Review article

Tubo-Ovarian Abscess: A Literature Review

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Abstract

Tubo-ovarian abscess (TOA) is a severe complication of pelvic inflammatory disease (PID), primarily affecting women of reproductive age. It arises from a polymicrobial infection, often involving both aerobic and anaerobic pathogens, and presents with a highly variable clinical picture, ranging from mild, nonspecific symptoms to acute pelvic pain and high fever. The diagnosis of TOA is based on a combination of clinical evaluation, laboratory markers of inflammation, and imaging techniques, with ultrasound serving as the first-line modality. In more complex or ambiguous cases, CT and MRI are valuable in distinguishing TOA from other pelvic pathologies such as malignancies, ovarian torsion, or gastrointestinal conditions. Treatment has evolved significantly, favoring conservative management with broad-spectrum antibiotics and minimally invasive drainage techniques guided by ultrasound or CT. Laparoscopy remains a valuable tool in selected cases, allowing both therapeutic and diagnostic interventions. However, surgical management is indicated in cases of rupture, failed conservative treatment, or diagnostic uncertainty. Despite advances in treatment, complications such as abscess rupture, sepsis, infertility, and chronic pelvic pain remain significant concerns. Preventive strategies focus on reducing the incidence of PID through comprehensive sexual education, barrier contraception use, STI screening, and empirical treatment of sexual partners. Given the asymptomatic nature of many STIs, the development of rapid diagnostic tools and vaccines for pathogens such as Chlamydia trachomatis and Neisseria gonorrhoeae is essential. TOA management thus requires a multidisciplinary approach aimed at early recognition, individualized treatment, and preservation of fertility.

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Introduction

Tubo-ovarian abscess (TOA) is a serious complication of pelvic inflammatory disease (PID), most commonly affecting women of reproductive age, particularly between 20 and 40 years. It is estimated that up to 34% of PID cases may progress to TOA, while approximately 60% of women with TOA are nulliparous, underlining the significant impact on future fertility and reproductive health (1–4). Although rare in postmenopausal women and adolescents, TOA should not be overlooked in these populations (5,6). The pathophysiology of TOA is complex and often polymicrobial, involving anaerobic and aerobic bacteria, with Chlamydia trachomatis and Neisseria gonorrhoeae playing roles in early infection stages (3,7). Given the variable clinical presentation and the potential for serious complications such as rupture, sepsis, and infertility, early diagnosis and an individualized treatment approach are critical (3,8,9). This review aims to summarize current knowledge on the etiology, diagnosis, differential diagnosis, treatment, complications, and prevention of TOA, with emphasis on clinical decision-making and fertility preservation.

Etiology and Pathophysiology

Tubo-ovarian abscess (TOA) most commonly arises as a complication of pelvic inflammatory disease (PID), although the exact mechanism by which PID progresses to abscess formation remains not fully elucidated (3,7). While TOA typically develops via an ascending route from the lower genital tract, it may also arise secondarily due to other intra-abdominal infections such as appendicitis, diverticulitis, or pyelonephritis. In such cases, the infection spreads directly through contiguous tissues or via hematogenous dissemination. TOA represents a polymicrobial infection involving a combination of aerobic, anaerobic, and facultative microorganisms. It is believed that pathogens such as Chlamydia trachomatis and Neisseria gonorrhoeae play a role in the early stages of infection, such as cervicitis and PID, facilitating colonization of the upper genital tract by bacteria from the lower genital tract. The most frequently isolated organisms from TOA include Escherichia coli, Bacteroides fragilis, other Bacteroides species, Peptostreptococcus, Peptococcus, and aerobic streptococci. In women with prolonged use of an intrauterine device (IUD), TOA is often associated with infection caused by Actinomyces israelii, which is important to consider in both diagnostic and therapeutic approaches (7). Risk factors for TOA largely overlap with those for PID, including multiple sexual partners, early onset of sexual activity, lack of contraceptive use, low socioeconomic status, and a personal history of PID or IUD insertion (3,7,10). Adolescents and young adults are considered particularly vulnerable due to higher-risk sexual behaviors, such as early sexual debut and more frequent partner changes. Literature data indicate that the majority of PID cases, estimated between 60% and 80%, occur in women under 25 years of age. With regard to IUD use, although there is a recognized risk of PID following insertion, it is generally low and most pronounced during the first month after insertion, especially in women exposed to sexually transmitted pathogens such as Chlamydia trachomatis or Neisseria gonorrhoeae (11). TOA most commonly occurs in women of reproductive age, however, cases have also been reported in women who are not sexually active. In adolescents with TOA, comorbidities such as Crohn's disease, congenital anomalies of the urogenital tract, previous pelvic surgeries, or translocation of bacteria from the gastrointestinal tract may also play a role in the pathogenesis (12). In postmenopausal women, the etiology of TOA significantly differs from that in younger women. Instead of sexually transmitted infections, the main risk factors are recent pelvic procedures such as endometrial biopsy, vaginal hysterectomy, and colporrhaphy (5). Notably, up to 45% of postmenopausal women who develop TOA have undergone recent gynecologic procedures involving the uterus, particularly the endometrium (13). As previously mentioned, both PID and TOA are polymicrobial infections that typically result from the ascending spread

