SURGICAL SITE INFECTIONS AND PROPHYLACTIC ANTIBIOTICS

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A DNP Project Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Nursing Practice

For submission to *Association of Perioperative Nurses Journal*

Capella University

August 2016

Abstract

Surgical site infections (SSIs) have negative clinical and financial outcomes for patients and healthcare organizations. Each surgical site infection increases cost, no longer to the patient, but to the organization. SSIs are considered nosocomial infections and are the most common seen with the surgical patient. The need to find ways to decrease the incidence of SSIs is a primary concern for a federal healthcare organization on the central eastern coast of the United States. A quality improvement plan was implemented using the antibiotic protocol from the Center for Medicare and Medicaid (CMS) and the Surgical Care Improvement Project (SCIP), which focused on providing antibiotics 60 minutes before incision. During a 30 day timeframe with 136 Operating Room cases completed, 96% received antibiotics prior to 60 minutes with no SSIs noted.

Keywords: surgical site infections, prophylactic antibiotics, protocol, SCIP

Surgical Site Infections and Prophylactic Antibiotics

Surgical site infections (SSIs) have negative clinical and financial outcomes for patients and healthcare organizations. Each surgical site infection increases cost for the organization. SSIs are considered nosocomial infections and are most commonly seen with surgical patients. A patient plagued with an SSI will require a prolonged stay in the hospital, either in a regular bed or Intensive Care Unit (ICU). The need to find ways to decrease the incidence of SSIs is a primary concern for health care organizations.

SSIs are a primary concern to a federal healthcare facility on the central eastern coast of the United States. The facility pledges to provide the best care to veterans based on evidence. The old practice in the facility had the anesthesia personnel giving preoperative antibiotics 30 minutes before incision and sometimes minutes prior. The surgical team knew it was not in compliance with evidence according to the Center for Medicare and Medicaid (CMS) and the Surgical Care Improvement Project (SCIP) measures.

Various studies concurs with prophylactic antibiotics and the timing of the same, providing credence for SCIP measures. Data collected through surgical flow charts and the computer system, Veterans Health Information Systems and Technology Architecture (VISTA), that tracks infections and other perioperative concerns, was able to communicate any decrease seen with following project protocols. Perioperative charting was done through the Electronic Medical Record (EMR) and the VISTA surgical package. During the phases of the implementation process the project manager appraised and evaluated the data. Success of the project was based on the time between the dosing of the antibiotic and the surgical incision. The outcome measure were reduced SSIs and 100% compliance of the SCIP quality measure.

Description of the Problem

The surgical patients at a federal healthcare organization was the population. The problem was an increase in surgical site infections seen in 2013. The facility's surgical site infections rates had increased to 40% of surgical procedures. The SSIs were tracked in VISTA. The population group, Veterans with numerous morbidity issues including Hypertension, Diabetes, Hepatitis, Psychiatric Disorders and socioeconomic situations.

As perioperative surgical site infections are the most common nosocomial infections seen in the surgical patient[1], patients with co-morbidities are faced with repetitive wound closure surgery, increased mortality and greater socioeconomic impacts, if diagnosed and treated for SSIs. The practice change of adhering to SCIP measures with prophylactic antibiotics for this federal facility is crucial to implement.

Description of the Setting

The setting is a federal healthcare facility located on the central eastern coast of the United States. This facility serves 22,000 veterans annually with over 150,000 outpatient visits. There are 58 acute care beds and 60 nursing home beds. The facility is an intermediate surgical complexity facility which performs Vascular, General Surgery, Ophthalmology, Sports Medicine, ENT, Urology and Thoracic surgical services.

There are four Operating Rooms (OR) and an endovascular suite. Eighty-nine percent of the cases are outpatient elective procedures and 11% inpatient emergent or urgent. Emergent cases are those that need to be done immediately and urgent are those that need to be done within 24 hours. The surgeons have blocked operating room time though emergent cases will prevail over elective cases. Patients are initially prepared for surgery in their first appointment with the surgeon. On the day of surgery, patients are admitted through the Ambulatory Surgery Unit

(ASU). In the ASU, the patients change into a hospital gown, is provided intravenous access and an assessment of their nothing by mouth status. The patient's perioperative documents are checked for completeness and the antibiotic is administered.

Statement of Intended Outcomes

The intended outcome was a decrease in the number of surgical site infections. SCIP core measures focus on the administration of antibiotics and the surgical patient. The SCIP-*INF*-1 addresses the process of antibiotic administration to be 1 hour of incision time, with the belief that it provides the opportunity for the medication to travel through the body and be available at the surgical site at the time of incision[2]. A data tool was used for each patient and tallied daily (Appendix A).

