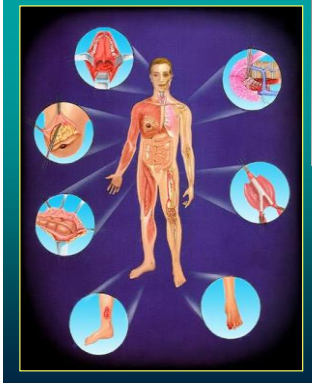

Reducing the Risk of Surgical Site Infections Using Evidence-Based Interventions: Are We Really Improving Outcomes in the Post-SCIP Era?

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MEDICAL COLLEGE OF WISCONSIN

1

Disclaimer – Caveat

"I DON'T HAVE ALL OF THE ANSWERS"

Surgical Site Infections Often Represent a Complex and Multifactorial Process - the Mechanistic Etiology or the Search for Resolution May be Quite Elusive – Therefore, Risk Reduction is an Evolutionary Process

2

First a Little History Lesson

The "Good Old Days" in the Operating Room

3

Studies in Aseptic Technique

George Emerson Brewer, M.D.
JAMA April 24, 1915

- Clean operative wound infection rate

1895	39.0%
(…would bring the profession in disrepute)	
1897	7.0%
1899	3.2%
1912	2.4%
1913	1.6%

4

Cubs clean sweep

Changes coming for reeling Sox SPORTS

METRO JON HILKEVITCH'S GETTING AROUND

Fuel-saving idea for CTA

ITT design converts diesel buses into hybrids

Chicago Tribune

Monday June 25, 2007

EDITOR'S NOTE

Tom Skilling is back: on the back

Staph infections rampant

Study: 1.2 million hospital patients at risk

By Judith Graham

MRSA infections

PREVIOUS ESTIMATE

126,000 annually

NEW ESTIMATE

5

Goal of the Surgical Care Improvement Project (SCIP)

Reduce preventable surgical morbidity and mortality by 25% by the year 2010

6

GUIDELINE FOR PREVENTION OF SURGICAL SITE INFECTION, 1999

Mitigating Risk - Surgical Care Improvement Project (SCIP) – An Evidence-Based "Bundle" Approach

- Timely and appropriate antimicrobial prophylaxis
- Glycemic control in cardiac and vascular surgery
- Appropriate hair removal
- Normothermia in general surgical patients
- Did we reduce preventable surgical morbidity and mortality by 25% by the year 2010?

Is this the Holy Grail?

7

Does the Process Improve the Outcome?

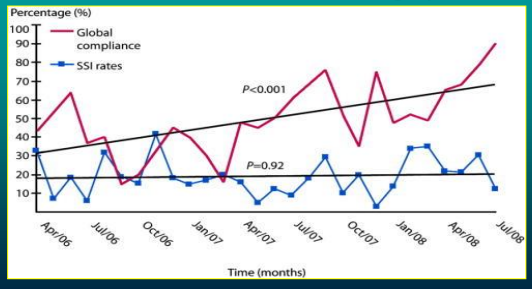
Association of Surgical Care Improvement Project Infection-Related Process Measure Compliance with Risk-Adjusted Outcomes: Implications for Quality Measurement

The author's analysis suggest that, "…there was little or no association between compliance with most SCIP infection-related process measures and ACS NSQIP risk-adjusted outcome…….with the exception of administration of the appropriate antibiotic (SCIP-2)."

Ingraham et al. J Am Coll Surg 2010;211:705-711

8

An Increase in Compliance With the Surgical Care Improvement Project Measures Does Not Prevent Surgical Site Infection in Colorectal Surgery



Pastor et al. Diseases of the Colon & Rectum 2010; 53:24-30

9

Surgical Site Infection Prevention

Time to Move Beyond the Surgical Care Improvement Program

Mary T. Hawn, MD, MPH,† Catherine C. Vick, MS,* Joshua Richman, MD, PhD,*† William Holman, MD,*† Rhiannon J. Deierhoi, MPH,* Laura A. Graham, MPH,* William G. Henderson, MPH, PhD,‡ and Kamal M.F. Itani, MD§*

Results: There were 60,853 surgeries at 112 VA hospitals analyzed. SCIP adherence ranged from 75% for normothermia to 99% for hair removal and all significantly improved over the study period ($P < 0.001$). Surgical site infection occurred after 6.2% of surgeries (1.6% for orthopedic surgeries to 11.3% for colorectal surgeries). None of the 5 SCIP measures were significantly associated with lower odds of SSI after adjusting for variables known to predict SSI and procedure type. Year was not associated with SSI ($P = 0.71$). Hospital SCIP performance was not correlated with hospital SSI rates ($r = -0.06$, $P = 0.54$).

Conclusions: Adherence to SCIP measures improved whereas risk-adjusted SSI rates remained stable. SCIP adherence was neither associated with a lower SSI rate at the patient level, nor associated with hospital SSI rates. Policies regarding continued SCIP measurement and reporting should be reassessed.

(*Ann Surg* 2011;254:494–501)

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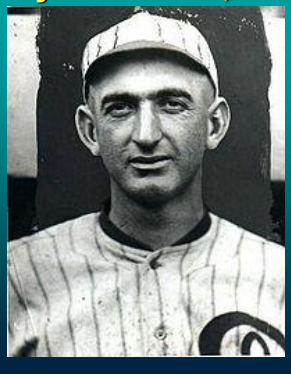
Say It Ain't So, Joe



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Reducing the Risk of Surgical Site Infections: Did We Really Think SCIP Was Going to Lead Us to the Promised Land?

Charles E. Edmiston, Jr.,[1,2] Maureen Spencer,[2] Brian D. Lewis,[2] Kellie R. Brown,[2] Peter J. Rossi,[2] Cindy R. Hanan,[2] Heidi W. Smith,[2] and Gary R. Seabrook[2]

Abstract

Background: Surgical site infections (SSIs) are associated with substantial patient morbidity and death. It is estimated that 750,000–1 million SSIs occur in the U.S. each year, utilizing 5.7 million extra hospital days and costing more than $1.6 billion in excess hospital charges.

Method: Review of pertinent English-language literature.

Results: The Surgical Care Improvement Project (SCIP) was embraced as a "one-size-fits-all" strategy to reduce postoperative infectious morbidity 25% by 2010. Unfortunately, the evidence suggests that SCIP by itself has had little efficacy in reducing the overall risk of SSI. Whereas the SCIP initiative represents a first national effort to focus on reducing postoperative infectious morbidity and deaths, it fails to consider salient risk factors such as body mass index and selected surgical practices, including tourniquet application prior to incision.

Conclusion: Rather than focus on a single risk-reduction strategy, future efforts to improve surgical outcomes should embrace a "SCIP-plus" multi-faceted, tiered interventional strategy that includes pre-admission antiseptic showering, state-of-the-art skin antisepsis, innovative antimicrobial technology, active staphylococcal surveillance, and pharmacologic-physiologic considerations unique to selective patient populations.

Nationalizing Risk Reduction—The SCIP Mandate

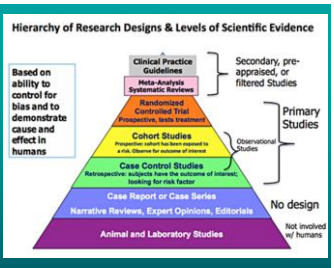
TRADITIONALLY, THE THREE CORNERSTONES viewed as essential for reducing the risk of postoperative surgical site infection (SSI) were exquisite surgical technique, timely and appropriate antimicrobial prophylaxis, and peri-operative skin antisepsis. However, recognition of the influence of certain patient co-morbidities has required additional considerations. It is estimated that 750,000–1 million SSIs occur yearly, resulting in an additional 2.5 million hospital days at a cost exceeding $1 billion [1,2].

The Surgical Care Improvement Project (SCIP), developed by the Centers for Medicare and Medicaid Services and implemented in 2006, was designed as an evidence-based initiative to be applied broadly across selected surgical services, with a stated goal of reducing morbidity and mortality rates 25% by the year 2010 [3]. The specific infection prevention measures are improvements in antimicrobial prophylaxis that involve timing, choice of agent, and discontinuation within 24 h; appropriate hair removal (clipping rather than shaving); normalizing core body temperature within a defined time in colorectal procedures; and glycemic control in cardiac patients, which has been translated in most institutions to include the development of tight glycemic control protocols.

Implementation of the SCIP initiative required a multidisciplinary approach to achieve 95% compliance with each core process measure. Failure to achieve a national benchmark goal results in a punitive reduction in CMS reimbursement (2%), which corresponds to a "pay-for-performance" carrot-and-stick approach to improving patient outcomes. The original SCIP normothermia process measure has been expanded to include patients other than those having colorectal surgery.

Edmiston et al. Surgical Infection 2011;12:169-177

12



"The practice of evidence-based medicine means integrating individual clinical expertise with the best external evidence from systematic reviews."

Sackett et al. Evidence-based medicine: what it is and what it isn't. BMJ 1996;312:71-72

13

"Healthcare institutions, professionals, and perhaps surgeons in particular tend to believe that their care and outcomes are better than they actually are."