of pathogens from the lower genital tract to the uterus, fallopian tubes, ovaries, and peritoneal cavity (7). TOA formation begins when pathogens cause epithelial damage and necrosis in the fallopian tubes, creating favorable conditions for the invasion and proliferation of anaerobic bacteria. The cumulative destruction results in purulent exudate formation. Inflammation is accompanied by tubal edema, which exacerbates intraluminal agglutination in endosalpingitis and leads to distension of the affected tube. Consequently, the fallopian tube becomes thickened and dysfunctional, potentially resulting in partial or complete obstruction and subsequent complications such as infertility or ectopic pregnancy. The abscess may extend to adjacent structures, including the ovary, contralateral fallopian tube, bladder, and bowel. It is presumed that pathogens may reach the ovary through the site of ovulation. If the inflammatory process is not halted, the boundaries between tissues become obscured, complicating identification of pelvic organs (7,14,15). In advanced stages, rupture of the abscess may occur, leading to life-threatening peritonitis. Peritonitis is characterized by fibrinous exudate on the serosal surfaces of the uterus, fallopian tubes, and ovaries, resulting in adhesion formation among the tubes, ovaries, bowel, and omentum, as well as with other pelvic structures. Over time, these adhesions may evolve into pelvic fibrosis, a known cause of chronic pelvic pain (14,15).

Clinical Presentation

The clinical presentation of tubo-ovarian abscess (TOA), like that of pelvic inflammatory disease (PID) from which it most commonly develops, is highly variable, ranging from mild symptoms to acute pelvic pain with high fever. This nonspecific symptomatology highlights the need for a comprehensive, multidisciplinary approach to diagnosis and management (9). The most common and prominent symptom reported by nearly all patients with TOA is lower abdominal and pelvic pain (16). While pain is a consistent feature, its duration can range from acute, severe pain to chronic, persistent discomfort lasting for weeks or even months (8). In addition to pain, fever appears to be another frequent symptom indicative of TOA. One study reported that between 19% and 76% of patients with this condition present with a body temperature above 38.5˚C (2). Another study concluded that a symptom triad consisting of a body temperature ≥38˚C, diarrhea, and leukocytosis significantly aids in identifying TOA in patients with PID. In that same study, approximately 60% of TOA patients reported diarrhea upon admission, and diarrhea was notably more frequent among those requiring surgical intervention (1). Other symptoms may also be present, including nausea, vomiting, tachycardia, chills, and vaginal discharge (9,17,18). Although marked leukocytosis is observed in 66%–80% of women with TOA, clinicians must be aware that the clinical presentation of this condition is so diverse that the absence of classical signs such as leukocytosis and pyrexia does not exclude the diagnosis (19). In cases where the abscess ruptures, the clinical status can deteriorate rapidly with the development of sepsis, representing a medical emergency (18).

