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Article

Effect of laparoscopic adhesiolysis on reproductive outcome

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Abstract. *Background:* Peritoneal and peri tubal adhesions are a major factor for infertility accounting for 25-30% of cases. We conducted this study in order to observe the outcome of clinical pregnancy after the procedure of salpingo-ovariolysis, with a minimum follow-up period of six months. The aim is to observe the clinical pregnancy outcome after laparoscopic removal of peritoneal related to the uterus and ovaries and peri tubal adhesions in patients with peritoneal and peri tubal adhesions after a minimum period of six months. *Methods:* A total of eighty patients with the complaint of infertility and diagnosed with features suggestive of pelvic adhesions (by hysterosalpingogram or by formal pelvic ultrasound) were admitted to perform laparoscopic adhesiolysis and were observed for a period of 6 months to record clinical pregnancy outcome over this period. *Results:* The result of clinical pregnancy outcome after a follow-up period of 6 months after the date of surgery, shows 68.8% of cases did not achieve clinical pregnancy, while 31.1% did achieve clinical pregnancy during the given time period. *Conclusion:* Laparoscopic treatment of adhesions has an important role in infertility workup. Adhesions should be properly assessed preoperatively as regards the history of previous operations and through investigations (hysterosalpingogram and ultrasound) to aid the process of documentation for retrospective analysis as well as proper post-operative record keeping of intra-operative surgical details for future reference.

Keywords: Laparoscopy, infertility, adhesiolysis, Clinical pregnancy, tubal

Introduction

Adhesions eventually become the outcome of healing of the injured peritoneum, and specifically due to imbalance between the deposition of fibrin

produced by injured tissue and the fibrinolytic activity. The fibrinolytic system present in endothelial cells and mesothelial cells controls the process of fibrin degradation after tissue injury.(1) The exudate resulting from increased vascular permeability is rich in substances like fibronectin, glycosaminoglycans and inflammatory cells. This will lead to fibrin deposits that form an adhesion between two previously unconnected surfaces or structures. Usually, the fibrin deposits are degraded by the process of fibrinolysis, which is controlled by the enzyme plasmin produced by macrophages and mesothelial cells.

The negative impact of adhesions that develop from gynecologic surgery are devastating like changes of normal anatomy leading to difficulty in dissecting tissue plains at subsequent operations (e.g., adhesions to the anterior abdominal wall). As a result, cutting of adhesions before performing the intended operation will take a longer time, increased hospital stays and readmissions, and predisposes patients to complication such as unintentional damage to the blood vessels, bowel, bladder, and the ureter.(2) Secondly, postsurgical adhesions are incriminated to be a main reason for conversion from laparoscopy to laparotomy in a multitude of procedures. Effects that sometimes happen is when intraperitoneal bands of adhesions involve the intestines leading to intestinal obstruction or when adhesions affect the uterine tube and tubo-ovarian relationship, leading to consequences such as infertility and increased risk of ectopic pregnancy.

Infertility is defined by the World Health Organization (WHO) as the inability to conceive after 1 year of unprotected sexual intercourse. Nearly 50–80 million women are estimated to have subfertility/infertility every year**.(3)** Intra-abdominal adhesions occur in as many as 60% of women who have performed major as well as laparoscopic gynecologic procedures.(4) One of the most commonly encountered causes for subfertility in women is a pathology of the Fallopian tube.(5) While excluding other ailments of the reproductive system such as endometriosis, polyps, previous infections or operations may lead to intra-abdominal adhesions and therefore to dysfunction of the Fallopian tube.

Objective:

Peritoneal and peri tubal adhesions are a major factor for infertility accounting for 25-30% of cases. The present study is to observe the outcome of clinical pregnancy after the procedure of salpingo-ovariolysis, with a minimum follow-up period of six months.

Methods

Study design, setting and participants

A group of 80 females were allocated based on their personal desires/preferences after explanation of the advantages and potential side effects of the intervention. An informed consent was obtained from all patients included in the research. The research was conducted ethically in accordance with the World

Medical Association Declaration of Helsinki (IRB No.00012098, Ethics committee, Faculty of medicine, Alexandria University))

During the study period, participants enrolment was used to reach target sample size.

