Empowering the Surgical Patient: A Randomized, Prospective Analysis of an Innovative Strategy for Improving Patient Compliance to the Preadmission Showering Protocol

Charles E. Edmiston, Jr. PhD[1,2], Candace J. Krepel, MS[1,2], Sarah E. Edmiston, M.Ed,[1,2] Maureen Spencer, M.Ed,[3] Cheong Lee, MD,[1] Kellie R. Brown, MD,[1] Brian D. Lewis, MD,[1] Peter J. Rossi, MD,[1] Michael Malinowski, MD,[1] and Gary Seabrook, MD[1]

[1]Department of Surgery (Division of Vascular Surgery), [2]Surgical Microbiology Research Laboratory, Medical College of Wisconsin, Milwaukee, Wisconsin and [3]Infection Prevention Consultants, Boston, MA

Introduction

- Surgical site infections (SSIs) are responsible for significant morbidity, mortality and excess utilization of healthcare resources.[1-5]
- The preadmission antiseptic shower is accepted as an effective strategy for reducing the risk of SSI.[6-9]
- The following study analyzes the benefit of an innovative electronic patient alert system (EAS) for enhancing compliance to a preadmission showering protocol with 4% chlorhexidine gluconate (CHG).

Materials and Methods

- The present investigation was reviewed and approved by the Institutional Human Subjects Review Board (IRB).
- Following informed consent 80 healthy volunteers were randomized into one of 4 skin antiseptic showering groups (N= 20 per group):

  Group A —

  4% CHG Two Shower Arm (evening/morning)

  1. A1: EAS group (SMS-text, email or voicemail), N = 20
  2. A2: Non-EAS group, N = 20

  Group B —

  4% CHG Three Shower Arm (2 consecutive evenings/1 morning)

  1. B1: EAS (SMS-text, email or voicemail), N = 20
  2. B2: Non-EAS group, N = 20
- Study volunteers were instructed to apply the 4% CHG-soap (StartClean, CareFusion, Leawood, KS) to their body using a sponge applicator provided in the kit, covering all body surface areas, excluding the face and scalp.
- All subjects were instructed to report back to the investigator's laboratory. The timing and return for determination of CHG skin surface concentrations was staged to occur 10 to 14 days after informed consent, randomization and receiving study supplies.
- The volunteers were asked their preference for receiving an electronic alert prior to each showering event (SMS-text message, email or voicemail).
- The CHG skin surface concentration assay is based on an adaptation of a United States Official Monograph for the Identification of chlorhexidine gluconate solution and previously described.[10]
- The sites tested included a 3 cm^2 area on the right-left antecubital fossae, abdomen and right-left popliteal fossae.
- The principle investigator was blinded to all randomization codes until the final volunteer was processed at which point the code was broken and individual groups analyzed by Analysis of Variance (ANOVA) and paired t-test (MINITAB Statistical Program, MINITAB Inc., State College, PA).

Results

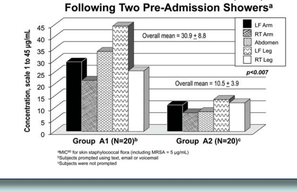
- No adverse events were noted in the study. Eighty percent (32/40) of study volunteers preferred to receive a SMS-text message alert prior to showering, while 6 (15%) and 2 (5%) volunteers preferred to be prompted by email or voicemail, respectively.
- **Figure 1** documents the mean skin surface concentrations of 4% chlorhexidine gluconate (CHG) in subjects who showered twice (group A, evening/morning).
- **Figure 2** documents the mean skin surface concentrations of chlorhexidine gluconate (CHG) in those individuals who were instructed to shower three times (group B, 2 consecutive evenings/morning).
- In those volunteers who did not received an electronic alert there was a 66% and 67% reduction, respectively in the mean composite skin surface concentration of CHG in the 2 and 3-showering group.
- **Table 1** documents the subgroup analysis of the amount of unused CHG returned by men, women and all volunteers in groups A1, A2, B1, and B2.
- Male volunteers were more likely to return a larger volume of unused CHG than female study subjects in groups A2 and B2 (non-alerted subgroups).

Table 1
Subgroup Analysis, Residual Aqueous 4% CHG in Men, Women and all Study Subjects

Study Groups[a,b]		Mean Residual CHG (mL)[c]
Group A1	Men (4)	37.9 ± 18.9
	Woman (16)	25.4 ± 22.4
	All (20)	30.5 ± 21.9
Group A2	Men (7)	46.1 ± 28.6
	Woman (13)	30.1 ± 20.4
	All (20)	37.7 ± 24.6
Group B1	Men (5)	29.0 ± 21.4
	Woman (15)	22.5 ± 18.2
	All (20)	24.4 ± 20.5
Group B2	Men (6)	42.9 ± 29.1
	Woman (14)	36.3 ± 27.5
	All (20)	39.7 ± 28.9

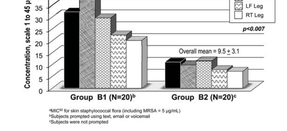
[a] volunteers in group A instructed to take two showers, A1 volunteers received 2 electronic alerts; A2 volunteers did not receive an electronic alert reminder
[b] volunteers in group B instructed to take three showers, B1 volunteers received 3 electronic alerts; B2 volunteers did not receive an electronic alert reminder
[c] no significant difference in mean residual CHG between all study groups

