Published in final edited form as:

Contraception. 2013 April ; 87(4): 497–503. doi:10.1016/j.contraception.2012.04.005.

Controversies in Family Planning: Postabortal pelvic inflammatory disease

Jennefer A. RUSSO¹, Sharon Achilles¹, Teresa DePINERES², and Laura GIL³

¹Department of Obstetrics, Gynecology, and Reproductive Sciences, Magee-Womens Hospital, Pittsburgh, PA 15213-3180

²University of California, San Francisco, San Francisco, CA 94143

³Fundacion Orientame, Bogota, DC, Colombia

Keywords

abortion; pelvic inflammatory disease

In July 2011, we performed a review of the literature to develop a protocol for the management of infection after medical and surgical abortion. The protocol is to be used by a legal abortion provider in Bogota, Colombia. The questions we sought to answer were the following:

- How is postabortal infection defined and diagnosed?
 - Is there a clinical distinction between endometritis, salpingitis, and parametritis?
- What is the incidence of postabortal infection?
- What are risk factors for postabortal infection?
- What are the most common microorganisms involved in postabortal infection?
- What are the sensitivity, specificity and predictive values for each test used in the diagnosis of postabortal infection? Is there a need to order these tests?
- What is the best antibiotic treatment regimen for postabortal infection?
- Are there long-term sequelae associated with postabortal infection? If so, what are they?
- Should the partner of the patient with a postabortal infection be treated?

© 2013 Elsevier Inc. All rights reserved.

Corresponding author: Jennefer A. Russo, Magee-Womens Hospital, 300 Halket Street, Pittsburgh, PA 15213/
russo.jennefer@gmail.com/412-641-3464/412-641-1133 (FAX).

Disclosures: None of the authors has a conflict of interest to report.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Literature review

We searched Pubmed for the following terms and combination of terms: “postabortal infection”, “elective abortion infection”, “pelvic infectionelective abortion”, “pelvic inflammatory disease induced abortion”, “pelvic inflammatory disease elective abortion”, “endometritis elective abortion”, “endometritis induced abortion”, “treatment infection elective abortion”, “treatment endometritis abortion”. We also used relevant references from the reviewed studies and from the textbook, *Management of Unintended and Abnormal Pregnancy* [1] and included review articles regarding pelvic inflammatory disease (PID).

We eliminated the following from the review: articles on prophylaxis or screening, articles before 1970, studies of infection after spontaneous abortion, case reports, and studies that included patients who presented after illegal or illicit abortions.

Definitions

Pelvic infections, whether temporally related to an abortion or not, are generally diagnosed clinically. Clinical findings of pelvic infection, ranging from most common to least common in the referenced studies, may include a combination of the following:

- adnexal tenderness [2–26]
- fever [3, 4, 8, 9, 11–14, 16, 17, 19, 21, 22, 24–33]
- uterine tenderness [3, 4, 6, 7, 9, 13–15, 17, 19, 22–24, 26, 28–30, 32, 34]
- lower abdominal pain [4, 5, 8, 10, 13, 18, 20, 21, 23, 25, 26, 30, 33]
- pelvic pain [3, 5, 7, 15–17, 22, 28, 29, 31, 34, 35]
- excessive or abnormal bleeding [13, 14, 17, 18, 22, 25, 26, 33]
- palpable adnexal mass [2, 6, 9–12, 14, 21, 22, 28, 31–33]
- purulent discharge from the cervical os [2, 4, 6, 20, 22, 24–26, 33]
- vaginal discharge [3, 9, 13, 14, 22, 25, 26, 34]
- cervical motion tenderness [4, 5, 8, 20, 21, 23–25]
- cervical friability [24]

Most studies in which a time frame for diagnosis of postabortal infection is given define postabortal infection as a pelvic infection that occurs within 4 to 6 weeks following an abortion procedure [6, 9, 17, 34–39].

In this review, we will use the term “postabortal PID” to describe the range of infections that can occur after abortion. Although some studies of postabortal complications delineate differences between endometritis and salpingitis, most do not, as the distinction is difficult to classify clinically.

Incidence

The incidence of infection after surgical abortion is 0.5% as determined by meta-analysis of data from large studies of abortion complications [14, 40–53]. For medical abortion, existing meta-analyses and reviews reported uterine infection in 0.01–0.21% of mifepristone and misoprostol medical abortion regimens [54, 55], 0.21% of mifepristone and another prostaglandin medical abortion regimens [54], 0.45% of vaginal misoprostol regimens[55], and 0% of methotrexate and misoprostol medical abortion regimens [54]. Notably, there were a total of 2264 study participants in all 13 of the included studies using methotrexate

and misoprostol regimens. Since infection following medical abortion is rare, it is not surprising that no infections occurred in this relatively small number of participants.

