

Insights on Postoperative Infections in Gynecology: A Narrative Review

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ABSTRACT

Aim: Postoperative infections in gynecology are common throughout the surgical field. Infections create a major impact on surgeons as well as on patients. With the appropriate use of antibiotics, the chances of infections reduce immensely and prevent morbidity for the same. This review helps to understand the occurrence, preventable risk factors, and complications of postoperative infections with various gynecology surgeries.

Background: The literature reviewed in this narrative article is obtained from various databases such as PubMed, Scopus, and Web of Science using medical subject headings (MeSH) compliant keywords such as surgical site infections, wound abscess, pelvic pathologies, and consulting-related books. References from year old to new were assessed and relatable information was included.

Review results: Studies included reflect the impact of postoperative infections in various surgeries and the timely use of antibiotics in controlling the outcome. Many factors like gender, duration of hospital stay, and co-morbidities also play a significant roles in the outcome.

Conclusion: Studies depict the importance of recognizing the symptoms of the patient, and with the use of appropriate investigations, identifying the pathogens involved in postoperative period; eventually timely use of antibiotics in preventing such cases in the future. These steps shall help in reducing the overall burden for doctors, nurses, and on the patient's side as well.

Clinical significance: The most common complications of gynecological surgeries include cellulitis, endometritis, and urinary tract infections (UTI). Early diagnosis and timely use of antibiotics to prevent further complications and morbidity in these patients are of utmost importance. Priority should be given to early detection and identification of risk factors associated with postoperative surgeries. Most of the common pathogens involved awareness regarding the use of antibiotics prophylactically and eventually prevention of postoperative infections under various gynecological surgeries.

Keywords: Pelvic pathologies, Prophylactic antibiotics, Surgical site infections, Urinary tract infections.

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BACKGROUND

Postoperative infections in gynecological operations are rampant in third-world countries, the complications of which include surgical site infections, cellulitis, abscesses, and pelvic infections. These complications create a major impact on the course of postoperative recovery for the patient. An increase in the use of higher antibiotics has reduced the chances of infections, though they possess the potential to produce antibiotic resistance. Appropriate use of broad-spectrum antibiotics has helped immensely in controlling postoperative infections.¹ The crux of these infections lies in understanding the normal vaginal flora, commensal organisms, and finding the host and surgical risk factors associated which will eventually lead to decrease morbidity and mortality in gynecology-related cases.² The objective of this study is to evaluate the incidence of postoperative infections in gynecology with as in-depth understanding of the causative organisms behind it, the most common procedures which lead to infections, identify the risk factors as well as analyze the importance of prophylactic use of antibiotics in reducing the incidence of postoperative complications.

In between 2% and 5% of all surgical procedures, surgical site infections (SSIs) are recognized as common surgical consequences. It is the second most prevalent nosocomial infection as a result, accounting for 19.6% of all infections found in hospitalized patients and 38% of infections found in surgery patients. One of the most effective SSI prevention techniques has been surveillance.

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A study conducted in Italy reported that the SNICH protocol (National Surveillance System of Surgical Site Infections), which analyzed data from 127 Italian hospitals for the years 2009, 2011, and all of 2013, is the most recent national surveillance conducted in Italy. The only implementation of a surveillance approach, following the advised prophylaxis measures, resulted in a decrease in SSIs; their incidence has been demonstrated to be comparable to that of European or American populations. Furthermore, recent research has provided compelling evidence that the development of novel devices such as sutures coated with triclosan or dressings

infused with silver nanoparticles is directly related to a decline in the frequency of SSIs. In conclusion, 14,000 SSIs might be prevented annually, saving anywhere between 50 million and 175 million euros over the course of three years if common preventive approaches were used for all surgical procedures conducted in the nation.³

Since the beginning of time, surgical site infections have been a part of humanity. Despite the fact that medical advancements have decreased their prevalence, they remain a significant issue. Hospitalization costs are significantly raised as a result of surgical site infections. The entire scientific community is searching for ways to avert severe consequences because of this. The purpose of the study is to provide current theories about the causes and preventative measures of surgical site infections. Most of the time, patient-owned microorganisms are to blame for surgical site infections. Exogenous and hospital flora are more advantageous in hospital stays longer than 5–7 days. The most frequent pathogen that is isolated is Methicillin-resistant Staphylococcus aureus (MRSA) strains are becoming more prevalent.