Differential Diagnosis

The clinical presentation of a tubo-ovarian abscess (TOA) can sometimes resemble other gynecological or gastrointestinal pathologies. Conditions to consider in the differential diagnosis include appendicitis, endometrioma or other ovarian cysts, ectopic pregnancy, diverticulitis, and malignant tumors (3). For example, patients with a ruptured corpus luteum cyst may present with lower abdominal pain, nausea, vomiting, and cervical tenderness on pelvic examination. Radiological findings typically reveal a cystic adnexal lesion with thickened walls and internal echoes, along with the presence of hemoperitoneum (20). Pain in the right lower quadrant accompanied by fever and leukocytosis is frequently seen not only in TOA but also in acute appendicitis (21). In contrast, diverticulitis typically presents with left lower quadrant pain, fever, leukocytosis, and possible gastrointestinal symptoms and pelvic pressure (22). A CT sign that can be particularly

useful in differentiating TOA from gastrointestinal conditions such as appendicitis, diverticulitis, Crohn's disease, and perforated cecal neoplasms is an anteriorly displaced and thickened round ligament (23). Another distinguishing feature is the presence of the right ovarian vein entering a right pelvic abscess, which has been shown to have 100% specificity and 94% sensitivity in favoring the diagnosis of TOA over periappendiceal abscess (24). Conversely, in the case of a complex adnexal mass without pyrexia, ovarian malignancy should be suspected (3). On imaging, TOA often appears as an inflammatory infiltrative process with ill-defined margins extending to adjacent organs, making it difficult to distinguish from ovarian cancer. As previously noted, complex TOAs on MRI typically present as cystic-solid or multilocular cystic lesions with thickened walls and septations, along with dilated fallopian tubes, features that may also be seen in ovarian tumors (25). Adnexal torsion is another clinical entity that may mimic TOA. Patients with torsion may present with acute lower abdominal pain, often accompanied by nausea and vomiting. Nausea and vomiting occur in approximately 70% of adnexal torsion cases, significantly more frequently than with other gynecologic causes of pelvic pain. Due to the nonspecific nature of the clinical presentations in both adnexal torsion and TOA, diagnosis may be delayed, potentially leading to serious complications such as ischemia and necrosis in torsion, or abscess rupture in TOA (26). Certain symptoms of ectopic pregnancy can also resemble those of TOA, including pelvic pain, adnexal tenderness, and signs of an acute abdomen. Additionally, the adnexa on the affected side is often enlarged and tender (27). Therefore, in all women of reproductive age, a pregnancy test is mandatory (3).

Diagnosis

The diagnosis of tubo-ovarian abscess (TOA) is established through a combination of medical history, physical examination, laboratory tests, and imaging studies. Although physical and laboratory findings are not specific for this condition, the clinician should perform a complete blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), cervical swabs for sexually transmitted pathogens such as Chlamydia trachomatis and Neisseria gonorrhoeae, and a pregnancy test (28,29). In the history-taking process for women suspected of having TOA, particular attention should be paid to the aforementioned risk factors such as early onset of sexual activity, multiple sexual partners, lack of barrier contraception, previous episodes of PID, prior pelvic or abdominal surgeries, use of intrauterine devices (IUD), and immunosuppression (1,29). During physical examination, patients typically present with lower abdominal pain and signs of peritoneal irritation, such as rebound tenderness and abdominal wall rigidity. Due to muscular guarding, pelvic and abdominal examination can be significantly limited. A vaginal examination is essential and may reveal mucopurulent vaginal discharge, while bimanual palpation often demonstrates adnexal tenderness (9,15). Laboratory tests in patients with TOA typically reflect an underlying inflammatory and infectious process. Elevated ESR levels and CRP levels are useful in predicting the outcome of pelvic inflammatory disease and possible progression to TOA. Elevated values were also associated with longer hospital stays and more severe disease courses (30). Imaging studies are essential in diagnosing TOA, with ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) being the most important modalities. Ultrasound is a non-invasive and widely available diagnostic tool, making it the first-line imaging method (9,31). Its sensitivity ranges from 56% to 93%, while specificity ranges from 86% to 98%. These broad ranges are due to variations in imaging technology, operator expertise, patient population characteristics, and differences in study methodologies (32). Although CT is not the first-choice modality for TOA diagnosis, it is extremely useful in cases with inconclusive or atypical ultrasound findings and in patients with comorbidities presenting with overlapping symptoms (21,23). The most common CT finding in TOA is a thick-walled, fluid-filled adnexal mass with internal septations. Additional findings may include gas bubbles within the mass,

