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Research Article

Use of Standardized Processes to Achieve Optimal Pre-Surgical Skin Asepsis

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Abstract

Surgical site infections are a significant threat to patient safety, they increase patient mortality and morbidity, and increase health care expenditures. A pre-surgical protocol that implements two applications of 2% Chlorhexidine gluconate using prepackaged cloths is an evidence-based practice that kills and then prohibits the growth of potentially dangerous skin flora. The purpose of this project was to evaluate the effectiveness of 2% Chlorhexidine gluconate cloths when administered twice pre-surgically to reduce the incidence of surgical site infections and to improve pre-surgical documentation. The Iowa framework for quality improvement was used with results demonstrating that, while documentation remained an area for improvement, there was a significant decrease in surgical site infections over the comparison group.

Keywords: EMR Documentation; Patient Safety; Pre-Surgical Skin Asepsis; Surgical Site Infection; Teamwork; Two Percent Chlorhexidine Gluconate Cloths

Introduction

A quality improvement program was initiated in a small, acute care community hospital in Chicago to reduce the incidence of Surgical Site Infections (SSIs). Surgical site infections are the most common Healthcare Acquired Infections (HAIs) with an estimated occurrence of more than 500,000 each year with an associated mortality rate of 25% [1,2]. The Centers for Disease Control and Prevention (CDC) has issued standard definitions of SSIs, required surveillance periods, and the reporting protocols with which healthcare institutions and providers must comply [3]. The [3] estimated that more than 16 million operative procedures were completed in acute care hospitals in the United States in 2010.

Surgical Site Infections

Surgical site infections contribute significantly to additional hospital days and cost, up to \$7 billion annually [4]. Research has shown that 40-60% of SSIs are preventable, but that hospitals have

not changed practices to meet current Evidence-Based Practice (EBP) guidelines [5,6]. The Joint Commission (TJC) initiated an SSI Change Program with three objectives: identification of current practices, confirmation of which SSI prevention methods are efficient and development of an SSI guide to implementing those practices which have been identified as being effective [7]. The Joint Commission included SSI prevention using proven guidelines as one of the 2016 Hospital National Patient Safety Goals [8].

Available Knowledge

The research literature on this topic has found that repeated application of CHG before surgery provides the substantial antimicrobial concentration needed to inhibit most preventable SSIs [1,9]. Use of 2% CHG is a cost-effective method of reducing and prevention of methicillin-resistant *Staphylococcus aureus* infections, which pose a serious threat to post-operative SSI acquisition [10]. Recent research has shown that using 2% CHG-impregnated cloths increased compliance and resulted in a higher concentration of CHG on the skin [1,11]. Additionally, CHG has a sustained antimicrobial action for several hours after application [12]. Reduction in SSIs should be of paramount consideration for

every health care organization due to potential penalties, increase use of the institution's resources, and the impact of an SSI on the patient and their families [13].

Hand-off communication and thorough documentation in the patient medical record is the responsibility of the nursing staff. Standardized checklists the use of hand-off communication between caregivers or transitions in the level of care and implementation of checklists are necessary to ensure that critical information is communicated as part of the standard of care [14]. Failure to document 2% CHG application before surgery in the patient's medical record is considered an omission of task or assessment completion. The lack of thorough documentation can result in tragic consequences that include anaphylaxis, wrong-site surgery, and HAIs. Organizations depend on accurate data input to evaluate the success of interventions, their cost, patient satisfaction, drug interactions and in the collection of mandated information by the Centers for Medicare and Medicaid Services (CMS) [15].

Teamwork is a critical component of nursing care delivery. In the acute care setting, teams are needed to move patients, coordinate care delivery and for both nurse and patient education. It is imperative that managers communicate with the front-line staff to identify barriers, needs and promote safe delivery evidence-based patient care [16]. All of those who contribute to patient care are considered members of the health care team. For this project, the Iowa Model of Research-Based Practice to Promote Quality Care (Iowa Model) was used as the framework that utilized input from project stakeholders and team members to assess all aspects of the project's progress [17].

