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Tubo-ovarian abscesses and the effect of transvaginal ultrasound guided drainage – a retrospective cohort study

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ABSTRACT

Objective: Tubo-ovarian abscesses (TOA) are a serious complication to pelvic inflammatory disease with long-term complications such as infertility and chronic pain. Treatment consists of intravenous antibiotics combined with laparoscopic or transvaginal ultrasound-guided drainage (TVULD), but the evidence regarding optimal treatment are scarce, and evaluation of short- and long-term effects have yielded inconsistent results. Our aim was to evaluate the effect of transvaginal ultrasound-guided drainage with antibiotic treatment on both short- and long-term outcomes for patients admitted with a tubo-ovarian abscess.

Methods: All women admitted with a TOA to our department were included from March 2017- May 2020. They were evaluated with a gynecological examination, TVUL, white blood cell count (WBC) and CRP. All received intravenous antibiotics and were evaluated for possible TVULD. All received orally administered antibiotics upon discharge, and follow-up was with a 1-3-month interval until patients were without symptoms or underwent laparoscopic surgery.

Results: Forty patients were included, 30 (75%) premenopausal. Mean size of TOA were 6.3 cm (SD 2.3), and 35 (87.5%) patients received both antibiotics and drainage. Eighteen (45%) patients underwent secondary surgery following the TOA, and when comparing the surgery vs. non-surgery group we found that at admission temperature, WBC count at admission, aspirated material in ml and need of more than one drainage predicted undergoing laparoscopy following discharge. However, when performing multivariate analysis comparing the two groups regarding the abovementioned factors as well as age, admission time, antibiotic treatment time and follow-up, we did not find any statistically significant difference (*p=0.072).* Finally, we found that more than one drainage increased the risk of undergoing laparoscopy (OR 8, *CI 1.43-44.92).*

Conclusion: TVULD combined with antibiotics are a safe and effective treatment for TOAs. We found a trend supporting that patients needing laparoscopy following initial TVULD present with a more severe clinical picture and that different clinical and paraclinical factors could be used as predictors for undergoing secondary laparoscopy. Finally, we saw that patients with more than one drainage, have an increased risk of requiring secondary laparoscopy. These findings and predictors need to be tested and confirmed in larger prospective studies.

Keywords: Tubo-ovarian abscess; Pelvic inflammatory disease; Transvaginal ultrasound-guided drainage; Antibiotics; Laparoscopic surgery; Intrauterine device; Fertility

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INTRODUCTION

Tubo-ovarian abscesses (TOAs) and pyosalpinxes are a severe complication to pelvic inflammatory disease (PID), often affecting sexually active women in their fertile age (1), and up to 35% of women with a PID develop a TOA (2-4). Risk factors include untreated sexually transmitted disease (STD), endometriosis, infection, or inflammation in adjacent pelvic structures such as the colon and appendix, as well as due to pelvic malignancy (5-7). TOAs are associated with long-term complications such as intraabdominal adhesions, infertility, ectopic pregnancy, and chronic abdominal pain (8). Treatment with intravenous antibiotics alone is effective in 34-88% of patients, and risk factors for failed conservative treatment with antibiotics include large size of pelvic mass, high initial WBC count, high age and smoking (9). Therefore, the need of invasive intervention in combination with antibiotics is still present (5). Transvaginal ultrasound guided drainage (TVULD) has been shown to be safe and effective (10-12), reducing the need of laparoscopic intervention (13) and infertility rate (14, 15).

The National Danish Guidelines favors TVULD as treatment over surgery. In cases where surgery is needed, laparoscopy is favored over laparotomy (16, 17). Furthermore, admission time and subsequent sick leave are often long in cases with TOAs, resulting in significant unwanted social and economic issues for the patients. TVULD seems to reduce morbidity and length of hospitalization as well as sick leave (11), but this is poorly described in the literature. Consensus concerning the ideal management of patients with TOAs is sparse. Based on guidelines, pyosalpinx and TOA are treated similarly. The current recommendations for treatment consists of drainage with antibiotics as first line treatment for TOAs ≥ 3-5 cm and/or WBC > 15 x109/l; whereas TOAs < 3 cm and/or WBC < 15 x 109/l can be managed with antibiotics alone (14). However, these are low grade evidence recommendations, calling for further studies to unify the treatment of TOAs, since no large randomized controlled trials (RCT) have been performed to clarify the precise effect of TVULD vs. laparoscopic drainage and surgery (18).

