



**TITLE:** Chlorhexidine for the Prevention of Surgical Site Infections: Clinical Effectiveness and Guidelines

**DATE:** 11 February 2013

### RESEARCH QUESTIONS

1. What is the comparative clinical effectiveness of chlorhexidine versus povidone-iodine for the prevention of surgical site infections?
2. What is the clinical effectiveness of chlorhexidine-based disinfection procedures for the prevention of surgical site infections?
3. What is the clinical evidence regarding the benefits and harms of the implementation of a complete chlorhexidine environment for surgical procedures?
4. What are the evidence-based guidelines regarding the use of a complete chlorhexidine environment for surgical procedures?

### KEY MESSAGE

Seven systematic reviews, two randomized controlled trials, and six non-randomized studies were identified regarding the use of chlorhexidine for the prevention of surgical site infections. No relevant evidence-based guidelines were identified.

### METHODS

A limited literature search was conducted on key resources including Medline, Pubmed, The Cochrane Library (January 2013), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No methodological filters were applied. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 01, 2010 and January 30, 2013. Internet links were provided, where available.

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The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**RESULTS**

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines. Seven systematic reviews, two randomized controlled trials, and six non-randomized studies were identified regarding the use of chlorhexidine for the prevention of surgical site infections. No relevant evidence-based guidelines and no relevant information regarding the benefits and harms of the implementation of a complete chlorhexidine environment for surgical procedures were identified. Additional references of potential interest are provided in the appendix. This is an update of a previous CADTH report published in May, 2010: <http://www.cadth.ca/media/pdf/htis-L1/J0437%20Full%20Chlorhexidine%20Environment%20final.pdf>

**OVERALL SUMMARY OF FINDINGS**

*Chlorhexidine versus Povidone-iodine*

Evidence from two systematic reviews<sup>6,7</sup> and one non-randomized study<sup>13</sup> suggested that chlorhexidine antiseptics was more effective than iodine for the prevention of surgical site infection (SSI). The authors of one non-randomized study<sup>12</sup> found no difference between chlorhexidine and iodine antiseptic protocols for the prevention of post-cesarean SSI. Further detail is included in Table 1.

<b>Table 1: Chlorhexidine versus Povidone-Iodine Antisepsis for the Prevention of SSI</b>			
<b>Author, Year</b>	<b>Antiseptic Protocols</b>	<b>Results</b>	<b>Conclusions</b>
<i>Systematic Reviews and Meta-Analyses</i>			
Lee et al., <sup>6</sup> 2010	Preoperative chlorhexidine antiseptics vs. iodine antiseptics	In an MA of 9 RCTs, chlorhexidine antiseptics was associated with significantly fewer SSIs than the iodine protocol (adjusted risk ratio, 0.64 [95% CI [0.51-0.80]).	Authors concluded that preoperative chlorhexidine was more effective than antiseptics with iodine in preventing SSIs.
Noorani et al., <sup>7</sup> 2010	Preoperative chlorhexidine vs. povidone-iodine antiseptics prior to clean-contaminated surgeries	Results of 6 included studies found that chlorhexidine antiseptics was associated with a reduction in surgical site infections when compared with povidone-iodine (pooled odds ratio 0.68, 95 per cent confidence interval 0.50 to 0.94; P = 0.019).	Authors concluded that preoperative chlorhexidine should be used to prevent SSI.
<i>Non-Randomized Studies</i>			
Menderes et al., <sup>12</sup> 2012	Povidone-iodine vs. chlorhexidine antiseptics prior to cesarean deliveries	The rates of SSI were similar between povidone-iodine and chlorhexidine antiseptic groups (5% chlorhexidine and 5.8% povidone-iodine; P=.58).	Authors concluded that operative time, not antiseptic protocol, was a predictor of SSI.
Levin et	Chlorhexidine +	Chlorhexidine alcohol antiseptics was	Authors concluded that

Author, Year	Antiseptic Protocols	Results	Conclusions
al. <sup>13</sup> 2011	alcohol vs. povidone + iodine antisepsis prior to gynecological laparotomy	associated with a decrease in SSI from 14.6% to 4.5% vs. the povidone-iodine protocol (p=0.011).	chlorhexidine antisepsis was significantly more effective at preventing SSI.

