

When Should Antibiotic Prophylaxis Be Performed to Prevent Surgical Side Infections? A Systematic Review

Cerrahi Alan Enfeksiyonlarını Önlemek İçin Antibiyotik Profilaksisi Ne Zaman Yapılmalı?

Bir Sistematik Derleme

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ABSTRACT

The systematic review was planned to examine the application time of antibiotic prophylaxis to prevent surgical side infections. The keywords, “antibiotic application time”, “antibiotic prophylaxis” and “surgical side infections”, were searched both in Turkish and English in Google Scholar, PUBMED, and EBSCO databases. A total of 5969 studies published between 2009 and 2019 were screened. After the literature review, 5 related studies that met the inclusion criteria were included in the study. Preoperative antibiotic prophylaxis and antibiotic application times were examined. In a study included in the study, it was shown that the risk of developing surgical site infection was reduced in patients who received antibiotics for proclactic purposes 60 minutes before incision line formation. In the remaining four studies, it was stated that prophylactic antibiotherapy applied 30 minutes before surgery minimizes the development of surgical site infection. It was revealed that the application of prophylactic antibiotherapy 30 minutes before the incision line minimizes the risk of infection in the surgical area and the literature should be supported by studies on the time of antibiotic administration.

Keywords: Surgical Side Infections, Antibiotics Prophylaxis, Antibiotic Application Time.

ÖZ

Sistematik derleme cerrahi alan enfeksiyonlarını önlemek için yapılan antibiyotik profilaksisi uygulama zamanını incelemek amacıyla planlandı. Google Scholar, PUBMED, EBSCO veri tabanlarında “antibiyotik uygulama zamanı”, “antibiyotik profilaksisi” ve “cerrahi alan enfeksiyonları” anahtar kelimeleri ile Türkçe ve İngilizce olarak 2009 – 2019 yılları arasında yayımlanan 5969 çalışma tarandı. Literatür incelendikten sonra konu ile ilgili olan dahil edilme ve dışlanma kriterlerine uygun 5 çalışma araştırma kapsamına dahil edildi. Ameliyat öncesi antibiyotik profilaksisi ve antibiyotik uygulama zamanları incelendi. Araştırma kapsamına alınan bir çalışmada insizyon hattı oluşumundan 60 dakika önce profilaktik amaçlı antibiyotik uygulanan hastalarda cerrahi alan enfeksiyonu gelişme riskinin azaldığı ortaya konmuştur. Kalan dört çalışmada ise ameliyat öncesi 30 dakika önce uygulanan profllaktik antibiyoterapinin cerrahi alan enfeksiyon gelişimini minimum seviyeye düşürdüğü belirtilmiştir. Profllaktik antibiyoterapinin kesi hattı oluşumundan 30 dakika önce uygulanmasının cerrahi alan enfeksiyonu görülme riskini en aza indirdiği ve antibiyotik uygulama zamanı ile ilgili yapılacak araştırmalar ile desteklenmesi gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: Cerrahi Alan Enfeksiyonları, Antibiyotik Profilaksisi, Antibiyotik Uygulama Zamanı

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INTRODUCTION

The definition of wound site infection, which develops after a surgical operation, and the first information regarding its treatment with some herbal drugs date back to the ancient Egyptian civilization. Hippocrates explained that the wound recovers faster when washed with vinegar water and dressed with a clean cloth. In 1867, Joseph Lister discovered asepsis and antisepsis applications that should be performed during the surgical process and, subsequently, postoperative mortality rates decreased seriously. Antibiotic applications in surgery started by Erlich and developed by Fleming. In 1940, Howard Florey started a new era by using penicillin for the treatment of surgical wounds^{1,2}. To date, it has been aimed to prevent surgical infections with applications such as sterilization methods, improvements in surgical techniques, appropriate air conditioning in the operating room, and appropriate antibiotic prophylaxis. Despite the current methods used to prevent the development of infections during the surgical process, surgical side infections are among the most important complications affecting mortality and morbidity rates, length of hospital stay, and cost³. The mortality rate of surgical side infections is reported to be 3% in the United States of America. According to the National Healthcare-Associated Infections Surveillance Network (NHAİ-Net) data, the prevalence of surgical side infection is 0.72% in Turkey⁴. Although SSI is among the common complications, it is seen in 3-20% of surgical procedures. Throughout the world, SSI is a significant problem all over the world and is more common in developing countries⁵.

Surgical Side Infection (SSI) is defined as an infection that develops after a surgical procedure or between 30 to 90 days after the surgery. In cases where a foreign body (implant, prosthesis) is placed inside the body during surgery, this period can get longer up to one year⁶. Surgical side infections are examined in three groups: superficial incisional, deep incisional, and organ/space surgical side infections. SSI is among the most common nosocomial infections⁷. The risk of surgical side infections is affected by the

patient, surgery, personnel, and hospital characteristics. A systematic and rational approach should be embraced to reduce this risk. If correctly applied, surgical prophylaxis is an important part of this approach⁸.

