4-033

Is Antimicrobial Closure Technology a Clinically Effective Strategy for Reducing the Risk of Surgical Site Infections (SSI): A Meta-Analysis?

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Introduction

Surgical site infections comprise 20% of all healthcare-associated infections, having a significant impact on patient morbidity, mortality and healthcare resources. Current national initiatives (SCIP) have had limited impact on improving patient outcomes, stimulating a search for adjunctive risk reduction interventions to compliment the 4 core SCIP measures. The present meta-analysis evaluates the current evidence-based literature in an attempt to validate the efficacy of antimicrobial (triclosan-coated) sutures as an effective adjunctive strategy for reducing SSI in selective surgical patient populations.

Methods

Systematic Literature Search:

The Cochrane Collaborative handbook formed the basis for this analysis, Center for Evidence-Based Medicine (CEMB) at the University of Oxford.[1]

- Systematic search to identify randomized control trials (RCT) was performed on PubMed, Embase/Medline, the Cochrane database group (Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Health Economic Evaluations Database and Database of Health Technology Assessments) and www.clinicaltrials.gov using their own search engines.
- References obtained with abstracts, keywords and notes were exported to EndNote (EndNote X5 Thompson-Reuters, Carls bad, CA, USA).
- Duplicate reference were identified using the software's default settings, and shortlists publications were screened separately by two practicing physicians, a surgeon and a healthcare epidemiologist.
- Data extraction applied to all eligible RCTs and consisted of study design, the number of patients in the triclosan-coated and non-antibacterial suture arms, or back-calculating it from overall sample size percentage per arm; recording the number of patients in the suture arms who presented with post-surgical infection or back-calculating it from the study arms sample size and the percentage of infections per arm; recording clinical characteristics to be included in the labels of the meta-analysis.

Statistical Analysis:

The measure of effect chosen in this meta-analysis was the risk ratio (RR). The meta-analysis performed a two-tailed test of the null hypothesis (H0) that triclosan-coated and non-antibacterial coated sutures present the same risk of SSI, against the alternative hypothesis (H1) that the risk is different. H0 was rejected in favor of H1 if the RR of SSI had a 95% confidence interval that did not encompass 1, and was not rejected if the confidence interval did encompass 1. The pooled RR of the meta-analysis was calculated using a random-effects model on the assumption that the available studies estimated different treatment effects (the RR) between protocols. The meta-analysis assessed the risk that the systematic search may have missed studies that were unfavorable to one arm causing a "publication bias". This was performed by visually analyzing the funnel plot of individual studies and by testing the Egger regression intercept.[2,3] The homogeneity of studies was tested in the meta-analysis using the Cochran's Q statistic which tests the null hypothesis that all studies evaluated the same effect.[4] The meta-analysis would be considered robust if the removal of no study changed the direction of the pooled effect and if its 95% confidence interval did not cross 1. The meta-analysis was performed using CMA software (Comprehensive Meta Analysis v2.2.027, Englewood, NJ, USA).

Results

- 20 relevant clinical trials were identified from peer-reviewed literature.
- Meta-analysis of SSIs in the triclosan-coated suture and non-antibacterial sutures was performed in 7 eligible RCTs which presented evidence level 1b or met criteria to be pooled with 1b.
- Random-effects model (**Figure 1**) showed a RR of 0.482 with a 95% confidence interval of 0.31 - 0.75, which indicates a statistically significant reduction in the risk of SSI when triclosan-coated sutures were compared with non-antibacterial sutures ($p = 0.0012$).
- The fixed-effects model (**Figure 2**) showed a close RR of 0.483 and a 95% confidence interval of 0.32 - 0.73 ($p = 0.0006$).
- The Cochran's Q statistic was not significant given the 10% threshold for type-I error defined in the protocol and the I^2 was less than 4.41% (<50% protocol-defined threshold). Therefore the RR estimates of the seven remaining and eligible studies were homogeneous in spite of the diversity of their settings.
- The possibility of a publication bias was graphically assessed by the funnel plot (**Figure 3**). The Egger regression intercept test demonstrated an intercept that was not significantly different from zero, which was consistent with the funnel plot.