Risk Factors

Age less than 20 at the time of abortion, the presence of chlamydia, and patient history of prior PID has been associated with postabortal PID [56]. Lower genital tract infection has been implicated as a risk factor for progression to upper genital tract infection: active chlamydia cervicitis increases the risk of postabortal PID three to four times. Bacterial vaginosis has been found by some authors to double the risk of postabortal PID [9]. There is no conclusive association between postabortal PID and either gestational age at the time of the abortion, parity, or socioeconomic status [56].

A recent systematic review [57] of postabortal IUD insertion in which studies that compared immediate postabortal IUD insertion with either no IUD insertion or delayed IUD insertion reported that all groups experienced similar rates of pain, bleeding days and infection. As postabortal infections are rare, the number of subjects with postabortal infection in each group was very small, limiting the ability to draw firm conclusions regarding differences in the timing of IUD insertion relative to infection risk. Although there are several studies that suggest increased risk of infection with postabortal IUD placement, all of these studies are very small and have methodological issues [57]. Therefore, the authors of the systematic review of postabortal IUD insertion concluded that the risk of PID is not increased with postabortal IUD insertion.

To date, there are no published data regarding the risk of infection and timing of re-initiation of intercourse after abortion.

Common microorganisms

Neisseria gonorrhoeae and *Chlamydia trachomatis* are the most commonly identified microorganisms associated with postabortal PID [2, 3, 5, 21, 24, 27, 28, 34, 37, 56, 58]. Of the chlamydia-negative patients in one study who developed postabortal sepsis, the organisms isolated were anaerobic *streptococci*, *enterobacteriaceae*, and Gram-negative anaerobes [3]. In a study that performed uterine and cervical samples in patients with endometritis after first trimester abortion, the most common anaerobes isolated were *peptostreptococcus* and *bacteroides* [32]. A published review of clindamycin use for obstetric and gynecologic infections reports *E. coli*, group B *streptococcus*, anaerobic *streptococci*, and *bacteroides* as the most common organisms responsible for bacteremia with septic abortion [20].

Although infection after medical abortion is most commonly linked with the same organisms as those found in surgical abortion, there are several high-profile cases of fatal toxic shock associated with *Clostridium* species after medical abortion. In the United States, there were 199,000 medical abortions performed in 2008, the most recent year data was collected [59]. In the past 10 years, there have been eight deaths attributed to infection with this bacterium in the United States and Canada[60, 61]. Of note, *Clostridium* infections have also been associated with other obstetric and gynecologic procedures, including vaginal delivery, dilation and curettage and cervical conization procedures[62].

Diagnostic tests

Some studies include the following laboratory tests to support the diagnosis of postabortal PID:

- elevated erythrocyte sedimentation rate (ESR)[6, 8, 10–13, 17, 21, 24, 26, 27, 31, 33]
- pathologic wet mount[4, 13, 24]
- elevated C-reactive protein[4, 24, 26]
- positive tests for gonorrhea or chlamydia[21, 24, 26]
- elevated serum leukocytes[24, 26, 30]
- abnormal ultrasound[24]
- endometrial biopsy[24]
- abnormal laparoscopic findings (Gold Standard for diagnosis)[7, 11, 21, 24, 28, 38]

In a review of PID literature, the only available evidence regarding the predictive value of any exam finding or laboratory test is discussed by Soper [23]. Soper reports that the negative predictive value is 94.5% for PID when both a normal cervical examination and a normal number of white blood cells are found on wet mount [23].

Both the Centers for Disease Control (CDC) and British Association for Sexual Health and HIV (BASHH) recommend treatment for PID based on a clinical diagnosis including the presence of lower abdominal or pelvic pain and one or more of the following on exam: cervical motion tenderness, uterine tenderness, or adnexal tenderness[24, 26]. Only one-third of women with PID will have fever [23].

Antibiotic treatment

A variety of outpatient and inpatient treatments for pelvic inflammatory disease exist. We focused our search on specific antibiotic regimens for treatment of postabortal endometritis, and then we widened our approach to include guidelines for the treatment of PID, given the paucity of data on antibiotic treatment of postabortal PID. Neither the CDC nor Royal College of Obstetricians and Gynaecologists (RCOG) guidelines include specific recommendations regarding postabortal PID [24, 25]. We also focused our attention on outpatient regimens, as those were most relevant to our patient population and practice model in Bogota, Columbia.

