International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614
ISSN (E): 2522-6622

www.gynaecologyjournal.com
2022; 6(1): 37-41
Received: 19-11-2021
Accepted: 23-12-2021

Luis Humberto Sordia-Hernández
MD, PhD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Felipe Arturo Morales-Martínez
MD, PhD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Cristina Aidé Ramírez Colunga
MD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Luis Humberto Sordia-Piñeyro
MD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Otto Hugo Valdés-Martínez
MD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Selene M Garcia-Luna
PhD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

María Ofelia Sordia-Piñeyro
MD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Dr. Jose Eleuterio Gonzalez
Universidad Autonoma de Nuevo Leon, Monterrey, Mexico

Corresponding Author:
Luis Humberto Sordia-Hernández
MD, PhD, Department of Gynecology and Obstetrics, Facultad de Medicina y Hospital Universitario, Mexico

Factors Associated with the need for bilateral salpingo-oophorectomy with or without hysterectomy in patients with a tubo-ovarian abscess

Luis Humberto Sordia-Hernández, Felipe Arturo Morales-Martínez, Cristina Aidé Ramírez Colunga, Luis Humberto Sordia-Piñeyro, Otto Hugo Valdés-Martínez, Selene M Garcia-Luna, María Ofelia Sordia-Piñeyro and Dr. Jose Eleuterio Gonzalez

DOI: https://doi.org/10.33545/gynae.2022.v6.i1a.1112

Abstract
Tubo-ovarian abscess (TOA) represents the most serious form of pelvic inflammatory disease. Some patients with TOA can be treated medically, others require surgery. Surgical treatment can be conservative or radical surgery, the reproductive consequences and symptoms associated with early menopause are often devastating for these women. The objective of this retrospective study is to evaluate the clinical characteristics related to the need for performing bilateral salpingo-oophorectomy in patients with a tubo-ovarian abscess. A total of 105 patients who were included. Of these patients, 26 (27.3%) received medical treatment, and 79 (73.7%) surgical treatment. In the latter, 31 had conservative surgery and in 48, bilateral salpingo-oophorectomy was performed. A positive correlation, statistically significant, was found between the number of sex partners, four or more, the size of the abscess, 10 cm or more, and the bilaterality of the abscess with the need to perform more radical surgery.

Keywords: tubo-ovarian abscess, surgical treatment, radical surgery, salpingo-oophorectomy

Introduction
A tubo-ovarian abscess (TOA) represents the most serious form of pelvic inflammatory disease. The wide spectrum of symptoms of patients with pelvic inflammatory disease (PID) usually makes this diagnosis difficult. This allows the disease to progress to the most serious forms [1]. The evolution of patients with TOA can be life-threatening [2], so it is very important to make an early diagnosis and establish the most appropriate treatment according to the conditions of each patient. Although some patients with TOA can be treated medically, particularly uncomplicated cases [3], patients with TOA usually require surgery [4]. Surgical treatment can be conservative trying not to affect the reproductive capacity of women with this disease; however, a large number of women usually require more radical or definitive surgery, such as bilateral salpingo-oophorectomy with or without hysterectomy [5].
PID and TOA occur more frequently in women of reproductive age [6], so the reproductive consequences and those related to the symptoms associated with early menopause, as a consequence of this type of more radical surgery, are often devastating for these women.
The objective of this study is to evaluate the clinical characteristics related to the need to perform definitive surgery, understanding as definitive surgery a procedure that implies uni or bilateral removal of the fallopian tubes plus removal of both ovaries with or without hysterectomy in patients with a tubo-ovarian abscess.

Material and methods
This is a retrospective study that was carried out at the Dr. José Eleuterio González University Hospital in Monterrey, Mexico with the approval of the Ethics and Research committees. The study included all patients treated at this hospital with a diagnosis of tubo-ovarian abscess in the period between January 1, 2015, and June 30, 2020. The diagnosis of TOA was made if the patients presented clinical data of severe pelvic inflammatory disease according to the criteria described by the

Centers for Disease Control and Prevention and additionally with images suggestive of ovarian tube abscess diagnosed by vaginal ultrasound or nuclear magnetic resonance imaging.