Enrolled participants were subjected to thorough history taking to identify symptoms and type of infertility. Women were enrolled based on symptoms suggestive of pelvic/ peri tubal adhesions and imaging in the form of hysterosalpingography ± formal ultrasound imaging with features of adhesions.

Women with symptoms of infertility and imaging in the form of hysterosalpingography and/or ultrasound denoting adhesions presented to the outpatient gynecology clinic at Elshatby maternity hospital located in Alexandria, Egypt were recruited to participate in the study depending on their intervention, whether it is laparoscopy or combined hysteroscopy and laparoscopy.

Patients were admitted to the hospital after filling their names and signing the consent for surgery.

Inclusion criteria:

- Women aged 20 – 35 years presenting with primary or secondary infertility, previously diagnosed with features suggestive of pelvic adhesions (by HSG and U/S).

Exclusion criteria:

1. Ovarian pathology.
2. Abnormal semen parameters (according to WHO criteria)
3. Congenital uterine abnormalities.
4. Frozen pelvis
5. Grade III/IV endometriosis.

The intervention

All patients received 1g of chosen IV antibiotic preoperatively. The operation consent was revised and standardized, conventional laparoscopy procedure was performed. The patients lie in extended lithotomy position and surgical draping is done after surgical disinfection with betadine solution. After 1-2 minutes of surgical disinfection, Veress needle is inserted through the Umbilicus into the peritoneal cavity with safety measures performed during insertion to avoid bowel or vascular injury. Tests to ensure intraperitoneal insertion is done and gradual insufflation of the abdomen is performed till reaching adequate intraperitoneal pressure of 12-18mmHg on average. Upon reaching adequate intraperitoneal pressure, a 10mm trocar is inserted through the umbilicus carefully till “hissing “sound is heard denoting intraperitoneal placement. The laparoscopy video camera is connected to 0^0 endoscope and White balancing is performed before inserting the endoscope

using a white background. Gradual insertion of the camera is performed and inspection of the abdomen and pelvis for adhesions by inspecting the subdiaphragmatic area, right and left paracolic areas and the pelvic area including the uterus, ovary, fallopian tubes, Douglas pouch and uterovesical pouch. Insertion of secondary 5mm trocars in suprapubic, right and left iliac regions according to surgical preference. Type of adhesions, whether dense or filmy adhesions and site of adhesions is noted and recorded, and scoring of adhesions was done using Peritoneal adhesion index score (PAI). The process of adhesiolysis is performed accordingly using electrocoagulation with dense adhesions or through directly using scissors for filmy, thin adhesions. As a routine procedure protocol, methylene blue dye test is performed to test tubal patency already confirmed preoperatively by hysterosalpingography. Irrigation by 0.9% normal saline followed by suction using suction -irrigation instrument is performed to ensure hemostasis and decrease the possibility of adhesions reformation. Site of trocar insertion is noted for any hematomata then the trocars are removed under vision. Closure of the trocar ports is done using 2/0 Vicryl absorbable sutures. If the patient was to perform hysteroscopy the procedure was to be commenced after performing laparoscopy.

Follow-up: post-course assessment

All patients enrolled in the study were requested to return to the hospital after 3 and 6 months from date of laparoscopy surgery. After performing surgery, the patients were requested to notify if pregnancy has occurred, as they were further requested to perform quantitative β-HCG serum level. If serum level is exceeding 1500mmol/l, the patient is requested to return to Elshatby maternity hospital and perform formal transvaginal ultrasound for documentation of intrauterine gestation and fetal pulsation.

Outcome measure

Clinical pregnancy over a period of follow-up of six months following laparoscopy.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov and Shapiro-Wilk test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, and standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the 5% level.

The used tests were

1- Chi-square test

For categorical variables, to compare between different groups.

2- Monte Carlo correction

Correction for chi-square when more than 20% of the cells have expected count less than 5.

3- Mann Whitney test

For abnormally distributed quantitative variables, to compare between two studied groups.