In many surgical procedures, pre-operative antibiotic medication lowers the incidence of surgical site infection. Antibiotic kind, dosage, and timing all matter when it comes to preventing postoperative infections. Skin antiseptic used prior to surgery is also crucial. Povidone iodine and chlorhexidine gluconate are the two most often utilized compounds. According to recent findings, the chlorhexidine alcohol solution is a more effective agent. Conclusions: The updated recommendations for preventing surgical site infections were announced in 2017 by the Centers for Disease Control and Prevention.⁴

REVIEW RESULTS

Postoperative infections in gynecology are the most common complications to occur after gynecological procedures.⁵ Surgical site infections arise more commonly around 30 days after the procedure which may be superficial infections at the surgical site or deep infections which travel to other abdominal organs or spaces.³ A study Amenu et al. states an increased rate of surgical site infections postoperatively, hence the need for its awareness and prevention.⁶ The surgical site rate was estimated to be 11.4%. Out of those who had the infection, 35.2% were the contaminated wound and the rest 64.8% were the clean wound. It was also seen that the percentage of infections was higher in emergency obstetric surgeries than the elective ones (Table 1).

Another study of Misganaw reported an increased risk of SSI by 23.4% who had undergone surgeries. The study also depicted

Table 1: Sequelae of SSIs in obstetrics and gynecological surgeries

Parameters	Category	Outcome
Surgical site infections	Superficial	59 (67.0%)
	Deep	19 (21.6%)
	Other organs/spaces	10 (11.4%)
Postoperative day	≤7 days	66 (75.0%)
	8–14 days	22 (25.0%)
Additional days in hospital	≤7 days	29 (33.0%)
	8–14 days	35 (38.8%)
	15–30 days	22 (25.0%)
	≥31 days	02 (2.3%)

the importance of timely medical management of ceftriaxone and metronidazole which contributed to 47.46%. Out of 59 operations, inappropriate antibiotic administration was 48.6%. Many risk factors have been reported in the study such as comorbidities, duration of the surgery, and gender (Fig. 1).⁷

Prevalence of SSIs after the discharge was 5.8% who had undergone a hysterectomy reported by Madeira and Trabasso and the most prevalent among SSI type was the superficial incisional type.⁸ Alkaaki et al. observed that SSIs prevalence was 16.3%, with 9% reporting deep infections and 45% having deep and superficial infections. The most prevalent organism obtained was *Escherichia coli* (*E. coli*) followed by *Enterococcus*.⁹ Shahane et al. in their study showed the most common pathogen was *E. coli* (31.25%) followed by *Pseudomonas aeruginosa* (25%) and *Staphylococcus aureus* (22%). They also reported that prolonged duration of surgeries and drain insertion was not strongly associated with the incidence of SSIs. In most of the cases reported for SSIs, the organisms were a part of the normal flora of the skin and mucous membrane, and viscera.¹⁰

DISCUSSION

It is important to know the causative organisms behind these infections. In the gynecological procedures the main source of pathogen lies endogenously, which might be in the skin or the vagina.⁵ Most commonly being gram-positive organisms, i.e., *staphylococci* which are mostly seen with laparoscopic procedures where skin incisions are not made.¹¹ But with procedures like hysterectomy or vaginal surgeries or pelvic surgeries most common organisms causing it would be poly microbial arising from the endogenous flora, which could be gram-negative aerobes and gram-positive cocci.¹² The most common complication seen with a hysterectomy and cesarean delivery is pelvic cellulitis and endometritis. It is seen that without the use of antibiotics, these cases lead to approximately 30–40% of females developing endometriosis with an unscheduled cesarean delivery, and with scheduled delivery, 10–15% of females develop this condition.^{13,14} Even pelvic infections are seen more in premenopausal females having done vaginal hysterectomies and are also more prevalent in females who have bacterial vaginosis, who bleed in excess during the time of surgeries.¹⁴ One-third of the females undergoing vaginal hysterectomy develop pelvic cellulitis and do not undertake antibiotics.^{12,14} An observational study, on the risk of infections due

