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Reducing Surgical Site Infections Through Combination Skin Preparation Benchmark Study

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Executive Summary

Reducing surgical site infections allows for a tremendous reduction in healthcare costs, reduces length of hospital stay, decreases hospital readmissions, and promotes patient safety. The Centers for Disease Control and Prevention estimates that surgical site infections have a 3% mortality rate and 75% of all surgical site infection-related deaths are directly attributable to the surgical site infection (Centers for Disease Control and Prevention [CDC], 2020). With millions of surgeries being performed every year, the reduction of surgical site infections enhances patient safety and ensures the protection of the public. Currently, no standard protocol exists for skin preparation beyond the parameters of maintaining sterile technique throughout the skin preparation, patient allergies, and surgeon preference. To accurately assess one type of skin solution over another, one must ensure the technique used to sterilely prepare the patient is consistently being performed correctly. This encompasses the use of education in evidence-based practice and requires the input and commitment of educators and stakeholders throughout the process.

A project evaluating the efficacy of an alcohol-based surgical skin preparation solution versus an alcohol and iodine combination skin preparation solution is necessary to standardize skin preparation for surgery. Current evidence suggests using both alcohol and iodine to attain skin asepsis prior to incision will provide superior protection against surgical site infections. Developing a standardized use of an evidence-based skin preparation solution will potentially lead to a decrease in post-operative infection in the clinical setting.

1. Rationale for the Project

Different types of surgical skin preparation solutions impact the risk of surgical site infections as a myriad of differing types of skin preparation solutions exist. Some skin aseptic

solutions possess varying percentages of alcohol, others consist of betadine scrub solution and paint, and some contain a combination of alcohol and iodine. As the Centers for Medicaid and Medicare Services does not reimburse for infections acquired while in the hospital, surgical site infections have gained notice in the healthcare industry. The use of alcohol-based skin preparation solutions has increased drastically over the last decade with the advent of Chloraprep, though little research has been done to validate its frequency of use in surgical cases. Betadine has historically been considered the standard for skin asepsis in surgery; however, that does not necessarily imply that iodine-based skin preparation solutions are the best practice. A comparison between an alcohol-based skin preparation solution alone versus an alcohol and iodine skin preparation is necessary to determine overall patient outcomes. Since alcohol skin solutions and iodine skin solutions work in different ways, the use of the two reagents combined should result in fewer post-operative infections. Reducing the rate of surgical site infections is an ongoing initiative designed to reduce cost, decrease hospital readmissions, and provide better patient care. Designing a benchmark study in which the use of an evidence-based skin preparation solution can potentially lead to a decrease in post-operative infection in the clinical setting.

2. Synthesis of Literature

Surgical site infections have been studied relentlessly for decades; causes, prevention, and techniques designed to reduce surgical site infections have been evaluated extensively throughout the last half century. An examination of the types of surgical skin preparations which provide the strongest efficacy in eliminating skin flora, thereby reducing the risk of surgical site infections has also been a topic of interest among many in the field of surgery. The advent of alcohol-based skin preparations such as Chloraprep created much discussion between the use of

alcohol in skin asepsis and the use of iodine-based skin preparation solutions. Starting in 1970, a myriad of comparisons has been made over the years comparing alcohol, iodine, and a combination of the two to determine which solution is the most effective at eliminating bacteria from the skin prior to incision. Some studies compared sequential use of solutions, for example, prepping the skin with alcohol and subsequently prepping the skin with an iodine-solution. Others contrasted the use of Chloraprep and Duraprep, an alcohol and iodine containing solution. For this benchmark study, a comparison is made between the efficacy of Chloraprep and Duraprep.

In 2016, Davies and Patel examined the rate of surgical site infections in patients undergoing craniotomies; their basis for evaluating the efficacy stemmed from the concept that iodine and alcohol eliminate bacteria through different mechanisms, thus the use of both alcohol and iodine would allow better protection against a surgical site infection. The results revealed that a combination skin preparation significantly reduced the incidence of surgical site infections following craniotomies. In addition to reducing surgical site infections in neurosurgery patients, cardiac patients were studied and while the presence of incisional infections remained the same in both cohort groups, organ space infections showed a decrease when both alcohol and iodine were used as a skin preparation for patients undergoing cardiac surgery (Raja et al., 2018).

Orthopedic surgeries carry a unique risk for a surgical site infection because they often require the use of implants. Implantable devices are foreign to the body and increase the chance of a surgical site infection. Peel et al. (2019) determined through a randomized controlled trial that the use of iodine and was superior to reducing the incidence of surgical site infections in joint arthroplasties. This is a similar finding to the randomized controlled trial of Xu, Fowler, and Goitz (2017) when examining the efficacy of alcohol and iodine for elective hand surgeries.

