INCIDENCE AND OUTCOME OF NASAL AND GROIN METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS CARRIER STATE IN PATIENTS ADMITTED FOR ROUTINE CARDIAC SURGERY

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ABSTRACT

Objective: *To find out the incidence of nasal and groin Methicillin-resistant Staphylococcus aureus (MRSA) carrier status in patients undergoing routine cardiac surgery and to study its effect on post-operative wound infections with MRSA.*

Material and Methods: *Patients undergoing routine cardiac surgery between 30-04-2007 and 31-10-2007 at Rehman Medical Institute, Peshawar were enrolled in the study. Nasal and groin swabs were taken on admission to check for MRSA carriage. Patients requiring emergency surgery were not included in the study. Swabs for culture and sensitivity were taken from patients with post-operative surgical wound discharge. The post-operative wound infections were compared in the MRSA carrier (carrier group) and non-carrier (control group) groups.*

Results: *Out of 333 (297 open-heart and 36 close-heart) patients undergoing routine cardiac surgery during this period, 52 (18 %) open and 2 (6 %) close heart patients had either nasal or groin or both swabs positive for MRSA. Two patients developed post-operative mediastinitis; one of them was with MRSA from the control group. The patient with mediastinitis with organisms other than MRSA was excluded from study. Two other open-heart patients, one from each group, developed superficial sternotomy wound infection with MRSA. The difference in the incidence of post-operative wound infections with MRSA in the two groups was not significant statistically. All patients who developed surgical site infection with MRSA were diabetic.*

Conclusion: *Pre-operative MRSA carriers, undergoing elective cardiac surgery, did not have a statistically significant higher incidence of post-operative MRSA wound infections.*

Key Words: *Cardiac Surgery, Wound Infection, MRSA carriers.*

INTRODUCTION

Post-operative wound infection is a dreaded complication of any surgery. Mediastinitis is a serious complication of cardiac surgical cases. High inhospital mortality ranging from 7 % to 20 % has been reported with mediastinitis.[1-3] Various studies have reported the incidence of deep sternal infections after cardiac surgery to be from 0.25 % to 4.0 %.[4-7] Long-term mortality in the year after the operation is also increased in patients who had mediastinitis.[1,8] Mortality with superficial sternotomy infections is reported to be more than 5%.[7] Close heart surgical cases usually do not require median sternotomy. Though rare, but like any other surgical site, close-heart cases requiring opening of the pericardium can potentially develop mediastinitis.

One of the most common pathogens associated with post-operative mediastinitis is Staphylococcus aureus.[9,10] Post-operative wound infections with Methicillin-resistant Staphylococcus aureus (MRSA) are growing in number world over. Methicillin-resistant Staphylococcus aureus was reported to be the cause of poststernotomy mediastinitis in more than 64 % of the cases in one study.[11] Nasal carriage of

DETAILS OF OPEN-HEART PROCEDURES PERFORMED

Open-Heart Procedures	Frequency (n=297)	% age
Coronary Artery Bypass	169	56.9 %
Mitral / Aortic / Tricuspid Valve Surgery	66	22.2 %
Surgery for Congenital Heart Diseases	47	15.8 %
CardiacValvur surgery + Coronary Artery Bypass	10	3.4 %
Miscellaneous	05	1.7 %

Table 1

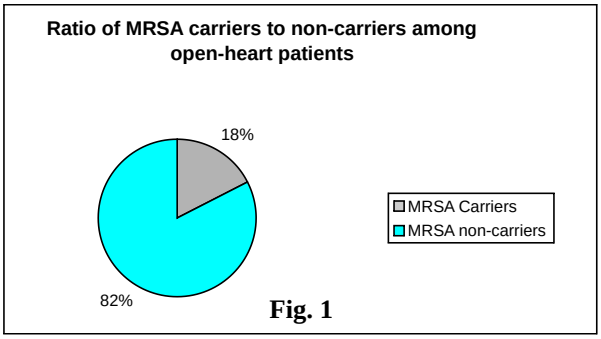

Fig. 1

S. aureus has been identified as a major risk factor for wound infection after cardiac surgery.[12] Cimochowski and colleagues have shown reduction of sternal wound infections with the application of intranasal mupirocin.[13] Resistance to mupirocin has been reported by Cookson.[14] Higher poststernotomy mediastinitis related deaths were seen in Methicillin-resistant S. aureus group than in Methicillin sensitive group of patients.[15] Cheng-Hsin has proposed a prospective study to assess the association between positive culture results of nasal swabs obtained before operation and sternal wound infection after the operation.[11]