Recent studies have proposed different assessment tools to predict the risk of negative long-term outcomes following a TOA, as well as predicting the need for initial drainage and laparoscopy. One study separated patients who needed surgical intervention for the TOA into different risk groups (A-D) based on different clinical and paraclinical parameters (age, size of TOA, WBC count etc), which resulted in a score from 0-5. They showed that patients in group D (score of 5) had a 90% risk of failure of antibiotic treatment compared to only 20% in group A (19). Other studies found that fever and increasing size of TOA increased the number of admission days as well as the need of undergoing laparoscopic treatment for the TOA significantly (20, 21) These tools could be of potential interest if they are validated in the future.

The aim of this study was to evaluate the effect and safety of treatment of TOAs with TVULD and antibiotics as well as evaluate the clinical and paraclinical features of patients admitted to our clinic with a TOA.

MATERIALS AND METHODS

Study design and patients

This is a retrospective, consecutive, descriptive cohort study. Our primary aim was to evaluate the effect of TVULD and antibiotic treatment on both short- and long-term patient outcomes.

Secondary aim was to evaluate clinical and paraclinical features of patients with a TOA and factors predicting the need for undergoing secondary laparoscopic surgery.

All women over the age of 18 admitted to our Department of Gynecology, Obstetrics and Fertility, Copenhagen University Hospital Herlev with a TOA from March 2017 to May 2020 were included in the study. All patients were examined prior to admission with clinical and gynecological examination and TVUL. Inclusion and exclusion criteria were the following:

Inclusion criteria:

- All patients with a verified TOA and/or pyosalpinx on TVUL

Exclusion criteria:

- Patients with PID without a TOA
- Patients with pelvic abscesses due to diverticulitis or appendicitis

Data were evaluated and analyzed retrospectively. A comprehensive review and analysis of patient medical records for demographics, medical and surgical history, referral symptoms, WBC and CRP, microbiology, length of hospital stay, and type of treatment for TOA, were performed after the last patient was included in the study. Furthermore, all medical records were evaluated regarding pregnancy following the TOA. No interim analysis was performed.

This study was approved by the Danish Data Collection Agency with study nr. 2012-58-0004. This approval was part of a collective approval for research regarding TOAs with acceptance nr. VD-2018-65 and I-suite nr.: 6283. Date of approval was the 23rd of March 2018.

Ultrasound-guided drainage procedure

All women were evaluated with basic clinical examination, gynecological examination, and TVUL. Ultrasound guided drainage of TOAs > 5 cm are routinely performed at our Department by a senior gynecologist. Patients with a TOA < 5 cm were clinically and biochemically evaluated to assess the need for drainage, but in general, all TOAs available for drainage were drained, regardless of size.

The patient was routinely offered an opioid as pain relief prior to the procedure. For the vaginal ultrasound probe, an anesthetic gel (Xylocaine gel) was used as local anesthetic. Assisted by an expert sonographer and/or a junior colleague, the TOA was located on TVUL, and transvaginal drainage performed with a 22G, 16G or 14G needle (Argon Medical Device Inc., TX 75751 USA), selected according to the viscosity of the abscess. Irrigation of the cavity with a saline solution followed, and at the discretion of the gynecologist, a catheter was placed in the abscess cavity for continuous irrigation, ordinarily four to six times a day. A catheter is regularly placed, when the abscess cavity is very large or if it is impossible to drain all abscess material at once. A specimen of the aspirated material was subsequently sent for further microbiological evaluation, and antibiotic treatment then correlated according to the bacterial resistance pattern.

Patients were evaluated every second day with TVUL during hospitalization, and secondary drainage was performed if necessary, based on clinical and paraclinical features of the patient.

