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Laparoscopy versus open surgery for the surgical management of tubo-ovarian abscess (TOA). Is there a beneficial impact of early endoscopic intervention in terms of fertility rates?

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ABSTRACT

Objectives: To compare success rates and complications in women undergoing laparoscopic versus open surgical management of tubo-ovarian abscess. We further examined whether early laparoscopic intervention has any impact on pregnancy rates in a subgroup of infertile patients following frozen-thawed embryo transfer.

Material and methods: Hospital records of 48 patients diagnosed with TOA between January 2015 and December 2020, who underwent surgical intervention or received only medical treatment were analyzed. All patients were hospitalized, and parenteral antibiotics were commenced on admission initially. Laparoscopic or open surgery was performed within 48 hours course of intravenous antibiotherapy (early intervention) or later according to the clinical findings and antibiotherapy response.

Results: Of 48 patients with TOA, 18 (37.5%) underwent laparoscopic and 30 (62.5%) underwent open surgical intervention. The median postoperative hospital stay was shorter (4.5 days vs 7.5 days, respectively; $p = 0.035$), and postoperative opioid analgesic requirement was lesser in the laparoscopy group compared to open surgery group (22% vs 53%, respectively; p = 0.034). Intra- and post-operative complication rates were similar between the groups. Of these 48 patients, seven were diagnosed to have TOA following oocyte retrieval, and four of these conceived with frozen thawed embryo transfer all of whom underwent laparoscopic surgery within 48 hours of diagnosis.

Conclusions: Minimal invasive surgery should be preferred even in the presence of severely adhesive and inflammatory TOA in order to improve postoperative outcomes. Moreover, early laparoscopic intervention may be considered in infertile patients with an aim to optimize pregnancy rates in a subsequent frozen-thawed embryo transfer.

Key words: laparoscopy; open surgery; pelvic inflammatory disease; tubo-ovarian abscess

INTRODUCTION

Tubo-ovarian abscess (TOA) is usually a complication of pelvic inflammatory disease. It also occurs as sequalae complicated appendicitis or diverticulitis and following pelvic surgery, and can be severe and life-threatening [1]. Almost one-third of patients hospitalized for pelvic inflammatory disease develop a tubo-ovarian abscess. Although old databases reported a mortality rate between 1.7 and 7.1% for PID, the mortality rated by Centers for Disease Control and Prevention (CDC) from PID was less than 1% in 2017 [2]. TOAs are polymicrobial infections usually caused by a combination of aerobic, anaerobic, and facultative pathogens. Even though first-line management of TOAs is antibiotherapy with success rates approaching 70%, some patients especially with bigger abscess formation do not respond to antibiotherapy well and require some type of surgical intervention [3]. Historically, the gold standard treatment is abdominal hysterectomy together with salphingo-oophorectomy [4]. However, many patients with tubo-ovarian abscess occur in reproductive aged women with significant concerns regarding future fertility seeking for fertility sparing surgical options.

Transvaginal ultrasound or computed tomography-guided abdominal drainage and laparoscopic surgery are well established minimally invasive modalities in the management of TOAs. Even though there are certain benefits of image-guided drainage in the short term, such as minimal or no anesthetic risk and less surgical risks [5], long-term impacts especially on fertility outcomes compared to surgical treatment have not been well studied. With advanced technology and greater experience, minimally invasive surgery has been increasingly performed safely and effectively in the management of pelvis abscess.

MATERIAL AND METHODS

In this retrospective cohort study, conducted January 2015 and March 2020, a total of 48 women who underwent surgical treatment for tubo-ovarian abscess (TOA) at the Ankara University Cebeci Hospital and Ankara HRS Women’s Hospital were included. The inclusion criterion was TOA diagnosis based on history, physical examination, ultrasonography images, and laboratory findings. The exclusion criteria were non-surgical treatment, including only antibiotherapy and the absence of full follow-up data.

All patients were hospitalized, and parenteral antibiotics were commenced on admission. They initially received an empiric antibiotic protocol, including clindamycin plus gentamicin or cephalosporin and metronidazole. Patients with a history of antibiotic treatment before admission and persistent fever beyond 48 hours were treated by imipenem or piperacillin-tazobactam. A laparoscopic or open surgery was performed within 48 hours course of intravenous antibiotherapy (early intervention) or later according to the clinical findings. The surgical interventions included a combination of abscess drainage, copious saline irrigation, adhesiolysis, salphingectomy, salphingo-oophorectomy, or hysterectomy as indicated in surgical exploration findings and according to patient’s fertility desire.

