

# Infección de herida quirúrgica

Decennial 2010

## 756 Operating Room Ventilation with Laminar Airflow: Effect on Severe Surgical Site Infection Rates in Hip Replacement Surgery

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- Background: Ventilation systems are widely used in operating rooms (OR) in many countries assuming that they are of benefit in the prevention of surgical site infections (SSI).
- Objective: To investigate the impact of high-efficiency particulate air (HEPA) - filtered air conditions, either turbulent or directed by (vertical) laminar airflow, on severe SSI rates in hip replacement surgery due to arthrosis.
- Methods: We accomplished a retrospective cohort-study based on routine surveillance data from July 2004 to June 2009. Active SSI surveillance was performed according to the methods and definitions given by the US National Nosocomial Infection Surveillance system. Corresponding to our previous investigations five years ago, surgical departments were assigned to 2 groups according to the OR ventilation technique in place: (i) conventional turbulent ventilation with HEPA - filtered air; (ii) HEPA - filtered laminar airflow ventilation by (vertical) laminar airflow supply air diffusers. We accomplished a multivariate analysis – determined by generalized estimating equations (GEE) taking into account the departments as a cluster – to control for possible confounding factors: gender, age and American Society of Anaesthesiologists (ASA) score of the individual patients; duration of operation; turbulent or laminar airflow OR ventilation; area at least 2,40 m x 3,20 m and additionally deflectors. Only aseptic operations were considered in this study.

- Results: 58 surgical departments participating voluntarily in the German national nosocomial infections surveillance system “KISS” were included (a total of 38 701 hip replacement operations with 270 severe SSI, severe SSI rate: 0.70). The risk for severe SSI did not differ whether (i) conventional turbulent ventilation or (ii) laminar airflow OR ventilation was used. Adjusted odds ratio: 1.44 <0.63-3.30>. Equally, the size of the ceiling did not change the risk for developing a severe SSI (Adjusted odds ratio: 0.94 <0.44–2.00>).
- Conclusions: OR ventilation with laminar airflow showed no benefit for severe SSI after hip replacement surgery due to arthrosis. Thereby, we confirmed the data of our previous study covering the period from 2000-2004.

## 511 Cost-Effectiveness of Universal MRSA Screening on Admission to Surgery

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- **Background:** This study assessed the cost-effectiveness of universal rapid MRSA screening with PCR on admission to surgery as compared to a strategy involving risk-factor screening or standard surgical admission without screening.
- **Objective:** Policy-makers have recommended universal screening on admission to reduce nosocomial MRSA infection. Risk profiling algorithms and rapid PCR tests are now available and have been evaluated in published literature, yet cost-effectiveness data are limited. Decisions taken by hospital administrators regarding investments in infection control would benefit from economic evaluations. This study aimed to assess the cost-effectiveness of rapid PCR screening.
- **Methods:** A decision analytic Markov model from the hospital perspective compared costs and effects of three strategies: (1) rapid PCR screening; (2) screening patients with risk factors (prior hospitalization or antibiotic use) combined with pre-emptive isolation and contact precautions pending chromogenic agar results; (3) no screening. Clinical and epidemiology data were taken from a large well-designed study at the University of Geneva Hospitals as well as published literature. Costs were derived from hospital accounting systems. Uncertainty in key input variables was explored through sensitivity and threshold analyses.
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- **Results:** Compared to no screening, the universal PCR strategy resulted in slightly higher costs (CHF 10,358 vs. 10,503) but fewer infections (.009 vs. .004) in the decision model, producing an incremental cost-effectiveness ratio (ICER) of CHF 30,769 per infection avoided. The risk factor strategy was both more costly and less effective than PCR, although after varying key epidemiologic inputs the costs and effects of both screening strategies were similar relative to no screening. Sensitivity analyses suggested that prevalence of MRSA carriage on admission predicts cost-effectiveness (figure), along with the probability of cross-transmission (a surrogate for the efficacy of standard efficacy control measures), the costs of MRSA infection, screening costs, and contact precaution costs. Higher rates of cross-transmission, higher on-admission prevalence and higher costs per MRSA infection improve the cost-effectiveness of universal screening as the benefits of early detection are greater. In contrast, lower rates of cross-transmission, and higher costs for screening and infection control measures worsened the cost-effectiveness of rapid PCR.
- **Conclusions:** Compared to risk profiling with pre-emptive isolation, universal screening is not strongly cost-effective at our center. However, local epidemiology plays a critical role. Settings with higher prevalence of MRSA colonization may find universal screening cost-effective and in some cases potentially cost-saving