The records of these patients were reviewed and the following data were obtained: age; marital status; level of education; smoking; alcohol consumption; age at the start of sexual activity; the number of sex partners; the number of pregnancies; the number of deliveries, Caesarean sections, abortions, ectopic and molar pregnancies; a history of sexually transmitted diseases; a history of pelvic inflammatory disease; family planning methods used, including current and previous use of an intrauterine device; as well as the presence of fever, diarrhea, or pelvic pain.

Physical examination findings such as fever were analyzed, as well as the presence of vaginal discharge, pain upon mobilization of the cervix, pelvic pain, abdominal pain, and the presence of peritoneal irritation; the number of leukocytes was evaluated with a complete blood count.

The treatment used in each patient was reviewed, whether it was only medical, that is, broad-spectrum antibiotics, or surgical treatment; whether it was conservative: abscess drainage, unilateral or bilateral salpingectomy, salpingectomy with unilateral oophorectomy; or radical or definitive surgical treatment, that is, unilateral or bilateral salpingectomy with bilateral oophorectomy with or without hysterectomy. Finally, two groups were formed: Group One composed of patients with a diagnosis of ovarian tube abscess treated with "radical" surgery and Group Two that included patients with a diagnosis of ovarian tube abscess who were treated conservatively, either only with medical treatment based on broad-spectrum antibiotics or conservative surgery respecting at least one ovary and the uterus. The results of both groups were compared.

The statistical analysis was performed using SPSS version 21 for Mac (IBM, Armonk, NY, USA). The outcomes in both groups were compared using the χ^2 test Student´s t-test as appropriate. A P-value of less than 0.05 was considered statistically significant. A logistic regression model was applied to the variables that showed a statistically significant difference using Nagelkerke R2 values.

Results

A total of 105 patients who were admitted with a diagnosis of tubo-ovarian abscess were included. Forty-eight patients underwent bilateral salpingo-oophorectomy (n = 5) or total hysterectomy plus bilateral salpingo-oophorectomy (n = 43). A total of 57 patients were included in Group two. Of these patients, 26 received medical treatment and 31 were treated with conservative surgery, unilateral salpingectomy (n = 6), or unilateral salpingectomy with unilateral oophorectomy (n = 25).

The age of the patients ranged from 17 to 64 years. The mean age of the patients in Group 1 was 35.5 (SD ± 8.45) years of age and that of the patients in group 2 was 32.4 (SD ± 10.3). The difference was not significant with a p-value of .141. There were also no significant differences in relation to the age at the start of an active sex life, number of pregnancies, deliveries, cesarean sections, or abortions. A significant difference was found between both groups in the number of sex partners. The mean number of sex partners in Group 1 was 3.88 vs. 2.04 in Group 2. The difference was statistically significant with a $p < .001$. The characteristics of the patients in both groups in relation to age and gynecological-obstetric history are listed in Table 1.

A correlation was found between the number of sex partners and the possibility of requiring radical surgery; the OR was 2.8 (95% CI 2.52-3.23). In those women who reported only one sex partner, 4 out of 28 required radical surgery, in contrast with those with more than 4 sex partners who underwent this type of surgery in 28 out of 35, which represents 80%. The difference was significant with a p-value <.001. These results are shown in Table 4.

A total of 58 patients were intrauterine device users; 100% were carriers of a copper-T device. Of these patients, 28 (48.3%) were treated with radical surgery, and 30 (51.7%) with conservative surgery or medical treatment. The difference was not statistically significant (p = 0.558). No significant difference was found if the device threads were visible or not at the time of the physical examination on admission. There were also no differences in the possibility of radical surgery in relation to a history of previous pelvic inflammatory disease or a history of sexually transmitted infections. These results are summarized in Table 2.

Regarding physical examination data at the time of admission, a negative correlation was found between body temperature and the need for radical surgery. We found that the mean temperature for group 1 patients was 37.3°C (SD ± 8.70), in contrast to the mean of group 2 which was 37.8°C (SD ± 9.0). The difference was statistically significant with a p-value <.001.