Antibiotic treatment

Antibiotics were administered according to the Danish National Clinical Guideline (2017), with first line therapy being i.v. Ampicillin combined with rectal or i.v. Metronidazole. If a patient was allergic to Penicillin, Ampicillin was replaced with Cefuroxime. If a patient was admitted with or developed sepsis, treatment was i.v. Piperacillin + Tazobactam, Metronidazole and one dose of Gentamycin. If needed, antibiotics were changed according to the bacterial resistance pattern from the cervical swab and/or the drained pus. Later, when treatment was altered to orally administered antibiotics, this was chosen to follow the same resistance pattern. Patients were switched to oral treatment after >24 hours with no fever or if a significant drop in CRP and WBC following drainage was observed. In cases of a sterile abscess and no growth from the cervical swab, broad spectrum treatment with Amoxillicin or Doxycycline, (in cases of Penicillin allergy), combined with Metronidazole for 7-10 days was prescribed.

Follow up

All patients were routinely evaluated clinically and with TVUL 1-2 weeks after discharge. The need for prolonged antibiotic treatment was determined at the discretion of the gynecologist. If necessary, further follow-up was performed in our outpatient clinic with a 1-3-month interval until the patient presented without symptoms or until elective surgery was performed.

All patient files were evaluated for fertility and complications following the discharge from our clinic resulting in a follow-up period of 1-4 years.

Age in years, median	**41.5**
Cycle, n (%)	
Premenopausal	30 (75%)
Perimenopausal	8 (20%)
Postmenopausal	2 (5%)
Temperature at admittance in Celcius, mean (SD)	38.1 (0.9)
Cervical swab, n (%)	
Yes	37 (92.5%)
No	3 (7.5%)
IUD, n (%)	
Yes	15 (37.5%)
No	25 (67.5%)
Location of TOA, n (%)	
Right	10 (25%)
Left	22 (55%)
Bilateral	8 (20%)
Size of TOA in cm, mean (SD)	6.3 (2.3)
Ultrasound-guided drainage, n (%)	
Yes	35 (87.5%)
No	5 (12.5%)
Number of drainages, n (%)	
1	25 (71.5%)
>1	10 (28.5%)
Aspirated material in ml, mean (SD)	57.1 (10.1)
Surgical intervention, n (%)	
Yes	18 (45%)
No	22 (55%)
Smoking, n (%)	
Yes	27 (67.5%)
No	11 (27.5%)
Unknown	2 (5%)

Table 1: Demographics and patients characteristics of included women with Tubo-ovarian abscesses.

Statistical analysis

Demographic data are presented as mean with standard deviation (SD), median with range, or number with percentages (%), as appropriate. Test for normality was performed with Shapiro-Wilcox. Chi-square or Fischer's exact was used for comparison of categorical data. To compare means, independent-samples t-test was used. A two-sided p-value <0.05 was considered significant. For all statistics, IBM SPSS Statistics 25 (SPSS, Chicago, USA) were used.

RESULTS

Patient characteristics and clinical presentation

Forty patients were identified, included in, and constituted the study cohort (Table 1). Of these, thirty (75%) were premenopausal, eight (20%) perimenopausal and two (5%) postmenopausal. Median age was 41.5 years. All patients presented with initial symptoms of lower abdominal pain, fever, cervical motion tenderness and/or sepsis; but most commonly with lower abdominal pain and fever (n = 27, 67.5%). No patients presented with septic shock. All patients were evaluated with basic clinical examination, gynecological examination, and TVUL at admission. Paraclinical status was evaluated with WBC and CRP at admission, after drainage of the TOA and at discharge, as well as when needed during admission with 24-48-hour intervals (Figure 1).

Mean CRP count was 147.4 g/l (SD 91.3) at admission and 27.7 g/l (SD 28.7) at discharge. Mean WBC count was 14.8 x 10^9/l (SD 4.2) at admission and 8.2 x 10^9/l (SD 2.2) at discharge (Figure 1). Mean number of days admitted was 8.3 (SD 5.1) and mean number of days of antibiotic treatment was 17.5 (SD 7.2). Two patients were post-menopausal and had no malignant lesion in relation to the TOA. One patient with endometriosis presented with a TOA in relation to an endometrioma. 27 (67.5%) of the included women were smokers. Of the 40 patients included, 35 (87.5%) were evaluated at our department 1-2 weeks after discharge. Median follow-up in our outpatient clinic was 3 months (Figure 2).

