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Article

Predicting Failure of Antibiotic Therapy in Tubo-Ovarian Abscess: a Literature Review

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Abstract: Tubo-ovarian abscess remains a leading cause of emergency abdominal surgery in women of reproductive age. Management starts with parenteral antibiotics, yet in published cohorts this fails in 18–70% of patients, and in about one in three in the largest series, while the decision to intervene is often delayed by 3–4 days. This review summarises data on predictors of antibiotic treatment failure and evaluates the prognostic value of existing scores. PubMed, eLibrary.ru and CyberLeninka were searched from 1990 to March 2026; 33 sources were included. Abscess size was the most reproducible predictor, but proposed cut-offs range from 4.5 to 8 cm. In individual studies, age, fever, leukocytosis, C-reactive protein (CRP), erythrocyte sedimentation rate, bilateral disease, parity, long-term intrauterine device use and CA-125 were independent factors. The Fouks (2019) and Yongue (2022; AUC 0.859 in the derivation cohort) scores showed poor discrimination on external validation (AUC 0.55–0.65). CRP dynamics look more promising: a decrease of less than 37.1% by day 4 was associated with treatment failure (AUC 0.755). All studies underlying the proposed cut-offs are retrospective. Prospective studies are needed that use predefined failure criteria and assess baseline ultrasound parameters together with early changes in inflammatory markers.

Keywords: *tubo-ovarian abscess; pelvic inflammatory disease; antibiotic therapy; prediction; C-reactive protein; risk score.*

Introduction

Tubo-ovarian abscess is the most severe form of pelvic inflammatory disease (PID), and it is not a rare finding. In a Japanese national database of 27,841 women with PID, 15.9% required surgery [1], and among patients admitted with complicated PID an abscess is seen on ultrasound in roughly every second case (51.1%) [2]. Nor is the disease confined to the reproductive years: 6–18% of episodes occur after menopause [3].

The approach is well established. The patient is admitted and started on broad-spectrum parenteral antibiotics, and intervention follows if therapy fails or the course becomes complicated [4, 5]. About 70–75% of patients respond to antibiotics [6, 7]. For the rest, failure is costly, above all in time. In a Singapore cohort the decision to proceed with an invasive procedure was made after a mean of 4.0 ± 2.1 days of antibiotic therapy; these patients received intravenous antibiotics for 9.4 days versus 3.6, and stayed in hospital for 10.8 days versus 4.5 [8]. Operating at the height of inflammation is difficult, as anyone knows who has had to free the adnexa from a mass in which bowel and bladder are fused to the abscess wall. In a series of 177 procedures for abscess, the bowel, bladder or ureter was injured in 5.1% of cases [9]. Surgery after failed antibiotics is needed in about one patient in four [10].

If failure could be predicted at admission, a high-risk patient could be offered drainage straight away instead of waiting for the expected failure. This is exactly the goal that the authors of prognostic scores set themselves [11]. There is also a long-term side to the question, and for women planning a pregnancy it matters: after conservative treatment alone, pregnancy rates of 4–15% have been reported [12].

The aim of this review was to summarise data on clinical, ultrasound and laboratory predictors of antibiotic treatment failure in tubo-ovarian abscess and to assess the prognostic value of the proposed scores.

Search methods

We searched PubMed/MEDLINE, eLibrary.ru and CyberLeninka from 1990 to March 2026. The term "tubo-ovarian abscess" was combined with "predict*", "risk factor*", "score", "failure", "surgery", "drainage", "C-reactive protein", "procalcitonin" and "neutrophil"; Russian-language searches used the equivalents of "tubo-ovarian abscess" and "purulent inflammatory diseases of the uterine adnexa". We included original studies comparing patients with successful and failed conservative treatment, as well as systematic reviews and clinical guidelines. Case reports were excluded, as were series limited to children and adolescents. Titles and abstracts were screened first, followed by full texts. In total, 33 sources were selected. Outcome definitions varied too widely for quantitative synthesis, so the review is narrative.

Frequency of antibiotic treatment failure

How many patients still need surgery or drainage after a course of antibiotics depends on whose series one reads (Table 1). In the classic 1991 study, 90 of 119 patients (75%) showed an initial clinical response [6]. Later, failure was recorded in 18.4% in Singapore [8] and in 20.7% in another Singapore cohort [13]. Large Turkish series of 296 and 318 patients reported 25.7–29.3% [14, 15]. An American cohort gave 34.4% [16]. In small samples the proportion reached 42.8–53.1% [17, 18]. The largest study, TOAST, included 425 patients and 522 admissions; of the 450 cases started on antibiotics alone, 159 (35%) needed additional surgical or radiological intervention before discharge [19].