Leucorrhoea was found in 35 of 48 patients (72.9%) of the patients in Group 1 and 46 of 57 (80.7%) patients in Group 2. There was no difference between the two groups. There was also no difference between the two groups in the characteristics of leucorrhoea: white, yellow, green, or fetid.

The number of leukocytes at the time of admission was not related to the possibility of performing radical surgery. The mean for Group 1 patients was 20.4 x 10^9/L (SD ± 17.5) and that of Group 2 was 19.7 x 10^9/L (SD ± 16.5); the p-value was .836.

The presence of bilateral abscesses, demonstrated by pelvic ultrasound, was related to the possibility of performing radical surgery. The OR was 1.2 (95% CI 1.14 - 1.30). It was found that when the abscesses were bilateral, 18 out of 23 (78.3%) patients required radical surgery, in contrast to patients who presented only one abscess where radical surgery was performed in 30 out of 82 (32.6%) patients. The difference was statistically significant with a p-value <.001.

Likewise, the size of the abscesses was positively related to the possibility of radical surgery. The OR was 2.9 (95% CI 2.76 - 3.04). Radical surgery was performed in 3 out of 27 (11.1%) patients whose abscess or abscesses measured 1 to 4 cm. In patients whose abscesses measured between 5 and 9 cm, it was performed in 26 out of 58 (44.8%) patients. On the other hand, 19 out of 20 (95%) of the patients whose abscesses measured more than 10 cm were treated with radical surgery. The difference was statistically significant with a p-value <.001.

The logistic regression model showed a positive correlation of radical surgery with the presence of bilateral abscesses, the size of abscesses larger than 10 cm, and the number of sex partners with a Nagelkerke R2 of 0.762.

A culture of cervical secretion was taken from all patients at the time of their hospital admission. In 60.0% of the patients (63/105) included, it was possible to isolate at least one germ. The most frequently found microorganism was *streptococcus*; this organism was reported in 20 (31.7%) of the 63 patients with a positive culture. Six were reported as *Streptococcus* viridans, six *Streptococcus agalactie*, and five were *Streptococcus* spp, one *S. sanguinis*, and one *S. anginosus*. Other bacteria found were *Escherichia coli* in 9 patients (14.2%), and *Staphylococci* in 7 patients (11.1%). Of the latter, 4 were reported as *Staphylococcus aureus*, 2 as *Staphylococcus pneumonie*, and one coagulase-negative *Staphylococcus*. The rest of the cultures reported various bacteria such as *Bacteroides*, *Enterococci*, and

Enterobacter, among others. None of the isolated germs was associated with a higher incidence of definitive surgery.

A culture was taken from the intrauterine devices that the patients carried. In total, microorganisms were cultivated in 48 of the 58 IUD carriers. It is worth mentioning that 100% of the patients carried a copper-T. The most frequent microorganism found was *Staphylococcus*; this bacterium was reported in 66.6% of patients with positive cultures (32/48). Of these, 30 corresponded to coagulase-negative *Staphylococcus* and one to *Staphylococcus aureus*. These were followed in frequency by *Streptococcus* in 14 patients (29.1%) and *Escherichia coli* in 10 (20.8%). Less frequently, *Corynebacterium* and *Enterococci*, among other germs, were reported. The presence of *Staphylococcus* in the culture of the intrauterine devices was not associated with a higher incidence of pelvic abscesses (p = 0.75) or with a higher probability of definitive surgery (p = 0.35).

There were 12 surgical complications among the patients included in this study, which correspond to 11.4% of the total. Among the patients in Group one (n = 48), there were 7 (14.4%). The most common complication in this group was surgical bowel injury, which was reported in 5 of the 48 patients (10.4%). One patient (2.1%) suffered an injury to the ureter that was treated with anastomosis and the application of a double j catheter (double pigtail ureteral stent); one patient presented surgical wound dehiscence.

Five complications were reported among the patients who were treated with conservative surgery, which represented 8.8%. The five complications were intestinal injuries. All intestinal lesions in both groups were treated with intestinal resection and end-to-end anastomosis. No statistically significant difference was found between the groups. One patient died, which represented 0.9% of the total included in the present study; this patient was from Group 2.

