = 2 CS	34 (85%)	3 (7.5%)	37 (92.5%)
Total	37 (92.5%)	3 (7.5%)	40 (100%)

P value = 1.00 (Fisher's exact test).

P value is not significant but further study with increased number of patients may give us a clear guideline.

TABLE 7 | Visibility of cervix.

Visibility	Cervix visualized	Cervix not visualized
No of patients	40	1
Percentage	97.6%	2.4%

1 out of 41 pt had operative h/o 2 LSCS + Open Appendectomy

1 out of 41 pt had operative h/o 2 LSCS + Lap Appendectomy + Lap cholecystectomy + Lap ovarian cystectomy

1 out of 41 pt had exclusive history of open appendectomy; she had no history of LSCS (Table 8).

3.4 Type of CS scar

The majority of the patients (95.2%) with a history of previous LSCS had Suprapubic transverse scar. Vertical or transverse scars will not make any impact on deviation in the technique of Lap TL because in all these types of incisions peritoneum is opened vertically. So, it depends on the technique of closure in the form of closing/not closing the peritoneum. Even closure/non- closure of the visceral peritoneum will make adhesions if visceral peritoneum is not closed and raw area is left in the peritoneal cavity leading to adhesions with the surrounding organ commonest being the small intestine (Table 9).

3.5 Time of operation

The majority of patients, 32 (78.1%), had Interval Lap TL. 7 (17.1%) had concurrent Lap TL with suction & evacuation. 2(4.8%) had Lap TL following 2nd trimester MTP. We had done Lap TL following 2nd trimester MTP as a research project and follow-up is going on (Table 10).

3.6 Difficulty in lap TL

The Standard modification carried out in all patients of previous LSCS was supraumbilical insertion of Veres needle and trocar-cannula. In 32(75.6%) patients, there was no difficulty in applying the fallopian ring. 8(19.5%) patients

TABLE 8 | Operative history of patients.

No of LSCS	No of patients	Percentage
1	3	7.5%
2	32	80%
3	5	12.5%
Other surgeries	1 out of 41 pt had operative h/o 2 LSCS + Open Appendectomy 1 out of 41 pt had operative h/o 2 LSCS + Lap Appendectomy + Lap cholecystectomy + Lap ovarian cystectomy 1 out of 41 pt had operative h/o Open Appendectomy with obstetric h/o: P4L4 with prev 4 FTND	

TABLE 9 | Type of CS scar.

Type of CS SCAR	No of patients	Percentage
Vertical scar	2	4.8%
Supra pubic transverse scar	39	95.2%

TABLE 10 | Time of operation.

Time of operation	No of patients	Percentage
Interval lap TL	32	78.1%
Concurrent with 1st trimester MTP(suction evacuation)	7	17.1%
After 2nd trimester MTP	2	4.8%

TABLE 11 | Difficulty faced during lap TL.

Difficulty faced	No of patients	Percentage
No difficulty	32	75.6%
Modification in application of fallopian ring (after doing adhesiolysis and creating window)	8	19.5%
Difficulty in Manipulation of Cervix due to Inaccessible cervix	1	4.9%

had peri-tubal adhesions. The window was created in the avascular area of the omentum and tubes were assessed and successful fallopian ring application was carried out. All patients with previous scars were taken for Lap TL by Senior faculties not less than the Professor. This may be the reason that in 75% of patients, there was no difficulty (Table 11).

3.7 Intra operative complications

12.2% of patients had extraperitoneal insufflation of gas which was done by the resident and later corrected with intraperitoneal insufflation of gas by the senior. None of the patients required a second incision to do intraperitoneal insufflation of gas.

1(2.4%) patient had uterine perforation during manipulation. In this uterine manipulator was not used but Hegar's dilator was used. Perforation was tiny and did not require any intervention.

In 1(2.4%) patient transection of the fallopian tube occurred while it was being taught to junior faculty members and was taken care of by applying a fallopian ring on both cut ends of the transected tube with a satisfactory loop length.

In 1(2.4%) patient hematoma of about 3 × 3 cm occurred in mesosalpinx, was not increasing in size, and was observed for 5 min. The tip of the tong of the ring applicator might have touched the vein of the pampiniform plexus running in the broad ligament parallel to the fallopian tube.

In 1(2.4%) patient, there were dense adhesions, and almost the pelvis was frozen. On the left side, it was possible to create a window in the avascular area of the omentum, identify the fallopian tube, and apply a fallopian ring. The patient was not ready to go for a triple-puncture operative laparoscopy. If the patient had agreed, the procedure of applying fallopian ring on the other side would have been completed (Table 12).

3.8 Postoperative complications

10 (24.4%) patients had mild postoperative pain which they could bear with. The pain was because we had used atmospheric air rather than carbon dioxide. All 10 patients responded to routine analgesics in the form of diclofenac.

Serous discharge was present in 2(4.8%) patients, which required repeat dressing only once.

There was superficial wound infection in the form of local infection at the site of the wound which was deep into subcutaneous and required dressing for 2–3 days.

None of the patients had TL failure till today and long-term follow-up is going on (Table 13).

3.9 Comparison between number of lower segment caesarean section and type of lower segment caesarean section with complication

Comparison between number of LSCS and intra op adhesions present:

$P = 0.5445$ (Fisher's exact test)

Statistically, P value is not significant but clinically intra OP 33% of patients (8 out of 24) required adhesiolysis to complete the procedure (Table 14).

Complications with type of scar

$P = 0.55$ (Fisher's exact test)

P value is not significant which is evident because either vertical or transverse scar will not make any difference in scar formation. It is late complications in the form of incisional hernia which is markedly reduced in Pfannenstiel scar as compared to vertical scar. Pfannenstiel scar is

TABLE 12 | Intra operative complications.