Populations differ, of course, but something else matters more: authors define failure differently. Some count only surgery, others any intervention including needle drainage, and while some exclude patients operated on within the first day, others keep them in the sample. The point at which therapy is declared ineffective ranges from 48–72 h to "at the treating physician's discretion" with no fixed limit at all. And since in every one of these studies the decision to intervene was left to the clinician, the "failure rate" partly describes the habits of a particular hospital rather than the disease.

Table 1. Frequency of antibiotic treatment failure and predictors of failure in studies of tubo-ovarian abscess

Study	n	Failure, %	Significant predictors	Diameter cut-off
Reed et al., 1991 [6]	119	25	comparison of antibiotic regimens	—
Dewitt et al., 2010 [20]	135	31	diameter	>8 cm[1]
Greenstein et al., 2013 [16]	122	34.4	diameter, leukocytosis, age, parity	—
Güngördük et al., 2014 [14]	296	25.7	diameter, CRP, ESR	—
Akkurt et al., 2015 [21]	76	26	diameter, leukocytosis, age, smoking	—
Topçu et al., 2015 [22]	109	—[2]	diameter	6 cm
Farid et al., 2016 [23]	61[3]	24.6	white cells >16 × 10^9/L, diameter	5.18 cm
Kinay et al., 2016 [24]	164	26.2	diameter, fever, parity >2	6.5 cm
Inal et al., 2018 [15]	318	29.3	diameter, menopause, diabetes mellitus, long-term IUD use, fever, bilateral and multilocular abscess	6.5 cm
Fouks et al., 2019 [25]	335	—	age, leukocytosis, diameter, bilateral disease	—
Chan et al., 2019 [8]	136	18.4	diameter, BMI	7.4 cm
Levin et al., 2019 [17]	91	42.8	CA-125	—
Alay et al., 2019 [18]	81	53.1	age, NLR	—
Wong et al., 2020 [13]	102	20.7	age >40 years, diameter, fever	7 cm
Akselim et al., 2021 [26]	146	—	age, BMI, CRP, diameter	6.25 cm
Tugrul Ersak et al., 2021 [27]	124	70.2	parity, diameter, duration of IUD use	4.5 cm
Yongue et al., 2022 [11]	214	—	temperature, CRP, diameter	—
Marshall et al. (TOAST), 2025 [19]	425[4]	35	fever, diameter, CRP	—
Baer et al., 2026 [28]	166	—	G. vaginalis, guarding, recent intervention	—

Note: [1] cut-off associated with complications; [2] outcome defined as "poor prognosis" (surgery or hospital stay longer than 7 days); [3] patients who started treatment with antibiotics alone (of 113); [4] 522 admissions, failure calculated for the 450 cases started on antibiotics. IUD, intrauterine device; BMI, body mass index; NLR, neutrophil-to-lymphocyte ratio; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; "—", not reported in the source abstract.

Abscess size: the main but unstable predictor

The association between abscess size and outcome is reproduced in almost every study, and the difference between groups is visible in the means alone, without any modelling. In patients who required intervention, Greenstein et al. measured 7.3 cm versus 4.4 cm [16] and Dewitt et al. 7.7 versus 6.3 cm [20]. Two other studies reported 67.9 versus 53.6 mm [21] and 79.4 versus 50.9 mm [26], and an Israeli cohort 75 versus 57

mm [17]. Each additional centimetre increased the odds of failure 1.28-fold [8] and added 0.4 days to the hospital stay [20]. In TOAST the odds rose by 2% with every millimetre [19].

Authors have not agreed on a cut-off (Fig. 1). The lowest, 4.5 cm, was proposed by Tugrul Ersak et al. [27], and a slightly higher one, 5.18 cm, by Farid et al. [23]. At 6 cm the risk of an adverse outcome rose eightfold [22]. A cut-off of 6.25 cm gave a sensitivity of 88.1% and a specificity of 82.2% [26]. Two groups independently arrived at 6.5 cm [15, 24]. Wong et al. settled on 7 cm [13] and Chan et al. on 7.4 cm [8], while abscesses larger than 8 cm were more often complicated [20]. The association looked strongest in a Turkish series of 318 patients, where a 6.5 cm cut-off gave an odds ratio of 16.6 (95% CI 8.7–31.6) and an AUC of 0.868 [15]. Korean data spoil the picture: after adjustment for age and ESR, both of which remained independent in the same model, the link between diameter and intervention was only borderline (p = 0.065) [29].