Discussion

Our results show a significant relationship between the possibility of performing a bilateral oophorectomy with or without hysterectomy in patients with a tubo-ovarian abscess and the size of the abscess or abscesses, their bilaterality, and a history of multiple sexual partners.

Initial treatment of women with a tubo-ovarian abscess is usually with broad-spectrum antibiotics [7, 8]. The efficacy of treating tubo-ovarian abscesses with antibiotics alone is controversial. Some studies have reported that it is possible to successfully treat tubo-ovarian abscesses with antibiotics alone in up to 70% of cases [9, 10]. In this study, only one-quarter of the patients were treated with antibiotics alone. This result is consistent with the data reported by Topçu *et al*. in 2015[11] who mentioned that 20.2% of the patients from a cohort of 109 patients had a favorable evolution after treatment with only antibiotics.

In some guidelines, the treatment of a tubo-ovarian abscess is considered surgical [4]. Surgical treatment of a tubo-ovarian abscess can be conservative, trying to preserve the reproductive potential of the patients. This approach includes percutaneous aspiration of the abscesses, even with the instillation of antibiotics into the abscesses [12, 13]. It is also possible to perform a laparotomy, even a laparoscopy, to drain the abscesses or to perform either a unilateral or bilateral salpingectomy. However, the definitive treatment of tubo-ovarian abscesses is hysterectomy with bilateral salpingo-oophorectomy [12]. In this study, three out of every 4 participants were treated with surgery. And of these, 60% (48/79) were treated with bilateral salpingo-oophorectomy, the vast majority (89.5%; 43/48) with hysterectomy.

The age of the patients has previously been related to the possibility of developing tubo-ovarian abscesses and the need for surgery [14]. The age of the patients included in this report was on average similar to that previously reported by Habboub in 2016 [15]. He reported a mean age of 37.8 years in a group of patients with tubo-ovarian abscess. In this same study, he reported that more than 60% of the participants were between 30 and 49 years of age. Despite the fact that more aggressive clinical conditions have previously been reported in older patients with tubo-ovarian abscess [16], in this study, no association was found between the age of the participants and the need for radical surgery.

In a study previously reported by our group, we found that the number of deliveries, but not the number of pregnancies, correlated with a greater probability of developing tubo-ovarian abscesses in a group of patients with severe pelvic disease [17]. However, in this study, we did not find any relationship between the number of pregnancies, deliveries, or abortions with the possibility of requiring radical surgery for a tubo-ovarian abscess.

The previously described risk factors for the development of a tubo-ovarian abscess are similar to those related to pelvic inflammatory disease and include the number of sex partners, a history of sexually transmitted diseases, a history of previous pelvic inflammatory disease, and the use of an intrauterine device [18, 19]. We only found a relationship between the number of sex partners and the possibility of requiring more radical surgery. We found that patients who reported more than 4 sexual partners had a greater risk of more aggressive surgery than patients with fewer sex partners. The number of sex partners is subjective data that depends on the willingness of the patients to mention the number of sex partners. This data must be taken with caution, not only due to the aforementioned subjectivity but also to the fact that we do not know with certainty the number of sex partners of the couples who had intercourse with the participants in this study.

The intrauterine device has been mentioned as a risk factor for both the development of pelvic inflammatory disease and tubo-ovarian abscess [8, 19]. This association has been reported in patients who have recently had an intrauterine device applied and also in women with more than 5 years of use [15]. We found no relationship between the intrauterine device use and the possibility of performing more radical surgery.

The most common clinical presentation in patients with a tubo-ovarian abscess is pelvic pain, fever, and the presence of a mass in the pelvic region. in this study, a negative correlation was found between the need for radical surgical treatment and the presence of fever greater than 38°C. It should be mentioned that the possibility of finding a fever above 38.5 was reported between 19% and 76% in a study published by Landers [20]. Other studies report fever in less than 50% of cases with tubo-ovarian abscesses at the time of admission [14]. Therefore, it is not surprising that the body temperature of the patients in this study did not, on average, exceed 38 degrees Celsius. It could be that the septic conditions of the patients with more severe symptoms explain the reason for this discrete but significant difference in body temperature found between the patients in both groups.