The use of prophylactic antibiotics is one of the generally accepted basic principles in surgery. Clinical studies on the use of prophylactic antibiotics showed that it reduces the risk of developing SSI after surgery^{9,10}. The time of antibiotic application is critical. To reduce the bacterial flora and adjust the host's normal defense mechanisms to a resisting level, the presence of the antibiotic in the tissue is desired during incision and during the potential microbial contamination period of tissues¹¹. The proliferation of bacteria that contaminate the surgical side during surgery is prevented by the antibiotics that reach the side with bleeding or serum leakage⁸. Therefore, the time of antibiotic application is important. In the literature, the first study on the time of antibiotic use was conducted by Burke in 1961. Burke revealed that antibiotics should be administered just before opening the incision to be protected from postoperative wound infections. It is recommended that the optimum application time of the prophylactic antibiotics is 30-60 minutes before surgery and that antibiotics should be given with the induction of anesthesia¹². The prophylactic use of antibiotics is limited¹³. It is reported that in many surgical procedures, it is not necessary to continue the administration of antibiotics in the postoperative period and that antibiotics increase the development of superinfections and resistance¹⁴. It is recommended that a single dose of prophylactic antibiotic is sufficient and that a second dose is used in prolonged surgeries and surgeries with high blood loss¹⁵.

In this systematic review, the effect of time of preoperative prophylactic antibiotic application to prevent SSI will be discussed. Within the scope of the research, the answer to the question "Is the time of antibiotic prophylaxis application effective in preventing SSI?" will be sought.

METHOD

Before the literature review, the databases, keywords, and their synonyms were determined. The keywords, “antibiotic application time”, “antibiotic prophylaxis” and “surgical side infections”, were searched both in Turkish and English in “GOOGLE SCHOLAR”, “PUBMED”, and “EBSCO” databases. A total of 5969 studies published between 2009 and 2019 were screened. The studies were examined by 2 people in the side of surgical diseases nursing, who were independent of the study, and a consensus was reached after discussing the differences. The inclusion criteria of the research are including the application time of antibiotic prophylaxis and publication in Turkish and English. Full-

text-accessible studies in Turkish/English, in which antibiotic prophylaxis was administered for surgical patients, and which included patients aged over 18 regardless of gender, race, the socioeconomic class were included in the study without limitation in the sample size. Studies that were not accessible in full text, which did not include prophylactic antibiotic application time, which were not published in Turkish/English, and which did not meet the inclusion criteria were not included in the study. After the literature review, 5 studies that met the inclusion criteria regarding the subject were included in the research.

RESULTS AND DISCUSSION

This study was conducted to examine the preoperative application time of antibiotic prophylaxis to prevent surgical side infections.

When the parenteral antibiotic application times before opening the incision line were compared, it was found that patient who received antibiotic prophylaxis 60 minutes before the incision showed a lower risk of developing a surgical side infection and that the antibiotic prophylaxis provided within 30 minutes before surgery¹⁶.

In their prospective randomized controlled study, Steinber et al. examined the preoperative antimicrobial prophylaxis (AMP) application times and frequency of SSI. 4472 cardiac surgery, hysterectomy, and hip/knee arthroplasty cases in 29 hospitals were randomly selected and included in the study. According to the study results, 1.6% of the patients who received AMP 30 minutes before the incision and 2.4% of the patients who had AMP 60 minutes before the incision had an infection and that the difference between them was significant ($p=0.04$)¹⁷.

Fujita and Daiko compared optimum prophylactic antimicrobial application time in three-site lymph node dissection and thoracic esophagectomy and short-term and long-term

antimicrobial applications in postoperative infectious event risk. Prolonged antimicrobial prophylaxis and short-term prophylaxis were compared in 257 patients who underwent esophagectomy. Antibiotic prophylaxis was applied to the short-term prophylaxis group 30 minutes before the incision and the application was repeated every three hours during the surgery. The prolonged AMP group, on the other hand, received one dose of antibiotic prophylaxis just before the incision and twice a day after the operation. In the intergroup comparison, it was stated that the difference between them was not significant and that short-term prophylaxis should be preferred for esophagectomy¹⁸.

In their randomized controlled study, Dlamini et al. examined the effect of the time of antibiotic prophylaxis application on the incidence of postoperative infections in patients who had a cesarean section. They revealed that AMP applied 30 minutes before opening the incision line reduced the incidence of postoperative SSI. It was found that the incidence of postoperative SSI was significantly higher in those who received AMP after opening the incision line¹⁹.

Shankar et al. evaluated AMP application in patients with an inguinal hernia who underwent elective mesh repair. The

experimental group received antibiotics during anesthesia induction. The incidence of wound infection was 7% in the antibiotic group and 10.5% in the control group. A deep surgical site infection developed in one of the cases in each group. Most infections developed between the seventh and twelfth days after discharge from the hospital. According to the study results, the use of routine antibiotic prophylaxis was not recommended as there was no significant difference in the risk of SSI in elective mesh repair of inguinal hernias between the experimental and control groups²⁰.

El-Mahallawy et al. found that there was no statistically significant difference between the application 30 minutes after the incision and the application more than 30 minutes after the

incision in terms of the incidence of wound infection. Moreover, it was revealed that in the case of clean-contaminated surgical wounds, the use of prophylactic antibiotics by induction and the application with anesthesia induction 30 minutes before opening the incision line are important in preventing infection²¹.

According to the study results examined, it was revealed that antibiotic prophylaxis should be applied a minimum of 30 minutes and a maximum of 60 minutes before opening the incision line to prevent SSI and the development of postoperative infection. As a result, it is seen that postoperative infection-related mortality and morbidity rates are reduced; the length of the hospital stay is minimized; the cost is reduced^{22,23}.

CONCLUSION AND RECOMMENDATIONS

It was determined that performing antimicrobial prophylaxis 30-60 minutes before opening the incision line minimizes the risk of surgical site infections and that the literature should be supported by studies on antibiotic application time. Conducting randomized controlled trials and meta-analyses on SSI is important in finalizing

controversial issues as well as providing high-evidence guidelines for preventive interventions. In this sense, it is recommended to follow up-to-date information regularly, increase compliance with preventive interventions, and adopt effective time management.

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