## 757 Using Preoperative Staphylococcus aureus Screening and Surgical Site Disinfection to Decrease Surgical Site Infections in Patients Undergoing Elective Total Hip (THA) and Total Knee Arthroplasty (TKA)

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- Background: Staphylococcus aureus (SA) has been recovered from approximately 50% of the prosthetic joint replacement-related surgical site infections (SSI) identified at the Hospital of St Raphael. Nasal (and probably skin) carriage of SA by patients is a recognized risk factor for SA SSI. In 2008, we undertook a program targeting endogenous SA carriage to decrease surgical site contamination leading to SSI.
- Objective: To decrease the occurrence of postoperative SSI in patients undergoing THA and TKA surgery.
- Methods: Our program, instituted in June, 2008, recommended that all patients scheduled for THA or TKA surgery undergo an anterior nares culture preoperatively to detect SA colonization. For patients testing positive, mupirocin ointment was administered for 2 days prior to surgery. Each patient received a packet of 2 chlorhexidine gluconate (CHG) impregnated cloths. Patients used one cloth to clean the surgical site and the second cloth to clean the surrounding skin the night before surgery. This process was repeated at the hospital on the morning of surgery. Other components of the SSI prevention bundle included clipping rather than shaving the surgical site when hair must be removed and proper prophylactic antibiotic administration. Surveillance was conducted utilizing the National Healthcare Safety Network (NHSN) methodology. We calculated SSI rates for a baseline period, 9/1/07 to 5/31/08 and a post intervention time period, 6/1/08 – 6/30/09.

- Results: For THA, the baseline infection rate was 3.0% and decreased to 1.0% during the post intervention time period. Five of 8 infections pre intervention were caused by SA while only one was identified during the 13 months following the new protocol. For TKA, the SSI rate was 1.0% in the baseline period, 0.84% in the post intervention period. Two infections were caused by SA in the baseline period, 4 infections in the post intervention period.
- Conclusions: Although not statistically significant, we have realized decreases in the occurrence of SSI in our patient population, especially in the patients undergoing THA. Improved compliance with all aspects of the prevention program is needed to establish if significant reductions can be achieved in SSI related to THA and TKA.

758 Preoperative surveillance for methicillin-resistant *Staphylococcus aureus* nasal colonization does not identify a majority of patients with postoperative staphylococcal infections in a Veterans Affairs hospital

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- Background:
  - The Department of Veterans Affairs methicillin-resistant *Staphylococcus aureus* (MRSA) Prevention Initiative requires routine surveillance for nares carriage of MRSA on admission, ward transfer, and discharge. These data could potentially be used to identify surgical patients at risk for postoperative staphylococcal infections who might benefit from peri-operative decolonization.
- Objective:
  - To test the hypothesis that pre-operative surveillance for MRSA nares colonization will identify a majority of patients who develop postoperative *S. aureus* infections.
- Methods:
  - We performed a retrospective review of all clean surgical procedures at a VA hospital from 1/07 through 3/09 and identified cases of postoperative *S. aureus* infection. Infections were classified as surgical site infections (superficial incisional, deep incisional, and organ/space) or non-surgical site infections and as MRSA or methicillin-susceptible *S. aureus* (MSSA) infections. For MRSA infections, the proportions with positive versus negative pre-operative nares MRSA results were determined.