Leukocyte counts greater than 15,000 have been related to the severity of infection in cases of tubo-ovarian abscesses [17]. However, we found no relationship between the number of leukocytes and the possibility of performing more radical surgery.

The bilaterality of abscesses has been related to a greater failure in conservative antibiotic treatments and also to a greater need for surgery [20]. In this study, it was found that almost 22% of the patients were carrying bilateral abscesses, and almost 80% of the patients required radical surgery. Likewise, the previously reported rate of bilaterality in abscesses is similar [20].

The size of the abscesses has been related to a greater need for surgical treatment. in various studies [21]. A diameter greater than 5 cm presupposes a poor response to antibiotic treatment and a greater possibility of requiring surgical treatment [7, 11, 21]. We found that the size of the abscesses is also positively related to the need for a more aggressive surgical treatment. We also found that the possibility of requiring surgical treatment that required the removal of both ovaries with or without a uterus was 95% if the size of the abscess or abscesses as a whole was greater than 10 cm. This is a very interesting finding because the simple size of the abscess (es) may suggest a more serious condition and the urgent need to surgically treat patients with large abscesses. Ideally, our patients should come for help as soon as symptoms begin; however, the bizarre clinical pictures of patients with a tubo-ovarian abscess means that by the time patients seek medical help, abscesses have grown too large. This exposes our patients to a greater risk of undergoing a definitive and radical surgery that will cause momentous changes in their lives. This is considering that most women with tubo-ovarian abscesses are in the reproductive stage of their lives.

It is important to note that in the logistic regression model that included the variables that showed a positive correlation with the possibility of requiring radical surgery; that is, the number of sexual partners, the bilaterality of the abscesses, and the size of these showed in the same manner, a positive correlation. Therefore, a model that includes a single well-oriented question in the interview, the number of sex partners, and the result of a pelvic ultrasound, which shows the size and bilaterality of the tubo-ovarian abscesses, can suggest the need for more extensive and radical surgery. This also alerts us to be prepared for a difficult surgery, and in theory, a higher risk of injury to neighboring organs.

The cultures of cervical secretions that were taken on the admission of the patients reported the growth of pathogenic flora in 60% of cases. The most commonly isolated germs were *Streptococci*, *E. coli*, and *Staphylococci*. Two or more germs were reported in most cultures, which correspond to the polybacterial nature that is characteristic of this disease [22]. Likewise, in patients with an intrauterine device, positive cultures for pathogenic flora were obtained in 80% and the most frequently isolated microorganisms were *Staphylococci*, followed by *Streptococci* and *E. coli*. The microorganisms involved as causative agents of pelvic infections can be those related to sexually transmitted infections, such as *Chlamydia* or *Neisseria gonorrhea* [5]; however, these microorganisms are isolated in endocervical cultures only in approximately one-third of cases. Conversely, these microorganisms are rarely isolated in cultures from the fluid obtained from abscesses [20]. The germs that have been most commonly reported in patients with tubo-ovarian abscesses are *E. coli* and *Bacteroids* [20]. *E. coli* was the most frequently isolated germ. It should be mentioned that no association was found between the presence of any particular germ and the possibility of performing definitive surgery in patients with tubo-ovarian abscesses.

We reported surgical complications in 11.4% of the total patients included. This correlates with what has been previously reported in the literature, where we found surgical complication rates of 12% as reported by Kaplan [22]. In this study, intestinal lesions were reported as the most frequent complications. We also found that intestinal complications were the most frequent. The complication rate was slightly higher in patients who underwent definitive surgery. We think that this greater number of complications was probably due to greater inflammation of the pelvic organs with the consequent participation of the intestinal loops in the inflammatory process. Likewise, the inflammatory process makes the tissues more friable, making dissection of the surgical planes more difficult, therefore increasing the risk of intestinal injury.

Tubo-ovarian abscesses can also be the consequence of malignant processes [23]. However, none of the participants in the study presented data of malignancy. The limitations of this study are its retrospective design, the fact that it was carried out in a single-center, and the number of participants.

Table 1: Gynecological and obstetric history.