Drainage and surgery

Mean size of TOA was 6.3 cm (SD 2.3) and mean amount of aspirated material was 57.1 ml (SD 10.1). In total 35 (87.5%) patients were treated with drainage and antibiotics, while 5 (12.5%) only received antibiotics (Table 1). Mean size of TOA in the drainage group was 6.4 cm (SD 2.4) and in the no drainage group, mean size of TOA was 5.3 cm (SD 1.5). When drainage was not performed, it was due to either the size of the TOA (too small to puncture) or the placement of the TOA (where bowel perforation could not be avoided). Ten (28.5%) patients had to undergo more than one drainage during hospitalization, either due to persisting TOA on TVUL or lack of clinical and biochemical improvement. No procedural adverse events were observed, and procedure was well-tolerated.

Overall, all clinical parameters such as fever and pain improved following drainage. The first day following drainage, mean CRP count was 151.9 (SD 94.8) and mean WBC count was 10.8 (5.2) (Figure 1). Eighteen (45%) patients underwent secondary surgery following the TOA due to persistent symptoms (16) or fertility desire (2), while 22 (55%) patients recovered completely without surgery (Table 1 and 2). Both post-menopausal patients were offered prophylactic bilateral salpingo-oophorectomy (BSO), but only one underwent surgery. Most common surgeries were unilateral/bilateral salpingectomy (n=10). In cases where fertility knowingly was desired, perioperative perturbation was performed. If no tubal passage was observed, both salpinges where removed, regardless of location of the lesion. Mean time in months from the diagnoses of a TOA to surgery was 4,56 (SD 3,45). No patients were re-referred to our clinic following laparoscopy due to persisting symptoms.

We found that women with a TOA, who underwent secondary laparoscopy, presented with an overall more severe clinical picture at admission, with a higher temperature, a higher WBC count and a higher amount of aspirated material from the TOA in ml. However, a multivariate analysis comparing the two groups, where we corrected for several factors, revealed no statistical significant difference between the two groups (p=0.072*)* (Table 2). We found that 8 out of 10 (80%) patients required more than one drainage during admittance, and that risk for undergoing surgery after more than one drainage were increased (OR 8, CI 1.43-44.92). Finally, we did not find a statistically significant difference for the risk of undergoing secondary laparoscopy regarding smoking and age.

Microbiotic findings and IUD

Thirty-seven patients (92.5%) had a cervical swab performed for chlamydia and gonorrhea, as well as for other bacteria and yeast (Table 1). Five (12.5%) had chlamydia, 1 (2.5%) had gonorrhea and 18 (45%) yielded no growth. If drainage was performed, a specimen of the aspirated material was sent for evaluation. The most common bacterial agent was E. Coli (n = 9, 22.5%).

Fifteen (37.5%) women had an IUD, which were removed and sent for evaluation. Eight (53.3%) of these had a positive bacterial growth. Two patients presented with an Actinomyces infection, one with an IUD and one without. They both received a longer course of antibiotics upon discharge (4-6 weeks) after consulting with a microbiologist. We found no difference regarding fever, clinical presentation, or length of hospital stay and treatment compared to the patients without an IUD.

Finally, they did not have a higher risk of undergoing surgery compared to patients without an IUD (OR 0.7, CI 0.2-2.6).

	Mean (SD) (surgery, n=18)	Mean (SD) (no surgery, n = 22)	P-value
Age	41.9 (11.42)	41.2 (14.04)	p=0.86
Size of TOA, cm	6.9 (2.58)	5.8 (1.97)	p=0.15
Aspirated material from TOA, ml	81.6 (78.01)	36.0 (37.66)	**p=0.023**
Temperature at admittance	38.5 (1.04)	37.8 (0.70)	**p=0.017**
CRP at admittance	154.2 (108.75)	141.8 (76.51)	p=0.68
WBC count at admittance	16.4 (4.69)	13.4 (3.27)	**p=0.025**
Antibiotic treatment, days	18.3 (4.98)	16.8 (8.71)	p=0.50
Admittance, days	8.6 (4.19)	8.1 (5.79)	p=0.78
Multivariate analysis (Wilks Lambda)	-	-	p=0.072

Table 2: Multivariate analysis of several independent factors investigated as a predictor for undergoing secondary laparoscopy between the women with a TOA, who underwent surgery vs. the women who did not need surgery. **SD**; Standard deviation. **TOA**; Tubo-ovarian abscess. **CRP**; C reactive protein. **WBC**; White blood cell count.