Intra operative complications	No of patients	Percentage
Extraperitoneal air insufflation	5	12.2%
Perforation of uterus	1	2.4%
Tubal transection	1	2.4%
Mesosalpinx Hematoma	1	2.4%
Incomplete tubal ligation (unilateral application of fallopian ring)	1	2.4%
None	32	78.2%
Total	41	100

TABLE 13 | Post OP complications.

Post-Operative complications	No of patients	Percentage
Post-operative pain	10	24.4%
Discharge from wound site	2	4.8%
Wound gap	1 (superficial)	2.4%
TL Failure	0	0%

TABLE 14 | Comparison between number of LSCS and intra op adhesions present.

	Yes	No	Total
Prev 1 cs	1 (2.5%)	2 (5%)	3 (7.5%)
Prev > / = 2CS	24 (60%)	13 (32.5%)	37 (92.5%)
Total	25 (62.5%)	15 (37.5%)	40 (100%)

$P = 0.5445$ (Fisher's exact test).

Statistically P value is not significant but clinically Intra OP 33% of patients (8 out of 24) required adhesiolysis to complete the procedure.

TABLE 15 | Complications with type of scar.

	Adhesions +	Adhesions-	Total
Vertical scar	2 (5%)	0	2 (5%)
Pfannenstiel scar	25 (62.5%)	13 (32.5%)	38 (95%)
Total	27 (67.5%)	13 (32.5%)	40 (100%)

$P = 0.55$ (Fisher's exact test).

P value is not significant which is evident because either vertical or transverse scar will not make any difference in scar formation. It is late complications in the form of incisional hernia which is markedly reduced in Pfannenstiel scar as compared to vertical scar. Pfannenstiel scar is cosmetically preferred. World over, the majority of patients are operated on by Pfannenstiel scar or its modification is preferred for LSCS.

cosmetically preferred. World over, the majority of patients are operated on by Pfannenstiel scar or its modification is preferred for LSCS (Table 15).

4. Discussion

As per the study by Szigetvari et al. (7), 23% of them had abdominal adhesions with previous abdominal surgery which is comparable with our study as although adhesions were found in 67.5% of the patients; only 19.5% (8 out of 40) needed adhesiolysis for application of fallopian ring. The rest of the patients had very few flimsy adhesions that did not require any further management. As per a review by Cochrane (8), there were 11 procedure-related complications in laparoscopic sterilization which were only 5 in our study. As per the study in women with two or more caesarean-section laparoscopic sterilization is safe and associated with low morbidity and can be performed as permanent method of sterilization if extra care is taken and is in part with the study conducted by Ghoshal et al. (9). As per the study by Huber et al. (2) out of 27,653 patients included in the study: The proportion of major complications was higher in Postpartum minilaparoscopic sterilization than interval

laparoscopic sterilization (0.39% versus 0.10%, odds ratio 4.0, 95% CI 2.15–7.44, $p < 0.001$) but not statistically different between interval laparoscopic sterilization (0.10%) and Postpartum laparoscopic sterilization (0.18%). Minor complications were statistically significantly more frequent in Postpartum minilaparoscopic sterilization (0.82%) than in interval laparoscopic sterilization (0.26%) or Postpartum laparoscopic sterilization (0.27%). There was no case of intra-operative or post-operative death in the study population.

Population explosion is a burning problem around the world particularly in Asia and Africa. WHO is actively helping many countries with temporary and permanent methods of contraception to curb population explosion. Tubal ligation particularly Laparoscopic tubal ligation is contributing a lot to limit population explosion in India.

As the percentage of Caesarean section has increased, the number of scars on the abdomen increases. The Scarred abdomen is a challenge for carrying out Laparoscopic tubal ligation as it is associated with a lot of complications if the expert person is not carrying out Lap TL. An attempt is made here to find out modification in technique, pre of assessment for Lap TL, and intra op modification required to carry out successful tubal ligation.

A senior person conversant with laparoscopy should attempt Lap TL in a patient of scarred abdomen. The surgeon should be conversant with a minor operative procedure in the form of adhesiolysis and creating window in the omentum to find out the fallopian tube.

Emphasis should be made very strictly on closing the abdomen layer-wise. It was observed that the majority of adhesions were in the patients in whom the visceral and parietal peritoneum were not closed. The resident should be taught to close the abdomen by standard technique.

Extraperitoneal insufflation, Bisection of the tube, minor hematoma in the broad ligament can be managed by proper technique.

In our series, we could not complete the procedure because pre op assessment was not carried out by the senior faculty member. It should be a standard protocol for verifying pre op assessment of patients undergoing Lap TL.

It would be highly desirable if CO₂ is universally available for carrying out pneumoperitoneum and for that matter it is desirable to have pneumoperitoneum apparatus.

Shortcuts of direct trocar insertion should be strictly avoided in patients with scarred abdomen.

Conclusion

All gynecologists should be trained in Lap TL. Lap TL in a patient with a scar on the abdomen is a preferable method rather than Laparotomy. Junior gynecologists should take the help of senior gynecologists conversant with doing Lap TL in patients with the scarred abdomen. Complications are comparable with those of Lap TL in non-scarred abdomen.

The Abdomen should be closed in layers. It should be a standard protocol for all gynecologists practicing in nation.

Tubal ligation by laparoscopy is thus safe, effective, less time consuming method for permanent contraception (1, 3).

Scar/scars on the abdomen are not a contraindication of Lap TL.

Author contributions

The research study was carried out jointly by SS and VP. Record keeping was done by VP under the supervision of SS. Both authors contributed to the article and approved the submitted version.

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Conflict of interest

We declare that the research was conducted in absence of any commercial or financial relationships that could be constructed as a potential conflict of interest.

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