CI = confidence interval; MA = meta-analysis; RCT = randomized controlled trial; SR = systematic review; SSI = surgical site infection; vs. = versus

*Chlorhexidine versus Other Protocols*

Two of the included systematic reviews<sup>1,5</sup> examined the use of preoperative chlorhexidine bathing versus other bathing or no bathing protocols, and did not find a benefit to the use of chlorhexidine for the prevention of SSIs.

When antisepsis with chlorhexidine gluconate (CHG) impregnated cloths was compared to standard protocols prior to surgery, the CHG protocol was found to be effective in preventing SSIs.<sup>2,9-11,14,15</sup> Though the included systematic review did not specify when the CHG protocol occurred,<sup>2</sup> the RCT<sup>9</sup> and non-randomized studies<sup>10,11,14,15</sup> specified that it occurred at home, prior to hospital admission for shoulder,<sup>9</sup> knee,<sup>10,14</sup> and hip<sup>11,15</sup> surgeries.

Authors of one systematic review comparing chlorhexidine-alcohol solutions with aqueous preparations or other alcohol compounds found chlorhexidine-alcohol solutions to be more effective than aqueous solutions, but similar to other alcohol compounds for the prevention of SSI.<sup>4</sup> Additionally, one of the included systematic reviews examined comparative studies to determine the clinical effectiveness of various preoperative skin antiseptic preparations and techniques without mentioning chlorhexidine specifically in the abstract.<sup>3</sup> While they concluded that antiseptic bathing was effective at reducing SSIs and that the method of antiseptic application was not an important factor in infection prevention, they also stated that it was difficult to separate the effects of the active antiseptic ingredient due to the fact that they are often used in combination with water or alcohol.

The only included study to examine the use of chlorhexidine hand scrub solutions for operating room staff, found that waterless CHG hand scrub was as effective as traditional scrub preparations in preventing SSI.<sup>8</sup> No further information regarding the implementation of a chlorhexidine surgical environment was identified.

Additional detail regarding the included studies examining chlorhexidine versus other antiseptic protocols is included in Table 2.

Author, Year	Antiseptic Protocols	Results	Conclusions
<i>Systematic Reviews and Meta-Analyses</i>			
Chlebicki et. al, <sup>1</sup> 2012	Whole body preoperative chlorhexidine bathing vs. placebo or no bath	16 trials were identified 6.8% of patients in the chlorhexidine group and 7.2% in comparator groups developed SSIs.	Authors concluded that there was no benefit to whole-body preoperative chlorhexidine bathing, however they suggested