Self-medication and injudicious use of antibiotics is very common in our society. This can lead to emergence of resistant strains of organisms. These organisms can potentially lead to outbreak of infections in hospitals in general and intensive care units in particular. The study concentrates on post-operative infection with MRSA in routine cardiac surgery cases only, as their admission in our unit is planned and the follow-up during the first month after surgery is almost 100 %. The main objective of the study was to find out the incidence of nasal and groin Methicillin-resistant Staphylococcus aureus (MRSA) carrier status in patients undergoing routine cardiac surgery and to study its effects on post-operative wound infections with MRSA.

MATERIAL AND METHODS

Setting: The study was carried out jointly by the Department of Cardiac surgery and Department of Microbiology at Rehman Medical Institute Peshawar from April 30 to October 31, 2007.

Subjects and specimens: Three hundred and thirty three patients admitted for routine cardiac surgery were included in the study. Patients undergoing emergency surgery and patients with surgical site infection with organisms other than MRSA were excluded from the study.

Routine specimens, to check for MRSA carrier status, were taken for culture and sensitivity from anterior nares and groins of the patients included in the study, using moistened cotton wool swabs, on admission. The swabs were immediately sent to the laboratory for processing. Based on the results, patients were grouped as MRSA *carrier group* and *non-carrier (control) group*. If there was any sternal wound discharge post-operatively, swabs from the discharge were sent for culture and sensitivity. Swabs from deep retro-sternal tissues were taken when patients required re-wiring of their sternum. The post-operative wound infections with MRSA were compared in the MRSA carrier (carrier group) and non-carrier (control) groups.

Patients' Preparation for Surgery: Once nasal and groin swabs were taken, patients were shaved for surgery on the evening before surgery. They had a bath with 4% chlorhexidine twice before going to theatre; once the evening before surgery and then early in the morning on the operation day. Patients received prophylactic antibiotics on induction and continued for 72 hours. A combination of cefotaxime and co-amoxiclav was used in all the patients. Co-amoxiclav was omitted in patients allergic to penicillin.

Culture and identification: Specimens were inoculated on to Mannitol salt agar (Oxoid, Hampshire, UK) and incubated at 37^0C for up to 48 hours. The isolates were identified as Staphylococcus aureus, by Gram staining, catalase, tube coagulase, and DNAase tests. Sensitivity testing for *MRSA* isolates was performed according to the CLSI guidelines by modified Kirby-Bauer disk diffusion technique using a 1µg oxacillin disk (Oxoid, UK) and Muellar-Hinton agar (Oxoid, UK)

POSTOPERATIVE INFECTIONS WITH MRSA IN THE MRSA CARRIER GROUP IN OPEN HEART SURGERY

Postoperative infections with MRSA	Frequency (n=52)	% age
Deep wound infection (mediastinitis) with MRSA	0	0.0 %
Superficial wound infection with MRSA	1	1.9 %

Table 2

containing 4% NaCl incubated at 35°C for 24 hours, using a bacterial suspension matching 0.5 McFarland turbidity standard. A zone diameter of ≥ 13mm was taken as sensitive, 11-12mm as intermediate and ≤ 10 as resistant. The MRSA were confirmed by using Oxacillin-salt screening Muller-Hinton agar containing 4% NaCl and 6-µg/ml oxacillin (Remel, USA). The plates were incubated at 35°C for 24 hours and examined carefully with transmitted light for evidence of small colonies (>1 colony) or a light film of growth, indicating oxacillin-resistance. Oxford strain of Staphylococcus aureus NCTC 6571 sensitive to methicillin and NCTC 12493 resistant to methicillin were used as control organisms (16).