RESULTS

Among a total of 48 patients with TOA, 18 patients (37.5%) underwent laparoscopy, and 30 patients (62.5%) underwent open intervention. Main presenting symptoms and findings were pelvic pain (52%), uterine tenderness (14.5%), cervical discharge (0.06%), abnormal bleeding (0.02%), and fever (16.6%). The median age was significantly higher in the open surgery group than the laparoscopy group (53.5 vs 34 years, respectively; $p = 0.006$). The duration and type of preoperative antibiotic use, preoperative white blood cell count, and serum CRP levels were all similar between the groups. The size of the abscess was also similar between the groups (Tab. 1). The type of surgical intervention was drainage in six patients (33.3%) and nine patients (30%), salpingectomy in 10 patients (55.6%) and seven (23.3%) patients, hysterectomy along with bilateral or unilateral salphingo-oophorectomy in one patient (11.1%) and 13 patients (43.3%) in laparoscopy and open surgery groups respectively ($p > 0.05$). Moderate to intense adhesiolysis was performed in all patients. There were no significant differences in intraoperative or postoperative complication rates (Tab. 2).

There was no difference in the duration of operation according to surgical approach (95 min. for laparoscopy vs 90 min. for open surgery; $p = 0.341$) and blood products' transfusion (27.8% vs 20.0%, respectively; $p = 0.535$) (Tab. 2). However, median postoperative hospital stay was significantly shorter in patients who underwent laparoscopy compared to patients managed with open surgery (4.5 days vs 7.5 days, respectively; $p = 0.035$). Although not statistically significant, there were three intraoperative bowel injuries (10%) in the open surgery group and none in the laparoscopy group. Minor serosal bowel injuries were all repaired by serosal suturing.

There were no complications including bladder injury, ileus, and bacteremia in any of the groups. There was less postoperative analgesic requirement including opioids in the laparoscopy group compared to open surgery group (22% patients in laparoscopy group vs 53% in the open surgery group; $p = 0.034$). One patient in the laparoscopy group experienced pulmonary embolism. There were no secondary surgeries, perioperative deaths, bacteremia, ileus, bladder/ureteric injury, and vascular injury in both groups.

In a further analysis, we explored the impact of early surgical intervention (within 48 hours of antibiotherapy) on postoperative outcome parameters (Tab. 3). Among all, 22 patients underwent early surgical intervention either laparoscopically or open. The postoperative laboratory parameters, analgesic requirements, and complication rates were similar between the groups. However, both median postoperative hospital stays (5 days vs 7 days; $p = 0.001$) and duration of postoperative antibiotic course (10 days vs 14 days; $p < 0.001$) were significantly shorter in the early surgical intervention group (Tab. 3). In the follow up data, we observed that 4/7 patients all of which developed TOA following oocyte retrieval and underwent early laparoscopic intervention within 48 hours of diagnosis and commencement of antibiotic treatment conceived with subsequent frozen-thawed embryo transfer. Moreover, 3 of 4 patients had ovarian endometriomas ranging between 5–7 cm.

DISCUSSION

In the current study, we demonstrated that laparoscopy could be safely and effectively performed in the management of tubo-ovarian abscess. We found that hospital stay is shorter and analgesic requirement is lesser in laparoscopy group compared to open surgery group with similar intraoperative and postoperative complication rates. Moreover, we observed that early surgical intervention has advantageous in terms of length of hospital stay and postoperative antibiotic use, and possibly fertility rates.

The treatment approach for pelvic abscess in reproductive-aged women is highly dependent on clinical presentation, patient characteristics, and desire to preserve future childbearing potential. Despite some published guidelines on PID and tubo-ovarian abscess by various societies, there are no clear-cut recommendations and uniform approach for surgical treatment [6, 7]. Even though most surgeons historically performed laparotomic approach, laparoscopic surgery has been practiced as a safe and effective method. Some guidelines recommend that laparoscopy may provide early resolution of the disease by dividing adhesions and draining abscesses [8]. Following widespread use of endoscopic surgery, multiple advantages have emerged including shorter hospital stay, cosmetic incisions, and lower surgical site infection rates compared to open surgery. Moreover, laparoscopy offers direct visualization providing complete diagnostic accuracy. On the other hand, laparoscopic surgery may be technically challenging in some patients with pelvic abscess due to severe adhesions and obliterated pelvic cavity which requires high surgical skills and experience.