The Project Goal

The aim of this project was to implement current EBP for pre-surgical CHG use on the inpatient units to reduce the incidence of SSIs in a six-week pilot quality improvement project. The project manager worked with the Chief Nursing Officer (CNO), Unit Manager (UM) and the organization's Infection Control (IC) Nurse to integrate the new pre-surgical CHG antisepsis protocol into the standard routine of the inpatient care providers. The over-arching goal of the project was to reduce SSI incidence as compared to data recorded during the same six-week period one year before implementation of the protocol.

The primary question that this intervention intended to answer was "In the inpatient surgical patient population, how would two applications of 2% CHG using prepackaged cloths the night before and the day of surgery influence the rate of SSIs over a six-week period?" Secondly, the project manager sought to determine the rate of compliance of EMR documentation of the intervention.

Methods

Setting for the Process Improvement

The focus of this project was to implement an inpatient pre-surgical skin asepsis protocol in a small, acute care community hospital. On the inpatient units, no standardized policy or process was in used for pre-surgical CHG application or patient education. A nurse educator was not available to answer questions of the clinical staff as to the EBP that has been identified, the proper technique, or the appropriate technique for the administration of pre-surgical CHG application.

The project setting was on two inpatient units where the majority of the inpatient surgical patients originated and returned for postoperative care. The inpatient setting was selected as an area where CHG application, patient and staff education, and documentation could be more accurately monitored as opposed to the outpatient setting. Both inpatient units had a mix of Registered Nurses (RNs) and unlicensed patient care technicians caring for their patient populations.

The need for a standard process to prevent SSIs was identified using internal data that indicated a rise in postoperative colorectal Class II SSIs and a consistent incidence of Class I SSIs during the fourth quarter of 2015. The number of surgical cases during that period was unavailable. Inpatient pre-surgical 4% CHG shower/bath compliance during the same period was reported by the IC nurse as having been between 47 and 80%. This data was provided at the monthly Quality Assurance and Process Improvement Committee meeting.

The Intervention

In addition to poor compliance with the one 4% CHG pre-surgical night-time shower, the Director of Nursing was concerned that there were few opportunities for front-line clinical nursing staff to initiate and become involved in the development of quality improvement initiatives. This project assessed processes, sought to change policies and improve patient outcomes.

The process improvement integrated the use of EBP and interdisciplinary cooperation to improve the culture of the patient-care units and enhance levels of nurse and assistive nursing personnel satisfaction [18]. Patient education concerning the recommended technique and purpose of the antiseptic application process was intended to improve patient satisfaction as their nurses personally assessed the patient's pre-surgical skin integrity and provided preoperative teaching [18].

Required Communication

Data input and documentation of the provision of care

is a fundamental component in ensuring delivery of evidence-based care and protocols throughout the continuum of services. Patient handoff information was updated to include the use of the whiteboards in the patient rooms to include the provision of the two 2% CHG applications. This process would be included in interactive bedside rounding. Interactive bedside rounding is a process recently put in place by the institution to engage the patients and their families in communicating the plan of care, identify opportunities for patient education, improve patient satisfaction, and add a layer of communication. Upon completion of CHG application, the patient care staff were instructed to document each use in the patient's EMR.

Competency for proper application of the product was established via staff in-services by the project leader, IC nurse, and unit manager. Most patient care providers were familiar with the product, but had not used the new six-cloth procedure now being implemented the night before and day of surgery. Staff members were given visual evidence of progress toward the goal and were encouraged to interact with the project leader and other team members to identify obstacles and provide input as to how the implementation of the two 2% CHG application process might be improved. Champions for the integration of the change were identified and encouraged to assist in the intervention as they learned how to determine other gaps in practice that would lead to other learning of quality improvement projects [19]. The team members for this intervention included the project manager, IC nurse, unit manager, the Director of Nursing, EMR Coordinator, Health Information Management Systems (HIMS) Director, and a clinical nurse educator.