A careful review of all relevant literature pertaining to surgical skin preparation solutions and the incidence of surgical site infections was done by Davies and Patel in 2016, where the results indicated the use of alcohol and iodine combined reduced the rate of surgical site infections. Mermel repeated a systematic review in 2019 and the results overwhelmingly supported the use of both iodine and alcohol to reduce the rate of surgical site infections.

3. Stakeholders

Stakeholders operate in the best interest of an organization. Prior to facilitating organizational change, stakeholders should be identified and profiled to promote more effective communication throughout change initiatives. The stakeholders are the individuals from whom the patient receives care, and while the definition of stakeholders can be extended to include hospital administrators, the marketing department, or financial committees in a facility, regarding this benchmark study, the primary stakeholders are defined as physicians, anesthesiologists, perioperative nurses, and surgical technologists. Each participant has their own role, and each member of the surgical team is equally committed to a safe, uncomplicated surgery. All members of the patient care team have a responsibility to inform the patient of what to expect throughout the surgical process; the physician has a duty to educate the patient on the benefits and harms of a surgical intervention (Elwyn et al., 2016). Thus, the roles of the stakeholders within the surgical unit include: the physician anticipating that the patient will have a positive outcome from the surgery, anesthesia limiting the patient's pain post-operatively while safely administering anesthesia throughout the surgery. The surgical nurse is responsible for ensuring all documentation is correct, all specimens are accurate, and the patient's loved ones are updated on a consistent basis. The surgical technologist retains track of instruments and countable items,

collects specimens, and maintains vigilance over the sterile field. All components work together for a safe, accurate surgery that will result in a positive patient outcome.

4. Implementation

The initial phase of implementation involves gaining the participation of stakeholders; upon approval from the facility, three to five surgeons willing to participate in this study must be identified. The surgeons must agree to use both types of skin preps on their surgical cases, an alcohol-based prep such as Chloraprep, and an alcohol and iodine prep, such as Duraprep. The surgeons will then be educated on what is being studied, why, and which kind of patients would be an acceptable fit for this study. Healthy patients with limited comorbidities and no active infection are the target subjects for this study. The patients will be followed and assessed for a surgical site infection over a three month period post-operatively. The procedures must be either the same or closely similar and cannot involve an implant, since the risk of infection increases with surgical procedures that involve implants. Surgeries such as an open abdominal hysterectomy or an open ventral hernia repair are the focus of this study as these cases are considered “clean” surgical cases yet are higher in risk for surgical site infections due to the large incision. No “dirty” cases such as colectomies will be permitted since they are the highest at risk for surgical site infections. Once we have gained a commitment from surgeons to participate, education of the staff will begin. Education for the surgical staff on the reduction of surgical site infections through the selection of a skin preparation solution will be the subsequent step in the implementation process. A patient consent form must be drafted and receive approval from the facility; the perioperative educator will then educate the nurses on when the consent will be used and how to ensure its completion. The Day Surgery department as well as members of the surgeons’ office staff will need to be educated on the patient consent form as they will also be

responsible for obtaining consent. The perioperative educator will assess the current technique of surgical skin preparation by the staff and begin to teach all perioperative nurses a uniform method to avoid improper technique being a variable in this study. Once a uniform technique has been achieved, the data collection can begin.

Communication with the selected surgeons is paramount as a list of optimal candidates who fit the criteria of being healthy with no active infections is created. If additional candidates arise during the study, the surgeon will contact the leader of the project, who will assign a specific skin preparation solution for the surgery. Consent from the patient must be obtained; this can be done in the surgeons' office at the time the surgery is scheduled, or in when the patient arrives for surgery. If it is done at the surgeon's office, it will need to be faxed to the facility along with the physician's orders for surgery. If it is to be done at the time of arrival for surgery, a consent should be placed in the patient's chart to be completed. Half of the patients will be sterilely prepped with Chloraprep, and the other half of the patients will be sterilely prepped with Duraprep. The patients will then be followed post-operatively for any signs of surgical site infections such as redness, swelling, discharge, pain at the incision site, or fever. Follow up will occur every two days for the first two weeks following surgery and will be weekly for the remainder of the three months.

