



## RESEARCH ARTICLE

# The management of tubo-ovarian abscess - A retrospective analysis of a centre offering outpatient intravenous antibiotic therapy [version 1; peer review: awaiting peer review]

Jhia Jiat Teh <sup>1,2</sup>, Sarah Wali<sup>2</sup>, Josephine Mollier<sup>1,2</sup>, Mark Gilchrist<sup>2</sup>, Tariq Miskry<sup>2</sup>

<sup>1</sup>Department of Medicine, Imperial College London, South Kensington, London, SW7 2AZ, UK

<sup>2</sup>St Mary's NHS Trust and Imperial College, London, W2 1NY, UK

**V1** First published: 01 Apr 2022, 11:386  
<https://doi.org/10.12688/f1000research.54997.1>

Latest published: 01 Apr 2022, 11:386  
<https://doi.org/10.12688/f1000research.54997.1>

## Open Peer Review

**Approval Status** AWAITING PEER REVIEW

Any reports and responses or comments on the article can be found at the end of the article.

## Abstract

### Background

Tubo-ovarian abscess (TOA) carries long-term sequelae in women of reproductive age. Consensus of the optimal treatment of tubo-ovarian abscess remains lacking. The aims of this study are to identify risk factors predicting the need for early drainage and compare clinical outcomes of current management practices of TOA.

### Methods

From 2015 to 2019, a retrospective cohort study of 92 women admitted to a tertiary centre for gynaecological surgery was performed. Patients with diagnosed TOA were classified into two groups: treatment with antibiotics only, and those receiving additional drainage. Primary outcomes included length of hospital stay (LoS), length of antibiotic treatment (LoA) and need for re-intervention.

### Results

In this study, 52 women (56.5%) were successfully treated with first line intravenous antibiotics; 40 (43.5%) received surgical drainage. Significant predictors for successful medical treatment only include age < 35 (OR: 0.89, 95% CI: 0.82-0.97) and abscess size < 6cm (OR: 0.17, 95% CI: 0.04-0.64), using multivariate analysis. Pyrexia  $\geq 38^{\circ}\text{C}$  predicted a need for drainage (OR: 3.82, 95% CI: 1.01-8.12). Patients who received additional drainage had significantly longer LoA, LoS and higher rates of re-intervention. Within this group, drainage within 72 hours of admission resulted in a trend towards shorter LoA and LoS than drainage after 72 hours, albeit not statistically significant.

### Conclusions

Parameters include age > 35 years, pyrexia  $\geq 38^{\circ}\text{C}$  and a TOA size > 6cm may independently predict the need for drainage of TOA. Early identification of these patients is imperative for timely surgical intervention to avoid prolonged hospitalisation, antibiotic usage, and

patient morbidity. More work is required to identify whether early drainage may reduce length of hospital stay and antibiotic treatment, including identifying certain patient groups who most likely to benefit from outpatient antibiotic intravenous therapy.

### Keywords

Tubo-ovarian abscess, Pelvic inflammatory disease, outpatient intravenous antibiotic therapy, malignancy, infection

**Corresponding authors:** Jhia Jiat Teh ([jhiateh@gmail.com](mailto:jhiateh@gmail.com)), Sarah Wali ([Sarah.wali@doctors.org.uk](mailto:Sarah.wali@doctors.org.uk))

**Author roles:** **Teh JJ:** Data Curation, Investigation, Project Administration, Supervision, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; **Wali S:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Mollier J:** Data Curation, Formal Analysis, Investigation, Methodology, Resources, Software, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; **Gilchrist M:** Supervision, Visualization, Writing – Review & Editing; **Miskry T:** Conceptualization, Project Administration, Resources, Supervision, Writing – Review & Editing

**Competing interests:** No competing interests were disclosed.

**Grant information:** The author(s) declared that no grants were involved in supporting this work.

**Copyright:** © 2022 Teh JJ *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Teh JJ, Wali S, Mollier J *et al.* **The management of tubo-ovarian abscess - A retrospective analysis of a centre offering outpatient intravenous antibiotic therapy [version 1; peer review: awaiting peer review]** F1000Research 2022, 11:386 <https://doi.org/10.12688/f1000research.54997.1>

**First published:** 01 Apr 2022, 11:386 <https://doi.org/10.12688/f1000research.54997.1>

## Abbreviations

AD: additional drainage  
 AO: antibiotics only  
 BASHH: British association of sexual health and HIV  
 CI: confidence interval  
 CRP: C- reactive protein  
 HIV: Human immunodeficiency virus  
 LoA: length of antibiotics  
 LoS: length of stay  
 OPAT: outpatient intravenous antibiotic therapy  
 OR: odds ratio  
 PID: Pelvic inflammatory disease  
 TOA: tubo-ovarian abscess  
 WCC: white cell count

## Introduction

Pelvic inflammatory disease (PID) is a polymicrobial infection of the female upper genital tract caused by ascending lower genital tract organisms, both sexually transmitted and normal microbiome. Its lifetime prevalence of 4.4% in sexually active women of reproductive age (18–44 years)<sup>1</sup> may be an underestimate as PID can be subclinical and is increasingly managed in the outpatient setting on clinical suspicion only.

