Postoperative Infection and Its Management Strategies - Review

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ABSTRACT

Post-operative infection still remains as a challenging one which occurs during the postoperative course. This can cause mild to severe complications and can even lead to death. Due to which this leads to serious consequences like expanded expenses in hospitals because of increased hospital stay and treatment. The area is marked to have pain, tenderness, edema and even discharges like pus is seen. The commonly involved organisms include the Staphylococcus, Streptococcus, Pseudomonas species and E.coli. The risk of acquiring the infection differs from one person to another. The paces of these infections differ from hospital to hospital and the site of contamination might be limited to a stitch line or might extend into the operative sight. The postoperative infections are combated by providing antibiotic prophylaxis before, during and after the surgery. The main challenge associated is the antibiotic resistance by the bacterial species, so it becomes difficult to evaluate the sound techniques for treating these infections. So this can be prevented by following pre-operative, intraoperative, post-operative surgical techniques. Proper strategies must be used to prevent and control these infections. The aim of this review is to analyze the postoperative infections and their management strategies.

INTRODUCTION

The postoperative infection is an infection which occurs within 30 days of operation or the postoperative course. The postoperative infection can cause extreme issues, including failure of surgical procedure, surgical complication, organ failure, sepsis and even death (Segreti, 2017). The risk of acquiring the infection differs from one person to another. The paces of these infections differ from hospital to hospital and the site of contamination might be limited to a stitch line or might extend into the operative sight. This type of surgical wound infection is a type of nosocomial infection. This infection can be respiratory disease; urinary tract disease or surgical wound contamination (Goswami et al., 2020). These infections represent 20%-39% of all those infections which are acquired in the hospital (Ameh, 2009).
Various patient-related elements like age, pre-existing disease, nutritional status, comorbid sickness and procedure-related factors include the delayed terms of medical procedure, lack of surgical instrument, poor surgical technique, preoperative preparation, all the factors significantly influence the risk of the surgical site infection (Owens and Stoessel, 2008; Ahmed, 2012). Studies have shown that both the gram-positive bacteria and gram-negative bacteria play a major role in causing these diseases (Hamm-Hayden, 1990). The causative agents multiple aerobic and anaerobic bacteria which include: Staphylococcus, coagulase-negative staphylococci, Pseudomonas species, Escherichia coli, Enterococcus spp, Acinetobacter (Girija, 2019; Girija et al., 2018), Klebsiella pneumoniae (Hariom et al., 2012; Girija and Priyadharsini, 2019). Enterococcus faecalis can cause a wide range of hospital-based infections out of them urinary infections are generally common and they are difficult to evaluate due to the resistance it gains over the drug (Marickar et al., 2014). Acinetobacter can cause serious and life-threatening issues which are also prone to have acquired resistance mechanism (Priyadharsini, 2018; J V Priyadharsini, 2018; Smiline et al., 2018). Importantly not only bacteria but fungi species like C.Albicans are causative agents. The antimicrobial medications are provided against the pathogen, which is given after the procedure (Girija and Priyadharsini, 2019; Monaco et al., 2009).

The postoperative infection still remains a challenging one in spite of improved surgical procedure and powerful antibiotics as the bacteria gain resistance against those antibiotics (Youssef, 2012; Ashwin and Muralidharan, 2015). Due to which this leads to serious consequences like expanded expenses in hospitals because of increased hospital stay and treatment. The danger of death in patients with these infections is more than expected when compared with the individuals who didn’t develop these surgical site infections (Anderson, 2014). The most important challenge associated with these infections are they are difficult to evaluate and assess to give a sound treatment for the infected ones. These bacteria also utilize higher levels of intrinsic and acquired resistance mechanisms over the antibiotics and it becomes difficult to choose the antibiotics (Engemann, 2003). This review is done to analyze and understand the complications of postoperative infection and the management strategies of post-operative infection control which becomes difficult due to the resistance gained by the bacteria. So there are various precautions which can be practiced before, during and after surgery to reduce the occurrence of postoperative infection.

**Post operative Infection**

Post-operative wound infections cause a major threat to the global population in the field of surgery which leads to many complications and also increased morbidity and mortality. The post-operative infection occurs during the postoperative course which has a higher risk of leading to death (Ghoneim and O’Hara, 2016). The classical clinical symptoms of these infections could include localised pain, pus or discharge spreading erythema, wound dehiscence and persistent pyrexia. The surgical site infection are classified into four categories based on the microbial contamination which includes: clean, clean contaminated, contaminated, dry and these classification are helpful in reporting a postoperative infection. The clean wound is considered to be clean and less colonization of bacteria is seen (Askarian, 2003).