Figure 1 Mean Skin Surface Concentration (µg/mL) of 4% Chlorhexidine Gluconate (CHG) Following Two Pre-Admission Showers[a]



[a]%BCP for skin staphylococcal flora (including MRSA = 5 µg/mL)
[b]Subjects prompted using text, email or voicemail
[c]Subjects were not prompted

Figure 2 Mean Skin Surface Concentration (µg/mL) of 4% Chlorhexidine Gluconate (CHG) Following Three Pre-Admission Showers[a]



[a]%BCP for skin staphylococcal flora (including MRSA = 5 µg/mL)
[b]Subjects prompted using text, email or voicemail
[c]Subjects were not prompted

Table 2
Standardization of the CHG Preadmission Shower Regimen

The following components should be included in preadmission CHG shower regimens, as part of a comprehensive surgical site infection prevention program.

1. Incorporate methods for reminding patients of the need to complete the shower regimens, using electronic alert systems (i.e., text messaging, emails, voice mails).
2. Emphasize the overall benefits of the preadmission antiseptic shower.
3. Provise both oral and written instructions to patients.
4. Define a precise amount of CHG (mL) used for each shower. Double application is warranted.
5. Instruct patients to take a 60-second pause (time-out) before rinsing.
6. Tell patient to avoid application of lotions, creams, emollients or perfumes following CHG application. These products may mask or have an adverse pharmacologic effect on antimicrobial activity of the CHG, and may also heighten skin sensitivity.
7. Direct patients to wear loose-fitting garment following CHG application.
8. Advise patients to rinse-off the CHG product immediately if significant burning or itching occurs, and to report occurence to their healthcare provider.
9. Instruct patients to keep CHG from the eyes or ears, and if exposed, rinse immediately.
10. Provide the CHG product to patients.
11. Include a telephone contact for patients to call with questions or concerns.

Conclusions

- The present investigation suggests that use of an electronic alert system was highly effective in elevating skin-surface skin concentrations of CHG in patients assigned to showering twice or three times compared to non-alerted subjects ($p<0.007$).
- It is important to note that the composite mean skin surface concentration of CHG in those subjects who showered three times was essentially identical to the composite mean concentration measured in volunteers who showered twice.
- While these findings deviate from a previous study published in 2008.[10] The authors suggest that an opportunity for maximum skin surface concentration of CHG can be achieved if institutions embrace an 11-point standardized preadmission showering regimen (**Table 2**).

Final Comment

Based upon the findings of this study an electronic alert system (SMS text messaging, email or voicemail) to remind patients of the need to complete a 2 or 3 shower regimen is a valid strategy for enhancing patient compliance, empowering them to become effective partners in their own healthcare experience.

References

1. Centers for Disease Control and Prevention, National Hospital Discharge Survey: 2010 table, Procedures by selected patient characteristics - Number by procedure category and age. http://www.cdc.gov/nchs/fastats/insurg.htm. Published 2010. Accessed August 27, 2013.
2. Reed D, Kemmerly SA, Infection control and prevention: a review of hospital-acquired infections and the economic implications. The Oscher J 2009;9:27-31.
3. Shepard J, Ward W, Milstone A, Carlson T, Frederick J, Hadhazy E, Perl T. Financial impact of surgical site infections on hospital: the hospital management perspective. JAMA Surg 2013. Doi:10.1001/jamasurg.2013.2246.
4. De Lissovoy G, Fraeman K, Hutchns V, Murphy D, Song D, Vaughn BB. Surgical site infection: incidence and impact on hospital utilization and treatment costs. Am J Infect Control 2009;37:387-397.
5. Herwaldt LA, Cullen JJ, Scholz D, et al. A prospective study of outcome, healthcare resource utilization, and cost associated with postoperative nosocomial infections. Infect Control Hosp Epidemiol 2006;27:1291-1298.
6. Jakobsson J, Perlkvist A, Wann-Hansson C. Searching for evidence regarding using preoperative disinfection showers to prevent surgical site infections:a systematic review. Worldviews on Evidence-Base Nurs 2011;(3rd quarter):143-52
7. Eiselt D. Presurgical skin preparation with a novel 2% chlorhexidine gluconate cloth reduces rates of surgical site infection in orthopaedic surgical patients. OrthopNurs. 2009;28:141-145.
8. Lipke VL, Hyott AS. Reducing surgical site infections by bundling multiple risk reduction strategies and active surveillance. AORN J 2010;92:288-96.
9. Kim DH, Spencer M, Davidson SM, Li L, Shaw JD, Gulczynski D, et al. Institutional prescreening for detection and eradication of methicillin-resistant *Staphylococcus aureus* in patients undergoing elective orthopedic surgery.J Bone Joint Surg 2010;92:1820-6.
10. Edmiston CE, Krepel CJ, Seabrook GR, Lewis BD, Brown KR, Towne JB. Preoperative shower revisited: can high topical antiseptic levels be achieved on the skin surface before surgical admission? J Am Coll Surg 2008;207:233-239.

Acknowledgement

All comments in this poster presentation represent the expressed opinion, deliberation and composition of the cited authors. The study was supported in part by a grant from CareFusion, Leawood, KS (CEE). Authors CJK, SEE, MS, CL, KRB, BDL, PJR, MM and GRS have no conflicts of interest to report.