Olle Ljungqvist, MD, PhD; Michael Scott, MD; Kenneth C. Fearon, MD, PhD
'Enhanced Recovery After Surgery. JAMA Surg. 2017;152(3):292-298

14

A Recent Experience Documenting That Our Efforts at Risk-Reduction Are Far From Perfect

The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infections in Patients Undergoing Colon Surgeries

15

Institutional Evidence-Based (Standard of Care)

Studied Components from Guidelines	Abbreviation	Where published*
Administering a weight-dependent dose of preoperative intravenous (IV) antimicrobial agents	IV Antibiotics	WHO, ACS, CDC
Using triclosan-coated sutures at the deep layer, organ layer and superficial layer	Triclosan Sutures	WHO, ACS, CDC
Controlling a patient's blood glucose at or below 200 mg/dl perioperatively	Blood glucose	WHO, ACS, CDC
Maintaining the patient's body temperature above 36.5 degrees Celsius once under care	Body temp	ACS, CDC
Putting a patient on oxygenation from preoperative period until at least 2 hours after waking in the post-operative period (delivered at a minimal with nasal cannula at 3 L)	Oxygenation	WHO, ACS, CDC
Prepping skin with: 2% CHG/70% isopropyl alcohol (ChloraPrep); or 4% aqueous CHG –(generic); or Aqueous iodophor (betadine); or Alcohol/iodophor – (Durapreo) or PCMX	Skin prep	WHO, ACS, CDC
Ordering mechanical bowel prep and antibiotics before surgery	MBP + oral ATBs	WHO, ACS

* World Health Organization (WHO), American College of Surgeons (ACS), Centers for Disease Control and Prevention (CDC)

Documented Compliance to Evidence - Based Mitigation Strategies

		Component Met							
	Total number of observed cases	Skin Prep	IV Antibiotics	Triclosan Sutures	Blood glucose ☹	Body temp ☹	Order pre-op MBP + oral ATBs ☹	Oxygenation ☹
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Site 1	319	319 (100)	305 (95.6)	176 (55.2)	263 (82.4)	40 (12.5)	122 (38.2)	3 (0.9)
Site 2	277	274 (99.6)	277 (100)	277 (100)	243 (87.7)	171 (61.7)	18 (6.5)	61 (22.0)
Site 3	262	261 (99.6)	253 (96.6)	212 (80.9)	49 (18.7)	30 (12.9)	18 (6.9)	16 (6.1)
Aggregate Sum	858 ☹	856 (99.8)	835 (97.3)	650 (75.8)	555 (64.9)	443 (51.6)	158 (18.4)	80 (9.3)

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Perceived Reason for Non-Compliant Behavior – Lack of Documentation or Lack of Data

17

Three Observations for Improving Efforts in Surgical Quality Improvement

"The finding of a recent internal review conducted of twenty-nine hospital site visits by the American College of Surgeons (ACS) found that most sites prioritized the need for more data over more improvement efforts, even when extensive data collection was already in place."

Ko CY et al, JAMA Surgery 2022 Sept 7, doi: 10.1001/jamasurg.2022.3122

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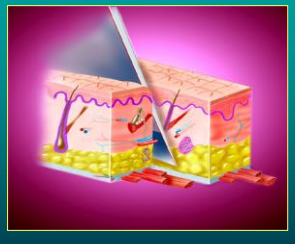
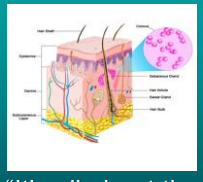
The Baseline Risk For All Patients Occurs At The Moment Of Incision





"It's all about the surgical wound"

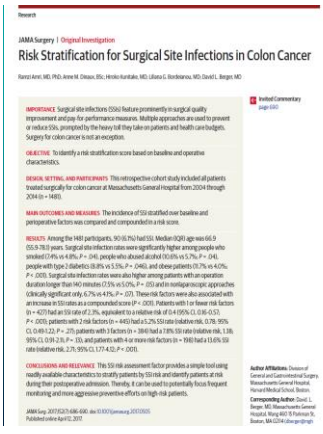
"….all surgical wounds are contaminated to some degree at closure – the primary determinant of whether the contamination is established as a clinical infection is related to host (wound) defense"

Belda et al., JAMA 2005;294:2035-2042

19

Lets Take a Deep Dive: Do We Really Need a Surgical Care Bundle to Reduce the Risk of Infection?

20



JAMA Surgery | Original Investigation

Risk Stratification for Surgical Site Infections in Colon Cancer

Risk Stratification

- Patient who smoked (7.4% vs 4.8%; *p = 0.04*)
- Patients who abused alcohol (10.6% vs 5.7%; *p = 0.04*)
- Patients with type 2 diabetics (8.8% vs 5.5%; *p = 0.046*)
- Obese patients (11.7% vs 4.0%; *p< 0.001*)
- Surgical site infection rates higher Operation duration longer than 140 minutes (7.5% vs 5.0%; *p= 0.05*)

These risk factors were also associated with an increase in SSI rates as a compounded score (*P < 0.001*).

- Patients with 1 or fewer risk factors (n = 427) - SSI rate of 2.3%
- Patients with 2 risk factors (n = 445) – SSI rate 5.2%
- Patients with 3 factors (n = 384) had a 7.8% SSI rate
- Patients with 4 or more risk factors (n = 198) > 13.5%

JAMA Surg 2017;152:686-690

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ORIGINAL CONTRIBUTION

Assessment of the Risk and Economic Burden of Surgical Site Infection Following Colorectal Surgery Using a US Longitudinal Database: Is There a Role for Innovative Antimicrobial Wound Closure Technology to Reduce the Risk of Infection?

Colorectal IBM MarketScan® Longitudinal Study (2014-2018)

- Infection Rate (107,665 Colorectal Patients): 23.9%
- 50% of infections diagnosed at 3-25 days while 75% of infections diagnosed by 2 months
- CDC-NHSN & ACS-NSQIP closes the books on colorectal surveillance at 30-days
- At 12-months "real-world" costs ranged from:
  - $36,429 - $144,809 – Commercial Payers
  - $17,551 - $102,280 – Medicare

Leaper et al. Dis Colon Rectum 2020;63:1628-1638

22

ARTICLE IN PRESS

Surgery

Assessment of risk and economic burden of surgical site infection (SSI) posthysterectomy using a U.S. longitudinal database

Previous Baseline Considerations for the Hysterectomy Patient Population

After CS – 2nd most common procedure in women of reproductive age in US.

SSI – Most common reason for unplanned readmission – Triples readmission rates and doubles total cost of care – Adds a minimum of 5K to the average cost of hysterectomy.

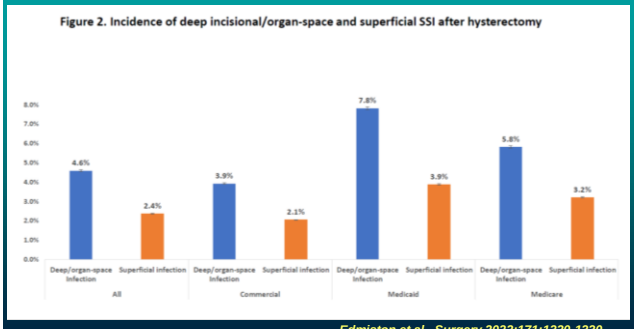
SSI rates after abdominal hysterectomy used as a metric to rank hospitals and assess financial penalties (CMS).

Previously published infection rates reported as 1%-4% - representing 6,000 to 24,000 SSIs annually in US.

Edmiston et al., Surgery 2022;171:1320-1330

23

Assessment of Risk and Economic Burden of Surgical Site Infection Post Hysterectomy (141,869) Using a US Longitudinal Database



Edmiston et al., Surgery 2022;171:1320-1330

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American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Impact of patient comorbidities on surgical site infection within 90 days of primary and revision joint (hip and knee) replacement

Charles E. Edmiston Jr., PhD[a], Abhishek S. Chitnis MPharm, PhD[b,c], Jason Lerner PT, MBA, MSc[c], Eloise Folly MPH[b], Chantal E. Holy PhD[b], David Leaper DSc, MD, ChM, FRCS, FACS, FLS[d]

IBM MarketScan Analysis of 498,681 Orthopedic Patients

2009 – 2015 Observational Cohort

- - 335,134 – TKR
  - 14,488 – rTKR (revision)
  - 163,547 – THR
  - 11,791 – rTHR (revision)

  - TKR – 2.2% Infection rate
  - rTKR – 15.6% " "
  - THR – 2.1% " "
  - rTHR – 8.6% " "

We found 34 comorbid risk factors
Baseline Cost - superficial/deep/ device-related: $10k to >100K
"..prevention is always better than the cost of resolving the problem.."

American Journal of Infection Control 47 (2019) 1225–1232

25

A More Than a Typical Scenario – What is the True Risk of Infection?

High Risk Patient:

- Immunosuppressive meds - RA
- Diabetes
- Advanced age
- Prior surgery to same joint
- Psoriasis
- Malnourished
  - morbid obesity
  - sAlb<35
  - low sTransferrin
- Remote sites of infection
- Smokers
- ASA = 4

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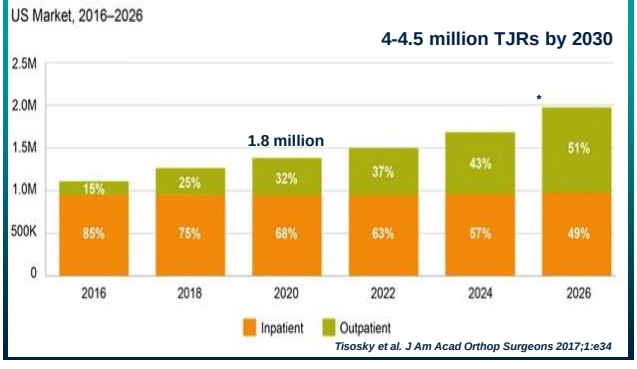
Projected Trends and it is not Pretty



Tisosky et al. J Am Acad Orthop Surgeons 2017;1:e34

27

4-4.5 Million Total Joint Implantations per Year by 2030 – Assuming a 2.18% Infection Rate Translates into ~80,000-90,000 PJI

Baseline - Conservative estimate ~$100,000 = 8-9 Billion US healthcare system

- Overall lifetime cost for a single case of a septic THA (age 65) using a one-way sensitivity analysis of $390,806 per patient.
- PJI is associated with a mortality rate of between 2 – 7%.
- Experts report that the five-year survival rate of patients with PJI is worse than with most cancers.