The tool was reviewed and compared to the (VISTA) report to ensure accuracy of information. The outcome measure value was to reduce SSI from 40% to 25% for the organization annually. For the purposes of the project, the goal was zero infections. The practice change compliance was gleaned from the data tool. Did the patient get the antibiotic 60 minutes before incision or not? Did the patient acquire a SSI? The information from VISTA and the tool was compiled during the implementation period to answer the questions using descriptive statistics.

Review of Evidence

Preventing SSIs has become a national issue and associated studies conclude providing prophylactic antibiotics is crucial. Mortality and cost increases with the advent of surgical site infections and the risk of death increases with patients who acquire them. Hospitals are challenged to decrease SSIs for the safety of patients and decrease their cost of hospital acquired infections (HAIs). There is increasing organizational cost due to CMS denying reimbursement for HAIs each year. There are SSI prevention strategies that advocate the appropriate timing and choice of prophylactic antibiotics[3].

Surgical site infections are considered a health care associated infection and occur in 2% to 5% of patients undergoing inpatient surgery, therefore approximately 500,000 patients contract SSIs in the United States each year[4]. As SSIs are health care associated infections, a concern of this federal organization was made, for the rates of their surgical site infections had risen since 2013.

The organization expanded the ability to offer the veteran implantable prosthetics and according to scientists[5], procedures which include inserting implants into the body are more at risk for infection. With implants and co-morbidities of the veteran patient, the rates of infection increased. The clinical problem warranted exploration and resolution. According to the research from SCIP[6] prophylactic antibiotics and timing will make a difference in decreasing SSIs.

Perioperative members of the surgical team are adamant about preventing SSIs and devote efforts to assuring patient safety. The surgical patients at this federal organization, have several co-morbidities and procuring a hospital acquired infection should not be one. Preparing the organization to follow the SCIP measure for preoperative antibiotics is integral for compliance with the Centers for Medicare and Medicaid (CMS) recommendations, industry standards and SCIP guidelines. In examining the clinical problem, a critical review of the literature was conducted. The critical review of the literature included a combination of articles from systematic, narrative, integrative and meta-analyses reviews and allowed for true integration of information into a practice change for implementation.

SCIP outlines six surgical site infection prevention measures that physicians can use to reduce the chances of infection at the incision site. Out of the six measures, three of them are considered core because they contain recommendations for the choice of prophylactic antibiotics, agent(s), and period of therapy and the timing of administration. The timing of the antibiotic is crucial when it comes to reducing SSIs. Even though clinical trials have shown the effectiveness of administering prophylactic antibiotics within one hour of the surgical incision in a bid to suffuse body tissues before incision, some surgeons fail to follow the guidelines. In 2013, scientists[7] found over 50% of patients undergoing hepatobiliary surgery did not receive prophylactic antibiotics prior to the surgery. As a result, the tissues of such patients were not adequately infused with antibiotics prior to incision, therefore exposing them to an increased risk of contracting a SSI. There have been several randomized studies that suggested prophylactic antibiotics are not needed, though these studies had small participant numbers and less demonstrated significance[8]. Many surgeons agree that the administration of prophylactic antibiotics before surgery decreases the chances of developing an SSI. However, practice differs on the timing, agent(s) or duration of use despite clinical trials recommending administration within one hour before incision.

The nexus between the individual surgeon preferences and the relative use of prophylactic antibiotics is to blame for the mixed reactions to the antibiotic core measures recommended by SCIP. For instance, with certain surgical operations it is recommended to use prophylactic antibiotics for a period of three months while some only recommend use for 24-48 hours after surgery. In a bid to ascertain factors that could predict the development of SSIs and the accompanying reasons, Scientists found a single error in one of the core measures was insignificant; however, two or more errors by a surgeon yielded significant results that led to a 95% chance of a patient developing an SSI. Therefore if any two of the three core measures recommended in the SCIP guidelines are not correctly implemented, the patient is almost guaranteed to result with a SSI within a few days after surgery[9].

Project Methods

As descriptive statistics were used to synthesize, describe and summarize the collected data[10] thus the exact number of surgeries (N =) during a 30 day period and the number of SSIs acquired during that time period (% of N) were enumerated. The project manager maintained the integrity of the data tools by collecting them and comparing them to the VISTA program documentation daily during the implementation phase. The project was presented to the facility Institutional Review Board (IRB) but did not require approval as it was a quality improvement practice change. All surgical patients during the 30 day timeframe for the project were included. The comparison was the effectiveness of the intervention, which is to provide the antibiotic according to SCIP measures, 60 minutes before incision time, versus the current practice. The anesthesia team was providing antibiotics to the surgical patient 30 minutes prior to the surgical incision and this practice had been in place since 2013. There was a steady rise of infection rates since 2013. SCIP measure adherence was the practice change and providing the Veteran optimal surgical outcomes was the goal.