A variety of parenteral regimens have shown effectiveness for the treatment of non-postabortal infection. Studies examining parenteral antibiotic treatment for postabortal infection do not exist, although many studies outline the regimens used for postabortal chlamydia or gonorrhea infection [12, 32, 34]. Given the available data and the recommendations of the CDC and RCOG, our recommendation when parenteral treatment is indicated is the use of gentamicin and clindamycin, with or without metronidazole. Patients should complete a 14-day course of antibiotics, including doxycycline with or without metronidazole, after discontinuation of parenteral antibiotics [20, 24, 25]. Alternative PID treatment regimens, such as cefoxitin and doxycycline, cefotetan and doxycycline, and ampicillin/sulbactam are also described by the CDC [24].

One study examined the treatment of PID with parenteral azithromycin monotherapy (500 mg IV in a single dose followed by 250mg orally once daily for 7 days) versus parenteral metronidazole (500 mg IV three times daily for 1 day followed by 400 mg orally three times daily for 12 days) or parenteral metronidazole and cefoxitin (2 g IV or IM four times daily for 14 days) with oral doxycycline (100 mg orally twice daily for 14 days) and probenecid (1 g orally in a single dose)[63]. Clinical success was similar in all groups: 94.6 to 98.1%,

but this study may not have been adequately powered to demonstrate differences between groups [63].

The literature is even more limited for oral treatment regimens for postabortal PID. Most studies have looked at the combination of doxycycline with another antibiotic for treatment of postabortal infection or non-postabortal PID. In one of the two studies in which postabortal PID was treated with doxycycline, postabortal “salpingitis” was diagnosed by pelvic pain, adnexal mass or elevated erythrocyte sedimentation rate. This is an atypical definition for the clinical diagnosis of PID which may have led to over-reporting of postabortal infections. Subjects diagnosed with postabortal “salpingitis” were treated with doxycycline 100 mg orally daily for 10 to 14 days after a loading dose of 200 mg, however the authors do not state a cure rate [16].

The CDC and RCOG outline several recommended options for outpatient treatment of mild PID. The most commonly used outpatient treatment option is a single dose of ceftriaxone (250 mg intramuscularly) followed by doxycycline (100 mg orally twice a day for 14 days) with or without metronidazole (500 mg orally twice a day for 14 days)[24]. This regimen is supported by data from the PEACH trial that compared inpatient and outpatient treatment of mild to moderate PID. The PEACH trial found outpatient treatment with cefoxitin and doxycycline to be as effective as an inpatient regimen with parenteral versions of these medications [64]. A randomized clinical trial of intravenous clindamycin and ciprofloxacin versus intramuscular ceftriaxone and oral doxycycline for mild PID also showed non-inferiority of a parenteral versus an oral regimen for treatment of mild PID[65].

Several alternative regimens are also described by both the CDC and RCOG. Using the CDC recommendations as a guide, and seeking less expensive alternative regimens for Colombian cash-paying patients, we found some evidence for alternative regimens. One small trial of 106 subjects with PID who received one dose of ceftriaxone (250 mg intramuscularly) and were then randomized to doxycycline (200 mg per day for two weeks) or azithromycin (1 g per week for two weeks) demonstrated improved clinical cure rates in the azithromycin group compared to the doxycycline group[66]. Other studies have demonstrated effectiveness using moxifloxacin monotherapy (400 mg orally once per day for 14 days) in comparison to doxycycline, metronidazole, and ciprofloxacin[67] or to ofloxacin and metronidazole[68]. For a Colombian population, doxycycline remains the least expensive option.

Finally, one published study has examined the use of metronidazole as an adjunct to existing treatment regimens. Bevan et al[63] compared the efficacy of azithromycin monotherapy with azithromycin plus metronidazole. There were similar cure rates in both groups (97.6% versus 95.5%), but the study was limited by its small number of subjects (approximately 100 subjects in each group).

Studies designed to investigate the relationship of bacterial vaginosis (BV) to PID or postabortal infection have had mixed results. Larsson et al.[6] reported that the presence of BV increased the risk of postabortal PID by a factor of three[6]. When metronidazole was added to the doxycycline prophylaxis given to all patients presenting for surgical abortion procedures, there was no observable decrease in the incidence of postabortal PID [69]. It is unclear whether either treating BV prior to abortion or adding metronidazole to the prophylaxis in patients with known BV would offer any benefit.