Measuring Compliance

Planned interventions to assist with the determination of the effectiveness of the intervention included ongoing auditing of the EMRs of inpatient surgical patients on the pilot units for protocol compliance and posting of communication tools in nursing stations and lounges. These tools would allow for the frontline staff to note barriers and suggest changes. A weekly histogram provided a summary of compliance with the protocol and the number of SSIs. As each week's data was displayed, staff members were able to determine the trend with the assumption that it would encourage them to improve their scores from week to week with a goal of 100% compliance.

One week following project implementation, the project leader was unexpectedly prohibited from accessing and auditing surgical inpatient EMRs on an ongoing basis for documentation of the new 2% CHG protocol and indications of potential SSI development by the Chief Nursing Officer (CNO). Despite the required written permission from the CNO before implementation, she restricted the project manager to conducting weekly audits

under the direct supervision of the HIMS Director [20].

When the project manager was the operating room (OR) charge nurse during regular working hours, preoperative checklists, labs, and 2% CHG application compliance were reviewed before calling the patient's nurse to inquire about the patient's readiness for surgery. This process presented an opportunity to remind the inpatient nurses caring for pre-surgical patients to complete the required documentation and tasks before transport to the OR.

Surveillance for Infection

Determination of the presence of an SSI at the institution would continue to be based on the parameters determined by the CDC [3]. SSIs were classified as being superficial incisional, deep incisional, or organ/space [21]. Surveillance methods to detect SSIs are either via direct or indirect methods. Daily assessment by the surgeon might be considered the ideal monitoring method however with the increase in same day surgery and next-day discharges, it is not always possible to conduct this assessment promptly.

Because of the ease of using the disposable, pre-packaged 2% CHG cloths and in-service education and materials with monitoring for proper technique, the assumption by the project manager was that near 100% compliance could be achieved. The research literature supports an increase in patient and staff satisfaction using the 2% CHG cloths while achieving high levels of CHG on the skin for SSI prevention [1]. The pre-implementation assumption was that SSI levels would decline during the implementation period as compared to historical data.

Anderson [21] found that indirect methods of surveillance are both reliable and concrete when done properly. Indirect oversight includes; monitoring of patient laboratory reports, nursing notes, discharge summaries, antibiotic use, surgeon and patient surveys and follow-up calls, or a return to surgery. The threats to accuracy include the patient or family misunderstanding postoperative instructions, surgeon under-reporting, or failure to identify the existence of an SSI during the mandatory reporting period of between 30 and 90 days postoperatively [3]. This project followed the institution's procedures that were put in place in 2015 when the IC nurse initiated a process to call patients and surgeon offices to determine if the patient had developed an SSI post-discharge.

Outcome Measurement

The outcome measures used much of the descriptive data provided by the institution. Recorded numbers of documented two 2% CHG applications were divided by the number of appropriate surgical cases to quantify the rate of respect for the project intervention. The number of surgical patients having undergone the new pre-surgical skin asepsis protocol who developed an SSI was compared to the number of patients who developed SSIs in the same period the year before.

A basic t-test was used to compare historical SSI data to the data collected during and for 30 days following the six-week project period. The t-test is an appropriate statistical analysis for a comparison of two groups with a small sample size. The pre-implementation assumption was that the new process would result in a reduction in SSIs. Thus, a basic t-test was used to interpret the results [22].

Limitations

Limitations included the small sample size. This restriction was directly related to the implementation site, which had low inpatient surgical volume. The data could not be controlled for the surgeon, surgical staff, sterile technique, unit distribution data from the previous year, or the quality of reporting by the IC nurse. Changes in patient care protocol encountered resistance from the patient care staff comfortable with the status quo, and unit champions were limited when administrative support languished [23,24].