An early intervention strategy including drainage along with intravenous antibiotics seems the best treatment approach to avoid long term complications of TOAs. In a prospective cohort study, CRP was demonstrated to be a sensitive and specific inflammatory marker for predicting TOA in patients with complicated PID, which significantly correlated with success or failure of conservative management [9]. To et al. [5] demonstrated that patients who received antibiotics alone were more likely to require further surgical intervention when compared with patients who additionally received image-guided drainage. In their study treatment selection was not affected by the presence of bilateral presence of abscess. For the long-term follow-up data, there were no differences between the groups in terms of residual pain, pregnancy outcomes, or infertility. The fertility rates were reported as 56.6% in the antibiotic-only group compared to 41.2% in the drainage group. However, it should be noted that abscess size was larger in drainage group compared to antibiotic-only group (8.5 vs 5.9 cm) which may be attributed to the fact that patients in the antibiotic-only arm generally presented with less severe disease. Notably, mean duration of hospital stay was longer in drainage group compared to antibiotic only group (13.3 vs

7.4 days). Size of the abscess, age of the patient, white blood cell count and serum CRP levels are found as important parameters for antibiotic failure in the studies.

Many studies demonstrated that image guided drainage alone or together with intracavitary antibiotic irrigation had high success rates in terms of symptom resolution and no requirement for any additional intervention [10–12]. In a systematic review enrolling a total of 975 patients aged 11 to 86 years, it was found that image-guided drainage of TOAs was associated with highest success rates, fewer complications, and shorter hospital stays compared with laparoscopy [3]. In contrast, other studies found shorter hospital stay with laparoscopy compared to image guided drainage. However, there is a great heterogeneity in terms of success rates, complications, and duration of hospitalization and not consistently reported in the studies. Moreover, the average abscess size ranged from 4.32 to 8.50 cm and the period for improvement on antibiotics alone before the intervention was not standard which varied between 0 and 6 days. In the primary management of tubo-ovarian abscess, we opted to use laparoscopic surgery instead of image guided drainage due to high clinical experience in both laparoscopy and open surgery. Evet though we don't have our own clinical data comparing laparoscopic surgery and image guided drainage, we have quite favorable results with surgical approach.

Doganay et al. reported an average duration of hospital stay as two days for laparoscopy, 7.4 days for laparotomy, and 11 days antibiotics-only treatment [13]. Similarly, Yang et al. [14] also showed a marked decrease in hospital stay (5.4 days vs 8.9 days; $p < .001$) and wound infections with laparoscopy compared to laparotomy. Regarding the complication rates Carlson et al. found that a laparoscopic surgical approach was significantly associated with a lower risk of perioperative complications compared to open surgery [15]. Even though we did not find any significant difference in surgical complication rates, bowel injury only occurred in 3 patients in the open surgery group. Conversion rates to laparotomy are strictly dependent on surgical skill, endoscopic experience, and severity of the adhesions. In a retrospective case series study, which compared the outcomes of 37 patients who were diagnosed with TOA after fertility treatments with 313 women who were diagnosed with TOA not associated with fertility treatments, conversion to laparotomy was more common in patients with endometriosis [16]. In our study three of laparoscopic TOA patients (16.6%) had endometrioma related tubo-ovarian abscess, however there was not any case of conversion to laparotomy. This is most probably due to the fact that all of the operations were performed by highly experienced laparoscopic surgeons.

The morbidity rates associated with surgical management of TOA were reported between 0.8% and 57% [15]. Carlson et al. [15] demonstrated that almost half of the patients treated with initial conservative management underwent laparoscopic exploration. Notably, studies showed that early surgical management has some certain advantages over late surgical intervention in terms of shorter hospital stay, earlier resolution of fever and less blood loss [17]. Similarly, in the current study we observed that when laparoscopy was performed within two days of diagnosis and antibiotherapy, the duration of postoperative hospital stay, and the length of postoperative antibiotic treatment were shorter. A thorough assessment of risk factors and identifying patients who may not respond to initial medical management would allow a prompt surgical intervention that provides a less complicated surgery with lower morbidity rates. In a large study including 4419 patients, the laparoscopic group had shorter operation duration (125 vs 166 min), fewer blood transfusions (4.7% vs 10.0%), and shorter length of hospital stay (5 vs 7 days; $p < 0.001$) compared with the open surgery group (2). As similar, despite similar operation times, the mean duration of hospital stay was shorter in the laparoscopy group compared to open surgery group in our study (4.5 vs 7.5 days; $p = 0.035$).