Tubo-ovarian abscess (TOA) is a severe complication of PID which affects approximately one third of women hospitalised with PID.<sup>2</sup> Rupture of a TOA is a rare surgical emergency, presenting with acute peritonitis and sepsis requiring emergency laparotomy with a mortality of 65-100% if treated with antibiotics only.<sup>3</sup> The majority of TOA, however, are unruptured and their management has changed over the years from radical surgery, often involving unilateral or bilateral adnexectomy and pelvic clearance, to more medical management involving enteral and parenteral broad-spectrum antibiotics, with or without drainage (radiological or simple surgical). This conservative approach has a documented efficacy of 16-95%, with recent studies showing success of 70% or greater.<sup>4</sup> The high success rate of medical management has meant that there is often a reluctance to manage these cases surgically with the associated risks of hemorrhage, visceral injury, and consequences of reduced ovarian tissue. There is published guidance on the use of outpatient parenteral antimicrobial therapy (OPAT) for intra-*abdominal* abscess although this does not address TOA specifically.<sup>5</sup>

Surgical drainage has been reserved by some for patients with diagnostic or therapeutic uncertainty.<sup>6</sup> The surgical approach is now more commonly laparoscopic drainage and washout. Alternatively, radiological drainage is a less invasive option and has additional advantages of being done under local anaesthesia and is repeatable with less risks than surgical drainage. It has also been suggested that this approach may also lead to faster recovery compared to antibiotics alone.<sup>7</sup>

Primary prevention of pelvic infection as well as early identification and treatment of women with suspected PID is pivotal to reduce the incidence of TOA and associated acute and chronic morbidity. The UK guidelines on the management of PID are available from the British Association of Sexual Health and HIV (BASHH) and it recommends various combinations of enteral and parenteral antibiotic regimens.<sup>8</sup> For TOA, the BASHH guidelines suggest *consideration* of drainage either laparoscopically or radiologically to help early resolution of disease. However, these guidelines do not provide explicit indications for drainage. In contrast, French guidelines strongly recommend that the first line approach should be radiological drainage for TOA > 3 cm.<sup>9</sup>

These differences have contributed to the ongoing debate on optimal management. As a result, currently, in the UK there is an *ad hoc* approach to the management of TOA with variation between clinicians and drainage generally only being considered when initial antibiotic therapy is unsuccessful (e.g. persistent pyrexia, pain, or rising C-reactive protein (CRP)). This study assesses women with TOA at our tertiary referral centre, St Mary's Hospital, in West London, investigating their demographics, management approach and outcomes. We aim to firstly compare risk factors present in patients who required antibiotics alone compared to those who required additional radiological or surgical drainage. Secondly, we aim to describe outcomes in these two groups to determine clinical factors that influence the selection of a particular treatment approach, including those treated with outpatient parenteral antimicrobial therapy.

## Methods

### Patient group

From January 2015 to June 2019, a historical cohort study was performed on a total of 92 patients (n = 92) admitted to a tertiary west London hospital for TOA. Patients were identified through a search of the hospital's electronic database, using diagnostic codes for TOA. Patients were included if a TOA was confirmed either radiologically or surgically. A total of 370 cases were reviewed to confirm eligibility, of which 278 patients were excluded as they had past medical history of TOA rather than an active encounter or did not have radiological or surgical confirmation of the diagnosis. Patients who had secondary TOA due to pre-existing intra-abdominal pathology were included in our analysis and discussion.

### Data collected

Following institutional approval from the audit team (Imperial NHS Trust service evaluation project reference number 404), data on demographics, clinical management, investigations, and patient outcomes were extracted from the hospital's electronic database. As the data was retrospectively collected and did not affect the included patients care no further ethical approval was required. Additionally, consent was waived by the ethics committee as the data collected from the hospital records were anonymized.

Demographic data collected included: age, body mass index (BMI), ethnicity, parity, and presence of comorbidities including endometriosis, intrauterine contraceptive device (IUCD) use, previous PID, immunocompromised state and smoking status (See [Underlying data](#)).<sup>10</sup> TOA data included its size, laterality, high vaginal swab (HSV) cultures and presence of any other intra-abdominal pathology.

Patients' records were reviewed for signs and symptoms of PID on presentation including lower abdominal pain, abnormal vaginal discharge, fever (defined as a temperature  $\geq 38^{\circ}\text{C}$ ), white cell count (WCC) and CRP at admission (See [Underlying data](#)).<sup>10</sup> Microbiology results of any microscopy, culture and sensitivity were also noted.

### Definitions and endpoints

After confirmation of TOA, all patients were started on the hospital's broad spectrum intravenous antibiotic regime for PID. Those that did not show improvement or who grew organisms with specific sensitivities were discussed with microbiology and had their antibiotic regimen tailored.

Based upon the management approach, all patients were classified into two groups. Group one consisted of patients treated successfully with intravenous antibiotics only (either short course or long course including OPAT). Successful treatment was defined as good clinical and biochemical response to antibiotics with down trending inflammatory markers. Conversely, Group two consisted of patients requiring drainage in addition to intravenous antibiotics due to lack of improvement or worsening of symptoms or inflammatory markers or recommendation on radiology report. Decision for the route of drainage was made on an individual patient basis by a multidisciplinary team involving gynecologists, radiologists, and general surgeons. The drainage approach included: (i) radiologically guided drainage, or (ii) laparotomy/laparoscopy. Laparotomy or laparoscopy involved a combination of washout, salpingectomy, adnexectomy, hysterectomy with bilateral salpingo-oophorectomy or bowel resection.

