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Original Article

Early ultrasound-guided drainage of tubo-ovarian abscesses versus conservative treatment: a retrospective cross-sectional study

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Abstract

Objective: To compare the short and long-term benefits (the length of hospital stay, surgical complications, and early clinical improvement) of adding early ultrasound-guided drainage to broad-spectrum antibiotic treatment.

Methodology: Patients undergoing tubo-ovarian abscess treatment between January 2017 and June 2022 in a tertiary hospital were retrospectively evaluated. Of the patients studied, 50 subjects were treated with antibiotics alone and 63 underwent guided drainage. Twenty-one individuals underwent early drainage within 72 hours of admission, and 42 underwent guided drainage after this period.

Results: There was no statistical difference in the length of hospital stay between the groups simultaneously, averaging 6.4 days for the controls, 5.1 days for the early drainage group, and 9.6 days for the late drainage group ($p = 0.290$). In the multiple linear regression with the length of hospital stay outcome and adjusting for potential confounding factors, there was an average reduction of 2.9 days in the hospital stay ($p = 0.04$) for the early drainage group (< 72 hours) compared to the controls. Early clinical improvement and an expected drop in CRP were more frequent in patients who underwent drainage. Length of hospital stay increases with abscess diameter: 0.4 [(95% CI 0.1 – 0.7) ($p = 0.05$)] days per centimeter, regardless of other variables.

Conclusions: Ultrasound-guided drainage of tubo-ovarian abscesses associated with antibiotic therapy is an effective treatment, with few complications, and may lead to clinical improvement especially when performed early.

Key words: Tubo-ovarian abscess; abscess; interventional; ultrasonography.

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Introduction

The female genital tract can be affected by ascending infection, either from sexually transmitted infections or vaginal flora. Pelvic inflammatory disease (PID) refers to acute infection of the upper genital tract, involving any or all of the following structures: uterus, fallopian tubes, and ovaries. Often it may result in endometritis, salpingitis, oophoritis, peritonitis, perihepatitis, and/or tubo-ovarian abscess (TOA) [1-3].

A tubo-ovarian abscess is an inflammatory mass involving the fallopian tube, ovary, and, occasionally, other adjacent pelvic organs. It may also occur independently of PID [1,2]. However, TOA typically occurs as a complication of PID in up to 15% of the cases. It is a serious life-threatening condition that requires aggressive medical and/or surgical therapy [4].

Prior to the use of broad-spectrum antimicrobials and modern surgical practices, the mortality rate associated with TOAs was 50% higher [2,5]. Antimicrobial treatment should initially be intravenous, followed by oral therapy for a prolonged period [6,7]. Previous studies show the response rate to oral treatment alone to be around 70% [8]. Antimicrobial therapy failure is characterized by an increase in the size of the abscess or peritonitis, and surgical intervention is necessary [9]. Options such as laparoscopy or laparotomy with abscess drainage, adnexectomy, or total hysterectomy with bilateral salpingo oophorectomy are considered definitive treatments [1].

A promising method of treating TOAs concomitant with the use of antimicrobials is drainage under direct guidance by image. The image-guided procedure has been used for drainage of pelvic collections with a success rate of up to 100%, as reported in a series of studies [9,10].

A promising alternative method for the treatment of TOA concomitant with the use of broad-spectrum antimicrobials is drainage under direct guidance by computed tomography (CT) or ultrasound. With the advent of minimally invasive new technologies, image-guided procedure has been used for drainage of pelvic collections with a success rate of up to 100%, as reported in a series of studies [9,10].

In view of the above, the main objective of the present study is to evaluate the short and long-term benefits of primary drainage, guided by ultrasound, to reduce the length of hospital stay, surgical complications, and promote early clinical improvement.

Methodology

Patient cohort

This was a single-center retrospective study in a public teaching hospital for women. We retrieved and reviewed medical records of patients with a diagnosis of tubo-ovarian abscesses who were admitted to the Gynecology Unit for specific treatment from January 2017 to June 2022.

The inclusion criteria for defining TOAs were: 1) a sonographic diagnosis based on the demonstration of a complex cystic mass with thick irregular walls; 2) partitions and internal echoes; 3) clinical signs and symptoms of pelvic inflammatory disease. The exclusion criteria were secondary surgical abscesses and oncologic subjects.

In total, 113 patients hospitalized with a TOA diagnosis were analyzed in this study, of which 50 patients received antibiotics alone and 63 were subjected to ultrasound-guided drainage of their tubo-ovarian abscesses plus antibiotics.