indistinct borders between the uterus and adjacent bowel loops, and inflammatory changes in surrounding organs (3,23,24,33). MRI is a highly valuable imaging modality for diagnosing TOA. Unlike CT, it does not emit ionizing radiation and is safe in pregnancy. It has also proven useful in distinguishing TOA from malignant pelvic processes. Although the appearance of TOA on MRI may vary depending on the disease stage, it typically presents as an ill-defined, fluid-filled adnexal mass with thick, irregular walls, showing hypointensity on T1-weighted images and hyperintensity on T2-weighted images. In clinical practice, TOA does not always exhibit a classic MRI appearance, many lesions demonstrate a combination of cystic and solid components (3,25,33).

Treatment

Over the past few decades, the principles of treating tubo-ovarian abscesses (TOAs) have significantly evolved due to the development of broad-spectrum antibiotics, advanced imaging techniques, and improved methods of abscess drainage. Treatment of TOA requires a 14-day course of antimicrobial therapy. Initially, antibiotics are administered parenterally, and once clinical improvement is achieved, therapy can be continued orally until completion. The decision to switch to oral antibiotics should be guided by clinical judgment, and TOA patients should be closely monitored for at least 24 hours. First-line treatment typically includes broad-spectrum intravenous antibiotics covering Neisseria gonorrhoeae, Chlamydia trachomatis, and anaerobic bacteria (34,35). Parenteral administration of clindamycin, metronidazole, and cefoxitin has shown high penetration into abscesses and contributes to abscess reduction. Negative prognostic factors for antibiotic therapy include abscesses larger than 5 cm, bilateral abscesses, age over 40, elevated initial leukocyte counts, increased CRP and ESR, and smoking (3,36). Minimally invasive drainage techniques via interventional radiology include ultrasound- or CT-guided aspiration of the abscess. These procedures are referred to as "minimally invasive" because they allow abscess evacuation without large incisions or open surgery. They can be used as first-line treatments in combination with antibiotics for patients with poor prognostic factors for antibiotic monotherapy, or secondarily in patients who fail to respond or clinically deteriorate. Drainage can be performed transabdominally, transvaginally, transrectally, or transgluteally. Reported success rates for these techniques range from 83% to 100%. Since these methods access the abscess through small skin punctures or natural orifices, they minimize tissue trauma, reduce postoperative pain, shorten hospital stays, and preserve fertility compared to open surgical approaches (3,37,38). Surgical treatment of TOA is indicated in cases of suspected surgical emergencies (e.g., abscess rupture), failed drainage, poor response to medical treatment and drainage, or diagnostic uncertainty. The choice of surgical approach depends greatly on disease severity. Laparoscopy is generally preferred due to its minimally invasive nature. However, midline laparotomy may be indicated for very large abscesses, coexisting conditions such as inflammatory bowel disease, or previous significant abdominal surgeries. Salpingo-oophorectomy and open drainage are more commonly required in refractory cases or when the abscess originates from the gastrointestinal tract. Surgical management of TOA can be technically challenging due to the friable nature of necrotic tissue, which is prone to bleeding during manipulation. Adhesions between bowel and pelvic structures are frequently present in TOA, increasing the risk of injury to internal organs during surgery. During the procedure, pus should be collected for microbiological analysis to potentially adjust antibiotic therapy. Postoperatively, intravenous antibiotic therapy should be continued (3,15,35–37,39).