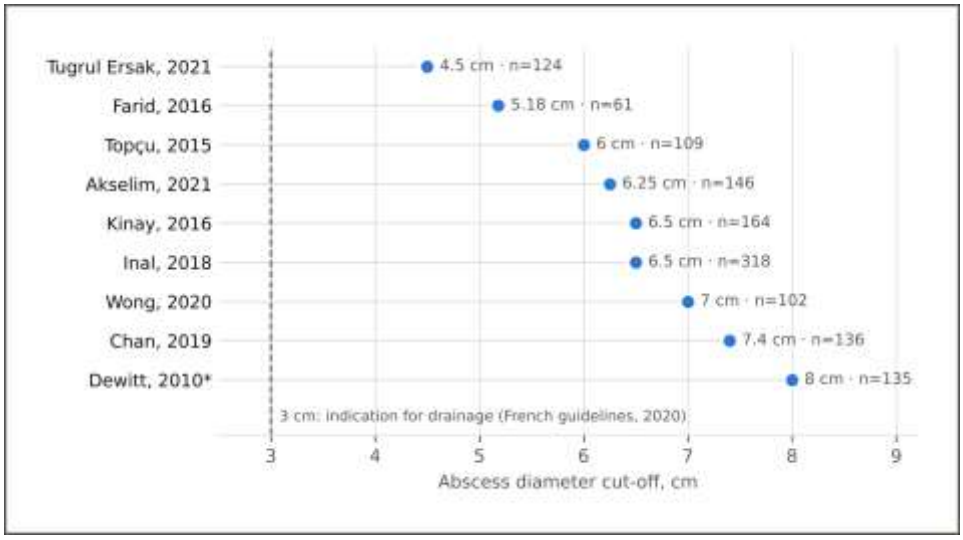


Fig. 1. Tubo-ovarian abscess diameter cut-offs proposed in different studies for predicting failure of antibiotic therapy. * Cut-off associated with complications rather than treatment failure. Dashed line: the diameter at which French guidelines recommend drainage [5].

Where does a spread from 4.5 to 8 cm come from? The reasons are methodological. The abscess was measured either by its maximum diameter or as the mean of two dimensions, at different time points and with different imaging methods, and the proportion of patients drained or operated on immediately at admission also differed between series. The cut-off was chosen by the Youden index in the same sample in which its accuracy was then assessed, which inevitably overstates that accuracy. The French guidelines approach the problem from a different angle: any collection larger than 3 cm should be drained [5]. Here the threshold is no longer a prediction of failure but an indication to evacuate pus. We find this approach more practical, because at the bedside it matters more to decide what to do with the pus than to guess whether antibiotics will cope.

Ultrasound morphology of the abscess does not appear to change the prognosis. Unilocular and multilocular masses and pyosalpinx were operated on equally often [24]. Bilateral disease is a different matter. In the Fouks score it increased the odds of intervention 2.2-fold [25], and in the series of Inal et al. both bilateral and multilocular abscesses were risk factors [15].

Clinical factors

The older the patient, the more often antibiotics fail, and this is seen in most studies. In the Fouks score age gave an odds ratio of 2.1 [25]. Akselim et al. found a cut-off of 41.5 years with a sensitivity of 71.3% and a specificity of 60% [26], and Wong et al. one of 40 years [13]. In the study by Akkurt et al., patients who underwent surgery were older, 44.9 years versus 39.1 [21]. In the Korean study age remained independent in the multivariable model as well [29].

Fever at admission was an independent factor in TOAST, with an adjusted OR of 1.72 (95% CI 1.11–2.67) [19], and also in the studies by Kinay et al. and Wong et al. [13, 24]. In the sample used to build the Yongue score, the median temperature was 38.2 degrees versus 37.1 in the two groups [11]. Less obvious is body mass index, which raised the risk in two studies: in one, each kg/m² increased the odds of failure 1.10-fold, with a cut-off of 24.9 kg/m² [8]; in the other the cut-off was 26.72 kg/m² [26].