Tubo-ovarian abscess can also occur following oocyte retrieval, due to direct inoculation of vaginal microorganisms, from an already existing PID, and direct needle puncture of a bowel segment. Although the true incidence of pelvic abscess after oocyte pick up is unknown, it ranges between 0.03% and 0.24% in reported studies [18, 19]. With increasing number of patients with endometriomas undergoing IVF, it has been more common to see endometrioma related pelvic abscess following oocyte pick up. In a retrospective study, it was demonstrated that pelvic inflammatory disease in women with endometriosis is more severe and refractory to antibiotic treatment, and more frequently required surgical intervention [20]. Similarly, in another case series, women with TOA after fertility treatments had severe clinical presentation and complicated clinical course compared with women with TOA not associated with fertility treatments [16]. Furthermore, the rate of surgical intervention, conversion rates to laparotomy and complication rates were significantly higher in patients with endometriosis. However, in a four year follow up study Villete et al. demonstrated that the onset of infectious processes in women with endometriosis is high variable, ranging from 4 to 120 days, and can also occur long after ART or even spontaneously [21]. Despite data are scarce regarding the impact of pelvic inflammation on the outcome of fertility treatments, the reported clinical pregnancy rates are extremely lower when TOA occurs following an ART cycle. In two different studies, pregnancy rates were reported as low as 0 and 9% in patients who develop pelvic abscess, compared to 29 and 30% in the control group without pelvic inflammation [19, 22]. Not only the presence of bacterial toxins may result in direct damage to the embryo, but also the pelvic inflammation can impair embryo implantation via cytokine secretion [23]. However, it not known whether copious irrigation of the pelvic cavity, resecting adhesions, removing all necrotic debris and abscess capsule has any further advantage over image guided drainage in terms of fertility rates. Regarding the long-term fertility rates, Buchweitz et al. found that while 3/16 patients (18.75%) in organ-preserving group achieved live births, only 1/24 women (4.1%) conceived in the non-organ preserving group. Moreover, the rate of complications was significantly higher in the group undergoing ablative treatment compared to organ preserving surgery group [24]. In the current study in a further subgroup analysis, we observed that four patients who underwent early laparoscopic intervention conceived in subsequent frozen-thawed embryo transfer cycles. Of these four patients, three had ovarian endometriomas. As some studies reported more extensive pelvic inflammation and increased incidence of conversion to laparotomy in patients with endometrioma, these specific group of patients may benefit from early surgical intervention in terms of pregnancy outcome.

CONCLUSIONS

We did not find any difference in complication rates, mean operation time, requirement for blood transfusion or surgical site infections between laparoscopy and open surgery groups. However, duration of antibiotic treatment and the length of hospital stay is shorter and analgesic requirement is lesser in laparoscopy group compared to open surgery. We suggest that laparoscopic management of tubo-ovarian abscess has some certain benefits over open surgery in experienced hands. It is still not clear whether early surgical intervention with removal all necrotic material and copious irrigation has benefit in terms of fertility rates over image guided drainage in the long term and should be clarified in further studies. However, it is important such a study requires a long follow up in a specific group of reproductive patients asking for future fertility.

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Conflicts of interest

The authors declare that they have no competing interests.

Ethics approval and consent to participate

This current study was approved by the Institutional Review Board (date: 29/12/2020; no: E.2733).

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Table 1. Demographics of the study and control group