Long-term sequelae

Heisterberg et al.[39] found a significant association between postabortal PID and subsequent spontaneous abortion (relative risk (RR) 4.4). Additionally, in this study of 493

women, 9.7% of women with postabortal PID reported infertility lasting more than one year. In comparison, 1.9% of women without a postabortal infection reported infertility ($p < 0.05$). Dyspareunia was also much more common in women with postabortal PID (RR 4.2). Chronic pelvic pain was reported significantly more often in women with postabortal PID than in women without it (13.8% versus 2.2%). Importantly, 41% of women with a history of postabortal PID had another episode of PID within one year, versus 5% in those without postabortal PID. Although sequelae described in this study were based on subject report alone, the rates reported are similar to those found in studies of PID not associated with abortion [23, 70]. Prompt treatment of postabortal pelvic infection is therefore critical to avoid long-term sequelae.

Partner therapy

In a randomized clinical trial of patients diagnosed with gonorrhea or chlamydia cervicitis, Golden et al [71] found differences in continuing infection or reinfection in groups given different modes of partner therapy. Gonorrhea and chlamydia infections were significantly less common at follow-up among those randomized to an expedited partner treatment group in which prescriptions for treatment of the partner(s) were given to the patients compared with those patients randomized to a standard-referral group (RR, 0.76; 95% confidence interval, 0.59 to 0.98). In this study, all partners were treated with cefixime 400mg and azithromycin 1 g orally. Based on these findings and on the difficulty and expense of gonorrhea and chlamydia testing in a relatively low-resource setting like Bogota, we have concluded that it is important and cost-saving to practice expedited partner therapy.

Listserv responses

The literature describes a variety of effective treatment options for pelvic infection but most published studies are of women with PID not associated with abortion. We therefore surveyed the listserv of family planning providers to determine the antibiotic regimens used specifically for the treatment of postabortal infection. These were the responses:

Response #1: The CDC guidelines are supposed to be followed. There are no studies which show the success of doxycycline therapy in someone with an established (true) infection. PID is a polymicrobial infection as you know and doxycycline alone is not sufficient for a true infection.

Response #2: CDC regimen for PID.

Response #3: I treat per CDC recommendations for PID, usually the outpatient regimen.

Response #4: We just do standard CDC regimen: ceftriaxone and doxycycline, and I usually also do the metronidazole, since I figure post-procedurally more likely to have something anaerobic. If they have a contraindication to any of those antibiotics and have had a negative gonorrhea pre-procedure, then I'm ok doing levofloxacin and metronidazole.

Response #5: I have tried to do the single dose IM of ceftriaxone 250 mg and doxycycline 100 mg bid for 14 days with metronidazole 500 mg bid for 14 days. Although I have also written for levofloxacin and metronidazole, I was just looking on the CDC STD guidelines and that's not recommended. However, the CDC does have amoxicillin/clavulanate and doxycycline, which I've never tried but sounds like it could be a good option.

Response #6: Most, if not all, of us use the CDC criteria for diagnosis and treatment of empiric PID, even after abortion. This allows an empiric diagnosis to be made based on: cervical motion tenderness OR uterine tenderness OR adnexal tenderness, increasing

the sensitivity of detection. Since the oral regimen for empiric PID (doxycycline and ceftriaxone with or without metronidazole) is broad spectrum and so covers the most likely post-abortion pathogens, it is appropriate in this setting. Based on this diagnostic criteria, all cases of salpingitis and endometritis can be considered PID, though not all PID could be called salpingitis or endometritis. Personally, I will delineate my diagnosis (only salpingitis or only endometritis) only when history, examination, or surgical findings clearly denotes one affected "area."

Response #7: You are right that we need to extrapolate for post-abortion, but that the same pathogens would be involved. Per CDC suggestion, we add metronidazole when BV is diagnosed per wet prep (or by clinical criteria for BV if you are in a setting where you cannot do wet prep). There is some data that suggest it should be added when tubo-ovarian abscesses are present. We have also added metronidazole when trichomonads are seen on wet prep in a patient who is immune-compromised or not improving on the traditional regimen, but that is rare. We do not pull IUDs, but I probably would if someone was not improving on a established parenteral regimens listed in the guidelines. I aspirate early in the presentation (upon start of antibiotics) if retained products are suspected and have a low threshold for the amount seen as retained in the face of PID. I have occasionally waited 12 h for antibiotics to take effect before re-aspiration for a very sick or atypical patient.

Response #8: FYI – the guidelines will be shortly updated (if not already) for treatment of documented GC – calling for azithromycin and ceftriaxone 250 mg even if the *Chlamydia* result is negative due to increased incidence of gonococcal resistance.