In the history, parity and intrauterine contraception matter. Kinay et al. identified parity above two [24], other authors high parity in general [16, 27]; long-term intrauterine device use became significant after 5.5 years [27]. In the series of 318 patients, menopause and diabetes mellitus were also classed as risk factors [15]. After menopause, the abscess is often preceded by an intrauterine procedure (up to 45% of cases) or by an intrauterine device left in place for many years (up to 50%) [3]. In an older woman with a pelvic mass, it is worth asking specifically about a coil and recent intrauterine procedures.

The Leipzig group (166 patients) took a broader view. Independent predictors of surgical treatment in their cohort were detection of Gardnerella vaginalis (OR 6.9; 95% CI 1.6–49.6), guarding of the anterior abdominal wall (OR 3.1) and a recent abdominal or gynaecological procedure (OR 5.6) [28]. Most scores take neither microbiology nor such details of the history into account.

Laboratory markers at admission

Among routine tests, the white cell count is usually the first one looked at. Failure was more common with a count above 16 × 10⁹/L, with group values of 18.7 versus 13.9 × 10⁹/L [23]; in the Fouks score leukocytosis increased the odds of intervention 2.2-fold [25]. The neutrophil-to-lymphocyte ratio separated the groups less well: AUC 0.69 at a cut-off of 6.97, sensitivity 79.1%, specificity 57.9% [18].

C-reactive protein has the most data behind it. In the Yongue score sample, median CRP was 243 mg/L with treatment failure and 151 with success [11]. Akselim et al. obtained a sensitivity of 68.3% and a specificity of 71.1% at a cut-off of 143.5 mg/L [26], and in TOAST each unit of CRP added 1% to the odds of failure [19]. Published cut-offs cannot be compared with each other. In one study it is 21.0 mg/L [14], in another 24.5 mg/dL, that is, 245 mg/L [15]. The tenfold difference reflects different units, assays and sampling times, and we would not transfer a cut-off from another laboratory to our own. ESR was as informative as CRP (cut-offs of 61 and 63 mm/h) [14, 15] and remained independent in a multivariable model [29].

Procalcitonin and CA-125 have been studied little, and the results are conflicting. Procalcitonin above 0.21 ng/mL predicted surgical treatment with a sensitivity of 69.1% and a specificity of 64.6% [30]. However, in inpatients with PID it did not distinguish responders from non-responders at admission; its accuracy was 49.1%, compared with 72.1% for CRP [31]. In an Israeli cohort the only independent factor of failure was CA-125 (OR 1.27; 95% CI 1.08–1.48) [17]. This finding has not yet been confirmed.

C-reactive protein dynamics

A single measurement at admission shows how severe the inflammation is, but says nothing about how the patient responds to treatment. Ribak et al. prospectively followed 94 patients with complicated PID. An abscess was present in 48 of them, and conservative treatment failed in 12 (25%); in these women CRP rose from admission to the first and second days (128, 174 and 215 mg/L), whereas with successful treatment a plateau was followed by a decline to 78 mg/L by the third day [2]. A retrospective series of 194 patients went further and proposed a quantitative criterion. A CRP decrease of less than 37.1% from baseline by day 4 predicted antibiotic failure with an AUC of 0.755 (95% CI 0.668–0.841), a sensitivity of 73.6% and a specificity of 60% [32].

Clinically this is attractive. The decision rests on the trajectory of the marker rather than on a snapshot at admission, that is, on the response of the individual patient, and it does not depend on absolute values, which differ from one laboratory to the next. There are two weak points. Both studies had few failures, 12 and 18 cases. And no one has yet tested prospectively what CRP dynamics add when combined with baseline abscess size. In our view, this combination comes closest to how a gynaecologist actually decides at the bedside: at admission she looks at the size of the mass on ultrasound, and by the third or fourth day at whether CRP has started to fall.

Prognostic scores and their external validation

The Fouks score (2019) was built on a retrospective cohort of 335 patients. It includes four features available at admission. Abscess diameter carried the greatest weight (OR 3.6). Leukocytosis gave an OR of 2.2, bilateral disease likewise 2.2, and age 2.1. In the highest-risk group antibiotics failed in 92% of patients, in the lowest-risk group in 20%. The score underwent internal (bootstrap) and temporal validation [25].

The Yongue score (2022) was developed in a multicentre retrospective study of 150 patients and tested on the next 64. It is simpler and includes body temperature, CRP and abscess diameter. A total of 4 points or more predicted the need for intervention with a sensitivity of 69%, a specificity of 88% and an AUC of 0.859 [11].