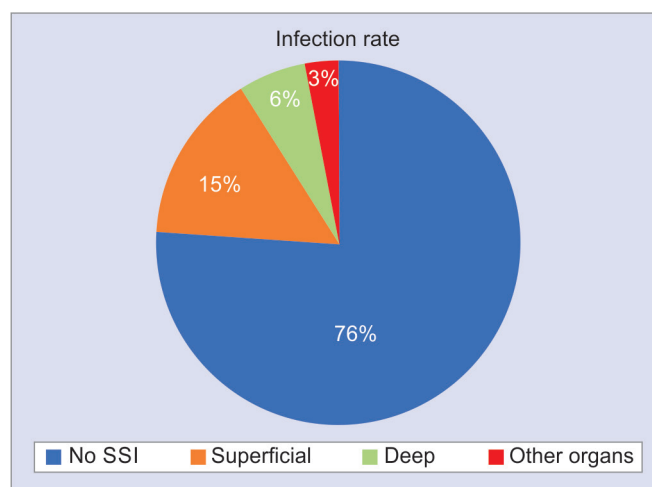


Fig. 1: Occurrence of surgical site infections in various conditions

to hysteroscopy was done, reports that 2116 hysteroscopies were done for various reasons like endometrectomy, polyp resections, fibroma resections, and uterine septa sections. Out of which 1.42% had developed infections and 0.85% cases were of endometritis and 12 were of Urinary Tract Infection (UTI). No serious complications were reported in hysterectomy procedures.¹⁵ With the production of both exogenous and endogenous flora, it leads to increase in wound gape was also studied.¹⁶

The dominant organisms in gynecological procedures are gram-positive cocci that is group B *streptococci*, *enterococci*, *staphylococci*. Also anaerobic gram-positive cocci like *peptococci*, and *pepto streptococci* organisms, aerobic gram-negative bacilli like *E. coli*, *Klebsiella pneumonia*, and *proteus* species. There are commensal organisms that are a part of normal vaginal flora but get introduced in the genital tract during vaginal examination, normal labor, or during the introduction of any instrument. All these organisms are the reason for causing pelvic pathologies like cellulitis and abscess, endometritis, surgical site infections, (etc.).¹⁷ Females most commonly manifest fever within 24–48 hours after the procedure, they develop tachycardia, and tachypnoea with lower abdominal pain and tenderness can be elicited in them. A physical examination along with general examination with lab tests like complete blood count, urine analysis, urine culture, and chest X-ray can be really helpful in coming to a diagnoses.¹⁸ These examinations and tests can also help us in creating differential diagnosis such as appendicitis, pneumonia, pyelonephritis or any viral infections, (etc.).¹⁷ In procedures like cesarean delivery or abdominal hysterectomy incisions, surgical wound infections occur approximately 3% and the incidences of wound infection are even less than 1% who undergo sterilization, postpartum sterilization, and some other laparoscopic procedures. Major risk factors that increase the chance of having these infections include obesity, immunodeficiency, pelvic inflammatory diseases, smoking, and excess use of steroids. Another study showed, that the prevalence of UTI was more common in women who are not under antibiotic therapy than the women who took the prophylactic antibiotic courses during the operative period.¹⁹ More than one-third of the prevalence of UTI was seen in urogynecological surgery, with *E. coli* being the most common uropathogenic amongst all 47.8% and 11.2% of extended spectrum beta-lactamase *E. coli*. In postoperative time period UTI occurrence was higher within 6 weeks which is 63.7% and 78.4% within 8 weeks period.²⁰