Ethical Consideration

No ethical concerns were identified when planning, implementing or evaluating this process improvement project. The intent of the project was to change the practice of using one 4% CHG bath before surgery to two applications of 2% CHG using prepackaged cloths to achieve optimal skin asepsis before surgery. The same agent was administered at a lower concentration using a different vehicle. No patients were excluded from the new protocol except those with known allergies to CHG or those undergoing procedures in which the use of CHG was contraindicated. The

project was judged exempt by an institutional review board.

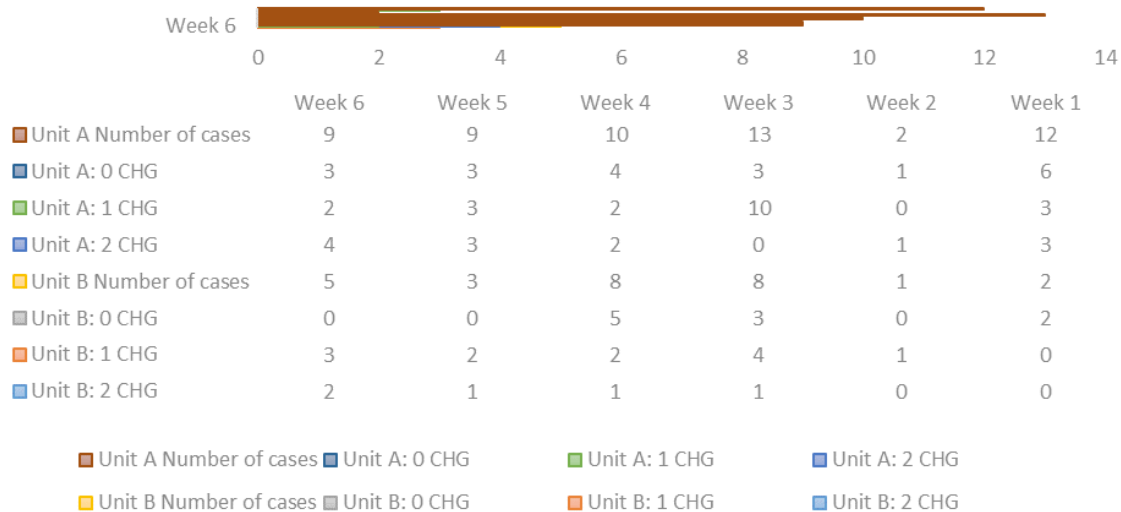
Determination of Inclusions

All eligible inpatient preoperative patients were included in the 2% CHG application protocol on the pilot units. During the implementation phase of the project, 350 surgical cases were performed in the OR. Of these, 61 were ophthalmologic, and CHG application above the neck was contraindicated. The remaining 259 procedures were then categorized into groups including outpatients versus inpatients, inpatient care units, pre-existing infections, and procedures requiring follow-up beyond the time constraints of this project.

Finally, inpatients were identified as belonging to the two units in which the new pre-surgical 2% CHG application was implemented. This classification process resulted in the determination that 119 patients had been admitted to the targeted units preoperatively. Of these inpatients, 82 patients monitored for compliance and 30 postoperative SSI follow-up: 27 patients were admitted in Unit A and 55 patients were located in Unit B. No SSIs were reported in either group during the study period, compared to 6 reported SSIs during the same period the previous year.

Data Analysis

The basic t-test for statistical significance calculated $p=0.0247$, assuming the surgical case volume and distribution was similar during the same period the previous year. A p-value of less than 0.05 is considered to show statistical significance. Despite the small sample size, the new protocol can be regarded as a success (Figure 1) demonstrates Unit Compliance.



Note. Histograms illustrate weekly unit compliance.

Figure 1: Unit Compliance with CHG Protocol.

Documentation Analysis

There was a considerable lack of compliance in documenting pre-surgical CHG application in the EMR. The results showed that on Unit A, only 8% of pre-surgical patients were documented as having received both 2% CHG applications, and only 14% on Unit B (Figure 1). There was an ongoing comparison of retained handoff communication forms used by the patient care providers. This analysis revealed that 19% of EMR documentation did not reflect the actual number of 2% CHG applications administered. Because this handoff tool was not part of the patient's chart, it can be hypothesized that many more handoff tools were discarded before analysis.