- Results:
- Of 5528 total clean surgical procedures, 37 (0.7%) were complicated by postoperative *S. aureus* infections, including 17 MSSA and 20 MRSA infections. Five of the 20 (25%) patients with MRSA infections did not have preoperative nares screening for MRSA. Of the 15 patients with MRSA postoperative infections and preoperative screening, only 6 (40%) had positive preoperative nares screening results. Thirteen of 20 (65%) MRSA infections and 14 of 17 (82%) of MSSA infections were surgical site infections.
- Conclusions:
- Preoperative screening for MRSA nares colonization identified only a minority of patients with subsequent postoperative *S. aureus* infections in our VA hospital. Preoperative screening for both MRSA and MSSA may be indicated to identify patients who might benefit from decolonization. Further research is needed to determine if development of postoperative MRSA infections despite negative preoperative nares results is due to colonization at sites other than the nares or to acquisition of MRSA during or after surgery.

## 827 Surgical Site Infection Reporting Readiness: A Survey of Washington State Hospitals

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- Background: A 2008 General Accountability Office report lists 15 states mandating surgical site infection (SSI) reporting. Assessing hospital resources & readiness to comply is critical to success of these healthcare associated infection (HAI) programs. Little information on workload impact is available to guide hospital or state HAI programs. Washington, where SSI reporting is to begin in January 2010, started readiness surveys in 2009.
- Objective:
  - Assess workload impact, support needed and level of readiness among Washington's hospitals to report SSI through the National Healthcare Safety Network (NHSN).
- Methods: Infection control programs at acute-care hospitals were asked to identify annual surgical volume for cardiac procedures with a sternal incision, hip or knee replacement, and hysterectomy (the procedures covered by state law to report). The on-line survey also asked questions about completing NHSN SSI training, which staff were involved in preparing to report, and whether NHSN variables could be acquired from electronic databases at that hospital. We also surveyed other state HAI programs and their hospitals' knowledge of time required to assemble data to upload to NHSN.

- Results: 63% (59/93) of Washington hospitals responded. Of the 59, 48 met criteria for mandatory SSI reporting. This is 69% (48/70) of all hospitals we anticipated would have to report. Annual case volumes for specific SSI procedures are shown in the table. Few states knew workload impact for hospital reporting; time estimates from 3 hospitals in other states, 1 in Washington, and one state based on its 13 hospitals (ranges shown in table).
- 81% (39/48) reported completing online NHSN training materials related to SSI reporting; 19% had not studied this material because of being too busy. None reported lack of access blocking online training materials.
- Most of the 48 indicated infection prevention staff would be involved in SSI reporting; some indicated support from Information Technology (23%), OR/Surgery leadership (19%), ICD-9 specialists (11%), or others (15%, including senior leadership, RN staff, Infection Control support staff, or unspecified).
- 81% of hospitals eligible to report lacked automated SSI information exchange (NHSN numerator & denominator variables). Monthly SSI reporting workload per type of surgery ranges from 0.04 hours in low-volume highly-automated hospitals to 6.25 in high-volume moderately-automated hospitals & from 0.5-41.6 across unautomated hospitals.
- Conclusions:
- Less than 25% of hospitals had involved staff beyond infection prevention and control to prepare for SSI reporting. Only 15% reported current automated database capability; without this, the workload of manual data review and entry for NHSN SSI surveillance can be formidable. Support for automating NHSN data element capture & upload capacity (electronic data interchange) is essential for efficient HAI reporting.

838 Surgical Services Improvement Plan (SSIP) Task Force. Dramatic effect of improved documentation on surgical mortality index

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- Background: In 2007 our hospital began submitting data to the National Surgery Quality Improvement Program (NSQIP). When the first report was available it demonstrated that our General and Vascular Surgery groups had a mortality index statistically greater than one.
- Objective: In January 2008, a Surgical Services Improvement Plan Task Force (SSIPTF) was created under the auspices of the Chairman of Surgery with the charge of reducing surgical mortality.
- Methods: The SSIPTF consisted of 8 groups focused on the following: 1) Documentation, 2) Preoperative optimization , 3) Communication, 4) SCIP Core Measures, 5) Intraoperative processes, 6) Surgery critical care, 7) Postoperative processes, 8) Discharge processes and complications developing post discharge. Each team was led by a surgeon chair and facilitated by Quality Improvement Coordinators, Six Sigma Black Belts and Green Belts. Teams met every two weeks for 1 hour for the last 20 months and were comprised of multidisciplinary members including physicians, nurses and other care providers, informatics' specialists, and administrative personnel.

