

Preoperative Screening and Decolonization Protocol for Methicillin – Resistant *Staphylococcus aureus*, Methicillin – Resistant *Staphylococcus epidermidis* and Methicillin Sensitive *Staphylococcus aureus* Prevents Orthopedic Surgical Site Infections

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ABSTRACT

Background: Methicillin resistant *Staphylococcus aureus* (MRSA), Methicillin resistant *Staphylococcus epidermidis* (MRSE) and Methicillin sensitive *Staphylococcus aureus* (MSSA) carriage is an independent risk factor for orthopedic surgical site infection (SSI). To determine whether a preoperative screening and decolonization protocols reduces MSSA, MRSA, and MRSE SSIs, we conducted a comparison of SSIs rate in the prescreening period with the post screening period of patients undergoing arthroscopic orthopedic surgery.

Methods: Patients in the post screening period were screened initially for MRSA and MRSE by collecting nasal, axillary and surgical site swabs. One month after the start of screening and decolonization we experienced one patient with MSSA SSI. Since then MSSA was also included in the screening protocol starting end of October 2009. Carriers were decolonized with mupirocin nasal ointment 3 times daily for 5 days, and chlorhexidine bath once daily for 5 days before surgery.

Results: During the study period 1108 patients under went preoperative screening. Among these 8 (0.7%) of patients were identified as MRSA carriers, 315 (28%) MRSE carriers and 206 (18%) were MSSA carriers. Overall 9 cases of SSIs were identified, 8 cases before screening, and one case after screening for MRSA and MRSE and no SSI were diagnosed after MSSA screening was added.

Discussion and Conclusion: Orthopedic SSIs is disabling and associated with increased cost. They prolong total hospital stay and double readmission rate. Patients with orthopedic SSIs have substantially greater physical limitation and significant reduction in their quality of life.

We conclude the implementation of a preoperative screening protocol for the identification and eradication of MRSA, MRSE and MSSA carriage and decolonization of patients undergoing orthopedic surgery is feasible and can lead to a significant reduction in surgical site infection.

Keywords

Screening, Decolonization, Reduction of surgical infections.

Introduction

Post surgical infections in orthopedic surgery are among the most

difficult and costly to manage. To prevent these infections requires identification of risk factors and appropriate intervention [1,2]. There is strong epidemiologic association between nasal carriage of *S.aureus* and development of *S.aureus* surgical site infection (SSIs). Carriers are two to nine times more likely to acquire *S.aureus*

SSIs than non-carriers [3-5]. In fact nasal carriage was the only independent risk factor for *S.aureus* SSIs in patients undergoing orthopedic surgery. The most common species *Staphylococcus epidermidis* infects implants and prosthetic heart valves following colonization of the skin and even clothes of patients and staff [7]. There is documented evidence of deep infection by this organism, and in a prospective study it was grown from skin swabs [8].

Only 2% of deep joint infections are due to (MRSA), while *S.epidermidis* causes about 60% of deep infections in joint replacement, 55% of which were resistant to methicillin [6]. Currently it does not form part of screening process before surgery, and it is logical that this should also be screened for preoperatively.

Intranasal mupirocin is an attractive preventive strategy because it is a safe and a simple method that eradicates nasal colonization in a wide variety of patients [4,5]. It also reduces SSIs in patients undergoing orthopedic surgery [9]. Recently chlorhexidine baths have been added to intranasal mupirocin in an effort to eradicate carriage of MRSA [10,11], and to reduce health-care associated infections caused by MRSA in the intensive care units [12]. The combination was simple and had no major side effects [10,11,13].