Results

Key Findings

Leading up to implementation all team members were anxious to begin the project. Several in-service programs were held before implementation. User reaction to the product used in the new protocol was positive. The patient care staff reported that the product was less confusing and time-consuming than the use of the 4% CHG liquid product. Use of the pre-packaged disposable cloths for the outline process was preferred because it reduced confusion as to the concentration of the 4% liquid product using basins and washcloths. The cloths were also said to be easier for obese patients to access skin folds.

In-service education continued to be conducted during implementation, and drop-in sessions were held during lunch breaks to educate those patient care providers that had not been able to attend scheduled in-services due to scheduling or work assignments. The project manager and the IC nurse visited the targeted units frequently during the implementation phase with informational packets and spoke with many of the patient care staff on a one-to-one basis to reduce confusion regarding the new 2% CHG protocol. The nurse manager assisted by reminding her staff during daily huddles and provided additional education when needed [25].

Both the IC nurse and the unit manager expressed their belief that more patients received two 2% CHG than was reported, due to the reduced volume of the product on each unit. Neither was concerned about the discrepancies in the documentation so long as the incidence of SSIs remained nil [15].

Successful Use of the Iowa Framework

The patient care staff, in keeping with the intended Iowa Framework for quality improvement, suggested modifications for the application instruction sheets and the development of a different instrument for handoff communication. Application instruction sheets were modified and reduced to pocket size, allowing the

caregivers easy access. Handoff communication sheets were developed that used the verification stickers attached to the outside package of the product, which was then initialed with time and day of application. The modified instruction sheets and handoff verification forms were put on display, using neon green posters in each nurse's station and multiple copies were provided for use. Unfortunately, the information on the verification forms was not always shared with the nurse and documented in the EMR [26].

Continued Gaps in Communication

Additional miscues in communication arose when difficulty in obtaining the product for unit use from the hospital supply department became an issue, despite planning sessions with the supervisor before implementation. Following intervention by the IC nurse, the issue was resolved. The product was delivered to the nursing units in boxes containing single packs, rather than the three packs used at the start of the implementation. All patient care staff were reminded to use three packages for each 2% CHG application, as outlined in the posted protocol.

Several patients and patient care providers reported that the product was cold. The product company, aware of the project well in advance, attempted to contact the organization's material management director via telephone and e-mail with no response. Warmers were routinely provided free of charge to any organization's nursing unit that used the product. Although no warmers were obtained during the implementation phase of this project, the project leader was committed to the initiative and brought key decision-makers together two months later, and warmers were finally obtained for all the nursing units.

The institution had been evolving over the course of the previous 18 months, with several transitions of power and resignation of key nursing personnel. Many organizational changes in leadership coincided with the project implementation, resulting in miscommunication [27].

Interprofessional Teamwork

An important observation by the project manager was the disinterest of the nurses for updates on the progress of the initiative. There was a clear line drawn between tasks performed by the nurses and the patient care staff. The nurses did not consider patient teaching and skin integrity inspection while applying the product to be among their responsibilities when preparing patients for surgery [28].

Completion of the preoperative checklist was found to be grossly incomplete in the majority of EMR flowsheets. This concern was voiced to the unit manager who said that noncompliance had been an issue for many years and she did not believe that it would change for many more years [28]. The project manager was concerned that the documentation of CHG application and

preoperative checklist completion had plummeted from the previously reported 47-80% to the 8.7% completion rate recorded during project implementation. The discrepancy was found to be the difference in defining preoperative checklist completion by the IC nurse who was assessing for input of the data she required and the definition of a complete checklist by an OR nurse who needs the entire checklist to ensure perioperative patient safety.