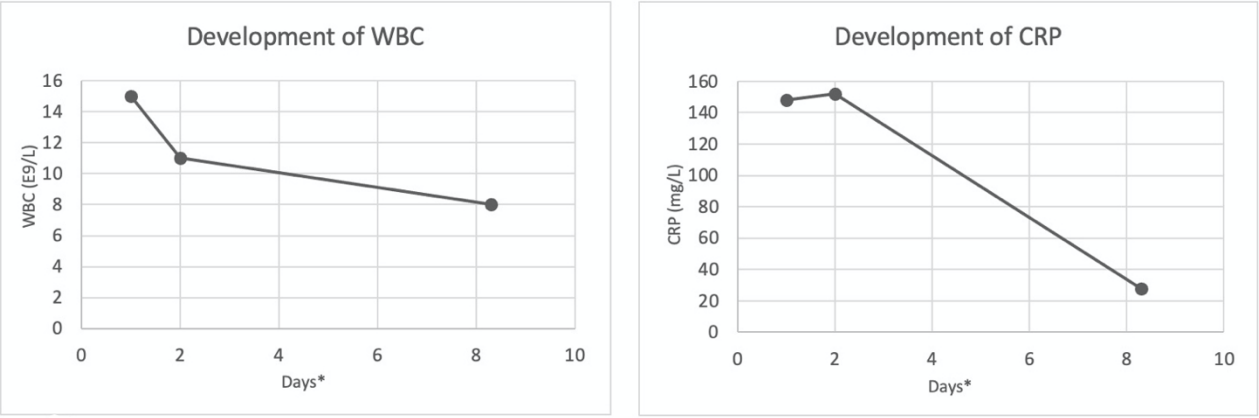

Figure 1: WBC and CRP count measured at admission, the day after initial drainage and the day of discharge of the patients who received drainage (*n=35*), to monitor response to treatment.

CRP; C reactive protein. **WBC**; White blood cell count

***WBC values (mean, SD):**

- Admission (day 1) = 14.8 (4.3)
- After drainage (day 2) = 10.9 (5.3)
- Day of discharge (day 8.3 (mean, SD 5.2) = 8.1 (2.2)

***CRP values (mean, SD):**

- Admission (day 1) = 142.8 (90.4)
- After drainage (day 2) = 155.7 (93.6)
- Day of discharge (day 8.3 (mean, SD 5.2) = 27.1 (28)

Fertility

In the group of fertile women (n=30), 4 (7.5%) obtained a pregnancy and carried to term following their TOA. Mean time from diagnosis of TOA to the delivery of a healthy infant was 23,25 months (SD 10,47). All four were treated with both TVULD and antibiotics, and two of the four later underwent surgery prior to their pregnancy. In both surgical cases, perioperative perturbation was performed. This resulted in unilateral salpingectomy for one and bilateral salpingectomy for the other. The patient who underwent unilateral salpingectomy had the opposite salpinx removed years before due to an ectopic pregnancy. Both surgical patients obtained pregnancy following the surgery with in vitro fertilization (IVF). The third patient became pregnant naturally and had developed a TOA following a mini hysteroscopy as part of fertility workup. She was pregnant, when she developed the TOA, and after treatment she carried to term. Subsequently, she became pregnant with her second child without fertility treatment. The fourth patient conceived with IVF and carried to term without complications.