Results

Preoperative investigation

As regards to hysterosalpingography, 15% of cases showed adhesions related to the right tube, while 27.5% of cases had adhesions related to the left tube. 33.8% of cases showed adhesions related to both fallopian tubes. Weak passage of dye was noted in 12.5% of cases. Other signs as presence of pelvic loculations of the dye near the fallopian tube or upward displacement of the tube formed around 10%of hysterosalpingograms. As regards to ultrasound imaging the majority of ultrasound images showed no abnormalities (92.5%), 3.8% showed right adnexal adhesions and 3.8% showed signs of left sided adnexal adhesions. **Table (1)**

Table (1): Distribution of the studied cases according to preoperative investigations (n = 80)

	No.	**%**
HSG		
Normal	1	1.3
Right tube	12	15.0
Left tube	22	27.5
Bilateral tubes	27	33.8
Weak smearing of both tubes/Minimal tubal spillage	10	12.5
Pelvic adhesions / Pelvic loculations / Upwards position of the tube	8	10.0
Ultrasound		
Normal	74	92.5
Right	3	3.8
Left	3	3.8

Operative findings

During laparoscopy, 18.8% of adhesions were found on the right side, 38.8% of adhesions were found on the left side and 33.8% were found on both sides. Other sites of adhesions including adhesions related to the colon composed 8.8% of cases. Regarding type of adhesions, 86.3% of adhesions were filmy adhesions, 7.5% showed dense fibrous adhesions, 2.5% showed omental adhesions and 3.8% showed

mixed omental and filmy adhesions. According to peritoneal adhesion index scoring (PAI), 86.5% of adhesions were classified as type 1 adhesions, distributed in the pelvic area, right and left lower regions mainly, and to a lesser extent in the left flank and right upper area of the abdomen. 13.5% showed type 2 adhesions and were distributed in the right and left lower areas of the pelvis. Sharp dissection only was used in 66.3%of cases while in 33.8% of cases bipolar or monopolar coagulation was used in addition to sharp dissection. Dye test using methylene blue was performed in all cases, and 55% of cases passed dye through the fallopian tubes on the first attempt of dye injection, while 45% required multiple attempts for subsequent passage of dye denoting tubal patency. **Table (2)**

Table (2): Distribution of the studied cases according to operative findings (n = 80)

	No.	%
Site of adhesions		
Right adhesions	15	18.8
Left adhesions	31	38.8
Bilateral adhesions	27	33.8
Colonic adhesions others	7	8.8
Type of adhesions		
Filmy adhesions	69	86.3
Omental adhesions	2	2.5
Dense adhesions	6	7.5
Mixed adhesions (Omental/filmy)	3	3.8
PAI		
1DEG	1	1.3
1E	17	21.3
1EF	14	17.5
1EG	17	21.3
1EGA	1	1.3
1EGF	6	7.5
1G	12	15.0
1GF	1	1.3
2EF	5	6.3
2EGF	3	3.8
2G	1	1.3
2GF	2	2.5
Method of adhesiolysis		
Sharp (scissors)	53	66.3
Sharp (scissors), electrocoagulation	27	33.8
Dye test		
First injection (Low pressure)	44	55.0
Multiple injection (High pressure)	36	45.0

Clinical pregnancy outcome

The result of clinical pregnancy outcome after a follow-up period of 6 months after date of surgery, showing 68.8% of cases did not achieve clinical pregnancy, while 31.1% did achieve clinical pregnancy during the given time period. **Table (3)**

Table (3): Distribution of the studied cases according to clinical pregnancy outcome (n = 80)

Clinical pregnancy outcome	No.	%
Pregnant		
No	55	68.8
Yes	25	31.3

Time to pregnancy throughout the six months interval

Regarding the duration between the time of surgery and the occurrence of pregnancy is represented below, showing that 36% of pregnancies occurred within the first two months after surgery, 44% of pregnancies occurred within two to four months after surgery, while 20% of pregnancies occurred within the last two months of the six months follow-up period. **Table (4).**

Table (4): Time to pregnancy according to bimonthly intervals throughout the six months period (n=25)