**Table 2: Chlorhexidine versus Other Antiseptic Protocols for the Prevention of SSI**

Author, Year	Antiseptic Protocols	Results	Conclusions
		Chlorhexidine bathing did not significantly reduce the incidence of SSI.	better designed trials with specific bathing protocols in order to make definitive conclusions.
Karki & Cheng, <sup>2</sup> 2012	No-rinse CHG impregnated washcloths vs. soap and water bathing, routine advice, or no intervention	5 of the included studies examined the impact of the antiseptic regime on SSI.  RR of CHG washcloth vs. a comparator: 0.29 (95% CI: 0.17-0.49).	Authors concluded that antiseptics with a no-rinse CHG washcloth significantly reduced the incidence of SSI.
Maiwald & Chan, <sup>4</sup> 2012	Chlorhexidine-alcohol compounds versus aqueous preparations or other alcohol compounds	Number of included studies not reported in the abstract.  Evidence suggested that chlorhexidine-alcohol solutions were more effective at preventing SSI than aqueous solutions, but was similar to other alcohol compounds.	Authors concluded that the efficacy of chlorhexidine is often based on the efficacy of chlorhexidine-alcohol solutions.
Webster & Osborne, <sup>5</sup> 2012	Showering or bathing with 4% CHG versus other protocols (including soap, placebo)	7 trials were identified.  CHG vs. placebo: RR was 0.91 (95% CI 0.80 to 1.04). RR increased to 0.95 when only high quality trials were included (95% CI 0.82 to 1.10)  Bar soap vs. CHG: RR 1.02, 95% CI 0.57 to 1.84  CHG vs. no bathing: 1 large study found CHG to be more effective (RR 0.36, 95%CI 0.17 to 0.79); 2 small studies found no difference.	Authors concluded that bathing with CHG was not more effective in preventing SSI than bathing with other products prior to surgery.
<b>Randomized Controlled Trials</b>			
Chen et al., <sup>8</sup> 2010	Waterless 1% CHG hand scrub versus traditional alcohol scrub formulation for hand washing prior to performing surgery	Incidence of SSI was not different between the two groups	Waterless CHG hand scrub for OR staff is as effective as traditional scrub preparations in preventing SSI.
Murray et al., <sup>9</sup> 2011	Home application of 2% CHG using an impregnated cloth versus a soap and water shower prior to shoulder surgery.	100 patients  No SSIs within a minimum of 2 months following surgery.	Authors concluded that CHG impregnated cloths may be useful for infection prevention.
<b>Non-Randomized Studies</b>			
Johnson et al., <sup>10</sup> 2012	Pre-admission cleansing with CHG impregnated cloths (used the evening and	2,213 patients, 478 using the CHG protocol, were examined retrospectively.  At-home CHG use was associated with	Authors concluded that the pre-admission use of CHG cloths seemed to be effective in

**Table 2: Chlorhexidine versus Other Antiseptic Protocols for the Prevention of SSI**

Author, Year	Antiseptic Protocols	Results	Conclusions
	morning before surgery) versus standard in-hospital preparation prior to knee arthroplasty.	a statistically significantly lower SSI incidence (0.6% vs. 2.2%) than the standard protocol group.	preventing SSI following knee arthroplasty.
Kapadia et al., <sup>11</sup> 2012	Pre-admission cleansing with CHG impregnated cloths versus standard in-hospital preparation prior to hip arthroplasty.	2,458 patients, 557 using the CHG protocol, were examined retrospectively.  At-home use of CHG cloths was associated with a statistically significantly lower SSI incidence (0.5% vs. 1.7%) than the standard protocol group.	Authors suggested that the pre-admission use of CHG cloths seemed to be effective in preventing SSI following hip arthroplasty.
Zywił et al., <sup>14</sup> 2011	Pre-admission cleansing with CHG impregnated cloths (used the evening and morning before surgery) versus standard in-hospital preparation prior to knee arthroplasty.	912 knee surgeries, 15% using the CGH protocol, were examined retrospectively  There was a lower incidence of SSI in the at-home CHG cloth group (0 vs. 3.0%) versus the standard protocol group.	Authors concluded that the pre-admission CGH protocol seemed to be associated with a reduction in SSIs.
Johnson et al., <sup>15</sup> 2010	Pre-admission cleansing with CHG impregnated cloths versus standard in-hospital preparation prior to hip arthroplasty.	1,134 patients, 157 were compliant with the CHG protocol, were examined retrospectively.  Non-compliant patients had SSI infection rate of 1.6%  CHG compliant patients had no SSIs	Authors concluded that an at-home CHG impregnated cloth protocol seemed to reduce the incidence of SSI following periprosthetic hip arthroplasty.

CHG = chlorhexidine gluconate; CI = confidence interval; MA = meta-analysis; OR = operating room; RCT = randomized controlled trial; RR = risk ratio; SR = systematic review; SSI = surgical site infection; vs. = versus



## REFERENCES SUMMARIZED

### Health Technology Assessments

No literature identified.

### Systematic Reviews and Meta-analyses

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### Guidelines and Recommendations

No literature identified.

### PREPARED BY:

Canadian Agency for Drugs and Technologies in Health

Tel: 1-866-898-8439

[www.cadth.ca](http://www.cadth.ca)

**APPENDIX – FURTHER INFORMATION:**

**Guidelines and Recommendations – rigour of methods unknown, or not specific to complete chlorhexidine environments**

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**Non-Randomized Studies – unclear if chlorhexidine-specific analyses are presented**

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See Ref #3 for updated version of this report.