Criteria for outcome evaluation

The patients were divided into two groups: an ultrasound-guided drainage of tubo-ovarian abscesses group and a conservative treatment group. The primary outcome variables analyzed were: length of hospital stay in days, automatically calculated in the spreadsheet using the day of admission and the day of discharge; as well as subjective clinical improvement, analyzing medical records of the presence or absence of pain or fever within 48 hours after starting the antibiotic treatment or intervention. As an objective criterion for clinical improvement, we used a 25% drop per day in C-reactive protein (CRP) after the start of treatment. The length of hospital stay was also compared between patients who underwent early ultrasound-guided drainage in less than 72 hours, later drainage after 72 hours of admission, and the control group. A subgroup analysis for drainage after less than 48 hours was also performed to assess the length of hospital stay.

For the analysis of secondary outcomes, the following variables were considered: need for ICU admission, need for (re)intervention (considering another treatment in patients using antibiotics and a new intervention, whether conservative or surgical, for patients already having undergone primary drainage), readmission in the first 60 days for a reason related to the pathology under study, and complications related to treatments or death.

The demographic variables studied were: age (years), size of the abscess (largest diameter in cm), and presence of comorbidities (HIV, diabetes and being overweight, considering a BMI ≥ 25 kg/m^2. When used to assess outcomes, these were studied in a grouped manner under the name "presence of comorbidities".

In all patients, the broad-spectrum antimicrobial treatment consisted of intravenous gentamicin and clindamycin, as well as ampicillin if there was no reported history of allergy. The decision to perform primary drainage was based on the clinical judgment of the attending physician and the availability of a qualified professional to perform it. Forty-two patients underwent late drainage and 21 underwent early drainage. The drainage treatment was the same for both groups and performed by two professionals with the same training.

Technique for the ultrasound-guided intervention

All of the drainage treatments were performed with direct guidance by transvaginal ultrasound, aiming to drain all accessible cystic areas using a Chiba needle n. 18 G coupled to an ultrasound guide. The patients were subjected to anesthetic sedation, in the operating room, in a sterile environment and conditions. With them positioned in lithotomy, vaginal antisepsis was performed with aqueous chlorhexidine, and punctures and aspirations of the contents of the collection were performed. The aspirated secretion was sent for cultural examination in most cases.

Statistical analysis

The analysis was performed with IBM SPSS Statistics for Windows, Version 20 (IBM Corp., Armonk, NY, USA). Categorical variables were described by frequencies and percentages. The normality of the variables was verified with the Kolmogorov-Smirnov test. Quantitative variables with a symmetrical distribution were described as mean and standard deviation and those with an asymmetrical distribution were described by the median and interquartile range. Categorical variables were compared using χ^2 or Fisher's exact tests; ANOVA was used to compare continuous and normally distributed variables. The Kruskal-Wallis test was used for variables with a non-normal distribution.

To assess the relationship between the factors and binary outcomes, a Poisson regression was used with a

robust variance and the quantitative outcome was assessed by multiple linear regressions. Two-sided *p* values < 0.5 were considered as indications of statistical significance.

Ethical Considerations

This study was approved by the Research Ethics Committee of the Grupo Hospitalar Conceição under protocol no. 50047715.9.0000.5530. As the study evaluated medical records retrospectively, informed consent was not performed and was waived by Research Ethics Committee.

Results

Patient Selection

A total of 113 patients diagnosed with tubo-ovarian abscesses secondary to PID were included in the study. Of the patients studied, 50 (44%) subjects were treated with antibiotics alone and 63 (56%) underwent guided drainage, and of these 21 (18%) underwent early drainage within 72 hours of admission.

Primary Outcomes

There was a significant difference in age and the largest diameter of the pelvic collection between the three groups, as shown in Table 1.

There was no statistically significant difference in the length of hospital stay comparing the three groups, as shown in Table 2. However, when comparing the hospital stay between the early drainage group versus the late drainage group, as well as between the control group versus the late drainage group, the latter had a longer hospital stay in both analyses, with a statistically significant difference ($p = 0.001$).

In the early clinical improvement and expected drop in CRP variables, we observed a statistically significant difference, simultaneously, between the three groups, as shown in Table 2.

Subgroup analysis

In a subgroup analysis where drainage occurred in the first 48 hours after admission, there was no statistically significant reduction in hospital stay between the groups, this being 4.6 days (95% CI 3.9 – 5.3) in the early drainage group, 8.8 days (95% CI 7.9 – 9.7) in the late drainage group and 6.4 days in the control group (95% CI 5.3 – 7.5) ($p = 0.202$).

Multiple linear regression analysis

In the multiple linear regression with the length of hospital stay outcome and adjusting for potential confounding factors (age, comorbidities and a larger abscess diameter), there was an average reduction of 2.9 days in the hospital stay [(95% CI -4.8 – -0.9) ($p = 0.04$)] for the early drainage group (< 72 hours) compared to the controls. On the other hand, the length of hospital stay in the group subjected to late drainage (> 72 hours) was longer on average: 2.4 days [(95% CI 0.9 – 3.9) ($p = 0.02$)]. The data above are shown in Table 3.