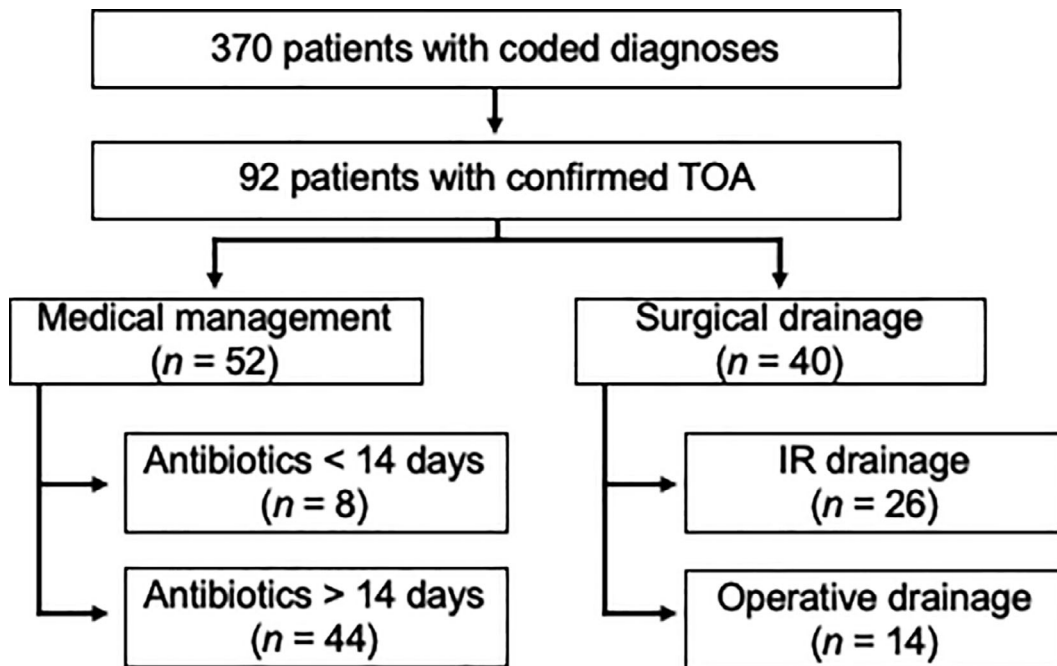
The main outcome measures were length of hospital stay (LoS), length of antibiotic treatment (LoA) and need for reintervention, including further antibiotics or drainage. Successful treatment was defined as clinical and biochemical improvement without recurrence of symptoms, further intervention, or hospital readmission.

### Statistical analysis

Data was analysed using *IBM SPSS Statistics version 25 (SPSS Inc, Chicago, IL, USA)*. Kolmogorov-Smirnov tests were used to assess for normality. Univariate analysis involved Mann-Whitney-U tests for comparison of medians of continuous variables and Chi-squared tests of independence for comparison of categorical variables to establish predictive risk factors for requiring additional drainage. Multivariate analysis involved a binary logistic regression model for any predictive factors found to be significant on univariate analysis. Statistical significance was defined as  $p < 0.05$ .

## Results

At the time of this study, 92 women were diagnosed with TOA. 52 (57%) patients were treated successfully with antibiotics alone and 40 (44%) patients required surgical or radiological drainage in addition to antibiotics ([Figure 1](#)). 15% of patients had a short course of antibiotics of no more than 14 days and 85% had a longer course of antibiotics ranging 15-64 (average 26 days). For patients requiring additional drainage, the decision made to perform drainage



**Figure 1.** Flowchart summarising the management of our cohort.

ranged between 0 to 196 days from presentation. 26 (65%) patients underwent image-guided drainage and 14 (35%) had surgical drainage. Of those 14 patients, 7 (50%) patients had immediate surgery on admission under the care of general surgeons due to clinical suspicion of other intra-abdominal pathologies.

#### Predictive factors

Demographic characteristics, clinical and biochemical laboratory values on admission between the two groups were compared and presented in [Table 1a](#) and [1b](#). Univariate analysis found that patients who required drainage (Group 2) were more likely to be febrile ( $>38^{\circ}\text{C}$ ) on admission ( $p = 0.038$ ) compared to patients treated with antibiotics only (Group 1). Patients in Group 2 had a significantly higher median age than those in Group 1 (42 vs 44 years,  $p = 0.041$ ). Size was also found to be a significant predictor of requiring drainage, with the median TOA size of 8 cm in Group 2 compared to 6.2 cm in Group 1 ( $p = 0.0001$ ). Positive high vaginal swab (HVS) cultures were also more likely in patients who required drainage ( $p = 0.027$ ). Although not statistically significant, all three positive blood cultures were in Group 2. There are no significant differences in parity, BMI, ethnicity, PID risk factors and admission inflammatory markers between the two

**Table 1a.** Demographics, clinical and laboratory findings of the study population based on the success of medical treatment of TOA<sup>†</sup>.