Parisi TJ, et al. Clin Orthop Relat Res. 2017;475:1891
Edmiston et al, AJIC 2019;37:1225
Kurtz et al. J Arthroplasty 2012;27:61-64

28

ORIGINAL ARTICLE

Postoperative Surgical Site Infections

Understanding the Discordance Between Surveillance Systems

Mariam N. Ali-Mucheru, MD,* Maria P. Sevilla, MD,† Vickie Milton, BSA,‡ Priya Sampathkumar, MD,* and David A. Rizzo, MD, MSHS*†

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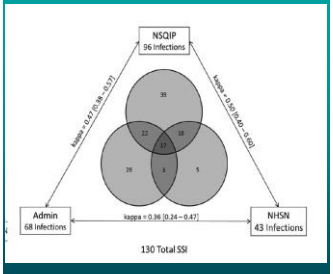

NHSN, NSQIP and Administrative chart review found concordance in 17/130 (13.1%) surgical site infections.

Mariam N et al. Ann Surg 2020;271:94

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What Evidence Exist to Document the Benefits of a Surgical Care Bundle?

30

Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery

Seth A. Waits, MD,* Danielle Fritze, MD,* Mousumi Banerjee, PhD,†‡ Wenxing Zhang, MA,* James Kabus, MS,* Michael J. Englesbe, MD,* Darrell A. Campbell, Jr, MD,* and Samantha Hendren, MD, MPH*

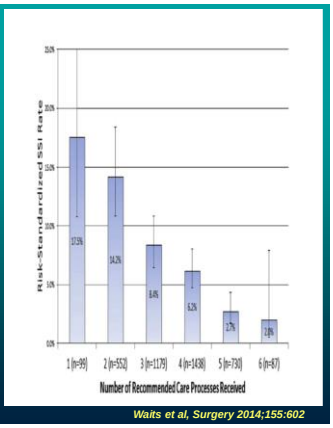
Background. Surgical site infection (SSI) remains a costly and morbid complication after colectomy. The primary objective of this study was to investigate whether a group of perioperative care measures previously shown to be associated with reduced SSI would have an additive effect in SSI reduction. If so, this would support the use of an "SSI prevention bundle" as a quality improvement intervention.

Methods. Data from 24 hospitals participating in the Michigan Surgical Quality Collaborative were included in the study. The main outcome measure was SSI. Hierarchical logistic regression was used to account for clustering of patients within hospitals.

Results. In total, 4,085 operations fulfilled inclusion criteria for the study (Current Procedural Terminology codes 44140, 44160, 44204, and 44205). A "bundle score" was assigned to each operation, based on the number of perioperative care measures followed (chlorhexidine Surgical Care Improvement Project 2 antibiotics, postoperative normothermia, oral antibiotics with bowel preparation, perioperative glycemic control, minimally invasive surgery, and short operative duration). There was a strong stepwise inverse association between bundle score and incidence of SSI. Patients who received all 6 bundle elements had risk-adjusted SSI rates of 2.0% (95% confidence interval [CI], 2.9–6.5%), whereas patients who received only 1 bundle measure had SSI rates of 17.5% (95% CI, 22.1–10.8%).

Conclusion. This multi-institutional study shows that patients who received all 6 perioperative care measures attained a very low, risk-adjusted SSI rate of 2.0%. These results suggest the promise of an SSI reduction intervention for quality improvement; however, prospective research are required to confirm this finding. (Surgery 2014;155:602.e.)

From the Departments of Surgery* and Biostatistics,† University of Michigan, Ann Arbor, MI



Waits et al, Surgery 2014;155:602

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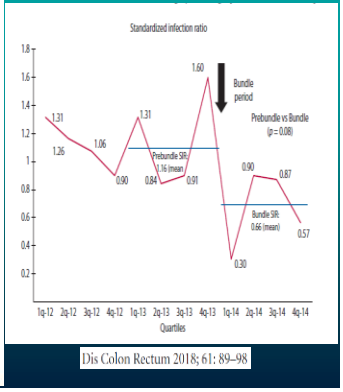
ORIGINAL CONTRIBUTION

An Effective Bundled Approach Reduces Surgical Site Infections in a High-Outlier Colorectal Unit

Emre Gorgun, M.D.,[1] Ahmet Rencuzogullari, M.D., F.T.R.S.,[1] Volkan Ozben, M.D., F.T.R.S.,[1] Luca Stocchi, M.D.,[1] Thomas Fraser, M.D.,[2,3] Cigdem Benlice, M.D.,[1] Tracy Hull, M.D.[1]

1 Department of Colorectal Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio
2 Department of Infection Disease, Cleveland Clinic, Cleveland, Ohio
3 Department of Quality, Quality & Patient Safety Institute, Cleveland Clinic, Cleveland, Ohio



Dis Colon Rectum 2018; 61: 89–98

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Consensus Statement

Consensus Bundle on Prevention of Surgical Site Infections After Major Gynecologic Surgery

Joseph E. Pellegrini, MD, CDCA, Paloma Toledo, MD, MPH, David E. Soper, MD, William C. Bradford, DO, Deborah A. Cruz, MSN, RNC, Barbara S. Levy, MD, and Lauren A. Lentnek, BS

Key Steps to Improving Surgical Outcomes in Gynecologic Surgery

- Readiness (Every Case) – **Establish standardized preoperative care protocols**
- Recognition and Prevention (Every Patient) – **Preoperative assessment of patient risk factors**
- Response (Every Case) – **Evidence-based mitigation of risk factors**
- Reporting and Systems Learning (Every Facility) – **Monitor outcomes and process metrics (standardize)**

Pellegrini et al. Obstet Gynecol 2017;129:50

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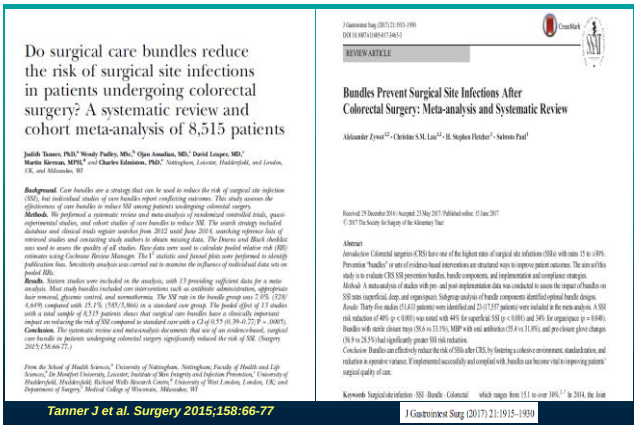

Do surgical care bundles reduce the risk of surgical site infections in patients undergoing colorectal surgery? A systematic review and cohort meta-analysis of 8,515 patients

REVIEW ARTICLE

Bundles Prevent Surgical Site Infections After Colorectal Surgery: Meta-analysis and Systematic Review

Tanner J et al. Surgery 2015;158:66-77

J Gastrointest Surg (2017) 21:1915–1930

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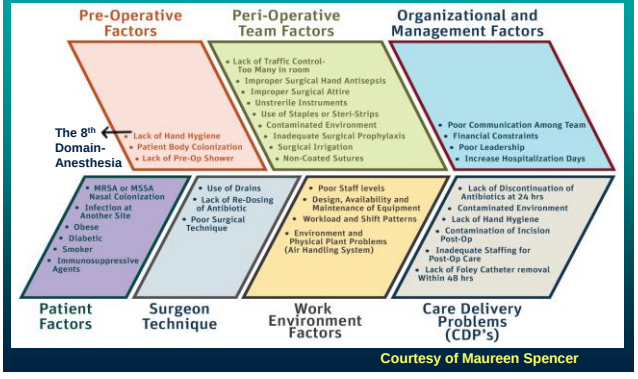
Risk is a Myriad of Events - SSI Fishbone Diagram



Courtesy of Maureen Spencer

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Are SSI Prevention Guidelines Helpful – A Mechanistic Basis?

36

Comparative Analysis of SSI Prevention Guidelines

INTERVENTION	WHO Guidelines	CDC Guidelines	ACS Guidelines	WISCONSIN SSI Prevention
Normothermia ★	Maintain normothermia	Maintain normothermia	Maintain normothermia	Maintain normothermia – 30-min prewarming reduces incidence of SSI = 1A
Wound Irrigation	No recommendation	Intraoperative irrigation recommended - povidone iodine	No recommendation	Recommend – 0.05% CHG (Professional Expertise)
Antimicrobial Prophylaxis ★	Short durational	Short durational	Short durational	Short durational – Follow ASHP weight-based dosing = 1A
Glycemic Control ★	Recommended	Recommended – No recommendation for HA1c	Highly beneficial	Highly beneficial HbA1c ≤7 (≤154) ≤8 (<183) = 1A
Perioperative Oxygenation	Recommended	Administer increased FIO_2 during surgery and immediate postop period	Recommended	Recommended – Strongest (High – 1A) for colorectal surgery
Preadmission Showers ★	Advised patients to bathe or shower with soap	Advise patients to bathe or shower with soap or antiseptic agent –at least night before surgery	Advise patients to shower with CHG	Two standardized shower/cleansing with 4% or 2% CHG night before/morning (High)
Antimicrobial Sutures ★	Use antimicrobial sutures independent of type of surgery	Consider use of triclosan-coated sutures for prevention of SSI	Recommended for clean and clean-contaminated, abdominal procedures and contaminated procedures	The use of triclosan represents = 1A clinical evidence – fascial and subcuticular closure

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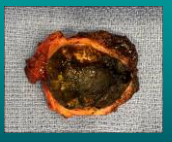
Normothermia – Always?