The data were collected preoperatively (time patient received antibiotic versus incision time), and postoperative (follow-up call seven days later) and then from the VISTA program 30 days after surgery. The VISTA program de-identifies patient specific information and focuses only on the SSI and the location of the same. The data tool drilled down to the variable of time. The antibiotic was to be given in the preoperative area, 60 minutes from the scheduled case time.

In this facility the programmed Operating Room (OR) scheduled case time represented what the incision time would be. The OR schedule was the guide for when the antibiotic was to be given. The data tool provided the visual reminder to staff to ensure the patient stays on track with the SCIP measure. As each case set up is different (a total knee arthroplasty versus a hernia repair), the staff gauged when to place the patient into the OR, realizing the antibiotic must be given 60 minutes before incision. A reflected scenario was that Mr. Smith is scheduled for a hernia repair at 0800; (a) Mr. Smith is asked to report to the facility at 0630, (b) at 0700, the prophylactic antibiotic (60 minutes before incision) is given intravenously by the preoperative nurse or anesthesia team in the holding area, (c) Mr. Smith is then wheeled into the OR by 0730, provided an anesthesia technique (general or moderate sedation), prepped and aseptically draped with the incision being made at 0800.

The data tool provided the information on compliance with the SCIP measures. As the previous practice had the Anesthesia personnel giving preoperative antibiotics 30 minutes before incision, it is not in accordance with SCIP measures.

Implementation

The implementation, which was a change in practice, was to provide prophylactic antibiotics 60 minutes before incision time for all surgical patients. The interdisciplinary team (anesthesia staff or perioperative nurse) administered antibiotics to the surgical patient, and documented the time of dose, during a 30 day timeframe. A data tool (Appendix A) was used daily. The tool outlined the communication between the surgical staff and the preoperative nurse. The tool was to follow the process of the antibiotic dosing to be 60 minutes prior to surgical incision. The data tool was originally developed for another federal healthcare facility in close proximity, considered to be the sister facility and was validated by the same. Communication and the process of the antibiotic dosing being given 60 minutes prior to incision, was easily tracked with the tool at the sister facility. The tool was tailored for the preoperative patient flow at the project's site.

The implementation of the project included the use of the data tool and the educational sessions on how to document with the tool for the perioperative and anesthesia staff. The implementation phase entailed debriefing the executive leadership team through all phases of the project. The tool contained the time the prophylactic antibiotic was administered, the surgical incision time, the name of the preoperative nurse, the name of the anesthesia provider, and the type of antibiotic given. The implementation entailed tallying the time between the dose of the preoperative antibiotic and the surgical incision. The patients were followed- up seven days postoperatively by the nurses and 30 days by surgeons with SSIs being documented in the electronic medical record (EMR). The VISTA program formulated the results from the EMR. For standardization, policies and procedures were developed with the implementation phase of the project.

Results

The practice change was effective. The percentage was calculated from the number of operating room cases completed and the number of reported SSIs at the end of the 30 day timeframe (*n* = number of cases). The percentage was calculated by dividing by the number of reported SSIs. The organization had a 40% rate annually (12 months) for SSI, with each month averaging 142 cases. During the project's 30 day timeframe (1 month), the number of cases was 136 with no reported SSIs (n=136 cases, 0% SSIs for the month). Of the cases, 96% received antibiotics prior to 60 minutes and the other 4% ranged from 1-59 minutes prior to incision.

Lessons Learned

Some of the lessons learned focused on the choice of the antibiotic and how it depends on the nature and duration of surgery. One of the standards of SSI guidelines is that surgeons must order supplemental dosages to be given during the process of surgery in circumstances where the operating time extends beyond the therapeutic window of the prophylactic agent used[11]. Similarly, this process should be repeated when the blood loss is more than 1.5 liters. Nonetheless, the case is different when it comes to orthopedic and colorectal surgeries where first or second-generation cephalosporin and metronidazole are used respectively. Though the use of a prophylactic antibiotic was linked with the project, the knowledge of supplemental antibiotics was important to consider when procedures exceeded the therapeutic time. During the project, the cases that an antibiotic was given within the 60 minutes of incision time though fell outside of the therapeutic time and was re-dosed was counted as following the guideline.

One barrier came with human error. If the forms were not filled out correctly and data were missing, the results would have been skewed. The VISTA program relies on humans to place the information in correctly, which made it imperative, that the daily and weekly checks were completed along with reinforcing this information in the educational sessions. The VISTA program is designed to calculate the percentages within 30 days and then produce reports. The importance of assuring all involved understood their roles to the practice change was integral. The project manager educated personnel on the change, reinforced it through educational sessions and made it sustainable though the development of policy and procedure.