Time to pregnancy (months)	No.	%
0-2	9	36
2-4	11	44
4-6	5	20

Discussion

Infertility is identified as 1 year of unprotected coitus without pregnancy. It is a global problem that approximately affects 8-12% of couples in the reproductive age group (around 50-80 million).(6) According to the World health organization (WHO), infertility can be classified as primary, when women have never conceived, and secondary when the couples cannot achieve pregnancy after at least one successful conception.(7)

Multiple factors can affect fertility, mainly abnormalities in ovulation (30-40%), abnormal semen parameters (20%), Tubal/ peritoneal causes (30-40%), and unexplained infertility (10%).(8)

In our study, we examined the effect of laparoscopic salpingo-ovariolysis on the clinical pregnancy rate by observation of the rate of spontaneous clinical pregnancy over a period of six months. For decades, the use of laparoscopy has been the mainstay tool for the diagnosis and treatment of pelvic pathologies, including adhesions that affect the tubo-ovarian relationship and thus affect pregnancy rates.

The study was conducted in the El Shatby maternity hospital endoscopy unit, Obstetrics, and Gynecology department, Alexandria University Hospital, and included 80 cases of infertility (primary, secondary and relative infertility) admitted for laparoscopic adhesiolysis.

In our study regarding demography, the mean age of females was 27.9±4.9 years (Table 1). Pantou et al(9) stated that the mean age of cases was 36.32 ± 1.57 years (25 cases). In this study, they aimed to show the effectiveness of laparoscopic surgeries in women with infertility and treated the underlying cause (whether adhesions, endometriosis, etc…) and treated accordingly. The cases were then followed up for 1 year to observe the rate of natural conception.

Dawood et al(10) mean age of the study was 27.56± 3.74 years (149 cases). This was a study comparing the role of laparoscopic adhesiolysis versus ICSI in cases of post-cesarean adhesion formation.

According to Elgergawy et al (11), the mean age was 29±9.8 years (43 cases). Similar to Dawood et al, this study was a randomized clinical trial between two groups: the first group underwent laparoscopic adhesiolysis and the second group was treated with ovarian stimulation and IUI over a period of one year.

Al-Husban et al(12) mean age of cases is 34.3± 7.7 years (296 cases). This was a retrospective cohort study in patients with previous histories of abdominopelvic surgeries to find the prevalence of adhesions, their severity, and their relation to the previous surgeries performed.

According to Nagakawa et al(13), 47 cases of unexplained (primary) infertility were divided into 5 groups according to age (≤ 25years, 26-30 years,31-35 years, 36-40 years, and over 41 years) and were compared to another group of 52 infertile patients who underwent ART treatment.

The mode of delivery was noted during our study and showed that 58.8% of cases (47 cases) did not achieve pregnancy, 37.5% of cases (30 cases) were delivered by cesarean delivery and only 3.8% of cases had a history of normal vaginal delivery (Table 1). All the study cases by Elgergawy et al(11) had a history of previous cesarean delivery.

Pantou et al (9) cases were all cases of primary infertility with or without previous history of IVF failure, unlike our study which included cases of primary infertility 51.3%, secondary infertility (40%), and relative infertility (8.8%) (Table 1). Al-Husban et al(12) stated that 128 cases of primary infertility and 154 cases of secondary infertility were admitted for laparoscopy.

Surgical history is an important factor affecting the tubo-ovarian relationship, namely abdominopelvic surgeries. In the present study, 17.5% had a previous history of abdominal and/or gynecologic surgery and 6.3% had non-gynecologic/abdominal surgeries. According to Al-Husban et al(12), 192 cases (62%.1%) had a history of previous surgeries, mainly abdominopelvic surgeries (187 cases) and cesarean section (84 cases).

The type of adhesions in our study was mainly of thin (filmy) type representing 86.3% of cases. Omental type of adhesions was noted in 2.5% of cases and thick (dense) adhesions were noted in 7.5% of cases. Adhesions were found on the right side in 18.8% of cases (15 cases), on the left side in 38.8% of cases (31 cases), on both sides of the pelvis in 33.8% of cases (27 cases), and other sites in 8.8% & cases. Al-Husban et al(12) documented filmy (thin) adhesions in 64.2% of cases (190 cases) and thick (dense) adhesions in 35.1% of cases (104 cases). They also stated that 7.8% of adhesions observed were related to the ovary (23 cases),4.1% were tubal (12 cases), and 5.1% were mixed pelvic adhesions (15 cases).