Aspetar Orthopedic and Sports Medicine Hospital in Doha is the region first specialized orthopedic and Sports Medicine Hospital. It provides the highest possible medical and surgical treatment for sports – related injuries in a state-of-the art facility, accredited by FIFA, F-Marc, ISO 1900, and ACI. Aspetar laboratory is CAP accredited. Aspetar is striving to be a center of excellence for Sports Medicine and Orthopedic surgery, providing quality service to athletes all over the world with particular emphasis on prevention of surgical site infections following orthopedic surgery. Surgical procedures started in December 2007 and the first case of SSI was diagnosed in December 2008 after shoulder surgery. This was followed by more cases and by October 2009 8 SSIs were diagnosed. All cases were caused by Coagulase Negative Staphylococci except one case caused by *S.aureus*.

The rate of SSIs a following orthopedic surgery in our institution between December 2007 and October 2009 was 2% with MRSE the dominant organism. To achieve our goal as a center of excellence with 0% SSI rate, we hypothesized the use of a preoperative screening for MRSA, and MRSE followed by decolonization protocol would lower infection rate in patients undergoing orthopedic surgery and can be cost effective. *S.aureus* was included later after we diagnosed the first case of *S.aureus* SSI in October 2009. The hospital established a multidisciplinary team with the goal of achieving zero surgical site infection rates. Part of the team effort involves empowering patients to participate in an eradication program. Since the preoperative screening started, the overall infection rate dropped from 2% to 0.

The purpose of this study was to evaluate the feasibility and efficacy of an institutional preoperative screening and decolonization program to detect and eradicate MRSA, MRSE, and MSSA in patients undergoing orthopedic surgery.

Materials and Methods

A preoperative screening protocol was approved by the Prevention and Control of Infection Committee and implemented for all patients undergoing surgery starting September 2009. Screening was performed by Preadmission Clinic Nurse and swabs were taken from the nose, axilla and expected surgical site. Swabs were cultured on blood agar and MRSA medium. Identification was done by API Staph, biomedieux –France, and susceptibility tests done by disc diffusion test following clinical laboratory standards institute guidelines (CLSI). The screening was done 2 weeks before surgery and later modified to 10 days before surgery. Patients who test positive for MRSA or MRSE were offered a decolonization course of intranasal 2% mupirocin ointment applied for each nares 3 times a day for 5 days, a 4% chlorhexidine bath once daily for 5 days and chlorhexidine hair shampoo on day 2 and 5. After 2 days off treatment rescreening is done. Patients who still remain positive for MRSA/MRSE will be placed on isolation precautions until discharged. Teicoplanin will be used for prophylaxis for patients who test positive for MRSA/E irrespective of the result of rescreening. Before the start of the screening education was provided both for the Preadmission Clinic Nurse on how to collect samples and for the patients on how to use the nasal cream and chlorhexidine bath.

During this period hand hygiene promotion campaign was performed together with surgical site infection prevention bundle (hair removal by clipping, appropriate antibiotic prophylaxis, proper skin disinfection and normothermia and normoglycemia throughout surgery). Patients identified as carriers of MSSA were included in the decolonization protocol after we diagnosed our first patient with MSSA surgical site infection, but follow up culture were not performed on these individuals.

For emergency surgery and international athletes, swabs will be collected and patients started on decolonization protocol. If the result of culture was negative the decolonization will be stopped.

Surveillance for SSIs was done for all patients for 30 days following National Health Safety Network (NHSN) [14] USA recommendations. Patients with implants will be followed for one year after surgery.

For the definition of SSIs CDC (Centers for Diseases Control and Prevention Atlanta Georgia) definition of surgical site infection was used [14]. Patients were educated about the rationale for the decolonization protocol. Patients were carefully assessed about their compliance with the decolonization protocol by the Pre admission Clinic Nurse.

The primary outcome measure was the number of SSIs due to MRSA/E and MSSA during the screening period compared with that in the year before the screening started.

Results

Table 1 shows the total number of surgeries and the total number of SSIs since the start of surgery in Aspetar.