	Group 1 (n = 52)	Group 2 <sup>†</sup> (n = 40)	P value*	All (n = 92)
<b>Demographic</b>				
Age, (years) [median (IQR)]	42 [36-46]	44 [40-49]	0.041	43 [38-48]
BMI (kg/m <sup>2</sup> ) [median (IQR)]	26 [22-29]	25 [23-31]	0.915	25 [22-30]
Nulliparous	24	11	0.345	35
Parous	28	22		50
<b>Ethnicity</b>				
Asian	2	6	0.05	8
Black	7	7		16
White	21	7		29
Mixed/Other	22	13		39

**Table 1a.** *Continued*

	Group 1 (n = 52)	Group 2 <sup>†</sup> (n = 40)	P value*	All (n = 92)
<b>Risk factors</b>				
Endometrioma	6	7	0.501	13
Endometriosis	9	9	0.721	18
IUCD	18	18	0.313	36
Previous PID	12	3	0.051	15
Sexually active	32	24	0.7	56
Smoking	14	18	0.114	33
Abdominal/Pelvic pathology or Post procedure	18	11	1	29
<b>Presenting symptoms</b>				
Abdominal Pain	52 (100)	40 (100)	-	92 (100)
Pyrexia >38°C	20 (38)	25 (63)	0.038	45 (49)
Vaginal discharge	21 (40)	14 (35)	0.756	35 (38)
<b>Laboratory findings</b>				
WCC (cells/mm <sup>3</sup> ) [median (IQR)]	16 [13-1]	15 [13-18]	0.386	15 [13-19]
CRP [median (IQR)]	189 [100-253]	233 [138-290]	0.143	204 [106-272]
Positive HVS growth <sup>‡</sup>	26/51 (51)	19/33 (57)	0.027	45/84 (54)
Positive Blood culture growth <sup>¶</sup>	0/29 (0)	3/25 (12)	0.126	3/54 (6)
<b>Imaging findings</b>				
Size of dominant abscess (cm) [median (IQR)]	6.2 [5.6 – 7.6]	7.6 [6.9 – 9.2]	0.001	7.0 [5.9 – 8.2]
Abscess size <6cm	20 (38%)	6 (15%)	0.027	
Unilateral	41 (79%)	24 (60%)	0.082	65 (71%)
Bilateral	11 (21%)	16 (40%)		27 (29%)
One imaging modality	30 (58%)	16 (40%)	0.141	46 (50%)
>1 imaging modality	22 (42%)	24 (60%)		46 (50%)

Abbreviations: TOA, tubo-ovarian abscess; BMI, body mass index; CRP, C-Reactive Protein; HVS, High vaginal swab; IUCD, intrauterine contraceptive device; PID, pelvic inflammatory disease; WCC, White cell count.

<sup>†</sup>Values are given as number (percentages), unless indicated otherwise.

<sup>‡</sup>Drainage performed in either radiologically or surgically.

<sup>§</sup>Positive HVS growths: Chlamydia, Gonorrhoea, E coli, Enterococcus faecalis, Group B Streptococcus, mixed anaerobes, normal flora including coliforms, Prevotella bivia, Staph aureus yeasts.

<sup>¶</sup>Positive blood culture growths: Gram positive cocci, Burkholderia multivorans, E. coli.

**Table 1b.** In-depth description of other pathologies present in our cohort.

Abdominal/pelvic pathology or post procedures	Group 1 (n)	Group 2 (n)
Gastrointestinal pathology <sup>†</sup>	5	3
Gynaecological pathology <sup>‡</sup>	6	4
Post-procedure <sup>§</sup>	7	4

<sup>†</sup>Appendicitis, small bowel obstruction, diverticulitis, enteritis.

<sup>‡</sup>Complete miscarriage, post-partum, necrotic fibroid.

<sup>§</sup>Hysteroscopy, laparoscopy treatment of endometriosis, Mirena coil insertion, ovarian cystectomy, hysteroscopy and coil insertion, hysterosalpingogram, hysteroscope, colposcopy.

**Table 2.** Assessment of the likelihood of unsuccessful antibiotic treatment.

Variable	Odds ratio (95% CI)
Age > 35 years	0.93 (0.87-0.99)
Pyrexia > 38°C	0.46 (0.16-0.30)
Dominant abscess < 6 cm	0.18 (0.05-0.76)

**Table 3. Comparison of clinical outcomes by treatment group.**

	Group 1 (n = 52)	Group 2 (n = 40)	P value	All (n = 92)
CRP at the end of stay (mg/L)	47 (15-109)	31 (13-57)	0.043	37 (14-92)
Duration of antibiotic therapy (days)	8 (16-28)	33 (22-46)	<0.001	22 (17-39)
Hospital stay (days)	6 (4-9)	13 (9-20)	<0.001	8 (5-14)
Need for readmission or reintervention (%)	3 (5.7%)	24 (60%)	<0.001	26 (28%)
<b>Group 1 only</b>				
	Drainage within 72hours (n=21)	Drainage after 72hours (n=19)	P value	
CRP at the end of stay (mg/L)	31 (9-77)	40 (29-55)	0.236	
Duration of antibiotic therapy (days)	24 (20-38)	40 (29-55)	0.462	
Hospital stay (days)	11 (8-19)	17 (12-24)	0.236	
Need for readmission or reintervention (%)	12 (57%)	12 (63%)	0.755	
<b>Group 2 only</b>				
	Radiological drainage (n=26)	Surgical drainage (n=14)	P value	
CRP at the end of stay (mg/L)	35 (10-61)	31 (22-54)	0.822	
Duration of antibiotic therapy (days)	44 (22-51)	27 (21-40)	0.187	
Hospital stay (days)	19 (9-20)	12 (8-21)	0.533	
Need for readmission or reintervention (%)	16 (62%)	8 (57%)	1.000	