5. Timetable/Flowchart

Due to the low surgical census because of Covid, a benchmark project was selected as the best course of action for this study. In previous semesters, the plan was to collect data from surgeries over the course of a three month period, beginning in late August and continuing through November. Careful consideration of this timeframe reveals it to be insufficient in length and should it be approved by the facility and implemented in the future, would require an

extended timeframe of six months to allow for appropriate data collection. Regarding this benchmark project, three months was allotted to gather post-operative data from selected patients. Table 1 represents the time frame to be anticipated for this study, beginning with the planning phase, and following through to the dissemination phase.

Table 1

Four Phases and Timeline of Benchmark Project to Reduce Surgical Site Infections

Planning	Implementing	Evaluating	Marketing
Two weeks	Twelve weeks	One week	One week
• Form an inter-professional team • Assessment of current data • Education for participating staff • Recruitment of physicians	• Implement the project change by prepping patient with alcohol and iodine based skin preps • Track progress of patients post-operatively	• Evaluate the rate of surgical site infections • Evaluate cost savings related to a reduction in surgical site infections	• Disseminate findings • Determine how to market the evidence to promote a permanent, sustainable practice change

6. Data Collection Methods

The benchmark study allowed for a literature review as a means of data collection. Should the benchmark study receive approval from the facility and be implemented, the data collection period will ideally occur over a six month period. The conclusions needed to determine if the change was successful will be a reduction in surgical site infections as evidenced by patient outcomes, decreased hospital stay, and no subsequent surgical procedures needed after the initial surgery. Patients recovering in the facility will be monitored for fever, purulent discharge, and redness and swelling as evidence of a post-operative infection. Patients who are discharged can be evaluated for a surgical site infection via telephone and in addition, at their

scheduled follow up appointment with their surgeon. The patients will be followed for three months post-operatively. Follow up will occur every two days for the first two weeks following surgery and will be weekly for the remainder of the three months. After collecting data from the patients at the end of three months, evaluation of which skin solution showed less surgical site infections can begin. Examine the success of the data collection methods by determining if any participants were lost due to lack of follow up or if any of the participants were eliminated for extenuating reasons. The skin solution that demonstrated the least number of surgical complications can be declared more effective at preventing surgical site infections and dissemination of this knowledge can begin.

7. Cost/Benefit

The cost of implementing this project is low as the only costs incurred are the costs associated with an additional consent. Pre-operative skin preparation is a standard of practice for perioperative nurses and therefore, the wages of nurses should not be factored into the costs of this project. Both surgical skin preparation solutions are readily available at every facility nationwide and therefore, additional revenue will not be necessary for the purchase of Chloraprep or Duraprep. The potential benefits from this benchmark project are substantial as surgical site infections result in significantly higher costs, are associated with increased morbidity and mortality, and extended length of stay post-operatively. In addition to posing a threat to patients, the costs associated with surgical site infections has been estimated to add $20,000 per admission while adding on an additional 9.7 days to each patient hospital stay (Fields et al., 2020). Since Centers for Medicare and Medicaid Services began declining reimbursements for hospital acquired conditions in 2008, the burden of cost rests upon the hospital facility (Centers for Medicare and Medicaid Services [CMS], 2020). The average annual

costs resulting from surgical site infections is estimated to be $3.3 billion, with much of the cost being passed to the hospital facility, where it is then passed on to the consumer, resulting in an increase in the cost of healthcare for everyone (CDC, 2020).

8.Discussion/Results

The results of this benchmark study are not available for evaluation and are predicated upon literature review. While there exists some resistance to establishing a standardization for skin preparation prior to surgery, there has also been positive feedback from many surgeons when queried about examining which skin solution was more efficacious at preventing surgical site infections. A goal of this benchmark study is to continue to promote a standardized protocol predicated upon evidence-based practice to promote safer patient outcomes.

Recommendations

Surgical site infections lead to increased patient and facility costs, lengthened hospital stays, and increase the risk of patient mortality. Changing the methods of skin preparation prior to surgical incision will lead to a reduction in post-operative infections, resulting in millions of dollars saved over time as patients are kept safer. Reducing surgical site infections should be a priority for every facility as post-operative infections are the costliest hospital acquired condition (CDC, 2020). The support of leadership is essential to participation in creative and dynamic teams that advance innovation. Using persuasive and innovative skills to promote change within in the department is the primary step. Once buy-in from leadership has occurred, a change initiative with a team of inter-professionals including administration, staff, surgeons, and perioperative educators to examine which surgical skin preparation solution is more effective at preventing surgical site infections can begin. The objective is to establish one skin preparation solution as superior over others and implement the use of the most effective solution as it will

result in a reduction of surgical site infections, reduce healthcare costs, and improve patient outcomes.

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