MeSH-related infections were found to be more prevalent in pelvic organ prolapse surgeries. Factors responsible for such complications could be biomedical material like the material used and its size and structure, type of procedures done, age of the patients, and any comorbidities present or not. Patients come with complaints of dysuria, vaginal discharge, any pelvic pain, urinary or fecal incontinence, or even dyspareunia. During vaginal examinations, induration and redness around vaginal incision areas, and formation of granulation tissue, formation of sinus tracts can be assessed. Hence, awareness regarding meSH-related infections is very important to rule out other risk factors.²¹ Pelvic abscess occurrence is less than 1% with the most common microorganisms being *anaerobic bacteria* and gram-negative *bacilli*.^{13,17} An abscess is more likely to be seen with cesarean delivery, in areas like the cul de sac, broad ligament or bladder, and anterior uterine wall. Even a mass can be felt in the front or behind the uterus. Lab tests would report elevated white blood cells, which is confirmed by imaging studies like Ultrasonogram (USG) or Computed tomography (CT) Scans. Patients are treated with broad-spectrum antibiotics for

aerobic as well as anaerobic microorganisms.^{22,23} Along with pelvic surgery, one of the most serious complications along with abdominal wound infection, pelvic cellulitis, and an abscess is septic pelvic vein thrombophlebitis. It is seen to occur in around 0.5–1% of cases.²³ The best way for confirmation is CT scan or Magnetic resonance imaging (MRI). They give a better visualization of clots, be it in the vena cava or ovarian vessels, broad ligament, (etc.). Reports suggest that a palpable mass is usually seen in the ovarian veins, more commonly on the right side. Also, small multiple thrombi in the pelvis have been recorded in certain cases.²⁴ Treatment with low molecular weight heparin (LMWH) has proven to be effective in controlling thrombus formation. Enoxaparin was also found effective along with advantages such as less monitoring, and low chances of heparin-induced thrombocytopenia which otherwise is seen more with unfractionated heparin.²⁵ These medical regimes are taken along with anticoagulants for a long duration almost around 3–6 months of duration.^{23,26} Another case report discussed the importance of the time period with respect to the increasing in the probability of infection. The study concluded that infection after the interval of 30 days had higher incidences when compared with the patient who had no infection during 30 day period, which is about 3.2 times higher and 1.9 times higher in terms of mortality.²⁷

Another study depicted the occurrence of sepsis post elective surgeries like hepatic, and thoracic procedures which showed medical as well as resource burden in that country. The occurrence was considered to have multiple facets in its development. About 1.21% of patients developed postoperative sepsis. In the United States, the emergence of sepsis after elective surgical operations imposes a potential clinical and resource use burden. Examination of how postoperative sepsis progressed following elective surgeries in a group of patients that was representative of the general population and analyzed the impact of hospital and socio-demographic factors.²⁸ Within 30 days following an operation, infections at the surgical site are referred to as surgical site infections. Globally, 23% of patients experience surgical site infections each year, with the worst complications leading to extended hospital stays, a rise in microorganism resistance to antibiotics, higher healthcare costs, psychological stress for patients and their families, and significant financial burdens on hospitals. As a result, the scope and contributing variables of surgical site infection at Wolaita Sodo University Teaching and Referral Hospital were evaluated in this study. Around 34 patients or 13% of the 261 patients experienced surgery site infection. The risk of surgical site infection would be greatly decreased by cutting preoperative hospital stays short, administering intravenous antibiotic prophylaxis prior to surgery, and providing wound care as directed.²⁹ The influence of healthcare-related infections is multifactorial as it includes health system costs, emotional burden, long-term disabilities and increased resistance to virulent organisms, increased hospital stay, comorbid illnesses, lack of training in sterilization and disinfections, inadequate hand washing practices and instrument cleaning techniques.^{30,31} All these factors contribute towards increasing the probability of infections by many folds. It was also depicted that patients more than 40 years were 6.45% more likely to develop SSIs than younger age groups.²⁹