Data Collection: Patients data was entered in a register along with reports of pre-operative groin /nasal MRSA swabs. Patients' surgical wounds discharge swabs reports, taken during the hospital stay or after discharge from the hospital, were also entered in the register. The record was re-checked retrospectively from the hospital central computer data system. Operation theatre record was checked for any re-wiring / re-intervention for deep sternal wound infection.

Statistical analysis: To test the significance of the difference between the two groups in respect of post-operative infection, both Fisher Exact and chi-square tests were applied. A p value of ≤ 0.05 was considered to be statistically significant.

RESULTS

A total of 333 cardiac surgical procedures were performed during this period. 297 (89.2%) of them were open while 36 (10.8%) were close heart procedures.

***OPEN-HEART PATIENTS GROUP*:** Out of 297 patients, 211 were male while 86 were females. Age range was between three years and eighty years with a mean age of 43.9. Fifty-two (52) patients out of 297 (18 %) patients admitted for open-heart procedures were either nasal (22 patients, 7.4 %) or groin (27 patients, 9.1 %) or both the sites (3 patients, 1 %) carriers; with a total of 55 positive swabs for MRSA on cultures done at the time of admission (Fig.1). The procedures performed on these patients are shown in table 1.

Mediastinitis / Deep sternal wound infections: Six patients had re-wiring of the sternum or debridement of the sternal wound for either sternal instability or discharge from retro-sternal space. Two of them had mediastinitis. One of the mediastinitis was due to MRSA (from the control group). He was a 78 years old man, with type II diabetes mellitus and had coronary artery bypass operation. The incidence of mediastinitis with MRSA in the control group of patients was 0.4%. None of the patients in the carrier group developed MRSA mediastinitis. Statistical analysis done for mediastinitis, comparing the carrier and control groups showed a p value of 0.82 by Fisher Exact Test and a p value of 0.39 with a chi-square value of 0.73 done by chi-square test. Both values are not statistically significant. The patient with non-MRSA mediastinitis was excluded from the study.

Superficial wound infections: Any patient with discharge from the sternal wound, either on the ward or presenting to outpatients, had swabs taken for cultures sensitivity. Two of these superficial sternal wounds swab were positive for MRSA. Both these patients were female and diabetic (type 2). Both of them had coronary artery bypass graft surgery. One of them was a nasal carrier of MRSA on pre-operative investigations. The incidence of superficial sternal infection in the carrier group of patients was 1/52 (1.92 %). The other patient with superficial MRSA wound infection was from the control group. The incidence of superficial wound

POSTOPERATIVE INFECTIONS WITH MRSA IN THE CONTROL GROUP IN OPEN HEART SURGERY

Postoperative infections with MRSA	Frequency (n=245)	% age
Deep wound infection (mediastinitis) with MRSA	1	0.4 %
Superficial wound infection with MRSA	1	0.4 %

Table 3

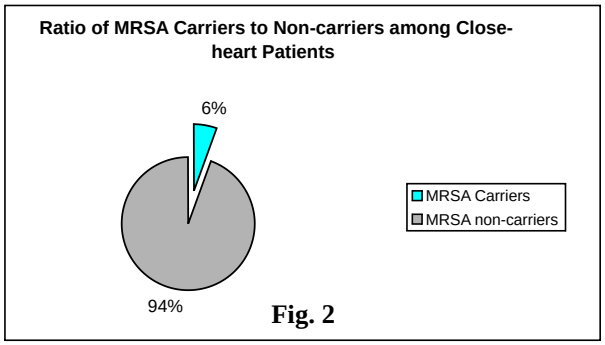

Fig. 2

infections in the control group was 1/245 (0.4%). Statistically the incidence of superficial wound infection in the two groups was not significant (p value 0.32 by Fisher exact test and a p value of 0.8 by chi-square test).

Table 2 and table 3 shows the incidence of infections in carrier group and control group respectively.

***CLOSE-HEART PATIENTS GROUP*:** This group comprised of 36 patients with male to female ratio was 1:1.6. Age range was from 2 months to 45 years with a mean age of 10.2. Two patients out of 36 (6 %) patients admitted for close-heart procedures were either nasal (n=1, 3 %) or groin carriers (n=1, 3%) of MRSA on cultures done at the time of admission Fig.2. Twenty eight of the procedures were performed for congenital heart diseases while eight of them were for acquired heart diseases. The procedures performed on these patients are shown in table 4. None of these patients (either from the carrier or from the control group) developed any wound infection.