New approaches in treatment

Given the increasing problem of antibiotic resistance in bacteria that cause tubo-ovarian abscesses, traditional antibiotic therapy is often ineffective. Because of this, researchers are exploring innovative strategies to either complement or replace current treatments. One promising strategy is CRISPR (Clustered

Regularly Interspaced Short Palindromic Repeats). This system is known for its ability to precisely edit genes and can be programmed to specifically target and degrade DNA sequences that contain resistance genes. A major advantage is that it can do this without harming the normal microflora. However, this technology is still in the early stages of development. Nanoparticles are increasingly being studied, either as drug carriers or as direct antimicrobial agents. Among the most frequently researched forms are silver nanoparticles, liposomes, and various metallic and polymeric structures, which can directly destroy pathogens or enhance the effect of conventional antibiotics. Thanks to their extremely small size, they are capable of penetrating even through biofilms and bacterial cell walls. Bacteriophages, or viruses that specifically infect bacteria, are another method of combating resistant bacteria. Their high selectivity and effectiveness, combined with low toxicity, make them an interesting alternative, though they are still rarely used in clinical practice. Antimicrobial peptides (AMPs), which are part of the innate immunity of many organisms, act by disrupting the integrity of the bacterial membrane. Their application in the treatment of gynecological infections is still under investigation. Monoclonal antibodies can be directed against specific bacterial structures, thereby facilitating their removal by the immune system. Although more commonly used in oncology and virology, they are increasingly being studied in the context of bacterial infections. A better understanding of microbiological pathogens and their resistance mechanisms is crucial for more effective treatment of tubo-ovarian abscesses, and it is necessary to continuously monitor resistance patterns and apply antibiotics rationally and in a targeted manner, in order to preserve their long-term effectiveness (40).

Complications

Abscess rupture is one of the most serious complications of TOA, occurring in approximately 15% of cases. It is life-threatening and may lead to peritonitis, sepsis, or septic shock, requiring urgent surgery. Sepsis is observed in 10–20% of cases, with a mortality rate of 5–10%. Timely intervention is essential and includes resuscitation, broad-spectrum intravenous antibiotics, oxygen therapy, blood cultures before antibiotics, lactate measurement, fluid resuscitation, and urine output monitoring (3,9). Intraoperative complications include injuries to gastrointestinal organs, while postoperative complications may involve wound infections, especially in patients with systemic conditions such as diabetes (9). If left untreated, PID and TOA can lead to long-term complications such as chronic pelvic pain, adhesions, ectopic pregnancy, subfertility or infertility, ovarian vein thrombosis, and pelvic thrombophlebitis (9,36). Chronic pelvic pain affects about one-third of women with TOA, particularly those with recurrent or severe disease. Its incidence increases with each episode, and that is 12% after one, 30% after two, and up to 67% after three or more episodes of PID or TOA (3). TOA often causes tubal damage, contributing to infertility. This includes fimbrial agglutination, tubal obstruction, hydrosalpinx, and muscular thickening. Scarring and adhesions during healing further impair fertility. The risk of infertility rises with each PID episode: 10–12% after one, 23–35% after two, and 54–75% after three episodes. Ectopic pregnancy risk is also significantly increased, up to sevenfold. In women with a history of TOA and subfertility, tubal patency assessment should be considered (3,7,41).

Prevention

Since TOA most often develops as a complication of PID, its prevention primarily relies on preventing PID. Key strategies include comprehensive sexual education, promoting the use and accessibility of barrier contraception and raising awareness of sexually transmitted infections (STIs), especially among adolescents. Comprehensive sex education has been shown to delay sexual initiation, reduce the number of sexual partners, and increase contraceptive use, thereby lowering rates of unintended pregnancy and STIs (42–44). Although schools are central for delivering such education, the internet has become a major source of health information for