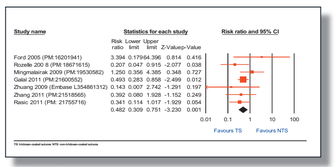

Figure 1.
Forrest Plot of Risk Ratio - Random- Effects Model

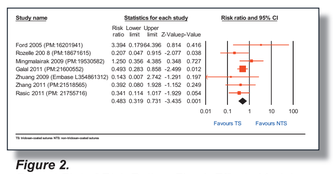

Figure 2.
Forrest Plot of Risk Ratios- Fixed- Effects Model

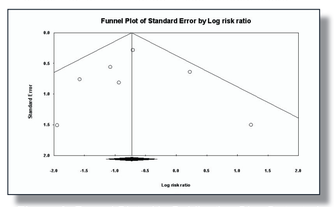

Figure 3. *Funnel Plot - No Publication Bias Detected*

Conclusion

- The results of this meta-analysis document that the null hypothesis (H0: use of triclosan-coated sutures have a similar risk of SSI than non-antibacterial sutures) can be rejected. The alternative hypothesis (H1: use of triclosan-coated sutures have a reduced risk of post-surgical infection than non-antibacterial sutures) can be accepted.
- The risk of SSI was significantly lower in patients treated with triclosan-coated polyglactin sutures compared to patient who received non-antibacterial suture technology (risk ratio: 0.482, 95% confidence interval of 0.31 - 0.75).
- The evidence level of this conclusion according to the CEBM rating method is 1a.
- The significance of the findings of this meta-analysis has shown that antibacterial-coated suture technology is an effective, adjunctive interventional strategy for reducing the risk of SSI within a wide variety of surgical procedures.

Evidence-Based Medicine is a Moving Target: Increasing the number of Randomized Controlled Trials (RCTs) evaluated to 9

- Two additional RCTs (Williams et al. and Baracs et al.) met the inclusion criteria defined in the protocol as well as against the eligibility criteria of the CEBM checklist.[1]
- One study compared triclosan-coated polydioxanone sutures versus non-triclosan polydioxanone sutures; another compared triclosan-coated polyglactin or poliglecaprone sutures in one arm versus identical but non-antibacterial comparators.
- The random-effects model (**Figure 4**) demonstrated a random-effects RR of 0.619, with a 95% confidence interval of 0.418 - 0.918, indicating a statistically significant reduction in the risk of SSI when triclosan-coated sutures were compared with non-antibacterial sutures ($p = 0.017$).
- A visual analysis of the funnel plot (**Figure 5**) reveals a mild asymmetry with one more study scattered on the left than on the right side with the Egger intercept test (was not statistically significant, two-tailed $p= 0.501$). These findings suggest no publication bias.
- This supplemental analysis suggests that use of triclosan-coated polyglactin sutures to reduce the risk of SSI is rated as evidence level 1a according to the CEBM classification. Evidence concerning triclosan-coated polydioxanone sutures based upon a single RCT is rated as CEBM evidence-level 1b.

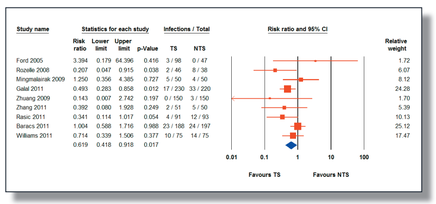

Figure 4. *Meta-Analysis, Random Effect Model*

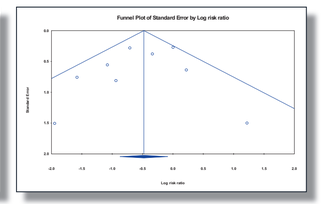

Figure 5. *Funnel Plot – No Publication Bias Detected*

Literature Cited

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Relevant Randomized Clinical Trials Included in Meta-Analysis

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- Rozzelle CJ, et al. Antimicrobial suture wound closure for cerebrospinal fluid shunt surgery: a prospective, double-blinded, randomized controlled trial. J Neurosurg Pediatr 2008;2:111-117.

Supplemental Publications

- Williams N, et al. Randomized trial of antimicrobial-coated sutures to prevent surgical site infection after breast cancer surgery. Surg Infect 2011;12:469-474.
- Baracs J, et al. Surgical site infections after abdominal closure in colorectal surgery using triclosan-coated absorbable suture (PDS Plus) vs. uncoated sutures (PDS II): a randomized multicenter study. Surg Infect 2011;12:483-489.