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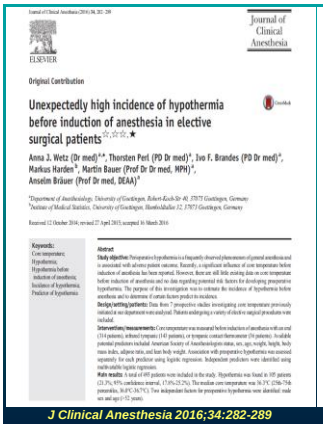

Journal of Clinical Anesthesia

Original Contribution

Unexpectedly high incidence of hypothermia before induction of anesthesia in elective surgical patients☆,☆☆,★

Anna J. Wetz (Dr med)[a,*], Thorsten Perl (PD Dr med)[a], Ivo F. Brandes (PD Dr med)[a], Markus Harden[b], Martin Bauer (Prof Dr Dr med, MPH)[a], Anselm Bräuer (Prof Dr med, BEAA)[a]

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Received 12 October 2016; revised 27 April 2015; accepted 16 March 2016

Keywords: Core temperature; Hypothermia; Hypothermia before induction of anesthesia; Incidence of hypothermia; Predictor of hypothermia

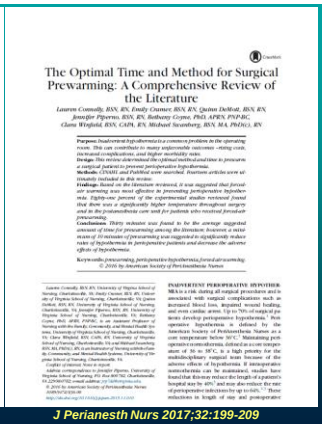
Abstract

Study objective: Perioperative hypothermia is a frequently observed phenomenon of general anesthesia and is associated with adverse patient outcomes. Recently, a significant influence of core temperature before induction of anesthesia has been reported. However, there are still little existing data on core temperature before induction of anesthesia and no data regarding potential risk factors for developing preoperative hypothermia. The purpose of this investigation was to estimate the incidence of hypothermia before anesthesia and to determine if certain factors predict its incidence.

Design, setting, patients: Data from 7 prospective studies investigating core temperature previously extracted in our department were analyzed. Patients undergoing a variety of elective surgical procedures were included.

Interventions/measurements: Core temperature was measured before induction of anesthesia with an oral (134 patients), infrared tympanic (145 patients), or tympanic contact thermometer (56 patients). Available potential predictors included American Society of Anesthesiologists status, sex, age, weight, height, body mass index, adipose ratio, and lean body weight. Association with preoperative hypothermia was assessed separately for each predictor using logistic regression. Independent predictors were identified using multivariable logistic regression.

Main results: A total of 405 patients were included in the study. Hypothermia was found in 105 patients (21.3%; 95% confidence interval, 17.6%-25.2%). The median core temperature was 36.3°C (25th-75th percentiles, 36.0°C-36.7°C). Two independent factors for preoperative hypothermia were identified: male sex and age (>52 years).



The Optimal Time and Method for Surgical Prewarming: A Comprehensive Review of the Literature

Laurann Connolly, BSN, RN, Emily Cramer, BSN, RN, Quinn DeMott, BSN, RN, Jennifer Piperno, BSN, RN, Bethaney Coyne, PhD, APRN, PNP-BC, Claire Wingfield, BSN, CAPA, RN, Michael Swanberg, BSN, MA, PhD(c), RN

Purpose: Inadvertent hypothermia is a common problem in the operating room. This can contribute to many unfavorable outcomes—rising costs, increased complications, and higher mortality rates.

Design: Comprehensive review of the literature was conducted time to prewarm a surgical patient to prevent perioperative hypothermia.

Methods: CINAHL and PubMed were searched. Fourteen articles were ultimately included in this review.

Findings: Based on the literature reviewed, it was suggested that forced-air warming was most effective in preventing perioperative hypothermia. Eighty-one percent of the experimental studies reviewed found that there was a significantly higher temperatures throughout surgery and in the postanesthesia care unit for patients who received forced-air warming.

Conclusions: Thirty minutes was found to be the average suggested amount of time for prewarming among the literature; however, a minimum of 10 minutes of prewarming was suggested to significantly reduce rates of hypothermia in perioperative patients and decrease the adverse effects of hypothermia.

Keywords: prewarming; perioperative hypothermia; forced air warming

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INADVERTENT PERIOPERATIVE HYPOTHERMIA is a risk during all surgical procedures and is associated with surgical complications such as increased blood loss, impaired wound healing, and even cardiac arrest. Up to 70% of surgical patients develop perioperative hypothermia.[1] Perioperative hypothermia is defined by the American Society of PeriAnesthesia Nurses as a core temperature below 36°C.[2] Maintaining perioperative normothermia, defined as a core temperature of 36 to 38°C, is a high priority for the multidisciplinary surgical team because of the adverse effects of hypothermia. If intraoperative hypothermia is avoided, studies have found that it may also reduce the length of a patient's hospital stay by 40%[3] and may also reduce the rate of perioperative infections by up to 60%.[4,5] These reductions in length of stay and postoperative

J Clinical Anesthesia 2016;34:282-289 | J Perianesth Nurs 2017;32:199-209

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Aggressive intraoperative warming versus routine thermal management during non-cardiac surgery (PROTECT): a multicentre, parallel group, superiority trial

Summary

Background Moderate intraoperative hypothermia promotes myocardial injury, surgical site infections, and blood loss. Whether aggressive warming to a risk normothermia temperature near 37°C improves outcomes remains unknown. We aimed to test the hypothesis that aggressive intraoperative warming reduces major perioperative complications.

Methods In this multicentre, parallel group, superiority trial, patients at 12 sites in China and at the Cleveland Clinic in the USA were randomly assigned (1:1) to receive either aggressive warming to a target core temperature of 37°C (aggressive-warmed group) or routine thermal management to a target of 35-37°C (routine thermal management group) during non-cardiac surgery. Randomisation was stratified in site, with computer-generated, randomly sized blocks. Eligible patients aged ≥65 years) had at least one cardiovascular risk factor, were scheduled for inpatient non-cardiac surgery expected to last 2–6 h with general anaesthesia, and were expected to have at least half of the anticipated skin surface available for warming. Patients requiring dialysis and those with a body-mass index exceeding 30 kg/m² were excluded. The primary outcome was a composite of myocardial injury (troponin elevation, epicenetic ischaemic origin), non-fatal cardiac arrest, and all-cause mortality within 30 days of surgery, as assessed in the modified intention-to-treat population. This study is registered with ClinicalTrials.gov, NCT01110375.

Findings Between March 27, 2007, and March 16, 2012, 5056 participants were enrolled, of whom 1903 were included in the intention-to-treat population (1507 in the aggressively warmed group and 2536 in the routine thermal management group). Patients assigned to aggressive warming had a mean final intraoperative core temperature of 37.3°C (SD 0·4) whereas the routine thermal management group averaged 35·4°C (SD 0·5), at least one of the primary outcome components (myocardial injury after non-cardiac surgery, cardiac arrest, or mortality) occurred in 246 (9·9%) of 2497 patients in the aggressively warmed group and in 259 (9·6%) of 2696 patients in the routine thermal management group. The common effect relative risk of aggressive versus routine thermal management was an estimated 1·04 (95% CI 0·87–1·24, p=0·69). There were 29 adverse events in patients assigned to aggressive warming (17 of which were serious) and 34 in those assigned to routine thermal management (30 of which were serious). One serious adverse event, in an aggressively warmed patient, was deemed to be possibly related to thermal management.

Interpretation The incidence of a 30-day composite of major cardiovascular outcomes did not differ significantly in patients randomised to 35·5°C and to 37°C. At least over a 1·5°C range from very mild hypothermia to full normothermia, there was no evidence that any substantive outcome varied. Keeping core temperatures at least 35·5°C in surgical patients appears sufficient.

Funding Bill and the Health and Medical Research Fund, Food and Health Bureau, Hong Kong.

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Hypothermia and Surgery:

Immunologic Mechanisms for Current Practice

Abstract

Objective—To examine cellular and immunologic mechanisms by which intraoperative hypothermia affects surgical patients.

Summary Background Data—Avoidance of perioperative hypothermia has recently become a focus of attention as an important quality performance outcome, aimed at optimizing the care of surgical patients. Anesthetized surgical patients are particularly at risk for hypothermia, which has been directly linked to the development of sepsis, such as coagulopathy, infection, cardiac myocardial events, and death after surgery. However, many of the underlying immunologic mechanisms remain unclear.

Methods—Venous blood samples from healthy volunteers were exposed for up to 4 hours to various temperatures following the addition of a 1 ng/mL lipopolysaccharide challenge. Innate immune function, assessed by the ability of monocytes to present antigen and coordinate cytokine release, was determined by qualitative and quantitative measurements of HLA-DR surface expression, Tumor Necrosis Factor-α (TNF-α) and anti-inflammatory (IL-10) cytokine release as the first 4 hours.

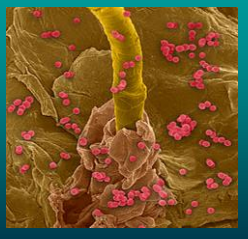
Results—Monocyte metabolism at hypothermic temperatures (34°C) reduced HLA-DR surface expression, delayed TNF-α clearance, and increased IL-10 release. Conversely, hyperthermia (40° C) increased monocyte antigen presentation and resulted in rapid decay of TNF-α. However, IL-10 release was also increased. Normothermia (37°C) attenuated IL-10 release following the initial proinflammatory surge.

Conclusion—Hypothermia exerts multiple effects at the cellular level, which impair innate immune function, and are associated with increased septic complications and mortality. These findings provide a physiological basis for perioperative temperature monitoring, which is a valid surgical performance measure that can be used to reduce surgical complications associated with avoidable hypothermia.