Patients undergoing late drainage had a prevalence ratio of 1.46 in the expected drop in CRP compared to the control group. The length of hospital stay increased with the abscess diameter: 0.4 [(95% CI 0.1 – 0.7) ($p =$

Table 1. Demographic characteristics of patients and tubo-ovarian abscesses (TOA) by study group.

Parameter	Total	Conservative Treatment	Early Drainage (< 72 hours)	Late Drainage (> 72 hours)	*p*
All patients (n (%))	113 (100)	50 (44)	21 (18)	42 (37)	
Age (years, average (± SD))	37.8 (±10.41)	34.4 (±11.91)	38.7 (± 8.31)	41.5 (± 8.02)	0.004
Parity (median, (interquartile range))	1.0 (0-2)	1.0 (0-2)	1.0 (0 - 2.0)	1.0 (0.75-2.25)	0.241
HIV (n (%))	7 (6.2)	2 (4.0)	0 (0.0)	5 (11.9)	0.125
Diabetes (n (%))	9 (8.0)	3 (6.0)	0 (0.0)	6 (14.3)	0.112
Overweight (n (%))	66 (62)	25(53.2)	15 (75)	26 (65)	0.21
Largest diameter of the abscess (cm, average (± SD))	7.27 (± 2.68)	6.08 (± 2.36)	9.0 (± 2.43)	7.81 (± 2.37)	0.001
Bilateral TOA (n (%))	35 (31)	13 (26)	9 (43)	13 (31)	0.374

Table 2. Comparative analysis of primary outcomes between groups (conservative treatment, early drainage and late drainage).

Parameter	Total	Conservative Treatment	Early Drainage (< 72 hours)	Late Drainage (> 72 hours)	*p*
All patients (n)	113	50	21	42	—
Length of Hospital stay (days, (mean ± SD))	7.39 (± 3.76)	6.44 (± 4.00)	5.19 (± 1.43)	9.62 (± 3.14)	0.29
Early clinical improvement (n (%))	89 (78.8%)	33 (66%)	19 (91%)	37 (88%)	0.012
Expected CRP Drop (n (%))	75 (71%)	28 (60%)	13 (69%)	34 (85%)	0.033

Table 3. Adjusted analysis of outcomes: expected drop in CRP and length of hospital stays.

	Outcome: expected drop in CRP adjusted PR (CI 95%)	*p*	Outcome: hospitalization time adjusted B (CI 95%)	*p*
Drainage > 72 hours	1.46 (1.09-1.95)	0.011	2.4 (0.9 – 3.9)	0.002
Drainage < 72 hours	1.04 (0.66-1.65)	0.853	-2.9 (-4.8- (-0.9)	0.004
Control	**ref**		**ref**	
Presence of Comorbidity	0.85 (0.65-1.11)	0.23	0.3 (-1.1 – 1.8)	0.664
Abscess diameter	1.04 (0.98-1.11)	0.181	0.4 (0.1 – 0.7)	0.005
Age	0.99 (0.98-1.01)	0.257	0.02 (-0.04 – 0.08)	0.548

0.05)] days for every centimeter, regardless of the other variables included in the model, as shown in Table 3.

Secondary Outcomes

In relation to the secondary outcomes, there was no significant difference between the groups regarding the need for ICU admission, need for (re)intervention, readmission, complications, or death, as shown in Table 4.

Of the 113 patients, there were no deaths, and three patients required ICU admission, one in the early drainage group (4.8%) and two in the late drainage group (4.8%). In the antibiotics-alone group, there was no need for intensive care. One patient in the drainage group (1.5%) presented a puncture-related complication with pelvic hematoma formation, with conservative treatment, without associated morbidity. The data above are shown in Table 4.

Discussion

In our study, we found a difference in the length of hospital stay between the three groups. Early intervention led to a reduction of 2.9 days in hospital stay, on average. On the other hand, late drainage increased the length of hospital stay by an average of 2.4 days compared to the controls. Similarly, To *et al.* showed an increase in the hospitalization time of the drainage cohort, with a mean of 13.3 days against 7.4 days for patients treated with antibiotics. Reinforcing our findings, To *et al.* state that if the patients had received early drainage instead of waiting 6 or 7 days for drainage, the average hospitalization time for the drainage group would have decreased [11].