youth. Therefore, digital sexual health education, delivered via online or mobile platforms, offers accessible, private, and anonymous learning opportunities. Hybrid programs that combine in-person and online components may be even more effective than traditional classroom education (43). Prevention and early detection efforts focus on Chlamydia trachomatis and Neisseria gonorrhoeae. In high-income countries, screening and treatment programs for asymptomatic C. trachomatis have been implemented, and many health authorities recommend annual screening for sexually active women under 25 or those at increased risk. Screening for N. gonorrhoeae is also advised for high-risk groups. However, in many low- and middle-income countries, such screening programs are unavailable due to financial and logistical constraints. In these settings, diagnosis is often based on symptoms and algorithms without specific lab tests, which poses a challenge, as these infections are frequently asymptomatic and go undetected. This highlights the need for affordable, rapid point-of-care diagnostic tests (42). Empirical treatment of sexual partners of women with cervical infections or PID is also crucial to prevent reinfection. Additionally, the World Health Organization has identified vaccine development against C. trachomatis and N. gonorrhoeae as a public health priority. Given the shared immune mechanisms involved, a combined vaccine may be a promising future tool in PID prevention (42,45).

Conclusion

Tubo-ovarian abscess remains a challenging gynecologic condition requiring timely diagnosis and an integrated therapeutic strategy. Although most cases respond well to conservative management, treatment success depends on early recognition, abscess size, and individual risk factors. Imaging-guided drainage techniques and broad-spectrum antibiotics have reduced the need for extensive surgical procedures and helped preserve reproductive function in many women (3,35,37,46,47). However, complications such as rupture, chronic pelvic pain, and infertility continue to represent major clinical concerns, especially in cases of delayed intervention (3,9,36). Preventive strategies, focused on STI education, screening for C. trachomatis and N. gonorrhoeae, and comprehensive sexual health programs, are essential to reduce the incidence of PID and its complications (42–45). Future efforts should include improved diagnostic tools and development of vaccines as long-term solutions for TOA prevention.

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Tuboovarijski apsces: pregled literature

Sažetak

Tuboovarijski apsces (TOA) ozbiljna je komplikacija upalne bolesti zdjelice, koja u najvećoj mjeri pogađa žene u reproduktivnoj dobi. Nastaje iz polimikrobne infekcije, često uključuje i aerobne i anaerobne patogene, i prezentira se vrlo varijabilnom kliničkom slikom – od blagih nespecifičnih simptoma do akutne boli zdjelice i povišene tjelesne temperature. Dijagnoza TOA-a temelji se na kombinaciji kliničke procjene, laboratorijskih upalnih markera i slikovnih pretraga, u prvome redu ultrazvuka. U složenijim ili nejasnim slučajevima, CT i MRI bitni su u razlikovanju TOA-a od drugih patologija zdjelice, kao što su maligniteti, torzija jajnika ili gastrointestinalna stanja. Tretman je značajno napredovao, u korist konzervativnog liječenja antibioticima štirokog spektra i minimalno invazivnih tehnika drenaže vođenih ultrazvukom ili CT-om.. Laparoskopija ostaje važna metoda u određenim slučajevima, omogućujući i terapeutske i dijagnostičke intervencije. Međutim, kirurški zahvati indicirani su u slučaju rupture, neuspješnog konzervativnog liječenja, ili nesigurnosti u dijagnozi. Unatoč napretku u terapijama, komplikacije kao što su ruptura apscesa, sepsa, neplodnost i kronična zdjelična bol i dalje predstavljaju značajne rizike. Preventivne strategije usmjerene su na smanjenje incidencije upalne bolesti zdjelice putem seksualnog odgoja, korištenja barijernih kontraceptivnih metoda, probira na seksualno prenosive infekcije i empirijskog liječenja seksualnih partnera. S obzirom na asimptomatsku narav mnogih spolnih infekcija, razvoj brzih dijagnostičkih alata i cjepiva za patogene kao što su *Chlamydia trachomatis* i *Neisseria gonorrhoeae* je ključan. Upravljanje TOA-om stoga zahtijeva multidisciplinarni pristup usmjeren na rano prepoznavanje, individualiziran tretman i očuvanje fertiliteta.

Ključne riječi: tuboovarijski apsces, upalne bolesti zdjelice, fertilitet, laparoskopija, ultrazvučno navođena drenaža