Response #9: Ceftriaxone, levofloxacin plus metronidazole for 2 weeks.

Conclusions

Based on the evidence and our survey of the listserv, we developed the following recommendations regarding postabortal infection:

- The CDC diagnosis for PID should be used, which includes one of the following in a patient presenting with abdominal pain: cervical motion tenderness, uterine tenderness, adnexal tenderness. All other lab studies, such as erythrocyte sedimentation rate and C-reactive protein can be used to support *but not make* the diagnosis. As per Soper [23], PID is unlikely in the setting of a normal appearing cervix and normal wet mount.
- Younger age, active chlamydia/cervicitis, and prior PID episodes are risk factors for postabortal infection. Postabortal IUD insertion does not appear to increase the risk of infection when compared to outcomes in women with no IUD inserted postabortally, but the existing studies have not been large enough to detect a significant number of infections. No studies have looked at the outcome of infection for postabortal versus interval IUD insertion. The presence of chlamydia increased the risk of postabortal PID by a factor of three to four in one study. Bacterial vaginosis also increases the risk by a factor of two, according to another study. There are no data relating timing of sexual activity to postabortal infection.
- A variety of anaerobes and aerobes have been cultured in studies of postabortal PID. Gonorrhea and chlamydia are commonly isolated as well. Therefore, postabortal PID, like PID not associated with abortion, is a polymicrobial process that needs to be treated with a broad spectrum regimen.
- The CDC recommendation for treatment with oral antibiotic regimen is effective, most commonly used, and less expensive than other regimens: ceftriaxone 250 mg

IM one dose plus doxycycline 100 mg orally twice a day for 14 days (or azithromycin 1g orally each week for two weeks) and metronidazole 500 mg orally twice a day for 14 days.

- Expedited partner treatment should be offered to patients diagnosed with postabortal PID.

References

1. Paul, M.; Lichtenberg, S.; Borgatta, L.; Grimes, D.; Stubblefield, P.; Creinin, M., editors. Management of Unintended and Abnormal Pregnancy. Comprehensive Abortion Care. Wiley-Blackwell; 2009.
2. Lee S, Chaudhuri P, Tay B. Prevalence of *Chlamydia trachomatis* in women seeking termination of pregnancy. Singapore Med J. 1991; 32:31–3. [PubMed: 2017702]
3. Wein P, Kloss M, Garland S. Postabortal pelvic sepsis in association with *Chlamydia trachomatis*. Aust NZ J Obstet Gynaecol. 1990; 30:347–50.
4. Bjartling C, Osse S, Persson K. The association between *Mycoplasma genitalium* and pelvic inflammatory disease after termination of pregnancy. BJOG. 2010; 117:361–4. [PubMed: 20015303]
5. Blackwell A, Thomas P, Wareham K, Emery S. Health gains from screening for infection of the lower genital tract in women attending for termination of pregnancy. Lancet. 1993; 342:205–10.
6. Larsson P, Platz-Christensen J, Thejls H, Forsum U, Pahlson C. Incidence of pelvic inflammatory disease after first-trimester legal abortion in women with bacterial vaginosis after treatment with metronidazole: a double-blind, randomized study. Am J Obstet Gynecol. 1992; 166:100–3. [PubMed: 1733176]
7. Hamark B, Forssman L. Postabortal endometritis in chlamydia-negative women-- association with preoperative clinical signs of infection. Gynecol Obstet Invest. 1991; 31:102–5. [PubMed: 2037257]
8. Osse S, Persson K. Postabortal infectious morbidity after antibiotic treatment of chlamydia-positive patients. Sex Transm Dis. 1989; 16:84–7. [PubMed: 2740963]
9. Larsson P, Bergman B, Forsum U, Platz-Christensen J, Pahlson C. *Mobiluncus* and clue cells as predictors of PID after first-trimester abortion. Acta Obstet Gynecol Scand. 1989; 68:217–20. [PubMed: 2618604]
10. Jonasson A, Larsson B, Bygdeman S, Forsum U. The influence of cervical dilatation by laminaria tent and with Hegar dilators on the intrauterine microflora and the rate of postabortal pelvic inflammatory disease. Acta Obstet Gynecol Scand. 1989; 68:405–10. [PubMed: 2520783]
11. Skjeldestad F, Dalen A. *Chlamydia trachomatis*: is it possible to reduce the number of infections after abortions? Scand J Prim Health Care. 1988; 6:125–8. [PubMed: 3387707]
12. Skjeldestad F, Tuveng J, Solberg A, Molne K, Dalen A, Buhaug H. Induced abortion: *Chlamydia trachomatis* and postabortal complications. A cost benefit analysis. Acta Obstet Gynecol Scand. 1988; 67:525–9. [PubMed: 3149124]
13. Giertz G, Kallings I, Nordenvall M, Fuchs T. A prospective study of *Chlamydia trachomatis* infection following legal abortion. Acta Obstet Gynecol Scand. 1987; 66:107–9. [PubMed: 3618133]
14. Heisterberg L, Branebjerg P, Bremmergaard A, Scheibel J, Hoj L. The role of vaginal secretory immunoglobulin A, *Gardnerella vaginalis*, anaerobes, and *Chlamydia trachomatis* in postabortal pelvic inflammatory disease. Acta Obstet Gynecol Scand. 1987; 66:99–102. [PubMed: 3497518]
15. Mills A. An assessment of pre-operative microbial screening on the prevention of post-abortion pelvic inflammatory disease. Br J Obstet Gynaecol. 1984; 91:182–6. [PubMed: 6696862]
16. Qvigstad E, Skaug K, Jerve F, Fylling P, Ulstrup J. Pelvic inflammatory disease associated with *Chlamydia trachomatis* infection after therapeutic abortion. A prospective study. Br J Vener Dis. 1983; 59:189–92. [PubMed: 6850266]
17. Westergaard L, Philipsen T, Scheibel J. Significance of cervical *Chlamydia trachomatis* infection in postabortal pelvic inflammatory disease. Obstet Gynecol. 1982; 60:322–5. [PubMed: 7121913]