Variable	Group 1	Group 2	P-value
Age, years	35.5 ± 8.45	32.4. ± 10.3	.141
Pregnancies, n	2.70 ± 1.44	2.27 ± 1.53	.167
Deliveries, n	1.67 ± 1.47	1.52 ± 1.52	.534
Cesarean section, n	0.86 ± 1.28	0.46 ± 0.82	.071
Abortions, n	0.16 ± 0.37	0.31 ± 0.64	.195
Sex partners, n	3.88 ± 1.98	2.04 ± 0.93	.001
IUD use, years	2.55 ± 1.12	2.33 ± 1.18	.195

IUD = intrauterine device

Data are presented as mean ± SD (standard deviation).

Table 2: Relationship between sex partners and radical surgery

Sex partners	Radical surgery	Conservative treatment
One	4/28 (14.3)	24/28 (85.7)
Two to three	16/42 (38.1)	26/42 (61.9)
Four or more	28/35 (80.0)	7/35 (20.0)

P< .001

Data are presented as n/n (percentage).

Table 3: Correlation between the use of an intrauterine device and a history of sexually transmitted disease

Variable	Group 1	Group 2	P-value
IUD use	28 (26.7)	30 (28.5)	.558
Visible strings of IUD	20 (19.0)	27 (25.7)	.400
History of PID	6 (5.7)	6 (5.7)	.751
History of STI	1 (0.95)	2 (1.9)	.662

IUD = intrauterine device; PID = pelvic inflammatory disease; STI = sexually transmitted infection.

Data are presented as n (%).

Table 4: Relationship of abscess size with radical surgery

Abscess size	Radical surgery	Conservative treatment
1 to 4 cm	3/27 (11.1)	24/27 (88.9)
5 to 9 cm	26/58 (44.8)	32/58 (55.2)
More than 10 cm	19/20 (95.0)	1/20 (5.0)

P = .001

Data are presented as n/n (percentage).

Conclusions

In conclusion, the presence of bilateral abscesses larger than 10 cm and the history of multiple sex partners should alert us to the possibility of having to perform a more radical surgery in patients with tubo-ovarian abscesses. This should prepare us for a more technically difficult surgery with a greater risk of surgical injuries to neighboring organs but above all, it should alert us to the unfortunate decision to remove both ovaries with the consequential impact on the quality of life of our patients.

These findings should encourage us to make efforts to diagnose tubo-ovarian abscesses as early as possible, unfortunately, the nonspecific clinical picture and the delay of our women in seeking medical help mean that even today a high number of patients with a tubo-ovarian abscess will end their reproductive life prematurely as a result of more radical surgery.