The clean-contaminated wound site is seen when the procedure enters into the body cavity. The contaminated wounds have no infection but the site of surgery is contaminated. For the dirty wounds, there is an active infection already present and the pathogenic species are active at the site of infection. These postoperative infections are further classified into organ or space and incisional which are manipulated during surgery. The incisional infection is then classified as a superficial infection which includes the skin and subcutaneous tissue and deep infection, which includes deep soft tissue muscle and fascia. These deep incisional and these spaces or organs which cause the most morbidity. These infections are still a major source of morbidity in many developed and developing countries. And the people acquiring these infections are higher, and it is reported to create an adverse event in hospitals due to medication error and improper guidelines before, during, after surgery. The most common causative agent is *S. aureus*, *Klebsiella* species, *E. coli*, *Proteus* species, *Streptococcus* species, *Enterobacter* species, *Acinetobacter*, *Pseudomonas* species and Coagulase-negative *Staphylococci* (Habib and Akbar, 2019). The contamination of wounds by these species is commonly characterized by the classical symptoms of pain, redness, swelling and an elevated temperature at the site of incision and systemic fever (Fry and Fry, 2007). *P. aeruginosa* is an opportunistic nosocomial pathogen, which causes a widespread infection and leads to morbidity in immuno compromised patients. A study has stated that the surgical site infection occurred 16.4% out of which the isolates which were found are 50% Klebsiella pneumonia, 27.8% Staphylococcus aureus, 11.1% of E.coli and Pseudomonas species (Iliyasu, 2016).
Risk factors involved

The pre-operative risk factors include age, race, diabetes mellitus, hypertension (Paramasivam et al., 2020), cirrhosis (Alkaaki et al., 2019). In addition to the microbial contamination, there are certain host-dependent factors like age, dietary status, lifestyle, any co-existing disease and immunocompetency. The hospital-related factors include the length of hospital stay, preoperative procedures like an antibiotic, antiseptic prophylaxis (Odom-Forren, 2006). Obesity is another patient-related hazard factor. The study has concluded that the incidence of surgical site infection in a patient with obesity is more than the non-obese patient (Cordero-Ampuero and de Dios, 2010). This obesity has been reported with delayed wound healing which could be a risk factor for deep infections. Diabetes is also a major risk factor as patients with this disease as comorbidity has a higher percentage of infection [66.66%] when compared to other morbidities such as hypertension and renal failure (Khairy, 2011). When a study was conducted in a teaching hospital of Saudi Arabia, the patient with diabetes has a greater risk of acquiring these infections, where 20 out of 80 patients with diabetic mellitus have developed an infection after the surgery. It is also very important to check whether the patient is hyperglycemic, or they are insulin resistance or diabetic for those who are undergoing major surgery. Cigarette smoking also inhibits wound healing and decreases blood circulation and increases nonfunctioning hemoglobin (Scott and Buckland, 2006). So the risk factors depend on the dietary status, obesity, diabetes, smoking, heart disease, hypertension, bleeding disorder, complex emergency surgery (Wiseman, 2015). The method related elements include poor surgical technique, a delayed span of operation, the nature of pre-operative skin preparation and ill-advised disinfection of careful instruments (Anderson and Kaye, 2009).

Organisms associated with postoperative infection

Postoperative infection is commonly caused by aerobic and anaerobic bacteria. The dominant pathogens are oxygen-consuming Gram-positive cocci (group B streptococci, enterococci (Vaishali and Geetha, 2018), and staphylococcal species), and anaerobic Gram-positive cocci (Peptococcus and Peptostreptococcus species), aerobic Gram-negative bacilli (Escherichia coli, Klebsiella pneumoniae, and Proteus species), and anaerobic Gram-negative bacilli (Bacteroides and Prevotella species). The bacteria which is commonly associated with surgical site infection are Staphylococcus aureus, which is the frequently reported causative agent (Gaynes et al., 2005). The nasal carriage of Staphylococcus aureus is noted to be 30% of the most healthy population and particularly Methicillin-resistant Staphylococcus aureus, these predispose the patients to have a higher risk of acquiring this infection. The antibiotic-resistant species have been found increasingly to be associated with nosocomial infection (Misteli, 2011). For example, Methicillin-resistance S.aureus, Vancomycin-resistant enterococci, and the extended-spectrum beta-lactamase gram-negative bacteria have gained more concerns. Many infections causing bacteria to withstand the antibiotic resistance or multi drug resistance and the major problem associated is the appropriate choice of drug to combat the situation (Hospenthal, 2011; Misteli, 2011). Interestingly other than bacterial species, certain fungi like C.Albicans are nosocomial pathogens which are also associated with having hush resistance to the antibiotic spectrum (Shahzan et al., 2019).