Discussion

This quality improvement project demonstrated a reduction in SSIs, with no infections reported in the patients whose progress was monitored. After the completion of the surveillance of the project manager, the IC nurse said no SSIs in any member of the inpatient unit's surgical population after 90 days who did not present with a pre-existing infection. Despite the unanticipated barriers and complications during the implementation of this project, the goal of reducing SSIs on the pilot units was successful. The organization continued the 2% CHG bathing protocol and expanded it to other inpatient units. The liquid 4% CHG product has been eliminated from preoperative skin preparation.

Several surgeons have subsequently expressed their desire to use the 2% CHG application protocol as part of bundled order sets for both their inpatient and outpatient populations. The use of bundled order sets would align with the SHEA Guidelines and other colorectal bundles being implemented nationwide [29,30].

Front-line Staff Involvement

A significant success of this project was the assistive nursing personnel's desire to participate in changing the pre-surgical skin asepsis process [20]. The ability to provide input as to how they can perform their assigned tasks using an easier and disposable product that was more reliable appealed to them. They became very involved in the evolution of the application instruction sheets, as well as the handoff tool using the product stickers. More education is required to show these providers where they can document CHG use into the EMR. They consider this to be the responsibility of the nurse and are already overwhelmed by their physical workload. Efficient and concise communication among caregivers is essential for patient safety [31].

Limitations

Compliance when introducing a new protocol requires vigilance and the physical presence of observers and auditing staff through the implementation period. These resource personnel should be visible, observe the proper technique is executed, and audit EMRs for completeness of documentation. Buy-in from nursing leaders was superficial and directly affected staff education and overall compliance [20].

A healthcare organization's commitment to nursing education and competency is a crucial component in providing the staff with evidence-based nursing research for implementation in their nursing practice. Disruption in organizational leadership stability, structure and expectations limited the project manager's ability to interact with the patient care staff in real time [27]. Auditing compliance with the protocol one week after the fact was not effective in changing pre-existing team behaviors. These obstacles directly affected compliance with the protocol. Inconsistent commitment from key stakeholders hampered efforts to improve patient outcomes and satisfaction [27].

Implications for the Future

The use of scripting by the OR's charge nurse when communicating with the nurses on the inpatient units can improve completion of preoperative documentation and the application of two 2% CHG applications [32]. These cues will alert the nurse as to what is required before the patient can be accepted for transfer to surgery. The charge nurse can also check the patient's EMR and call the nursing unit well in advance of the procedure to ensure compliance. The unit managers should be invested in remedying the breakdown of crucial, mandated handoffs as patients are transferred to other units: organizational leadership support must be present to reduce HAIs [33].

Implementation of timely analytics for EMR reviews and data mining would assist with the evaluation of staff compliance, numbers of assigned patients per nurse and assistive personnel, and the time interval between notification by the surgeon of intent to operate and the time of the operative procedure would offer meaningful insight [34]. Hard stops can be integrated into the EMR to improve preoperative checklist compliance, including 2% CHG pre-surgical skin asepsis. The creation of dashboards on provider's computers can display current data about the user and would increase the level of patient care compliance [35].

Conclusion

The repeated application of pre-packaged 2% CHG cloths for pre-surgical skin asepsis has been shown to reduce and prevent the presence of most of the microbes responsible for SSIs. Pre-packaged cloths with easy to follow instructions will result in proper product application to the patient's skin. This process improvement project to change pre-surgical skin asepsis protocol led to no SSIs which was a statistically significant improvement over the comparison group. When applied by the nurse, application of the product is an opportunity for thorough integument inspection and patient teaching. This process can improve patient outcomes and levels of patient and nurse satisfaction [13]. Modifications in the EMR to include hard stops and dashboards are useful tools to improve many areas of patient care compliance [35].

Future exploration might include evaluation of the incidence of other HAIs that can be reduced following two 2% CHG applications. These might include preoperative intravenous site infections, intraoperative central or arterial line placement, and preoperative anesthetic blocks, spinal, and epidurals. Hospitalized patients may be especially vulnerable to HAIs, and the use of two 2% CHG application can aid in the protection and prevention of infection.

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