	Laparoscopy (n=18)	Laparotomy (n=30)	P
Age, years mean (range)	43 (31-61)	53.5 (32-88)	0.006
Gravidity, n (range)	3 (0-4)	3.5 (1-6)	0.376
Parity, n (range)	2 (0-4)	3 (0-4)	0.131
Contraception, n (%)			0.276
None	4 (22.2)	2 (6.7)	
Menopause	1 (5.6)	5 (16.7)	
Intrauterine device	2 (11.1)	1 (3.3)	
Coitus interruptus	0 (0.0)	1 (3.3)	
Infertility, n (%)	2 (15.4)	0 (0)	0.174
Diabetes Mellitus, n (%)	0 (0)	2 (20)	0.136
Hypertension, n (%)	3 (27)	0 (0)	0.074
Cardiovascular disease, n (%)	0 (0)	1 (100)	0.283
Previous pelvic inflammatory disease, n (%)	5 (27.8)	8 (26.7)	0.933
Previous ovarian surgery, n (%)	0	1	0.283
Appendectomy, n (%)	3	1	0.314
Uterine surgery, n (%)	0	3	0.074
Preoperative antibiotics, n (%)	10 (55.5)	14 (46.6)	0.243
Cephalosporin and metronidazole	7 (70)	5 (35.7)	
Gentamycin and clindamycin	1 (10)	4 (28.6)	
Other penicillin group drugs and Metronidazole	2 (20)	5 (35.7)	
Preoperative antibiotic treatment, days (range)	4.5 (2-8)	3 (1-24)	0.354
US findings n (%)			0.185
No additional finding	12 (66.6)	19 (86.4)	
Endometrioma	3 (16.6)	1 (4.5)	
Ovarian cancer	0 (0)	2 (9.1)	
Bilaterality of the abscess, n (%)	6 (33.3)	13 (43.3)	0.703
CT performed, n (%)	3 (17.6)	14 (82.4)	0.060
Abscess size, n (%)			0.012
0-4 cm	3 (33.3)	1 (6.7)	
5-8 cm	5 (55.6)	3 (20.0)	
<8 cm	1 (11.1)	11 (73.3)	

Table 2. Main operative and postoperative findings.

	Laparoscopy (n=18)	Laparotomy (n=30)	P
Operative findings			

Type of operation, n (%)			0.95
Drainage	6 (33.3)	9 (30)	
Salpingectomy	10 (55.6)	7 (23.3)	
Hysterectomy + BSO/USO	2 (11.1)	13 (43.3)	
Others	0 (0)	1 (3.3)	
Duration of operation	95 (40-135)	90 (40-150)	0.341
Bowel injury, n (%)	0 (0)	3 (10.0)	0.166
Bladder injury, n (%)	0 (0)	0 (0)	N/A
Postoperative findings			
Follow-up			
Postoperative WBC, 109/L (range)	13.5 (7.1-15.3)	12.9 (7.8-20.6)	0.741
Postoperative CRP, mg/L (range)	98 (10.4-313)	106.9 (17.7-313)	0.552
Postoperative Fever, °C (range)	37.4 (36.2-38.1)	36.7 (36.5-37.2)	0.075
Postoperative antibiotics			0.217
Cephalosporin and metronidazole	11(61.1)	13 (43.3)	
Gentamycin and clindamycin	0 (0)	5 (16.6)	
Piperacillin–tazobactam	1 (5.6)	1 (3.3)	
Other penicillin group drugs and metronidazole	6 (33.3)	10 (33.3)	
Duration of postop. antibiotic treatment, days	10 (7-23)	13 (6-28)	0.150
Hospital stay, days (range)	4.5 (1-16)	7.5 (1-28)	0.035
Analgesia			
Postoperative diclofenac sodium, mg (range)	262.5 (75-1575)	383.3 (150-1350)	0.715
Postoperative opioid, mg (range)	0 (0-500)	100 (0-900)	0.013
No. of patients required opioid, n (%)	4 (22.2)	16 (53.3)	0.034
Postoperative complications			
Subileus, n (%)	0 (0)	0 (0)	N/A
Bacteremia, n (%)	0 (0)	0 (0)	N/A
Surgical site infection, n (%)	0	0	N/A
Blood transfusion, n (%)	5 (27.8)	6 (20.0)	0.535

Table 3. Impact of early surgical intervention on operative and post-operative outcome.

	Early surgery (n=22)	**Surgery after 48 h (n=26)**	**P**
Duration of operation	90 (40-130)	90 (40-150)	0.127
Postoperative WBC, 109/L (range)	12.8 (7.1-18.5)	15.3 (7.8-20.6)	0.482
Postoperative CRP, mg/L (range)	91.9 (10.4-173.5)	202.1 (13.1-313)	0.122
Postoperative Fever, °C (range)	36.5 (36.1-36.9)	37.2 (36.5-38.1)	0.702
Duration of postoperative antibiotic treatment, days	10 (6-17)	14 (7-28)	<0.001
Hospital stay, days (range)	5 (1-10)	7 (1-28)	0.001