YEAR	2008	2009	2010	2011	2012	2013	2014
January	38	36	30	42	54	63	69
February	29	52	21	22	44	38	53
March	36	40	34	55	62	66	62
April	37	40	36	51	46	57	78
May	44	41	36	40	44	42	52
June	34	29	42	65	42	70	77
July	21	15	21	33	36	49	28
August	36	41	17	30	12	14	29
September	35	11	18	49	45	67	62
October	50	25	35	48	52	41	59
November	60	26	39	36	54	75	71
December	29	0	29	38	43	36	62
TOTAL	449	356	358	509	534	618	702
Total Infections	1	7	0	0	1	2	0
Percentage	0.2	2.0	0.0	0.0	0.2	0.3	0.0
Benchmark	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table 1: Total number of surgeries and total number of SSIs: 2008-2014.

During the period of screening from September 2009 to May 2011, a total of 1108 patients underwent screening for MRSA/E and MSSA; during this period 625 surgical procedures were performed compared to 753 procedures during the prescreening period from December 2007 to August 2009.

Among the screened patients 206 patients (18%) were identified as MSSA carriers, 8 patients (0.7%) were identified as MRSA carriers, and 315 (28%) were identified as MRSE carriers.

SSIs rates were compared between the study screening period and the prescreening period. During the prescreening period 8 cases of SSIs were diagnosed among 753 surgeries for a SSIs rate of 1.06 % while during the screening period one case of SSI was diagnosed (0.16%). Therefore during the screening period a significant reduction in the infection rate was observed (Figure 1).

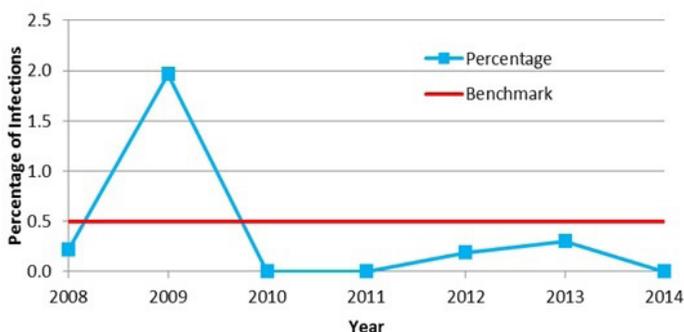


Figure 1: Percentage infections for 2008 to 2014.

All patients except one successfully completed all components of the decolonization protocol. Only one patient experienced skin rash on day 5 of the protocol and few patients complained from nasal irritation and headaches following the mupirocin nasal ointment, but continued their decolonization course.

Discussions

Orthopedic SSIs is disabling and associated with increased cost. They prolong total hospital stay and double readmission rate. Patients with orthopedic SSIs have substantially greater physical limitation and significant reduction in their quality of life [15]. Appropriate antibiotic prophylaxis and good surgical technique has major role in reducing SSIs. This depends on appropriate patient preparation. Preoperative screening of patients remains the mainstay for identification of patients who need isolation and for choosing the appropriate antibiotic for prophylaxis [16].

The overwhelming success of the MSSA and MRSA screening program in preventing deep infections [17,18] and the predominant isolation of MRSE in our patients led us to consider screening for MRSE. The results of our screening program showed 0.7% of the patients screened were positive for MRSA. This is comparable to the results of other screening programs 0.9% [19] and 1.3 % [20], while 28% of our patients screened positive for MRSE, similar to the result of James et al. who found 25% of prescreening skin swabs were positive for MRSE [6].

The cost effectiveness of such a screening program is important. Papia et al. [20] showed if early identification of MRSA in colonized patients prevented nosocomial transmission of the organism, to as far as 6 new patients, the screening program would save money. The addition of MRSE and MSSA to the screening program will further reduce the cost and improve efficiency [20].

The major limitation of our study is the introduction of other control measures to prevent SSIs including a major hand hygiene campaign and the surgical site bundle.

Nevertheless, despite this limitation, we believe the introduction of such screening program including MRSE, MRSA, and MSSA is useful in early identification of carriers, their decolonization, selection of appropriate antibiotic for prophylaxis and early isolation and contact precautions for those who remain colonized with MRSA.

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