Urinary tract infections (UTIs) are one of the most common complications occurring worldwide, mostly affecting females. It is commonly associated with female gender, sexual activity, cystitis, diabetes, obesity, previous UTI history, urinary obstruction, urinary retention, and postoperative infections such as SSIs.³² Typically *E. coli* is the most common uropathogenic associated with it. However,

the involvement of a wide range of gram-negative and gram-positive bacteria along with a few fungi has also been reported. Long-course treatment with antibiotics is used, but one problem associated with this is the conversion of normal vaginal flora and the gastrointestinal tract for developing resistance against these bacteria. Therefore UTI is considered an economic as well as public health burden affecting patient's quality of life.³³ Many novel methods for understanding UTI pathogenesis in such a way that we can target virulence pathways directly in controlling the infections have been assessed. Antibiotic regimes in various combination therapies are considered as it covers a broad range of *enterobacteriaceae* families such as the efficacy of *enterobacteriaceae* against extended spectrum beta lactamases (ESBL), *klebsiella pneumoniae* carbapenemase (KPC), and ampicillinase C (AmpC) producing gram-negative pathogens.³⁴ However, there is still a need of considerable effort in the future to bring about new treatment plans and reduce the suffering for such UTI patients. Also, there is a need to showcase the economic burden related to postoperative infections and SSIs. Since it's a worldwide issue, it creates a major impact on mortality, morbidity, stress factor, and even the financial aspects, especially talking about the low and middle-income countries that get the worst hit in relation to health care facilities. There is also a certain influence of doctor-patient ratio, hospital settings, the severity of infections, and patients co-morbid state which play significant roles in this multifactorial dimension. Factors included in the economic burden in the low and lower-middle-income countries include lack of studies and research, overall lack of proper, and skilled hospital facilities, the time-lapse and follow up especially in the crucial time period for the development of SSIs, (etc.). Another factor also contemplated is over-reliance on just one study and lack of presentation of other multiple factors behind it.³⁵

In cases of surgical incisions, skin preparation plays an important role in controlling the entry of infections inside. It can be done using alcohol preparation unless it is contraindicated. The preoperative check-up is equally important especially for the cases of glycemic control, it should be kept around <200 mg/dL and should be in the range of normal temperature. During the surgical procedure, proper oxygenation at the time of intubation along with normal pulmonary function tests plays a crucial role in preventing SSIs.^{36,37} Even in cases of emergency where blood transfusion is required, it should be done as it will also help in controlling the development of infections. Surgical site infections in obstetrical surgeries also become important since it becomes a significant marker of patient care and socioeconomic burden for healthcare workers.³⁸

CONCLUSION

The utmost importance is on the prevention part which would automatically reduce the incidence, and burden on the patient's side and hospital side too. Many approaches have been laid down like patients should use an antiseptic agent a day prior to the surgery. Antibiotic prophylaxis is to be given as per the guidelines. Significance also lies in identifying the causative pathogens like the dominant organisms in gynecological procedures are *gram-positive* cocci, i.e., group B *streptococci*, *enterococci*, and *staphylococci*. Also, anaerobic gram-positive cocci like *peptococci*, *pepto-streptococci* organisms, aerobic gram-negative bacilli like *E. coli*, *Klebsiella pneumoniae*, and *proteus* species and their impact on the outcome need to be understood. Some serious complications like an abscess, cellulitis, and UTI which is more common in females can be prevented. With proper knowledge, safe and antiseptic

practices, and judicious use of prophylactic antibiotics such cases can significantly reduce in the future and also be prevented.

CLINICAL SIGNIFICANCE

Several interventions are required to be carried out in gynecology, a lot of which are very helpful with the meticulous use of antibiotic prophylaxis that aids in the prevention of many postoperative infections such as surgical site infections, wound abscess, vaginal or abdominal hysterectomy, and pelvic pathologies. It's equally important to identify risk factors associated with certain procedures and take appropriate measures to reduce the chances of infections after the operation. Great importance to the physical examination as well as laboratory tests are necessary for the early diagnosis and treatment plan for a further approach to control infections. Physicians are required to pay great attention to surgical techniques, which will eventually decrease the burden of postoperative infections. Patients should be made aware of the importance of prophylactic antibiotics in certain surgeries like vaginal or abdominal hysterectomy, be it urgent or scheduled cesarean section, pregnancy termination, and cervical cerclage. The mechanism of such antibiotics is decreasing the bacterial overload at the incision site, and alteration the environment so as to reduce the bacterial growth, and result in increased phagocytic action. Also, the selection of antibiotics plays an important role against pelvic pathogens with more importance on its feasibility, economic value as well as ease of administration in patients.

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