Lancet 2022; 399: 1799–808 | Quadan et al. Ann Surg 2009;250:130

40

Standardization of the Preadmission Shower/Cleansing Strategy



- Scalp 6.0 Log_{10} cfu/cm^2
- Axilla 5.5 Log_{10} cfu/cm^2
- Abdomen 4.3 Log_{10} cfu/cm^2
- Forearm 4.0 Log_{10} cfu/cm^2
- Hands 4.0-6.6 Log_{10} cfu/cm^2
- Perineum 7.0-11.0 Log_{10} cfu/cm^2

Surgical Microbiology Research Laboratory – Medical College of Wisconsin

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Maximizing Skin Surface Concentrations of CHG: Embracing a Standardize Process Utilizing a Phamacokinetic Perspective (Dose, Timing, Duration)


Evidence for a Standardized Preadmission Showering Regimen to Achieve Maximal Antiseptic Skin Surface Concentrations of Chlorhexidine Gluconate, 4%, in Surgical Patients

Edmiston et al. JAMA Surg 2015;150: 1027

4% Aqueous CHG

- Dose - 4-ozs. for each shower
- Timing - 1-minute pause before rinsing (4% CHG)
- Duration - TWO SHOWERS (CLEANSINGS) – NIGHT BEFORE/MORNING OF SURGERY
- An SMS, text or voicemail reminder to shower
- A standardized regimen – instructions – Oral and written

CHG conc ≥1000 µg/ml


STANDARDIZATION OF THE 4% Chlorhexidine Gluconate (CHG) PREADMISSION SHOWER

www.dhs.wisconsin.gov/publications /p0/p00749.pdf

Remember the devil is always in the details

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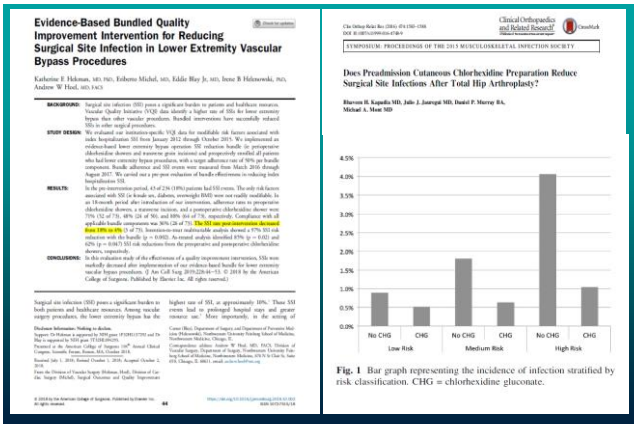
Evidence-Based Bundled Quality Improvement Intervention for Reducing Surgical Site Infection in Lower Extremity Vascular Bypass Procedures

Does Preadmission Cutaneous Chlorhexidine Preparation Reduce Surgical Site Infections After Total Hip Arthroplasty?

Fig. 1 Bar graph representing the incidence of infection stratified by risk classification. CHG = chlorhexidine gluconate.

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Antimicrobial Prophylaxis - Does BMI Increase Risk?

Perioperative Antimicrobial Prophylaxis in Higher BMI (≥30) Patients: Do We Achieve Therapeutic Levels?

Percent Therapeutic Activity of Serum / Tissue Concentrations Compared to Surgical Isolate (2002-2004) Susceptibility to Cefazolin Following 2-gm Perioperative Dose

Organisms	n	Serum	Tissues
Staphylococcus aureus	70	68.6%	27.1%
Staphylococcus epidermidis	110	34.5%	10.9%
E. coli	85	75.3%	56.4%
Klebsiella pneumoniae	55	80%	65.4%

Edmiston et al, Surgery 2004;136:738-747

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ASHP REPORT

Clinical practice guidelines for antimicrobial prophylaxis in surgery

DALE W. BRATZLER, E. PATCHEN DELLINGER, KEITH M. OLSEN, TRISH M. PERL, PAUL G. AUWAERTER, MAUREEN K. BOLON, DOUGLAS N. FISH, LENA M. NAPOLITANO, ROBERT G. SAWYER, DOUGLAS SLAIN, JAMES P. STEINBERG, AND ROBERT A. WEINSTEIN

Am J Health-Syst Pharm. 2013; 70:195–283

These guidelines were developed jointly by the American Society of Health-System Pharmacists (ASHP), the Infectious Diseases Society of America (IDSA), the Surgical Infection Society (SIS), and the Society for Healthcare Epidemiology of America (SHEA). This work represents an update to the previously published ASHP Therapeutic Guidelines on Antimicrobial Prophylaxis in Surgery,[1] as well as guidelines from IDSA and SIS.[2,3] The guidelines are intended to provide practitioners with a standardized approach to the rational, safe, and effective use of antimicrobial agents for the prevention of surgical-site infections (SSIs) based on currently available clinical evidence and emerging issues.

Prophylaxis refers to the prevention of an infection and can be characterized as primary prophylaxis, secondary prophylaxis, or eradication. Primary prophylaxis refers to the prevention of an initial infection. Secondary prophylaxis refers to the prevention of recurrence or reactivation of a preexisting infection. Eradication refers to the elimination of a colonized organism to prevent the development of an infection. These guidelines focus on primary perioperative prophylaxis.

Guidelines development and use

Members of ASHP, IDSA, SIS, and SHEA were appointed to serve on an expert panel established to ensure the validity, reliability, and utility of the revised guidelines. The work of the panel was facilitated by faculty of the University of Pittsburgh School of Pharmacy and University of Pittsburgh Medical Center Drug Use and Disease State Management Program who served as contract researchers and writers for the project. Panel members and contractors were required to disclose any possible conflicts of interest before their appointment and throughout the guideline development process. Drafted documents for each surgical procedural section were reviewed by the expert panel and, once revised, were available for public comment on the ASHP website. After additional revisions were made to address reviewer comments, the final document was

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The Mechanistic Benefit of Oral Antibiotics and Mechanical Bowel Prep

Edmiston CE et al. World Journal of Surgery 1990;14: 176–183

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The Efficacy of Oral Antimicrobials in Reducing Aerobic and Anaerobic Colonic Mucosal Flora

Jonathan I. Groner, MD; Charles E. Edmiston, Jr, PhD; Candace J. Krepel; Gordon L. Telford, MD; Robert F. Condon, MD, MS

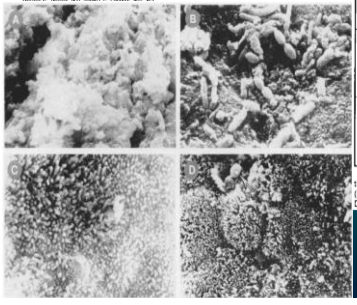

Table 1.—Quantitative Recovery of Aerobic and Anaerobic Mucosa-Associated Bacteria From Canine Colonic Segments*

Group	Microbial Recovery		
	Proximal	Midcolon	Distal
Aerobes			
A	8.6 ± 0.5	8.3 ± 0.6	8.7 ± 0.5
B	7.4 ± 1.6	6.7 ± 2.0	7.2 ± 1.7
C	5.5 ± 0.6	5.4 ± 0.8	5.7 ± 1.0
D	2.4 ± 0.7	3.1 ± 0.2	2.5 ± 1.2
Anaerobes			
A	9.5 ± 0.4	9.7 ± 0.4	9.8 ± 0.9
B	9.0 ± 0.9	8.6 ± 2.1	8.6 ± 1.6
C	8.2 ± 0.9	7.4 ± 0.7	7.4 ± 1.0
D	2.6 ± 1.0	3.0 ± 1.4	2.6 ± 1.1

*Expressed as $\log_{10}$ colony-forming units per milligram (wet weight) of tissue, mean ± SD. Group A (n = 6) received no bowel preparation; group B (n = 7), clean-liquid diet; group C (n = 8), mechanical preparation; and group D (n = 7), oral antimicrobial prophylaxis.

Groner, Edmiston, Krepel et al. Arch Surg. 1989;124:281

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ORIGINAL ARTICLE

The Role of Bowel Preparation in Colorectal Surgery

Results of the 2012–2015 ACS-NSQIP Data

Aaron L. Klinger, MD,* Heather Green, MS,* Dominique J. Monlezun, MD, PhD, MPH,† David Beck, MD,* Brian Kann, MD,* Herschel D. Vargas, MD,* Charles Whitlow, MD,* and David Margolin, MD*

Annals of Surgery • Volume 269, Number 4, April 2019

META-ANALYSIS

OPEN

The Role of Oral Antibiotic Preparation in Elective Colorectal Surgery

A Meta-analysis

Katie E. Rollins, MRCS,* Hannah Javanmard-Emamghissi, MRCS,* Austin G. Acheson, DM, FRCS,* and Dileep N. Lobo, DM, FRCS, FACS, FRCPE*†

Annals of Surgery • Volume 270, Number 1, July 2019

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Clostridium difficile disease: Diagnosis, pathogenesis, and treatment update

Lena M. Napolitano, MD, FACS, FCCP, MCCM,* and
Charles E. Edmiston, Jr, PhD, CIC FIDSA, FSHEA, FAPIC,† *Ann Arbor, MI, and Milwaukee, WI*

Clostridium difficile *infections are the leading cause of health care–associated infectious diarrhea, posing a significant risk for both medical and surgical patients. Because of the significant morbidity and mortality associated with* C. difficile *infections, knowledge of the epidemiology of* C. difficile *in combination with a high index of suspicion and susceptible patient populations (including surgical, postcolectomy, and inflammatory bowel disease patients) is warranted.* C. difficile *infections present with a wide spectrum of disease, ranging from mild diarrhea to fulminant colitis or small bowel enteritis and recurrent* C. difficile *infections. Early implementation of medical and operative treatment strategies for* C. difficile *infections is imperative for optimal patient outcomes. National and international guidelines recommend early operative consultation and total abdominal colectomy with end ileostomy and preservation of rectum. Diverting loop ileostomy and colonic lavage followed by intravenous metronidazole and intracolonic vancomycin administered via the efferent limb of the ileostomy should be considered as an alternative to total colectomy in selected patients. New and emerging strategies for* C. difficile *infection treatment include monoclonal antibodies, vaccines, probiotics, biotherapeutics, and new antibiotics. A successful* C. difficile *prevention and eradication program requires a multidisciplinary approach that includes early disease recognition, implementation of guidelines for monitoring adherence to environmental control, judicious hand hygiene, evidence-based treatment and management strategies, and a focused antibiotic stewardship program. Surgeons are an important part of the clinical team in the management of* C. difficile *infection prevention and treatment. (Surgery 2017;162:325-48.)*