Elgergawy et al (11) on the other hand stated filmy adhesions represented 68.29% of all cases, while thick adhesions represented 31.71% of cases. The majority of adhesions were tubal adhesions (73.17%), while ovarian adhesions and uterine adhesions represented 24.39% and 2.44% respectively. Pantou et al (9) stated during the study regarding the role of laparoscopy and natural conception that 25 out of 107 cases (23.3%) were diagnosed with peri adnexal and pelvic adhesions without stating sites of adhesions nor their type.

The main outcome of our study was to see the effect of adhesiolysis on the rate of clinical pregnancy over a period of six months. Our study showed that 31.3% of cases achieved pregnancy within the 6 months interval as shown in table (4). Also, the time to pregnancy was noted during our study and showed that 36% of cases achieved clinical pregnancy within the first two months, 44% of cases achieved pregnancy in the second 2 months of the follow-up period and 20% achieved pregnancy in the last two months of the follow-up period. Elgergawy et al(11) 43 cases out of 92 cases underwent laparoscopic adhesiolysis of mild peri tubal adhesions as a part of a case-control study. The follow-up period for spontaneous pregnancy was one year which resulted in a pregnancy rate of 76.7% (33 cases).

Pantou et al (9) on the other side stated that 25 cases had peri adnexal and pelvic adhesions monitored for natural conception over the course of one year, and 44% (11 cases) achieved pregnancy within this time frame.

In our study, there was statistical significance regarding clinical pregnancy in the younger age population, with a mean age of 26.2 ±4.83 years. In agreement with our study, Nagakawa et al (13) also stated the clinical pregnancy rate in the age group was almost 76% in comparison to other age groups and even higher than the second group receiving ART treatment.

No statistical significance was noted regarding the type of infertility, type of adhesions, or medical or surgical history of clinical pregnancy outcome (table 5).

The current study has some limitations. Firstly, the sample size and the follow-up period for achieving clinical pregnancy outcome was relatively short. A six months interval has not taken into consideration a suitable postoperative period of recovery after laparoscopic surgery. This partially explains why other studies with a longer, 1 -year follow -up period had a higher clinical pregnancy rate than ours. Moreover, the sample size was relatively small, leading to the inability to represent the correlation of some parameters like the history of previous cesarean delivery and its effect on infertility, in comparison showed by other previous studies, suggesting the role of chance, thus the need for a separate study to assess the effect of certain operations like cesarean section and their role in secondary infertility with a larger sample size.

Another limitation to be considered was the COVID-19 pandemic. During the pandemic, there was a marked limitation of elective cases admitted for laparoscopy with times of complete stoppage of elective surgeries in general. This led to a decrease admittance of cases fulfilling the inclusion criteria of the study throughout this critical period.

The present study is an important addition to the literature as it addressed a large group of cases who are admitted on daily basis to the laparoscopy unit in El Shatby maternity hospital due to pelvic and/or abdominal adhesions due to various causes as a part of infertility work-up. It allowed us to assess the performance of the unit and the medical staff regarding a fairly common procedure.

Statement of Ethics

The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.

Conflict of Interest Statement

All authors declare no conflict of interest.

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Author Contributions

Dr. Elaryan implemented the design, and collected, and interpreted the data. He also wrote the draft version of the article, including the abstract, introduction, methodology, results, and discussion. Most of the laparoscopic surgeries were performed by him.

Professor Dr. Moiety originated the concept and the design of the work. He revised the article and contributed with comments and supervised the laparoscopic procedures

Professor Dr. Hanafy contributed to interpreting and analyzing the data, as well as to writing the methodology and results section. Dr.Hanafy also supervised many of the laparoscopic procedures

Dr. Elfazary contributed to collecting the data, as well as writing the discussion. He also did the critical revision of the article. He also aided in the laparoscopic procedures.

All authors approved the final version of the article to be published.

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