18. Avonts D, Piot P. Genital infections in women undergoing therapeutic abortion. *Europ J Obstet Gynecol Reprod Biol.* 1985; 20:53–9.
19. Blanco J, Gibbs R, Duff P, Castaneda Y, St Clair P. Randomized comparison of ceftazidime versus clindamycin-tobramycin in the treatment of obstetrical and gynecological infections. *Antimicrob Agents Chemother.* 1983; 24:500–4. [PubMed: 6360038]
20. Zambrano D. Clindamycin in the treatment of obstetric and gynecologic infections: a review. *Clin Ther.* 1991; 13:58–80. [PubMed: 2029726]
21. McGregor J, Crombleholme W, Newton E. Randomized comparison of ampicillin-sulbactam to cefoxitin and doxycycline or clindamycin and gentamicin in the treatment of pelvic inflammatory disease or endometritis. *Obstet Gynecol.* 1994; 83:998–1004. [PubMed: 8190448]
22. Miller L, Thomas K, Hughes J, Holmes K, Stout S, Eschenbach D. Randomised treatment trial of bacterial vaginosis to prevent post-abortion complication. *BJOG.* 2004; 111:982–8. [PubMed: 15327614]
23. Soper D. Pelvic inflammatory disease. *Obstet Gynecol.* 2010; 116:419–28. [PubMed: 20664404]
24. Centers for Disease Control and Prevention. Sexually Transmitted Diseases Treatment Guidelines: Pelvic Inflammatory Disease. *MMWR.* 2010; (RR-12):59.
25. RCOG Guidelines: Management of Acute Pelvic Inflammatory Disease. 2011. (Accessed at <http://www.rcog.org.uk/womens-health/clinical-guidance/management-acute-pelvic-inflammatory-disease-32>)
26. British Association for Sexual Health and HIV UK National Guideline for the Management of PID. 2011. (Accessed at <http://www.bashh.org/documents/118/118.pdf>.)
27. Moller B, Ahrons S, Laurin J, Mardh P. Pelvic infection after elective abortion associated with *Chlamydia trachomatis*. *Obstet Gynecol.* 1982; 59:210–3. [PubMed: 7078867]
28. Stray-Pedersen B, Biornstad J, Dahl M, et al. Induced abortion: microbiological screening and medical complications. *Infection.* 1991; 19:305–8. [PubMed: 1800368]
29. Bryman I, Granberg S, Norstrom A. Reduced incidence of postoperative endometritis by the use of Laminaria tents in connection with first trimester abortion. *Acta Obstet Gynecol Scand.* 1988; 67:323–5. [PubMed: 3176954]
30. Barbacci M, Spence M, Kappus E, Burkman R, Rao L, Quinn T. Postabortal endometritis and isolation of *Chlamydia trachomatis*. *Obstet Gynecol.* 1986; 68:686–90. [PubMed: 3763086]
31. Qvigstad E, Skaug K, Jerve F, Vik I, Ulstrup J. Therapeutic abortion and *Chlamydia trachomatis* infection. *Br J Vener Dis.* 1982; 58:182–3. [PubMed: 6805851]
32. Moberg P, Gottlieb C, Nord C. Anaerobic bacteria in uterine infection following first trimester abortion. *Eur J Clin Microbiol.* 1982; 1:82–6. [PubMed: 6890898]
33. Darj E, Stralin E, Nilsson S. The prophylactic effect of doxycycline on postoperative infection rate after first-trimester abortion. *Obstet Gynecol.* 1987; 70:755–8. [PubMed: 3658286]
34. Burkman R, Atienza M, King T. Culture and treatment results in endometritis following elective abortion. *Am J Obstet Gynecol.* 1977; 128:556–9. [PubMed: 406787]
35. Osser S, Persson K. Postabortal pelvic infection associated with *Chlamydia trachomatis* and the influence of humoral immunity. *Am J Obstet Gynecol.* 1984; 150:699–703. [PubMed: 6541876]
36. Moberg P, Eneroth P, Harlin J, Ljung A, Nord C. Preoperative cervical microbial flora and post-abortion infection. *Acta Obstet Gynecol Scand.* 1978; 57:415–9. [PubMed: 726875]
37. Sorensen J, Thranov I, Hoff G, Dirach J. Early- and late-onset pelvic inflammatory disease among women with cervical *Chlamydia trachomatis* infection at the time of induced abortion-- a follow-up study. *Infection.* 1994; 22:242–6. [PubMed: 8002083]
38. Oskarsson T, Geirsson R, Steingrimsen O, Thorarinsson H. Lower genital tract infection with *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in women requesting induced abortion and in their sexual partners. *Acta Obstet Gynecol Scand.* 1990; 69:635–40. [PubMed: 2128792]
39. Heisterberg L, Hebjorn S, Andersen L, Petersen H. Sequelae of induced first-trimester abortion. A prospective study assessing the role of postabortal pelvic inflammatory disease and prophylactic antibiotics. *Am J Obstet Gynecol.* 1986; 155:76–80. [PubMed: 3524243]