**Table 4. Follow up imaging outcomes by treatment group.**

	Complete or partial resolution	P value	No improvement/worsening	P value	Not performed/received surgery	Total
Group 1	20 (50%)	0.194	11 (28%)	0.025	9 (23%)	40
Group 2	33 (63%)		5 (10%)		14 (27%)	

**Table 5. Length of OPAT treatment in days by treatment group.**

	All OPAT patients (n = 23)	Group 1 (n = 11)	Group 2 (n = 12)	Group 2 Pre-drainage (n = 5)	Group 2 Post-drainage (n = 7)
Median (IQR)	24 (14-36)	25 (16-36)	24 (13-35)	24 (16-27)	35 (14-36)
Minimum	5	9	5	10	5
Maximum	50	50	47	47	46

groups. All patients received imaging with half receiving multiple imaging modalities. 74 (80%) patients underwent transvaginal/abdominal ultrasounds, 58 (63%) underwent CT, and 10 (11%) underwent MRI.

A binary logistic regression model adjusting for age, fever, high vaginal swab, and TOA size for multivariate analysis is shown in Table 2. Variables found to be significant independent predictors of successful treatment with antibiotics only on multivariable analysis were age < 35 (OR: 0.89, CI: 0.82-0.97) and TOA size < 6 cm (OR: 0.17 CI: 0.04-0.64). A pyrexia  $\geq 38^{\circ}\text{C}$  on admission significantly predicted the need for additional drainage (OR: 3.82, CI: 1.01-8.12). Although HVS was significant on univariate analysis, this was not significant on multivariate analysis.

Comparison of clinical outcomes between the two groups is presented in Table 3. Patients in Group 2 had a significantly prolonged inpatient stay, length of antibiotics and need for re-intervention compared to Group 1 ( $p < 0.001$ ). In Group 2, the median length of time between admission and decision for surgical drainage was two days (IQR 1-5 days).

Those that had drainage within 72 hours of admission had a trend towards shorter LoA and LoS compared to patients receiving drainage after 72 hours, although this did not reach statistical significance. There was no difference in need for re-intervention between the two subgroups. 3 (3.26%) patients had malignant histology at surgery (all colorectal or intestinal). 69 patients received post-treatment follow-up imaging (Table 4). Patients in Group 2 were more likely to show no improvement or worsening of the TOA than those in group 1 ( $p = 0.0251$ )

In this cohort, 23 (25%) patients received OPAT ranging between 5-50 days (Table 5). In Group 1, OPAT was used to successfully manage 11 (21%) patients, with a median total antibiotics' duration of 47 days (IQR: 35-56 days) and a median OPAT length of 25 days (IQR: 16-35.5) The average age of this group was 40 years ( $\pm 9$  years), with an average TOA size of 7.0 cm ( $\pm 1.3$  cm), and 45% had bilateral abscess. Among those patients who required invasive intervention, 7 (58%) patients had pre drainage OPAT, and 5 (42%) had post drainage OPAT. There is no significant difference in the length of OPAT days between Group 1 and Group 2 (25 vs 26 days,  $p = 0.853$ ). There was no significant difference in OPAT days between those that received OPAT pre and post drainage ( $p = 0.749$ ), although numbers are small.

## Discussion

Our study described a cohort of patients with confirmed tubo-ovarian abscess (TOA) in a tertiary institute with detailed outcome measures. Our main findings were: age > 35 years, pyrexia  $\geq 38^{\circ}\text{C}$  and a TOA size >6 cm may independently predict the need for drainage. Our studies also compared the outcomes in patients who received short term inpatient antibiotics with OPAT.

### Predictors for necessitating invasive intervention

Increased age was the only demographic risk factor between the treatment groups in our study. Other studies have investigated possible risk factors for needing early drainage, but the literature is heterogeneous and often sample sizes used are too small to reach statistical significance. Chan *et al.* found that BMI  $\geq 24.9$  had an increased risk of needing drainage.<sup>11</sup> Fouks *et al.* created a risk assessment tool to predict patients that will need drainage based on four variables:



**Table 6. List of all microorganisms found in our cohort.**

Organisms grown
Burkholderia multivorans
Chlamydia
Escherichia Coli
Streptococcus anginosus
Enterococcus faecalis
Group B Streptococcus
Gonorrhoea
Gram positive bacilli
Gram positive cocci
Mixed anaerobes
Normal flora including coliforms
Prevotella bivia
Staphylococcus aureus
Streptococcus milleri
Yeast

age > 35 years, TOA size  $\geq 7$  cm, bilateral abscess and WCC > 16 cells/mm<sup>3</sup>.<sup>12</sup> Similarly, we found that women older than 35 years are more likely to need drainage. This could be due to associated comorbidities, more aggressive microorganisms, delay in diagnosis and treatment, and increased likelihood of a secondary TOA in older patients.