From the Department of Surgery, University of Michigan Health System, Ann Arbor, Michigan; and the Department of Surgery,† Medical College of Wisconsin, Milwaukee, Wisconsin*

Nepolitano & Edmiston Surgery 2017;162:325-348

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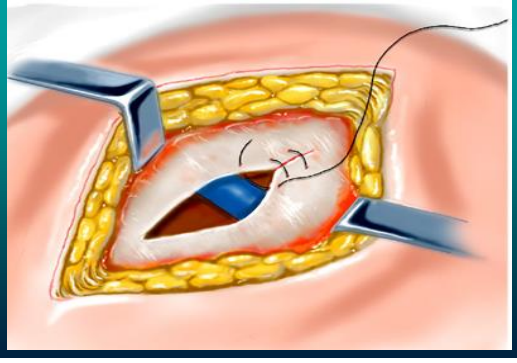
Can a Suture Really be a Nidus for Infection?

50

Do Evidence-Based Studies Validate the Use of an Antimicrobial (Triclosan) Wound Closure Technology?



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THE VIRULENCE OF *STAPHYLOCOCCUS PYOGENES* FOR MAN. A STUDY OF THE PROBLEMS OF WOUND INFECTION

S. D. ELEK AND P. E. CONEN
From the Department of Bacteriology, St. George's Hospital Medical School (University of London), London, S.W.1

Received for publication 9 August, 1957

LITTLE direct evidence is available about the virulence of strains of *Staph. pyogenes* to man. Garré (1885) infected himself with a strain obtained from a fatal case of osteomyelitis by rubbing a whole slope culture into the skin of the left forearm. Small pustules appeared around the hair follicles within a few hours, which enlarged and eventually coalesced into a large carbuncle, which took three weeks to heal with much scar formation. Similar experiments were carried out subsequently by Blimm (1885) and by Bockhart (1887). In this early work the dosage was not stated with accuracy as the aim was to prove that staphylococci were the true cause of carbuncles and wound infections, rather than an attempt to compare the virulence of different strains. It is noteworthy that both Garré and Bockhart failed to produce lesions in some of their experiments, and similar failures by other early workers were referred to by Neisser (1926). No quantitative information is available at present on the susceptibility of different individuals and the relative virulence to man of different strains.

The virulence of a microbe always relates to a given animal species. The mere fact that lesions may be set up in one experimental animal gives little if any indication of virulence for another species. In staphylococcal infection, the traditional approach of using a convenient laboratory animal may be completely fallacious, as was shown by the divergent results obtained by Prappier, Sonea and Panisset (1955), when they compared the virulence of a number of strains using different methods and animals. In spite of the vast volume of work done on the toxins of *Staph. pyogenes* there is no clear evidence that the same factors play a part in man, rabbit or guinea-pig. Indeed there is reasonable doubt about the rôle of alpha toxin in man, though this factor undoubtedly plays an important part in the evolution of lesions in rabbits.

As yet we have virtually no information about the minimal infective dose of any pathogen to man: only circumstantial evidence and analogies are available. The advent of penicillin and other antibiotics however, has rendered direct inoculation in volunteers relatively safe. The extensive literature on the virulence of staphylococci at present relates either to the production of coagulase and diffusible toxins demonstrable *in vitro* or *in vivo*, or to experimental lesions in animals, usually rabbits. These methods certainly delineate the group of staphylococci commonly associated with human disease, but they throw no light on possible differences in virulence between strains isolated from different sources. The wide distribution of coagulase-positive staphylococci on the human body and its environment suggests that in the evolution of lesions other factors must be

Elek SD, Cohen PE. Br J Exp Pathol. 1957;38: 573–586

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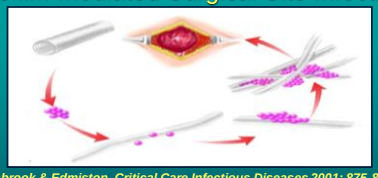
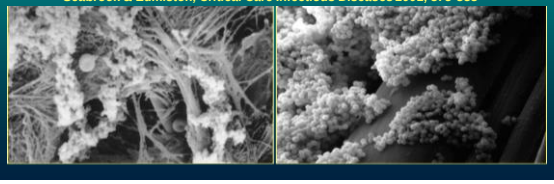
"The presence of a foreign body reaction in the form of sutures resulted in a dramatic reduction in the minimum inoculum required to produce pus (infection)."

Microscopic Perspective of a Deep Incisional Biofilm-Mediated Surgical Site Infection



Seabrook & Edmiston, Critical Care Infectious Diseases 2001; 875-888



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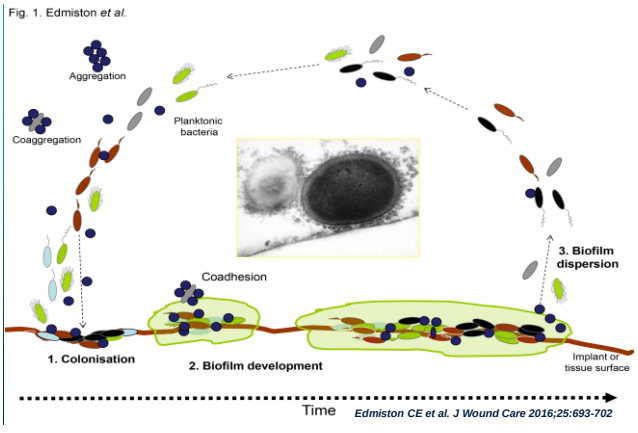

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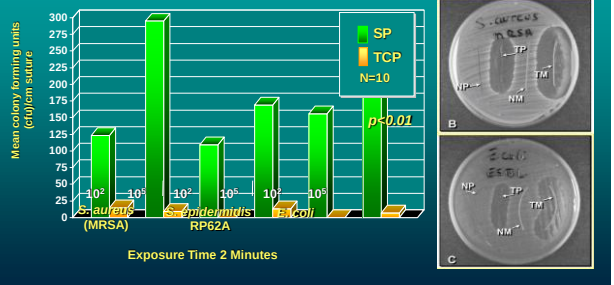
Mean Microbial Recovery from Standard Polyglactin Sutures Compared to Triclosan (Antimicrobial)-Coated Polyglactin Closure Devices



Edmiston et al, J Am Coll Surg 2006;203:481-489

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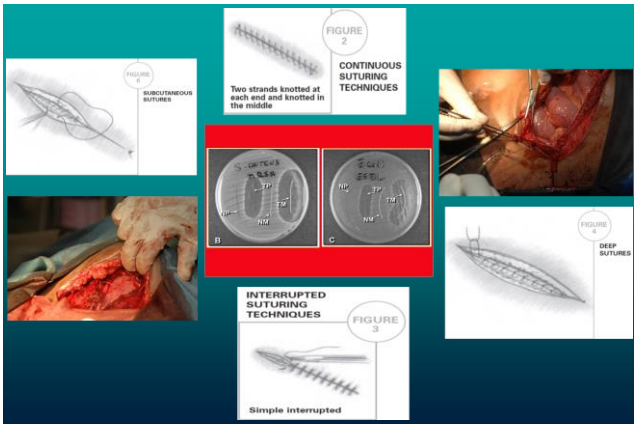

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Is there an evidence-based argument for embracing an antimicrobial (triclosan)-coated suture technology to reduce the risk for surgical-site infections?: A meta-analysis

Systematic review and meta-analysis of triclosan-coated sutures for the prevention of surgical-site infection

Edmiston et al., Surgery 2013;154;89-100 *Wang et al., British J Surg 2013;100;465-473*

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What Do the Various Meta-Analyses Tell Us About Triclosan Suture as a Risk Reduction Strategy?

- **2013** - *Sajid et al, Gastroenterol Report 2013:42-50: 7 RCT (1631 patients) – Odds of SSI 56% less in triclosan suture group compared to controls (p<0.04)*
- **2013** - *Wang et al, BJS 2013;100-465: 17 RCT (3720 patients) – 30% decrease in risk of SSI (p<0.001)*
- **2013** - *Edmiston et al, Surgery 2013;154:89-100: 13 RCT (3568 patients) – 27% to 33% decrease in risk of SSI (p<0.005)*
- **2014** - *Daoud et al, Surg Infect 2014;15:165-181: 15 RCT (4800 patients) – 20% to 50% decreased risk of SSI (p<0.001)*
- **2015** - *Apisarnthanarak et al. Infect Cont Hosp Epidemiol 2015;36:1-11: 29 studies (6,930 patients) – 26% reduction in SSI (p<0.01)*
- **2016** - *Guo et al, Surg Research 2016; doi:10.1016/j.jss.2015.10.015 – 13 RCT (5256 patients) (risk ratio [RR] 0.76, 95% confidence interval [CI] 0.65e0.88, p < 0.001)*
- **2017** – *Wu et al, Eur J Clin Microbiol Infect Dis 2017;36:19-32: 13 RCT (5,346 patients) (risk ratio [RR] 0.72,95% confidence interval [CI] 0.59-0.88, p<0.001)*
- **2017** – *De Jonge et al, BJS 2017;104:e118-e133: 21 RCT (6,462 patients) (risk ratio [RR] 28% reduction, 95% confidence ratio [CI] 0.60-0.88, p<0.001)*
- **2019** – *Ahmed I et al, BMJ 2019;9:029727; doi.10.1136/bml-open-2019-029727: 25 RCT (11,957 patients) – Test of overall effect: Z = 5.2 (p<0.0001)*

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How Does One Evaluate An Antimicrobial Risk - Reduction Technology – The Triclosan Suture Story?