DISCUSSION

In our study, we included 40 patients with a TOA, and 35 were treated with both antibiotics and drainage. We experienced no adverse outcomes with the drainage procedure or with the antibiotic treatment, and we've shown that TVULD in combination with antibiotics is a sufficient and safe treatment of TOAs, as several minor, retrospective studies have shown previously (10, 12, 22). The patients included received follow-up until either symptom free or until elective laparoscopic surgery was performed. Even though our cohort is small and with a multivariate analysis that did not find any statistical significant differences between the surgery and the non-surgery group, we did see a trend towards a more severe, clinical picture for the patients, who needed secondary laparoscopy following initial treatment, as in concordance with other studies (9). Our study suggests that size of TOA, temperature at admission and amount of aspirated material could be predictors for undergoing laparoscopic surgery following discharge, if evaluated in larger cohorts. Furthermore, we have shown that the risk of undergoing secondary laparoscopy is increased 8 times with several drainages. Previous studies have shown similar predictors when conservative treatment with antibiotics was chosen, and where primary surgical intervention was laparoscopic drainage (21, 23), but have not evaluated these predictors according to the risk for secondary laparoscopy. However, the combined results of the studies indicate that patients requiring laparoscopy, present with a more severe clinical and paraclinical profile. A study by Gjelland et al (5) from 2006, included 302 women found that 6.6% of women required surgery following TVULD of a TOA. This included patients where initial diagnosis was inconclusive or due to persisting pain from a TOA following repeated drainage. They did not find any significant difference between patients cured by TVULD and antibiotics alone and by patients requiring surgery. In our study, a little less than half of women with a TOA required surgery following discharge, either due to persisting pain or to a fertility desire, where outcome of fertility treatment is significantly improved following laparoscopy. Gjelland et al. included patients from 1986-2003, where laparoscopic surgery was of limited used, and conservative treatment was the primary and preferred option. This could be the reason for the discrepancies in percentage of surgery between their cohort and ours. However, more recent studies by Fouks et al (19) demonstrated that 49.8% of patients who failed antibiotic treatment would require surgical intervention, and initial laparoscopic drainage and salpingectomy during admission were most common. Perez-Medina et al. (11) performed a RCT where patients with a TOA were randomized to antibiotics or antibiotics + TVULD. They found that the addition of TVULD reduced the recovery time, but that some patients still presented with pain and persisting adnexal masses 4 weeks after discharge. These studies are in concordance with our results, and show that TVULD are effective regarding both short- and long term outcomes, but also illuminates that a number of patients will require more extensive treatment for their TOA, highlighting the potential effect of different predictors for needing surgery following discharge. If these results are confirmed in larger, prospective studies, these

predictors could perhaps aid in the decision regarding surgery vs. no surgery following discharge, thereby reducing the need for extensive follow-up, which is currently the practice. The optimal time for secondary surgical intervention following a TOA is undisclosed in the literature. Traditionally we recommend surgery after 6-8 weeks, to allow the intraabdominal infection to fully perish, as well as too ensure minimal adhesions. However, the timeframe for optimal surgical intervention will be challenged in upcoming prospective RCTs.

IUD is a debated risk factor for developing PID (22, 24). Of the 40 women in our cohort, 15 had an IUD at admission, and most have had it for more than 5 years. In a retrospective study of 114 IUD users, this was correlated to increased risk of development of a TOA (25). There are controversies regarding the removal of an IUD in the setting of infection. A recent retrospective study of a 121 patients showed no benefit of removing the IUD in the setting of a PID/TOA (26), but the clinical practice at our department is to remove the IUD, if more than 5 years have passed since insertion. We found no significant difference regarding clinical and paraclinical features between women with and without an IUD. We also found that women with an IUD had a similar risk of needing secondary surgery for their TOA compared to women without an IUD. This is in concordance to previous studies (27). Seven (47.5%) women in our cohort had a TOA and an IUD and underwent secondary laparoscopic surgery, whereas 18 women in total had surgery following their TOA. This shows that long term complications due to a TOA are comparable between women with and without and IUD (26).

The fertility in premenopausal women who have had a TOA is substantially reduced to about 15% (1), and will therefore benefit from early fertility evaluation. If pregnancy following treatment for TOA is not obtained within 6 months and hydrosalpinx persists, the guidelines for treatment of TOA (14) recommend laparoscopy with perturbation. In cases of tubal obstruction, salpingectomy is recommended, which is supported by a recent updated Cochrane review on fertility in patients with tubal disease (28). Drainage of the hydrosalpinx is not recommended due to the high recurrence rate. If both salpinges are removed, patients are referred to IVF treatment. In our study 3 of 4 (75%) TOA patients conceived following IVF treatment and one conceived naturally. Only two of the four women underwent laparoscopic perturbation following their TOA due to fertility desire, with subsequent unilateral and bilateral salpingectomy. In-