- Results: Early improvements were accomplished with documentation: for example, functional status: 45% to 92%, smoking pack years: 68% to 89% ( $P < 0.05$ ). Recent improvements (last 6-8 months) include a pilot screening program for nasal MRSA, creation of a preoperative video about mobility, incentive spirometry and pain control, design and piloting of an OR passport, improved VTE prophylaxis (85% to 95%,  $P < 0.05$ ), improved antibiotic redosing (20% to 90%,  $P < 0.05$ ), improved ICU mobility (14% to 85%,  $P < 0.05$ ), decreased hospital length of stay for ICU patients in mobility campaign (17.2 to 12.4,  $P < 0.05$ ), improved surgical floor mobility (80% to 100%). NSQIP data after the first year of the SSIP demonstrated that the surgical mortality index had decreased from an initial value of 1.21 down to 0.86 ( $p < 0.05$ ). This was associated with a dramatic increase in expected mortality (2.33 to 3.38) and no significant change in observed mortality (2.81 to 2.89). Notably in that same time frame our morbidity (surgical site infection, postoperative pneumonia) did not change significantly. This was not surprising given that many clinical interventions were not implemented until the end of the first year and were initially piloted on one unit or clinic.
- Conclusions: Our NSQIP surgical mortality index improved dramatically in association with improved documentation. As the other process improvements described are implemented more broadly, we anticipate reduced infectious complications and observed mortality

858 Association Between the Risk of Surgical Site Infection and Surgical Volume in Hospitals Participating in the Nosocomial Infection Surveillance Network of South-Eastern France

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- Background: The mortality and complication rates of many surgical procedures are inversely related to surgical volume. However, the few studies focusing on the association between surgical site infection (SSI) risk and hospital surgical volume have reported conflicting results.
- Objective: To determine if SSI risk is associated with surgical volume in hospitals in the south-east of France.
- Methods: An epidemiological survey was conducted based on data from an SSI surveillance network between 1995 and 2007. Each patient undergoing a urinary or a digestive surgical procedure during the last quarter of each year was included. Surgical volume, calculated for each procedure, was defined as the number of procedures conducted in the surgical unit during the last quarter and was categorised in three groups: 1)  $> 30$ , 2) 16 to 30, and 3)  $\leq 15$ . Risk factors (RF) of SSI were collected. A multivariate logistic regression analysis was performed by surgical procedure to identify if surgical volume was an independent RF of SSI. Confounders included in the model were the National Nosocomial Infection Surveillance (NNIS) risk index category, age, gender, multiple surgical procedures, celiosurgery, emergency surgery, ambulatory surgery, pre-operative hospitalisation duration, year and hospital type.

- Results: Prospective surveillance identified 118 SSI after 2,952 operations (attack rate (AR) = 4.0 %) in urology surgery and 419 SSI after 16,491 operations (AR = 2.5 %) in digestive surgery. A low surgical volume was not associated with SSI risk for colostomy, appendectomy, and prostatectomy, but was an independent RF of SSI for cholecystectomy (adjusted odds ratio for group 2 [aOR2] 1.56, 95% confidence interval [CI] 0.55–4.39; aOR for group 3 [aOR3] 2.98, 95% CI 1.09–8.19) and lower urinary tract surgery (aOR2 1.51, 95% CI 0.64–3.56; aOR3 2.37, 95% CI 1.15–4.87). A non significant trend was observed for hernia surgery (aOR2 1.81, 95% CI 0.89–3.67; aOR3 2.24, 95% CI 0.98–5.12).
- Conclusions: Undergoing cholecystectomy, lower urinary tract surgery, or hernia surgery in a surgical unit with a low volume of procedures increases the patient's risk of SSI. Patients should consider these findings in selecting a hospital to carry out these procedures. Although different possible explanations exist for these findings, in the context of the drive for economies, these kinds of results could nevertheless be used by health policy makers to decide to set up high-volume surgical units at regional level for some specific procedures.