Safety (>1 Billion strands)

- No MAUDE (FDA) reports (20 years) documenting significant evidence linking triclosan to adverse impact in surgical wounds; No evidence of pediatric toxicity, *Renko et al. Lancet Infectious Disease 2016;17:50–57;* No evidence of chronic toxicity, carcinogenicity, reproductive toxicity, immunotoxicity, cytotoxicity or intracutaneous. reactivity *Roidricks et al. Crit. Rev. Toxicol. 2010;40:422. doi: 10.3109/10408441003667514.*

Microbicidal Activity (Spectrum)

- Gram-positive and Gram-negative antimicrobial activity - No published studies have demonstrated that use of triclosan coated sutures are associated with the emergence of resistant surgical pathogens.

Evidence-based Clinical Effectiveness (Meta-Analysis)

- Currently 31RCT/Meta-Analysis in the peer-literature document clinical efficacy of triclosan (antimicrobial) suture technology.

Cost-Effectiveness

- Two recent studies, *[Singh et al. Infect Control Hosp Epidemiol 2014;35:1013; Leaper and Edmiston. British Journal Surgery 2017;104:e134-e144]* document that use of triclosan-coated sutures provides significant fiscal benefit to hospital, third party-payer and patient.

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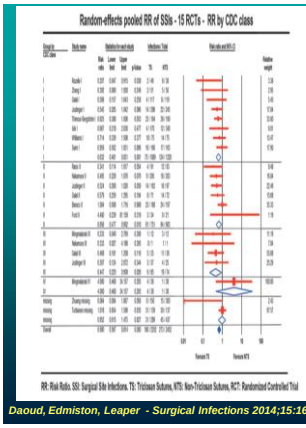

RR: Risk Ratio. SSI: Surgical Site Infections. TS: Triclosan Sutures. NTS: Non-Triclosan Sutures. RCT: Randomized Controlled Trial

Daoud, Edmiston, Leaper - Surgical Infections 2014;15:165-181

Multiple Clinical Studies Have Documented That Triclosan-Coated Sutures Provide A Significant SSI Risk Reduction For:

- Clean – Class I
- Clean-Contaminated – Class II
- And Contaminated Surgical Procedures – Class III

What about Class IV – Dirty surgical wounds?

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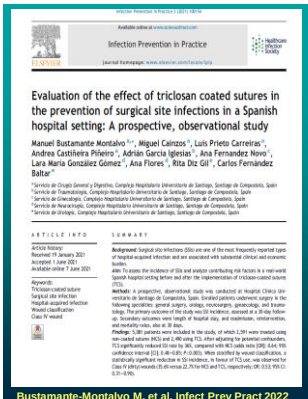
Infection Prevention in Practice

Evaluation of the effect of triclosan coated sutures in the prevention of surgical site infections in a Spanish hospital setting: A prospective, observational study

Manuel Bustamante Montalvo, Miguel Cainzos, Luis Prieto Carreiras, Andrea Castiñeira Piñeiro, Adrián García Iglesias, Ana Fernandez Novo, Lara María González Gomez, Ana Flores, Rita Diz Gil, Carlos Fernández Baltar

ARTICLE INFO

SUMMARY

Prospective, Observational Study of the Efficacy of Triclosan Coated/Impregnated Sutures Across the Surgical Spectrum

- 5081 patients included in the study: 2591 patients treated with non-antimicrobial sutures while 2490 treated with triclosan antimicrobial sutures
- Use of antimicrobial sutures resulted in a 36% reduction in SSI compared to non antimicrobial closure technology (*p<0.003*)
- A significant risk reduction was observed across the surgical spectrum including class IV (dirty) wounds (*p=0.019*)

Bustamante-Montalvo M. et al. Infect Prev Pract 2022 Mar;4:100192.

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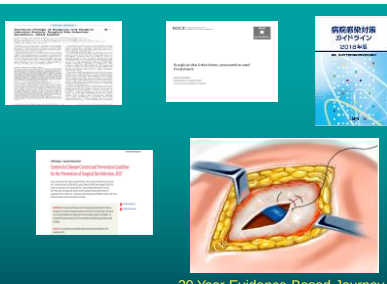

20 Year Evidence-Based Journey

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In 2022 – How Many Evidence-Based Interventions are Validated to Reduce the Risk of Surgical Site Infections Across the Surgical Spectrum?

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Selecting Evidence-Based (EB) Surgical Care Bundle

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CLINICAL

Implementation of a Wisconsin Division of Public Health Surgical Site Infection Prevention Champion Initiative

Gwen Borlaug, MPH, CIC, FAPIC; Charles E. Edmiston, Jr, PhD, CIC, FIDSA, FSHEA, FAPIC

ABSTRACT

Approximately 900 surgical site infections (SSIs) were reported to the Wisconsin Division of Public Health annually from 2013 to 2015, representing the most prevalent reported health care–associated infection in the state. Personnel at the Wisconsin Division of Public Health launched an SSI prevention initiative in May 2015 using a surgical care champion to provide surgical team peer-to-peer guidance through voluntary, nonregulatory, fee-exempt onsite visits that included presentations regarding the evidence-based surgical care bundle, tours of the OR and central processing areas, and one-on-one discussions with surgeons. The surgical care champion visited 10 facilities from August to December 2015, and at those facilities, SSIs decreased from 83 in 2015 to 47 in 2016 and the overall SSI standardized infection ratio decreased by 45% from 1.61 to 0.88 ($P = .002$), suggesting a statewide SSI prevention champion model can help lead to improved patient outcomes.

Key words: *surgical champion, surgical care bundle, SSI prevention, peer collaboration, evidence-based practice.*

Borlaug and Edmiston – AORNJ 2018;107:570-578.

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Building an Effective Surgical Care Bundle*

Baseline Evidence-Based Interventions – Designated High-1A**

- Normothermia – 1A
- Perioperative antimicrobial prophylaxis – Weight-based – 1A
- Antimicrobial (triclosan) coated sutures (fascia / subcuticular closure) – 1A
- Preadmission CHG shower/cleansing – Standardized regimen – 1A
- Perioperative antisepsis – 2% CHG/ 70% alcohol – 1A
- Glycemic control – 1A
- Separate wound closure tray – Moderate
- Glove change prior to fascia/subcuticular closure – Moderate
- Smoking cessation - High

Inclusive Evidence-Based Intervention for Consideration in 2019**

- Supplemental oxygen – Colorectal – 1A
- Oral antibiotics / Mechanical bowel prep – Colorectal – 1A
- Wound edge protector – Colorectal – 1A
- Staphylococcal decolonization – Orthopedic / CT - 1A
- Irrigation with 0.05% CHG - Moderate
- OR traffic control – Device-related procedures – Low

Evidence-Based Medicine is a Moving Target* * Published level of evidence*

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A New Era In Improving Patient Outcomes


Enhanced Recovery After Surgery
A Review

- Requires multidisciplinary team working together around the patient
- Multimodal strategy to resolve issues that delay recovery and cause complications
- A scientific, evidence-based approach to care protocols
- Studies document reduction in length of stay (lOS), decreased mortality, fewer postop complications and cost-effective
- Focus on nutritional aspects of care – includes the role of specific amino acids and perioperative nutrition
- May include 24 or more core elements that have scientific documentation for improving clinical outcome
- Requires an interactive management with continuous audits – Surgical leadership (support) is crucial and must exist within a collaborative framework

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LOYOLA UNIVERSITY HEALTH SYSTEM

Colorectal Surgery Enhanced Recovery Protocol

Pre-operative
- Patient education
- Smoking cessation
- Prehabilitation
- Nutrition assessment
- WOCN visit
- Diabetes Optimization
  - Universal HbA1C
- Preop Optimization Clinic
- Standardized Labs
- MRSA Screening
- Immunonutrition
  - Impact BID x 5 days
- Skin decontamination
  - CHG Shower
- Mechanical Bowel Prep
  - SUPREP split dose
- Oral Antibiotics
  - Neomycin 1g
  - Metronidazole 500mg
- Carbohydrate Loading
  - Ensure Pre-Surgery
- NPO
  - Continue clears

Day of Surgery
- Bowel Preparation
- Clears until 3-4 hours preop
- Carbohydrate Loading
  - Ensure Pre-Surgery
- Hair Management
- Skin decontamination
  - CHG Wipes
- Glucose Management
  - Acucheck in preop
- Patient Warming
  - Bair Paws
- Ileus Prevention
  - Alvimopan 12mg
- DVT Prophylaxis
  - Heparin 5000u
- Pain Management
  - Gabapentin 600mg
  - Celecoxib 400mg
  - Acetaminophen 975mg

Intra-operative
- Limit OR traffic
- Patient Warming
  - Bair Paws
- Skin Prep
  - Chloraprep by RN
- Antibiotics
  - Ceftriaxone 2g
  - Metronidazole 500mg
- Pain
  - TAP Liposomal bupivacaine
  - Ketorolac 30 mg
  - Ketamine 2 mcg/kg/min
- IV Fluids
  - Avoid overload
  - Avoid .9NS
- Glucose management
  - Hourly if DM
- Supplemental O_2 80%
- PONV prevention
  - Dexamethasone 8mg
  - Ondansetron 4 mg
- Avoid NGT / Drains
- Minimally invasive Surgery
- Wound protector
- Closing Protocol
  - Regown team
  - Redrape patient
  - Closing instruments
  - Triclosan sutures
  - Irrigation
- Prevena dressing