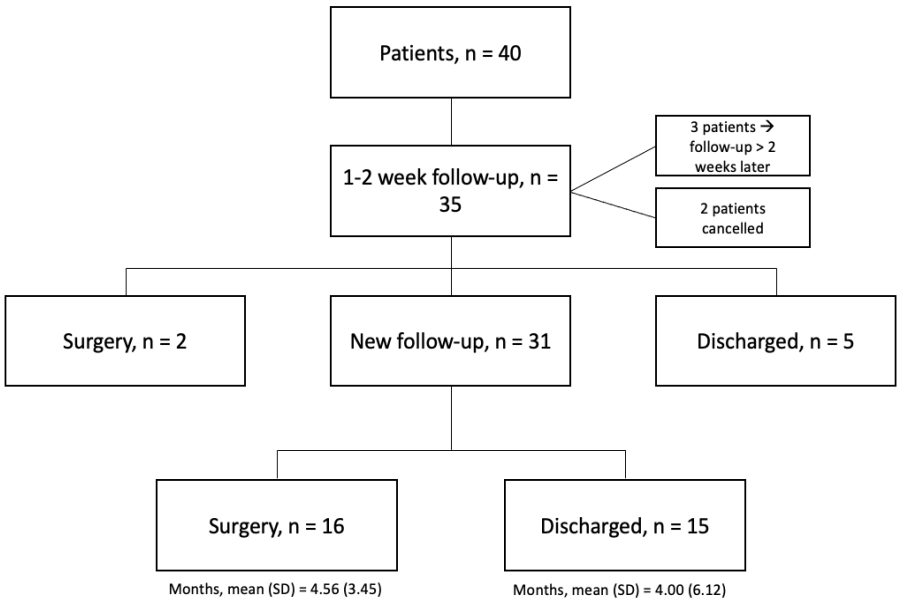

Figure 2: Follow-up regime for the patient cohort after discharge

dication for surgery were evaluated with our fertility specialists in each case. This indicates that even though fertility is significantly reduced following a TOA, spontaneous pregnancy is possible, and not all patients require surgery in order to conceive spontaneously. However, because only 4 patients in our cohort later conceived and since we did not include a routine question regarding fertility desire to all fertile patients in our cohort, we cannot derive anything statistically significant regarding optimal treatment and follow-up from our data.

This study has several strengths. We had a well-characterized group of unselected patients with a TOA as well as long patient follow-up, in some cases more than 4 years, which allowed comparison of subsequent fertility and the need for surgery. Our cohort was consecutively included, thereby eliminating the risk for selection bias. Finally, we were able to divide patients into two groups based on surgery or no surgery following their TOA, which resulted in comparable groups, accessible for statistical analysis. Our study also has different limitations. Patients were included continuously, but no randomization process was performed, so all patients were evaluated for the same treatment. Our study cohort is relatively small with only 40 patients reducing the statistical power of our results, resulting in risk estimates with a wide CI interval. Lastly, our department is an expert center with the convenience and assistance of two expert sonographers, suggesting that our findings may not easily be generalized to other settings.

CONCLUSION

In conclusion, we have shown that TVULD combined with antibiotics are a safe and effective treatment. Patients presenting with a TOA should be evaluated for TVULD within the first 24 hours after hospitalization and drainage should be performed regardless of size. Furthermore, we observed a trend in the group of patients needing secondary laparoscopy, who often presented with a more severe clinical picture, as well as having the need for several drainages. The trend towards being able to use different clinical parameters as predictors for the need of secondary laparoscopy following a TOA could be of interest in the future, and these predictors needs to be evaluated in larger, prospective studies. This could aid clinicians in providing patients with a better and more optimal regime regarding follow-up and surgery after discharge.

Conflict of interest: None

Author contributions: TFN and HVC planned the study. JIPG, TFN, and HVC collected the data, JIPG and TFN interpreted the data. JIPG conducted statistical analysis. JIPG wrote the initial draft of the manuscript with all authors contributing to and approving the final draft submitted.

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ABBREVIATIONS

CRP = C reactive protein
IUD = Intrauterine device
IVF = In vitro fertilization
PID = Pelvic inflammatory disease
RCT = Randomized controlled trial
STD = Sexually transmitted disease
TOA = Tubo-ovarian abscess
TVUL = Transvaginal ultrasound
TVULD = Transvaginal ultrasound guided drainage
USO = Unilateral salpingooophorectomy
WBC = White blood cell count

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