Another barrier encountered included the Pharmacy Department and their timely preparation of the antibiotics. To ensure the antibiotics were on the unit and ready, the perioperative nurses had to call the Pharmacy the night before and reconcile the OR schedule, the patients and the antibiotic ordered. Some of the outliers of the project were due to a delay in the delivery of the antibiotic to allow timely administration 60 minutes prior to incision, thus outliers were 1-59 minutes before surgery. The Pharmacy Department has since decided to have premixed antibiotics on the unit for the perioperative team to be able to follow the SCIP guideline.

Conclusion

In most cases, bacteria are responsible for surgical site infections. Most of these infections are acquired during the surgery process either from contamination in the operating room or the patient’s internal system. Various studies concurs with prophylactic antibiotics and thus provides credence in SCIP antibiotic measures. Data collected through a surgical flow chart (data tool) and the VISTA computerized infection tracking system, were able to communicate a decrease seen with following the project protocols.

In evaluating project success, careful attention was paid to the time between the dosing of the antibiotic and the surgical incision (documented on the data tool). The outcome measure was a reduction in SSIs for the organization and 100% compliance of the SCIP quality measure during a 30 day timeframe. There was not a SSI detected during 136 cases over the timeframe. Of these cases, 96% received antibiotics prior to 60 minutes and the other 4% ranged from 1-59 minutes prior to incision.

Prophylactic antibiotics have shown to be an effective tool for minimizing SSIs. The antibiotics are meant to reduce the risk of microbial proliferation during the operation at the incision site. Ultimately, compliance with the measures outlined by SCIP reduces chances of surgical site infections. The practice change of providing a prophylactic antibiotic 60 minutes before the surgical incision is a permanent part of the process for this federal facility, with the responsibility being an interdisciplinary one.

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APPENDIX A.

DATA TOOL: ANTIBIOTICS/INCISION TIME

SURGICAL SERVICES DIVISION

Patient Name=____________________ **Date of** **Procedure=__________________**	**Procedure=____________** **Incision Time=_____________**	**Postoperative** **Follow-up** **Date=_____________________** **Time=_______________**
Name of Preoperative Antibiotic= _____________________ **Time Given_____________**	**Time between Antibiotic and** **Incision=________________**	**Did the patient acquire a SSI?** Circle **YES** **NO** If Yes, what type? ______________________
Please Print Names & Sign	**Please Print Names & Sign**	**Please Print Names & Sign**
Preoperative Nurse= ________________________	**Anesthesia Provider=** _________________________	**Postoperative Nurse=** ______________________

APPENDIX B.

ABBREVIATIONS

1. Ambulatory Surgery Center (**ASU**)
2. Centers for Medicare and Medicaid (**CMS**)
3. Electronic Medical Record (**EMR**)
4. Hospital Acquired Infections (**HAIs**)
5. Intensive Care Unit (**ICU**)
6. Internal Review Board (**IRB**)
7. Operating Room (**OR**)
8. Surgical Care Improvement Project (**SCIP**)
9. Standard Operating Procedures (**SOP**)
10. Surgical Site Infections (**SSIs**)
11. Veterans Health Information Systems and Technology Architecture (**VISTA**)

[1] Compoginis & Katz, 2013.
[2] Drake, 2011.
[3] Anderson, 2014.
[4] Graling & Vasaly, 2013.
[5] Darouiche et al, 2012.
[6] CMS, 2014.
[7] Jianjun et al, 2013.
[8] Orthman, 2011.
[9] Young et al, 2011.
[10] Schmidt & Brown, 2012.
[11] Barchitta et al, 2012.

APPENDIX C.

STATEMENT OF ORIGINAL WORK

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Capella University's Academic Honesty Policy (3.01.01) holds learners accountable for the integrity of work they submit, which includes but is not limited to discussion postings, assignments, comprehensive exams, and the dissertation or capstone project.
Established in the Policy are the expectations for original work, rationale for the policy, definition of terms that pertain to academic honesty and original work, and disciplinary consequences of academic dishonesty. Also stated in the Policy is the expectation that learners will follow APA rules for citing another person's ideas or works.
The following standards for original work and definition of plagiarism are discussed in the Policy:
Learners are expected to be the sole authors of their work and to acknowledge the authorship of others' work through proper citation and reference. Use of another person's ideas, including another learner's, without proper reference or citation constitutes plagiarism and academic dishonesty and is prohibited conduct. (p. 1)
Plagiarism is one example of academic dishonesty. Plagiarism is presenting someone else's ideas or work as your own. Plagiarism also includes copying verbatim or rephrasing ideas without properly acknowledging the source by author, date, and publication medium. (p. 2)
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Statement of Original Work and Signature

I have read, understood, and abided by Capella University's Academic Honesty Policy (3.01.01) and Research Misconduct Policy (3.03.06), including the Policy Statements, Rationale, and Definitions.
I attest that this dissertation or capstone project is my own work. Where I have used the ideas or words of others, I have paraphrased, summarized, or used direct quotes following the guidelines set forth in the APA Publication Manual.

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