Post-operative
- Patient Warming
- Acucheck in PACU
- PONV
  - Ondansetron 4mg q6 x 48
- Ileus
  - Alvimopan 12 mg BID
  - Chewing Gum QID and PRN
- DVT Prophylaxis
  - Heparin 5000u q 8
- Pain
  - Acetaminophen 650mg q6
  - Ketorolac q6 x 6
  - Gabapentin 600 q12
  - Ketamine drip x 24-48h
  - Tramadol 50mg q6
  - Norco/Oxycodone PRN
- Rehabilitation
  - Up to chair POD#0
  - Ambulate QID
- WOCN
- Immunonutrition
- Nutrition
  - Clears POD#0
  - Low Residue POD#1
- Heplock POD#1
- Urinary Catheter
  - POD#1 for colectomy
  - POD#2 for proctectomy
- Supplemental O_2 until POD#1
- Post discharge phone call
- Follow up 1 week

Marc Singer, MD, FACS, FASCRS - Loyola University Medical Center, Chicago, IL

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CLINICAL

An Incision Closure Bundle for Colorectal Surgery

2.0 www.aornjournal.org/content/cme

Charles E. Edmiston, Jr. PhD, CIC; David J. Leaper, MD, ChM, FRCS, FACS, FLS; Sue Barnes, BSN, RN, CIC, FAPIC; William Jarvis, MD; Marsha Bernden, MSN, RNC, CIC; Maureen Spencer, MEd, BSN, RN, CIC; Denise Graham; Helen Boehm Johnson, MD

ABSTRACT

Surgical site infections (SSIs) are among the most common and expensive of all health care–associated infections, and as many as 30% are considered preventable. Surgical care bundles, which involve a small set of reliable, perfomed evidence-based practices, may effectively reduce SSI rates. However, closure of the surgical incision is one aspect of surgical care that is not well described in current SSI prevention bundles; this presents an opportunity for perioperative professionals to improve care by identifying and implementing evidence-based incision closure practices for high-risk procedures (eg, colorectal surgery). We propose and review the evidence supporting a colorectal incision closure bundle composed of a glove and sterile instrument set change, irrigation with 0.05% chlorhexidine solution, use of triclosan-coated sutures, removal of surgical drapes after applying postoperative dressings, use of topical skin adhesive or an antiseptic dressing, and distribution of comprehensive postoperative patient instructions.

Key words: colorectal surgical bundle, incision closure bundle, surgical site infection, SSI prevention bundle, colorectal surgery.

Surgical site infections (SSIs) represent a substantial burden to health care in the United States, accounting for greater than 22% of health care–associated infections (HAIs) and ranking as the most expensive of all HAIs.[1,2] Patients with HAIs experience higher mortality rates than those who do not experience HAIs. A 2012 review of HAIs in Pennsylvania indicated a mortality rate of 9.1% for patients with an HAI, compared with a mortality rate of 1.7% for patients who did not experience an HAI.[3] The annual cost for all SSIs in the United States is estimated to be between $3.5 and $10 billion.[1] The true costs, however, are likely to be far greater, because these numbers do not account for intangibles such as the postoperative quality of life in, patient suffering, lost productivity, pressure on home caregivers, medicolegal costs that often accompany procedures that are complicated by infection.[4]

As many as half of all SSIs could be prevented.[5] This statistic, in addition to pressure from consumer action groups (eg, the Consumer's Union), has led to mandated changes in performance-based reimbursement by the Centers for Medicare & Medicaid Services, which holds health care facilities accountable for their SSI rates and efforts directed at SSI prevention.[6] Accordingly, the stakes for health care facilities and their patients and caregivers are high, and this has resulted in vigorous efforts to identify and apply strategies that effectively reduce SSIs.

In this article, the term antiseptic refers to a nonantibiotic antimicrobial substance designed to reduce the risk of infection (eg, chlorhexidine gluconate [CHG], povidone-iodine). Antiseptics include bactericides, which are substances with proven ability to act specifically against

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Incisional Wound Closure Bundle

- Gown/Gloves change prior to wound closure [1,2,3]
- Dedicated wound closure tray [1,2,3]
- Irrigation with 0.05% CHG [2,3]
- Use of antimicrobial sutures for wound closure [1,2,3]
- Remove surgical drape after applying dressing [2,3]
- Application of skin adhesive (2-octyl cyanoacrylate) following subcuticular wound closure [2,3]
- Comprehensive postoperative patient instructions [2,3]

1: SSI Guidelines; 2: Expert opinion; 3: Peer literature

Edmiston CE, AORNJ 2018;107:552-565

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Do Surgical Care Bundles Provide A Fiscal Benefit – Why Should We Talk About Cost?

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Is There A Fiscal Benefit For Implementing a Surgical Care Bundle – The Actual Cost of Using Antimicrobial Wound Closure – A Generic 7 Item Colorectal – OB/GYN Scenario

(Estimated Cost of Surgical Care Bundle = $50-$75 ~ $60USD)

Low Estimated Cost Benefit of Surgical Care Bundle

$36,429 / $60 USD = can fund 607 additional surgeries

High Estimated Cost Benefit of Surgical Care Bundle

$144,809 / $60 USD = can fund 2,413 additional surgeries

A case in point: Are antimicrobial suture an expensive commodity?
3 to 5 strands ~$<0.30 per strand = $0.90 to $1.50 additional cost per case
(1.5% ~ 4.0% of total bundle cost)

Cost Data from Leaper, Spencer and Edmiston – DCR 2020;63:1628-1638

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What are the Major Barriers in the Implementation of an Effective Surgical Care Bundle?

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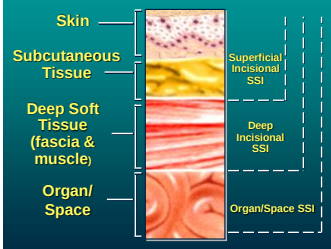
The Complexity of Risk – Major Barriers to Improving Surgical Patient Outcome



- Poor compliance – Complacency (laxity) and lack of documentation
- Lack of shared goals and priorities
- Poor communication
- Less than robust institutional commitment – Failure to standardized evidence-based initiative across the institution

"Remember when they say it is never about the money – It is always about the money"

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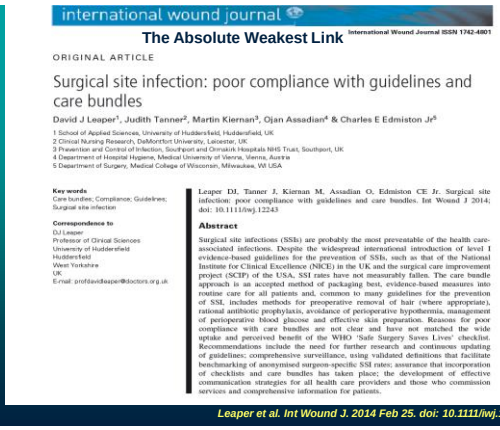
international wound journal

International Wound Journal ISSN 1742-4801

The Absolute Weakest Link

ORIGINAL ARTICLE

Surgical site infection: poor compliance with guidelines and care bundles

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Key words
Care bundles; Compliance; Guidelines; Surgical site infection

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Leaper DJ, Tanner J, Kiernan M, Assadian O, Edmiston CE Jr. Surgical site infection: poor compliance with guidelines and care bundles. Int Wound J 2014; doi: 10.1111/iwj.12243

Abstract

Surgical site infections (SSIs) are probably the most preventable of the health care-associated infections. Despite the widespread international introduction of level 1 evidence-based guidelines for the prevention of SSIs, such as that of the National Institute for Clinical Excellence (NICE) in the UK and the surgical care improvement project (SCIP) of the USA, SSI rates have not measurably fallen. The care bundle approach is an accepted method of packaging best, evidence-based measures into routine care for all patients and, common to many guidelines for the prevention of SSI, includes methods for preoperative removal of hair (where appropriate), rational antibiotic prophylaxis, avoidance of perioperative hypothermia, management of perioperative blood glucose and effective skin preparation. Reasons for poor compliance with care bundles are not clear and have not matched the wide uptake and perceived benefit of the WHO 'Safe Surgery Saves Lives' checklist. Recommendations include the need for further research and continuous updating of guidelines; comprehensive surveillance, using validated definitions that facilitate benchmarking of anonymised surgeon-specific SSI rates; assurance that incorporation of checklists and care bundles has taken place; the development of effective communication strategies for all health care providers and those who commission services and comprehensive information for patients.

Leaper et al. Int Wound J. 2014 Feb 25. doi: 10.1111/iwj.12243

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In Conclusion – What Have We Learned From Our Efforts to Improve Surgical Patient Outcomes Using Evidence-Based Practice?

- The efficacy of an evidence-based strategy to improve surgical outcomes requires institutional compliance (quality) and clear documentation of effort - The institution must have sufficient "skin in the game"
- All co-morbid risk must be considered when developing an effective mitigation strategy.
- The cost of mitigation is always minuscule compared to the human and fiscal cost of a surgical site infection – Will ERAS be the next frontier for change?

SSI Prevention Is Not a Solo Recital
But Rather a Symphony and We Are
All Part of the Orchestra

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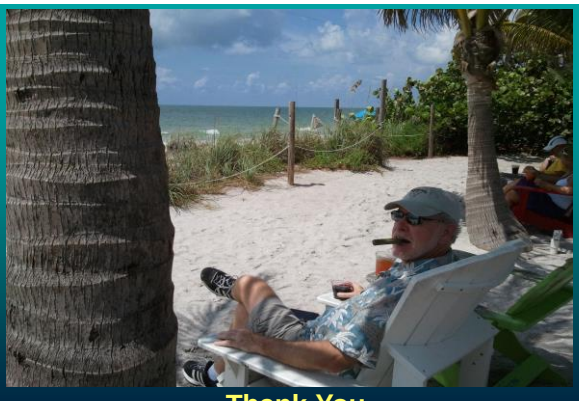

Thank You

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