Management strategies

The options to remove these infections are divergent. It is estimated that the 40-60% of these infections can be controlled and preventable under antimicrobial prophylaxis, proper infection control, and a guidance program (Schneeberger, 2002). For most of the patients, a single dose of antibiotic prophylaxis is more than enough to gain proper therapeutic effect. For those patients who are undergoing extended procedures more than 3-4 hours, the second dose of antibiotics must be administered at proper intervals even after surgery. The antimicrobial drug must be given at an interval of 30 minutes and should be administered 2 hours before the beginning of a procedure. Administration of extended-spectrum cephalosporins, penicillins, and carbapenems can be given as a solitary specialist to treat these sorts of infections. Depending on the patient’s response to the treatment, the protocol can be continued, or altered treatment or management strategies must be brought to prevent the infection.

Preoperative infection prevention

Patients should be advised to stop smoking at least 30 days before all the procedures begin and proper glucose tolerance levels, weight management must be taken care (DiGiorgio et al., 2012). Modification of dietary habits and keeping oneself clean (Selvakumar and Np, 2017; Shahana and Muralidharan, 2016) and self-hygiene and not to consume even alcohol and finally an antisepic wash can be recommended before surgery (Clarke-Pearson and...
The management of the preoperative drug is important and is categorised into prescriptions to stop, prescriptions to start, and prescriptions for altering. In some patients, bowel preparation has to be considered. Preoperative shaving and appropriate hair removal at the site of the incision must be done. Administration of vaccines can be done before or after surgery and it is found the vaccines are not contraindicated during surgery and vice versa (Pratha and Geetha, 2017).

Intraoperative infection prevention

The preventive measure in this stage has a multiphase approach which includes antibiotic prophylaxis, appropriate surgical technique and handling the tissues properly during surgery. The antibiotic administration should be done within 2 hours of surgery and it acts effectively when given before incision (Anderson, 2011). The proper surgical techniques include proper scrubbing, maintaining sterile instruments and use of antisepsic skin preparation, the commonly used ones are povidone-iodine, chlorhexidine gluconate (Vigliani, 2009). The proper tissue handling avoids acute hemostasis, unnecessary tension to the tissue and reduced dead space during wound closure. The explanation behind using cautious antimicrobial prophylaxis is to give a succinct course of an antimicrobial agent so as to diminish the microbial burden of intraoperative sullying to a level that can’t overwhelm the resistance system.

Post operative prevention

The post-operative preventive measures include tight glucose control, early enteral nutrition (Gaston and Kuremsky, 2010), protecting the surgical area for the 48 hours and then changing the injury dressing and surveillance program. If the risk factors are identified, then antibiotic prophylaxis can be done to reduce the risk of an infectious complication. Many herbal formulations are also found to have strong antibacterial effects against various bacterial species and it promotes better wound healing (Aafreen et al., 2019).

Challenges

It is very difficult to evaluate the sound techniques for that infection (Sakharkar, 2009). Poor response to therapy could be mainly due to the resistant microorganism and wound infection. The resistance which is gained by the bacteria makes it difficult to cure the infection by providing antibiotic prophylaxis (Nelson, 2017). There might be an increased hospital stay, so that could even reflect on the economy of a person. The risk of infection not only occurs because of the microorganisms but the host-related factors which include obesity, diabetes, food habits and immunocompromised conditions (Urban, 2006). The improper surgical technique and sterile conditions of operation theatres are some of the contributing factors which still happen. The lack of infection control programs in hospitals, and they lack both the awareness of the problem and also how to combat the situation to prevent these types of infection (Ogunsola et al., 2000).

CONCLUSION

Postoperative infection still remains a challenging one in most of the developing and even developed countries. There is an urgent need for infection control and prevention in various hospitals, to prevent these infections. Continuous education of hospital authorities and health care workers on the principle of infection control. As these surgical site infections are prevalent, but new techniques must be implemented to reduce the mortality rate by following the proper infection control protocols. If these risk factors are identified and eliminated then the harmful effect on the patient and the associated health care cost also significantly drops down with lesser hospital stay. So proper methods of treatment must be used and the advanced surgical techniques can be practiced to avoid these infections. With the constrained improvement of newer antimicrobials, the anti-microbial strains, alternative antimicrobial interventions are viewed as increasingly significant. So following adequate protocol in the infection control can prevent the infection from the surgical site.

Funding Support

The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

REFERENCES


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