Our hospital stay rate was shorter in the early intervention group: 5.1 days versus 6.4 days in the antibiotics-alone group. The authors hypothesize that there is no statistical significance due to the number of patients in this group (n = 21), with a study power of 33%. Likewise, when we analyzed the drainage in the less than 48 hours subgroup, the hospital stay was even shorter, averaging 4.6 days. Despite the clinical relevance of the result, there was not enough power to make the reduction statistically significant, in relation to the controls: 6.4 days (p = 0.202, n = 10 patients, power 29%).

In the case of early drainage within 24 to 48 hours of admission, some studies have shown shorter hospitalization times for patients undergoing guided puncture. According to Goharkhay *et al.*, the length of hospital stay was significantly shorter for the drainage group (4.5 days) compared to the antibiotics group (7 days). Perez-Medina *et al.* also reported a discrepancy of 3.9 days versus 9.1 days [6,12–14].

In a recent review, Goje *et al.* state that there is substantial evidence to show that reducing hospital stay improves financial, operational, and clinical results. The authors highlight discrepant results in terms of hospital stay, with a tendency for this to decrease with early drainage, and a delay in drainage being associated with an increase in hospital stay [15].

We considered the success rate by analyzing early clinical improvement with pain relief and an absence of fever within 48 hours of treatment or an expected drop in CRP. For this, we considered an expected drop of 25% per day in quantitative CRP values, based on the literature [16]. Considering this objective analysis of clinical improvement, 60% of the controls showed a decrease in CRP, compared to 69% and 85% of patients subjected to early and late interventions, respectively.

A subjective improvement was observed in 91% of patients in the early intervention group, 88% in the late drainage group, and 66% in controls. Similar results

Table 4. Comparative analysis of secondary outcomes.

Parameter	Total	Conservative Treatment	Early Drainage (< 72 hours)	Late Drainage (> 72 hours)	*p*
All patients (n (%))	113 (100)	50 (44)	21 (18)	42 (37)	-
Readmission (n (%))	24 (21.4)	9 (18.4)	4 (19)	11 (26.2)	0.635
(Re)intervention (n (%))	7 (6.2)	2 (4.0)	1 (4.8)	4(9.5)	0.525
Complications (n (%))	7 (6.2)	5 (10)	0 (0.0)	2 (4.8)	0.249
ICU admission (n (%))	3 (2.7)	0 (0.0)	1 (4.8)	2 (4.8)	0.294
Death (n (%))	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	a

a: No statistics are computed because DEATH is a constant.

were described in two studies regarding the clinical improvement of most patients within 3 days after aspiration of abscesses [6,12].

We did not obtain a significant difference between groups in (re)intervention rates, but the reviewed reports showed that women with TOAs who received image-guided drainage required surgery less frequently than those who received only antibiotics [11,17].

We also observed that the size of the abscess is directly related to hospital stay, with an additional 0.4 days for each centimeter increase in the largest diameter of the collection. The literature shows the same: the size of the abscess, regardless of the treatment, interferes with the length of hospital stay [9,18–20].

No patient in the isolated antibiotic therapy group required intensive care, which may be related to the greater severity of the patients who underwent a minimally invasive intervention. We can also consider the bias of the mean diameter of drained abscesses being greater than in the control group. This is in addition to the possible clinical judgment of healthcare professionals, who, when faced with a patient with an exacerbated clinical condition, tend to keep them hospitalized for longer.

Limitations of the current study include the retrospective nature of the data, as well as it being carried out in a single center. On the other hand, our study includes one of the largest groups of patients ever subjected to ultrasound-guided interventions, as well as a homogeneous group, including only women with TOAs associated with PID. Despite this being a retrospective collection, the data were reliable, especially in the analysis of early clinical improvement due to the use of the objective criterion of quantitative CRP.

In our study, we did not find significant morbidity associated with drainage procedures, even in febrile patients with severe symptoms. The literature indicates that if performed by trained professionals, guided drainage is a safe procedure with a minimal risk of complications [6,21]. Considering all of the above, guided drainage of pelvic collections must be considered the first line of treatment, in association with antibiotic therapy, showing good effectiveness and low potential for complications, promoting better results when performed early in less than 48 hours of admission.

Conclusions

Early ultrasound-guided drainage of tubo-ovarian abscesses associated with antibiotic therapy is an effective treatment, with few complications related to the procedure, and it may lead to cost reductions, since it reduces the length of hospital stay, when performed early, and promotes clinical and laboratory improvement, in a shorter time, compared to standard antibiotic-only treatment. More prospective studies and the development of evidence-based management protocols are of fundamental importance for treating TOAs.

Authors' Contributions

VSA, SCPR, MFJ and FFB participated in the revision of the manuscript. VSA, MFJ participated in the design, draft and revision of the study. SCPR evaluated the medical records of the case and control patients. VSA, SCPR, MFJ and FFB conceived the study and participated in its design, coordination and the drafting of the manuscript. All authors read and approved the final manuscript.

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