Although TOA size has been well-recognised as a risk factor for failing antibiotic management requiring early drainage, the recommended size threshold varies between 3-10 cm across multiple studies and international guidelines.<sup>7,9,11,13-17</sup> For example, French guidelines recommend all TOA  $\geq 3$  cm must be drained either radiologically as a first-line treatment or surgically due to higher risk of treatment failure and serious complications with antibiotics alone.<sup>9</sup> In our cohort, we found a TOA of 6 cm to be the maximum size of TOA for successful management with antibiotics only. The ability of antibiotics to penetrate large abscesses effectively is known to be limited because of reduced vascular supply, as well as the effects of encapsulation and acidity.<sup>18</sup> Benefits of early drainage also include the ability to identify causative organisms and sensitivities to better target antibiotic regimes. In our study group, a variety of organisms were grown from vaginal swabs, blood and aspirate cultures (Table 6). Many patients required discussion with microbiologists to guide antibiotic treatment in the event of unsuccessful empirical management of PID.

Studies have also found a raised WCC<sup>15</sup> or leucocyte to neutrophil ratio<sup>19</sup> or CRP<sup>15</sup> to be predictors for the need for drainage. We found no correlation between WCC or CRP and the need for drainage but found pyrexia  $\geq 38^{\circ}\text{C}$  to be significantly associated with the need for surgical drainage, which corroborates with other groups.<sup>11,15,17</sup>

### Comparison of management outcomes in Group 1 vs Group 2

Our study observed a significantly longer duration of inpatient stay and antibiotics use for patients that received invasive intervention (Group 2) compared to those who had medical treatment only (Group 1). This is consistent with findings by Chan *et al.* and Habboub *et al.*,<sup>11,20</sup> which may be reflected by increased clinical severity in patients in Group 2. On the contrary, Perez *et al.* found that patients who had drainage had a significantly shorter LoS compared to the antibiotic only group,<sup>13</sup> however their group was small and only included unilateral abscess and decision for drainage was within 6-12 hours of antibiotics.

Furthermore, we found that patients who received additional drainage were more likely to require readmission or further reintervention. This is consistent with the increased antibiotic duration and length of stay observed in these patients. In terms of methods of drainage, we found no difference in management outcomes when comparing surgical and radiological drainage. Differentiating a TOA from other intra-abdominal pathologies may pose a diagnostic challenge for radiologists. Nonclinical resolution of TOA despite broad spectrum intravenous antibiotics with or without drainage should prompt suspicion of alternate pathology causing a secondary TOA, especially non-gynecological malignancy. In our cohort, 3 patients (3%) were found to have colorectal or caecal malignancy. We could not find related incidences of

colorectal or gastrointestinal malignancy presenting as TOA in the literature and it is possible that this is an under-recognised underlying pathology.

### The effects of early versus delayed drainage

Jaiyeoba *et al.* suggested that failure of response to antibiotics within 48-72 hours (as characterised by persistent fever and increasing leukocytosis) should be considered for surgical drainage<sup>21</sup> and this is also highlighted in the BASHH guidance.<sup>8</sup> Our study found that patients who failed medical treatment received a median of two days (IQR 1-5 days) of antibiotics before a decision for invasive intervention was made, which is similar to the duration of  $4.0 \pm 2.1$  days by Chan *et al.*<sup>11</sup> In our study, 58% of patients who received invasive intervention within 72 hours of admission, justified by either poor clinical response to antibiotics or radiologists' recommendation. We found a trend towards reduction in length of antibiotics (24 vs 40 days) and length of stay (11 vs 17 days) in the subgroup that was drained within 72 hours compared to those that were drained >72 hours from admission, but this did not reach statistical significance. Our work suggests that there may be scope to recommend early intervention in specific groups of patients who have clinically severe disease whilst recognising there may be delays in accessing radiological drainage. In addition, surgical concerns about operating on friable tissues in the presence of sepsis can result in inappropriate perseverance with medical management with changing antibiotic regimens despite lack of initial clinical or biochemical improvement.

Although the general fear of operating in the acute phase of a TOA is the friability of tissues and bleeding, it is easier to operate on acute adhesions than on dense and vascular chronic adhesions, and Reich *et al.* describes the recommended technique of careful blunt dissection using a probe or aqua dissection.<sup>22</sup> Reich *et al.* also argues that patients with fertility desires should be managed with early surgical drainage to reduce the risks to fertility, as evidenced by Elmoghazy *et al.* who found that on second look laparoscopy the incidence of extensive adhesions with bilateral tubal block was significantly higher in the radiologically compared to the surgically drainage group.<sup>4</sup> A review on the fertility outcomes of different management of TOA concluded that with medical management alone the reported pregnancy rates were 4-15% and with the addition of laparoscopic drainage within 24 hours of antibiotics the reported pregnancy rates were 32-63%.<sup>23</sup>

### Outpatient parenteral antibiotic therapy

OPAT is a safe, evidence-based, and cost-effective regimen for the management of patients with a wide range of infections including complex deep-seated infection<sup>5</sup> and can be a valuable management option in patients not fit for surgery. In our cohort of patients, OPAT was used in the management of about a quarter of our patients. To our knowledge, our study is the first published study looking at the use of OPAT specifically in the management of TOA. The decision for the use of OPAT was made by an MDT involving gynecologists, infectious disease specialists, interventional radiologists and our established regional OPAT service.