## 862 Surveillance of surgical site infections by surgeons: biased underreporting or useful epidemiological data?

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- Background: Surgical site infections (SSIs) significantly increase postoperative morbidity and mortality. SSI surveillance is an established monitoring tool and decreases SSI rates.
- Objective: The purpose of this study was to compare prospective in-hospital SSI surveillance (I) by the surgical staff and (II) additionally by an infection control team (ICT). (III) The reference method was defined by data generated by the surgical team, supplemented by the ICT and completed by postdischarge surveillance with a postoperative follow-up of one year representing the sum of all available resources.
- Methods: During 24 months, all consecutive inpatient procedures (n=6283) were prospectively recorded by the surgical staff until patients' discharge (I). SSI rates were compared to the surveillance performed by the ICT (II) and to the reference method (III).
- Results: The overall SSI rate (reference method) was 4.7% (n=293), of which 187 (63.8%) were detected in-hospital and 106 (36.2%) after discharge. (I) The surgical staff detected 91/187=48.7% of in-hospital SSIs (91/293=31.0% of the reference), (II) the ICT an additional 96/187=51.3% during hospitalization (96/293=32.8% of the reference). Further cross-checking as performed in the visceral surgery department increased the surgeons' detection rate (I) to 59/105=56.2% of in-hospital SSIs (59/147=40.1% of the reference).
- Conclusions: SSI surveillance by the surgical staff detects almost half of all in-hospital SSIs and has the potential to increase the detection rate by simple interventions such as cross-checking. Such a relatively inexpensive surveillance system is an option for hospitals without an ICT or for low risk surgical procedures. Moreover, trends in SSI rates can easily be detected allowing early intervention.

## 867 Surgical Quality Improvement: Reducing Surgical Site Infection Rates in Colon Procedures

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- **Background:** Surgical site infection (SSI) is the second most common healthcare associated infection, accounting for 17% of all HAI's. Colon surgery has a high risk of SSI; NHSN colon surgery pooled means range from 4% - 11%, but some studies have reflected rates up to 26%. In 2005, we began a series of interventions to reduce the colon SSI rates.
  
- **Objective:** To reduce the SSI rates in colon surgical procedures using multidisciplinary quality improvement initiatives.
  
- **Methods:** Our study took place between 2004 and June 2009 and included all patients undergoing colorectal surgery in the University Hospital who met the Surgical Care Improvement Project (SCIP) criteria. SSI was defined using NHSN criteria. Observations and rate feedback to the units began in 2005. Phase I took place during 2005-2006 and included participation in the Michigan Surgical Quality Collaborative and standardization of perioperative patient skin cleansing and preparation protocols. Phase II, during 2006-2007 included staff observation and education, surgeon performance related quality assurance measures, and a multidisciplinary quality improvement grand rounds conference. Phase III began in 2008 and targeted intraoperative bowel technique. Feedback led to the formation of a multidisciplinary clinician work group, which made recommendations for standardized practice for colon procedures. Weight based prophylactic antibiotic measures were strengthened and intensive staff education on bowel technique and skin preparation were launched. In 2009, resident physician asepsis training and nursing staff skin preparation technique competency assessments in the clinical simulation lab setting were developed and piloted.

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- Results: Between Jan 2004 and June 2009, 1299 total SCIP colon procedures were performed (average 236 procedures/year). The SSI rate in 2004 was 26.5%, but there has been a downward trend since phase I. From Jan through June 2009, there were 13 SSIs in 80 procedures, with a rate of 16.3%. The baseline rate for 2004-2006 was 26.73% and the rate for the follow up period (2008- June 2009) was 19.5%, representing a 27% decrease in SSI incidence ( $p = .015$ ). In addition to fewer overall SSI's, there have been fewer deep and organ space infections requiring readmission and reoperation. In 2008, 47% of SSIs were superficial, 21% were deep, and 28% were organ-space, compared to 2009, when 92% of SSIs were superficial and 8% were organ-space infections.
- Conclusions: Standardization, best practices, and sustained multidisciplinary quality collaboratives have been successful in decreasing severe surgical site infections and reducing overall SSI in colon surgical procedures.