References

1. Landers DV, Sweet RL: Current trends in the diagnosis and treatment of tubo-ovarian abscess. Am J Obstet Gynecol. 1985;151:1098-1110.
2. To J, Aldape D, Frost A, Goldberg GL, Levie M, Chudnoff S: Image-guided drainage versus antibiotic-only treatment of pelvic abscesses: short-term and long-term outcomes. Fertil and steril. 2014;102:1155-1159.
3. McNeeley SG, Hendrix SL, Mazzoni MM, Kmak DC, Ransom SB, Levine E, *et al*. Medically sound, cost-effective treatment for pelvic inflammatory disease and tubo-ovarian abscess. Am J Obstet Gynecol. 1998;178:1272-1278.
4. Brun JL, Graesslin O, Fauconnier A, Verdon R, Agostini A, Bourret A. Col- lege National des Gynecologues Obstetriciens Francais: Updated french guidelines for diag-nosis and management of pelvic inflammatory disease. Int J Gynaecol Obstet. 2016;134:121-125.
5. Lareau SM, Beigi RH, Pelvic Inflammatory Disease and Tubo-ovarian Abscess. Infect Dis Clin N Am. 2008;22:693-708.
6. Ginsburg DS, Stern JL, Hamod KA *et al*. Tubo-ovarian abscess: a retrospective review. Am J Obstet Gynecol. 1980;138:1055-1058.
7. Lei Chu Hanbo Ma Junhua Liang Li, Li Aiqun Shen Jianjun, Wang Huaifang Li, Xiaowen Tong. Effectiveness and Adverse Events of Early Laparoscopic Therapy versus Conservative Treatment for Tubo-Ovarian or Pelvic Abscess: A Single-Center Retrospective Cohort Study Gynecol Obstet Invest. 2019. DOI:10.1159/000493855.
8. Workowski KA, Bolan GA; Centers for Disease Control and Prevention: Sexually transmitted diseases treatment guidelines, 2015. MMWR Recomm Rep. 2015;64:1-137.
9. Wiesenfeld HC, Sweet RL. Progress in the management of tuboovarian abscesses. Clinical Gynecology and Obstetrics. 1993;36:433-444.
10. Sweet RL, Schachter J, Landers DV, Ohm-Smith M, Robbie MO. Treatment of hospitalized patients with acute pelvic inflammatory disease: comparison of cefotetan plus doxycycline and cefoxitin plus doxycycline. American Journal of Obstetrics and Gynecology. 1988;158:736-741.
11. Topçu HO, Kokanali K, Guzel AI, Tokmak A, Erkilinc S, Umit C. Risk factors for adverse clinical outcomes in patients with tubo-ovarian abscess. J Obstet Gynaecol. 2015;35:699-702.
12. Goharkhay N, Verma U, Maggiorotto F. Comparison of CT- or ultrasound-guided drainage with concomitant intravenous anti- biotics vs. intravenous antibiotics alone in the management of tubo-ovarian abscesses. Ul- trasound Obstet Gynecol. 2007;29:65-69.
13. Aboulghar MA, Mansour RT, Serour GI. Ultra sono-graphically guided transvaginal aspiration of tubo-ovarian abscesses and pyosalpinges: an optional treatment for acute pelvic inflammatory disease. Am J Obstet Gynecol. 1995;172:1501-1503.
14. Hager WD. Follow-up of patients with tubo-ovarian abscess (es) in association with salpingitis. Obstet Gynecol. 1983 Jun;61(6):680-4. PMID: 6843924.
15. Habboub A. Middlemore Hospital experience with tubo-ovarian abscesses: an observational retrospective study. Int J Womens Health. 2016;8:325-340 https://doi.org/10.2147/IJWH.S105913
16. Halperin R, Levinson O, Yaron M, Bukovsky I, Schneider D. Tubo-ovarian abscess in older women: is the woman's age a risk factor for failed resonse to conservative treatment? Gynecol Obstet Invest. 2003;55(4):211-215.
17. Sordia-Hernández LH, Serrano Castro LG, Sordia-Piñeyro MO, Morales Martinez A, Sepulveda Orozco MC, Guerrero-Gonzalez G. Comparative study of the clinical features of patients with a tubo-ovarian abscess and patients with severe pelvic inflammatory disease. Int J Gynaecol Obstet. 2016 Jan;132(1):17-9. doi: 10.1016/j.ijgo.2015.06.038. Epub 2015 Sep 19. PMID: 26431590.
18. Granberg S, Gjelland K, Ekerhovd E. The management of pelvic abscess. Best Pract Res Clin Obstet Gynaecol. 2009;23(5):667-678.
19. Washington AE, Katz P. Cost of and payment source for pelvic inflammatory disease. Trends and projections, 1983 through 2000. JAMA 1991;266:2565-2569.
20. Landers DV, Sweet RL. Tubo-ovarian abscess: contemporary approach to management. Rev Infect Dis. 1983;5:876-84.
21. Chappell CA, Wiesenfeld HC: Pathogenesis, diagnosis, and management of severe pelvic inflammatory disease and tuboovarian abscess. Clin Obstet Gynecol. 2012;55:893-903.
22. Sweet RL, Gibbs RS. Mixed anaerobic-aerobic pelvic infection and pelvic abscess. In Sweet RL & Gibbs RS (eds.). Infections diseases of the female genital tract. 4th ed. Philadelphia, USA: Lippincott Williams & Wilkins. 2002, 176-206.
23. Gensheimer WG, Reddy SY, Mulconry M, Greves C. Case report: *Abiotrophia* / *Granulicatella* tubo-ovarian abscess in an adolescent virginal female. J Pediatr Adolesc Gynecol. 2010;23(1):e9-e12.