In the literature, the role of OPAT specifically for the management of TOA is unclear, and further research should aim to compare the efficacy of inpatient vs outpatient antibiotic therapy, as well as identify a subset of patients who may benefit most from OPAT. Interestingly, we identified three patients in our cohort who had TOA as the first presentation of colorectal or caecal malignancy. Two out of three patients had received OPAT for their presumed primary TOA. Although numbers are small, this suggests that all patients considered for OPAT should be managed with a high index of suspicion, whilst considering further investigations to exclude non-gynaecological malignancy, especially in those who did not respond to long-term antibiotics therapy. Hatcher found an 88% success rate of OPAT in the management of intraabdominal infection, they do not comment on the reason for failure for the 12% of patients and it would be interesting to know if they identified underlying malignancies as a cause.<sup>24</sup>

The study has several limitations. Firstly, data was collected retrospectively using hospital electronic records and may reflect retrospective case ascertainment. The relatively limited sample size captured the clinically unwell patients admitted with tubo-ovarian abscess. Secondly, potential selection bias may occur with the decision for surgical intervention in patients with TOA driven by decision of the clinical team based on personal clinical experience and judgement rather than based on hospital protocols. However, we believe the effect of heterogeneity was limited since the study is based on a tertiary hospital and decision making was largely confined to a number of experienced consultant gynaecologists. We did not make any specific conclusions on the use of OPAT in TOA since the number of cases were limited.

### Conclusion

There is a plethora of literature over more than 60 years on the management and outcomes of TOA yet there is to be consensus on the optimal management and timing of drainage for these women. Our study adds to this literature and helps in the understanding of our patient population's response to the varying management approaches. Our results suggest that

older, febrile patients with larger TOA are less likely to respond to antibiotic only management and may benefit from early drainage in combination with standard antibiotics. We await with interest the results from a French randomised control trial to shed more light on whether surgical drainage is more beneficial than radiological drainage in terms of long-term outcomes.<sup>25</sup>

Our future work includes developing a local policy to streamline the management of women with TOA in an attempt to reduce patient morbidity and duration of antibiotics and hospital stay. Importantly, such a policy should help identify women who may have secondary etiology for their TOA sooner to better manage these women. Given the associated morbidity in patients who fail medical management, we recommend early identification of this patients group for prompt and timely drainage with advantages such as early identification of causative organisms, improved antibiotic penetration, shorter hospital stay, as well as mitigating potential long-term sequelae including infertility.

## Data availability

### Underlying data

Open Science Framework: Tubovarian abscess, <https://doi.org/10.17605/OSF.IO/JYA8D><sup>10</sup>

This project contains the following underlying data: TOA data file: Excel Sheet containing anonymized data of patients

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

## Author contributions

JJT contributed to data curation, investigation, methodology, project administration, resources, validation, visualization, writing – original draft, writing – review and editing.

SW contributed to conceptualisation, data curation, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – original draft, writing – review and editing.

JM contributed to data curation, data curation, formal analysis, software, investigation, methodology, resources, validation, visualization, writing – original draft, writing – review and editing.

MG contributed to conceptualisation, investigation, supervision, writing – review and editing.

TM contributed to conceptualisation, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – review and editing.

## Acknowledgements

The study protocol was approved by the ethics (Imperial NHS Trust service evaluation project reference number 404).

## References

- Kreisel K, Torrone E, Bernstein K, *et al.*: **Prevalence of Pelvic Inflammatory Disease in Sexually Experienced Women of Reproductive Age - United States, 2013-2014.** *MMWR Morb. Mortal. Wkly Rep.* 2017; **66**(3): 80–83.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Wiesenfeld HC, Sweet RL: **Progress in the management of tuboovarian abscesses.** *Clin. Obstet. Gynecol.* 1993; **36**(2): 433–444.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Collins CG, Nix FG, Cerha HT: **Ruptured tuboovarian abscess.** *Am. J. Obstet. Gynecol.* 1956; **72**(4): 820–829.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Elmoghazy DA Sr.: **Operative Laparoscopy versus trans-vaginal ultrasound-guided aspiration in the management of acute tubo-ovarian abscess: A comparative clinical trial.** *Fertil. Steril.* 2004; **82**: S138.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Chapman AL, Seaton RA, Cooper MA, *et al.*: **Good practice recommendations for outpatient parenteral antimicrobial therapy (OPAT) in adults in the UK: a consensus statement.** *J. Antimicrob. Chemother.* 2012; **67**(5): 1053–1062.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Gjelland K, Ekerhovd E, Granberg S: **Transvaginal ultrasound-guided aspiration for treatment of tubo-ovarian abscess: A study of 302 cases.** *Am. J. Obstet. Gynecol.* 2005; **193**(4): 1323–1330.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
- Doganay M, Iskender C, Kilic S, *et al.*: **Treatment approaches in tubo-ovarian abscesses according to scoring system.** *Bratislavské lekárske listy.* 2011; **112**(4): 200–203.  
[PubMed Abstract](#)
- Ross J, Cole M, Evans C, *et al.*: **United Kingdom National Guideline for the Management of Pelvic Inflammatory Disease (2019 Interim Update).** British Association for Sexual Health and HIV Clinical Effectiveness Group (BASHH); 2019.
- Brun JL, Castan B, de Barbeyrac B, *et al.*: **Pelvic inflammatory diseases: Updated French guidelines.** *J. Gynecol. Obstet. Hum.*