40. Edwards J, Carson S. New technologies permit safe abortion at less than six weeks' gestation and provide timely detection of ectopic gestation. *Am J Obstet Gynecol.* 1997; 176:1101–6. [PubMed: 9166176]
41. Ferris L, McMain-Klein M, Colodny N, Fellows G, Lamont J. Factors associated with immediate abortion complications. *Can Med Assoc J.* 1996; 154:1677–85. [PubMed: 8646655]
42. Hakim-Elahi E, Tovell H, Burnhill M. Complications of first-trimester abortion: a report of 170,000 cases. *Obstet Gynecol.* 1990; 76:129–35. [PubMed: 2359559]
43. Hodgson J. Major complications of 20,248 consecutive first trimester abortions: problems of fragmented care. *Adv Plann Parenthood.* 1975; 9:52–9.
44. Morgentaler H. Report on 5641 outpatient abortions by vacuum suction curettage. *CMAJ.* 1973; 109:1202–5. [PubMed: 4758593]
45. Nathanson B. Ambulatory abortion: experience with 26,000 cases. *N Eng J Med.* 1972; 286:403–7.
46. Niinimäki M, Pouta A, Bloigu A, et al. Immediate complications after medical compared with surgical termination of pregnancy. *Obstet Gynecol.* 2009; 114:795–804. [PubMed: 19888037]
47. Schaefer G. Statistics on abortion in New York State from questionnaire. *Clin Obstet Gynecol.* 1971; 14:258–65. [PubMed: 5568247]
48. Tietze C, Lewit S. Legal abortions: early medical complications. *Fam Plann Perspectives.* 1971; 3:6–14.
49. Wulff G, Freiman S. Elective abortion. Complications seen in a free-standing clinic. *Obstet Gynecol.* 1977; 49:351–7. [PubMed: 840464]
50. Zhou W, Nielsen G, Moller M, Olsen J. Short-term complications after surgically induced abortions: a register-based study of 56117 abortions. *Acta Obstet Gynecol Scand.* 2002; 81:331–6. [PubMed: 11952464]
51. Buehler J, Schulz K, Grimes D, Hogue C. The risk of serious complications from induced abortion: Do personal characteristics make a difference? *Am J Obstet Gynecol.* 1985; 153:14–20. [PubMed: 4036997]
52. Peterson W, Berry F, Grace M, Gulbranson C. Second trimester abortion by dilatation and evacuation: An analysis of 11747 cases. *Obstet Gynecol.* 1983; 62:185–90. [PubMed: 6866362]
53. Pakter J, Nelson F. Abortion in New York City: the first nine months. *Fam Plann Perspect.* 1971; 3:5–12. [PubMed: 5122278]
54. Kahn J, Becker B, MacIsaac L, et al. The efficacy of medical abortion: a meta-analysis. *Contraception.* 2000; 61:29–40. [PubMed: 10745067]
55. Shannon C, Brothers LP, Philip NM, Winikoff B. Infection after medical abortion: a review of the literature. *Contraception.* 2004; 70:183–90. [PubMed: 15325886]
56. Heisterberg L. Pelvic inflammatory disease following induced first-trimester abortion. Risk groups, prophylaxis and sequelae. *Dan Med Bull.* 1988; 35:64–75. [PubMed: 3277798]
57. Steenland M, Tepper N, Curtis K, Kapp N. Intrauterine contraceptive insertion postabortion: a systematic review. *Contraception.* 2011; 84:447–64. [PubMed: 22018119]
58. Persson K, Osseer S. Serovars of *Chlamydia trachomatis* causing postabortion salpingitis. *Eur J Clin Microbiol Infect Dis.* 1989; 8:795–8. [PubMed: 2512150]
59. Jones R, Kooistra K. Abortion incidence and access to services in the United States, 2008. *Perspect Sex Reprod Health.* 2011; 43:41–50. [PubMed: 21388504]
60. Fjerstad M, Trussell J, Sivin I, Lichtenberg E, Cullins V. Rates of serious infection after changes in regimens for medical abortion. *N Engl J Med.* 2009; 361:145–51. [PubMed: 19587339]
61. Meites E, Zane S, Gould C. Fatal *Clostridium sordelli* infection after medical abortions. *N Engl J Med.* 2011; 363:1382–3. [PubMed: 20879895]
62. Fischer M, Bhatnagar J, Guarner J, et al. Fatal toxic shock syndrome associated with *Clostridium sordellii* after medical abortion. *N Engl J Med.* 2005; 353:2352–60. [PubMed: 16319384]
63. Bevan C, Ridgway G, Rothermel C. Monotherapy or combined with metronidazole compared with two standard multidrug regimens for the treatment of acute PID. *J Intl Med Rsrch.* 2003; 31:45–54.
64. Ness RB, Soper DE, Holley RL, et al. Effectiveness of inpatient and outpatient treatment strategies for women with pelvic inflammatory disease: results from the Pelvic Inflammatory Disease