On other people's data both scores lost most of their accuracy (Fig. 2). In TOAST the AUC of the Fouks score was 0.63 (95% CI 0.58–0.68) [19]. In a German cohort it reached 0.65 and the Yongue score 0.55, with no significant difference between them [28], which is little better than tossing a coin.

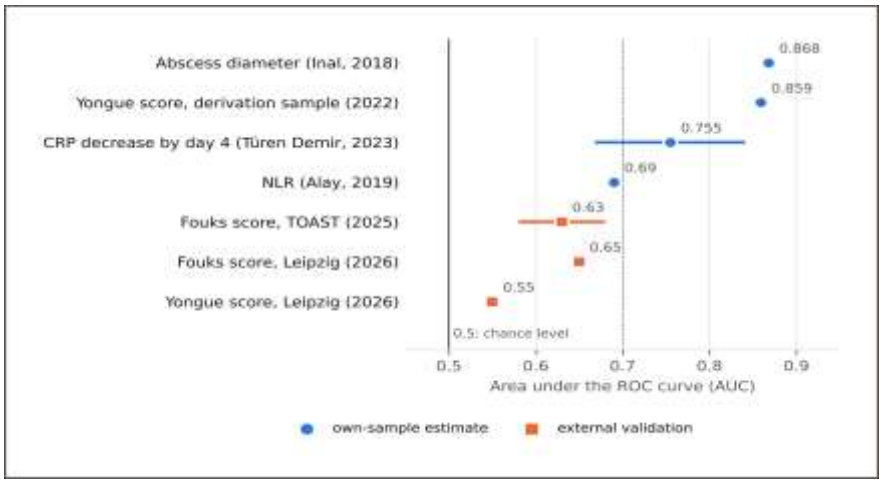


Fig. 2. Discriminative ability of predictors and prognostic scores for antibiotic treatment failure in tubo-ovarian abscess, in the authors' own samples and on external validation. Horizontal lines show 95% CI where reported in the source.

The reasons are not hard to see. The outcome in the derivation samples ("intervention required") was set by the surgeon's decision rather than by criteria agreed in advance. Events were few, laboratory predictors were measured in different units and at different times, and calibration and clinical utility (decision curve analysis) were not assessed at all. A model that describes the practice of one hospital inevitably loses accuracy in another.

Unresolved questions

There are several gaps, and they are connected. All studies on which the cut-offs and scores rest are retrospective; not a single prospective study with predefined criteria of treatment failure exists. Baseline ultrasound parameters and early CRP dynamics have been studied separately and never combined in one prospective model. The models have not been tested outside the countries where they were developed, and in the literature available to us we found no studies from Central Asia, including Uzbekistan. Finally, reporting of most models falls short of the TRIPOD standard, with neither calibration nor analysis of clinical utility.

Yet even an accurate prognosis is of little value unless it leads to action. Suppose a patient falls into the high-risk group. What should she be offered? Continued antibiotics under closer monitoring, early image-guided drainage or surgery: the literature gives no answer. The only randomised trial of early transvaginal aspiration was published in 1996 and included 40 patients. A favourable response at 48–72 h was achieved in 90% versus 65% with antibiotics alone [33]. Patients in that trial, however, were not selected by prognostic risk.

Our review has its own limitations. The search was restricted to three databases, and some values in Table 1 were taken from the abstracts of the sources, so a dash appears where the abstract did not report the figure. We found no domestic or regional studies comparing patients with successful and failed conservative treatment, and the conclusions rest almost entirely on foreign cohorts. No quantitative synthesis was performed, so the ranges given reflect the spread of the data rather than a pooled estimate.

Conclusion

Antibiotic therapy for tubo-ovarian abscess fails in 18–70% of patients, and in about one third in the largest series. Much of this spread comes from the different ways in which failure is defined.

The most reproducible predictor is abscess size, but cut-offs range from 4.5 to 8 cm and cannot be applied without validation in one's own population. Other clinical and laboratory factors are significant only in individual studies, the value of procalcitonin and CA-125 is unproven, and the Fouks and Yongue scores are not ready for clinical use given their performance on external validation (AUC 0.55–0.65).

The most promising marker, in our view, is early CRP dynamics, that is, its decrease by 72–96 h. Prospective studies are needed that combine it with baseline ultrasound parameters and link the prognosis to a specific treatment strategy.

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