- Reprod.* 2020; **49**(5): 101714. S2468-7847(20)30044-1 [pii].  
[PubMed Abstract](#) | [Publisher Full Text](#)
10. Teh J: **Tuboovarian abscess.** 2022, March 21.  
[Publisher Full Text](#)
  11. Chan GMF, Fong YF, Ng KL: **Tubo-Ovarian Abscesses: Epidemiology and Predictors for Failed Response to Medical Management in an Asian Population.** *Infect. Dis. Obstet. Gynecol.* 2019; **2019**: 4161394–4161398.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  12. Fouks Y, Cohen A, Shapira U, et al.: **Surgical Intervention in Patients with Tubo-Ovarian Abscess: Clinical Predictors and a Simple Risk Score.** *J. Minim. Invasive Gynecol.* 2019; **26**(3): 535–543. S1553-4650(18)30335-2 [pii].  
[PubMed Abstract](#) | [Publisher Full Text](#)
  13. Perez-Medina T, Huertas MA, Bajo JM: **Early ultrasound-guided transvaginal drainage of tubo-ovarian abscesses: a randomized study.** *Ultrasound in Obstetrics & Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology.* 1996; **7**(6): 435–438.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  14. Greenstein Y, Shah AJ, Vragovic O, et al.: **Tuboovarian abscess. Factors associated with operative intervention after failed antibiotic therapy.** *J. Reprod. Med.* 2013; **58**(3-4): 101–106.  
[PubMed Abstract](#)
  15. Güngördük K, Guzel E, Asicioğlu O, et al.: **Experience of tubo-ovarian abscess in western Turkey.** *Int. J. Gynaecol. Obstet.* 2014; **124**(1): 45–50. S0020-7292(13)00504-3 [pii]  
[Publisher Full Text](#)
  16. Farid H, Lau TC, Karmon AE, et al.: **Clinical Characteristics Associated with Antibiotic Treatment Failure for Tuboovarian Abscesses.** *Infect. Dis. Obstet. Gynecol.* 2016; **2016**: 5120293–5120297.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  17. Kinay T, Unlubilgin E, Cirik DA, et al.: **The value of ultrasonographic tubo-ovarian abscess morphology in predicting whether patients will require surgical treatment.** *Int. J. Gynaecol. Obstet.* 2016; **135**(1): 77–81. S0020-7292(16)30204-1 [pii].  
[Publisher Full Text](#)
  18. Wagner C, Sauer mann R, Joukhadar C: **Principles of antibiotic penetration into abscess fluid.** *Pharmacology.* 2006; **78**(1): 1–10. 94668 [pii].  
[PubMed Abstract](#) | [Publisher Full Text](#)
  19. Alay I, Kaya C, Karaca I, et al.: **The effectiveness of neutrophil to lymphocyte ratio in prediction of medical treatment failure for tubo-ovarian abscess.** *J. Obstet. Gynaecol. Res.* 2019; **45**(6): 1183–1189.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  20. Habboub AY: **Middlemore Hospital experience with tubo-ovarian abscesses: an observational retrospective study.** *Int. J. Women's Health.* 2016; **8**: 325–340.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  21. Jaiyeoba O, Lazenby G, Soper DE: **Recommendations and rationale for the treatment of pelvic inflammatory disease.** *Expert Rev. Anti-Infect. Ther.* 2011; **9**(1): 61–70.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  22. Reich H: **Laparoscopic Treatment of Tubo-ovarian and Pelvic Abscess.** Azziz R, Murphy AA, editors. *Practical Manual of Operative Laparoscopy and Hysteroscopy.* New York, NY: Springer; 1997.
  23. Rosen M, Breitkopf D, Waud K: **Tubo-ovarian abscess management options for women who desire fertility.** *Obstet. Gynecol. Surv.* 2009; **64**(10): 681–689.  
[PubMed Abstract](#) | [Publisher Full Text](#)
  24. Hatcher J, Costelloe C, Cele R, et al.: **Factors associated with successful completion of outpatient parenteral antibiotic therapy (OPAT): A 10-year review from a large West London service.** *Int. J. Antimicrob. Agents.* 2019; **54**(2): 207–214. S0924-8579(19)30094-9 [pii].  
[PubMed Abstract](#) | [Publisher Full Text](#)
  25. Patrick L, Michel C, Jean-Luc P, et al.: *Drainage of Tubo - Ovarian Abscess: DTOA.*  
[Reference Source](#)

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact [research@f1000.com](mailto:research@f1000.com)

**F1000Research**