- Evaluation and Clinical Health (PEACH) Randomized Trial. *Am J Obstet Gynecol.* 2002; 186:929–37. [PubMed: 12015517]
65. Arredondo J, Diaz V, Gaitan E, et al. Oral clindamycin and ciprofloxacin versus intramuscular ceftriaxone and oral doxycycline in the treatment of mild-to-moderate pelvic inflammatory disease in outpatients. *Clin Infect Dis.* 1997; 24:170–8. [PubMed: 9114143]
66. Savaris RF, Teixeira LM, Torres TG, Edelweiss MI, Moncada J, Schachter J. Comparing ceftriaxone plus azithromycin or doxycycline for pelvic inflammatory disease: a randomized controlled trial. *Obstet Gynecol.* 2007; 110:53–60. [PubMed: 17601896]
67. Heystek M, Ross J. A randomized double-blind comparison of moxifloxacin and doxycycline/ metronidazole/ciprofloxacin in the treatment of acute, uncomplicated pelvic inflammatory disease. *Intl J STDS AIDS.* 2009; 20:690–5.
68. Ross J, Cronje H, Paskowski T, et al. Moxifloxacin versus ofloxacin plus metronidazole in uncomplicated PID: results of a multicentre, double blind, randomized trial. *Sex Transm Infect.* 2006; 82:446–51. [PubMed: 16723364]
69. Achilles S, Reeves M. Prevention of infection after induced abortion. *Contraception.* 2011; 83:295–309. [PubMed: 21397086]
70. Safrin S, Schachter J, Dahrouge D, Sweet R. Long-term sequelae of acute pelvic inflammatory disease. A retrospective cohort study. *Am J Obstet Gynecol.* 1992; 166:1300–5. [PubMed: 1566789]
71. Golden M, Whittington W, Handsfield H, et al. Effect of expedited treatment of sex partners on recurrent or persistent gonorrhea or chlamydia infection. *N Engl J Med.* 2005; 352:676–85. [PubMed: 15716561]