DISCUSSION

The difference between MRSA and methicillin-susceptible Staph. aureus is resistance to β-lactamase-stable β-lactam antibiotics.[17] Jevons identified strains of Staph. aureus resistant to methicillin in 1961.[18] Infection with Methicillin-resistant Staphylococcus aureus is becoming endemic in many hospitals world over. MRSA is not an additional infection burden, but instead is replacing Methicillin-sensitive Staphylococcus aureus. MRSA has become the commonest cause of surgical site infections in English hospital.[19] Staphylococcus aureus is one of the most common pathogens associated with post-operative mediastinitis.[9,10] Methicillin-resistant Staphylococcus aureus was reported to be the cause of poststernotomy mediastinitis in more than 64 % of the cases in one study.[11]Various studies have reported different incidences of MRSA carriage. Colonization with methicillin-resistant Staphylococcus aureus, often a symptomatic, has been reported to be 4.0 % to 8.0 % in ICU patients, 0.18 % to 7.2 % of in-patients and 1.3 % to 2.0 % of the individuals in the community by Davis KA et al.[20] Incidence of MRSA among newly admitted patients to an urban hospital was 7.3%, which was higher than the 1.3% to 5.3% prevalence in the previous reports.[21] Finkelstein R et al have reported more than 2.5 new cases of MRSA infection or colonization per 100 admissions in their study.[22] Eighteen percent (18 %) of our pre-operative patients scheduled for open-heart surgery were found to either nasal or groin carriers of MRSA. The incidence was lower (6 %) in the close heart group of patients. Both these figures, in our study, for incidence of MRSA carriage on admission are very high. We could not find any local study to compare our incidence rate with it. Only two explanations are possible for the difference in the incidence rates in the open-heart group and close-heart group in our study:

1. The average age at the time of admission was more in the open-heart group
2. At least 56 % of the open heart-group patients had previous admission to hospital and an invasive procedure like coronary angiography.

All the three patients in our study who developed either superficial or deep sternal wound infections with MRSA were diabetic. Dodds Ashley and colleagues have recognized diabetes as a risk factor for postoperative mediastinitis due to

DETAILS OF CLOSE-HEART PROCEDURE PERFORMED

Close-Heart Procedures	Frequency (n=36)	% age
Patent Ductus Arteriosis (PDA) Ligation	17	47.2 %)
Close Mitral Commissurotomy	7	19.4 %
Pulmonary Artery Banding (PA Banding)	6	16.7 %
Modified Blalock-Taussig Shunts	3	8.3 %
PDA Ligation + PA Banding	1	2.8 %
Coarctation of Aorta Repair	1	2.8 %
Pericardectomy	1	2.8 %

Table 4

MRSA.[23]

MRSA carriage, specially nose, has been shown to increase the surgical sites infection.[24] Organisms can spread to other parts of the body in the nasal carriers of Staphylococcus aureus.[25] Mupirocin has been found to be useful in reducing the sternal wound infection.[13] but as mentioned earlier resistance to mupirocin has been reported.[14] Prolonged or widespread "blanket" use of mupirocin in hospitals and closed community outbreaks has been discouraged.[14]

All Surgeons, regardless of specialty, want to minimize the possibility of postoperative infection. Cardiac surgical patients are considered to be high risk because of the adverse effects of heart-lung machine. Cardiopulmonary bypass is known to impair humoral immunological defences, reduce phagocytosis, and activate leucocytes. Active surveillance of patients admitted for cardiac surgery for Staphylococcus colonization is desirable.[26,27] Routine use of vancomycin, as prophylactic antibiotic, in MRSA carriers undergoing cardiovascular surgery has been suggested but not generally accepted.[28,29]

We did not have reports of swabs taken, to check for MRSA carriage, till the 2nd post-operative day. Routine use of topical Mupirocin or prophylactic use of vancomycin was therefore not possible in those found carriers of MRSA. We used the same prophylactic antibiotics protocol for both groups of patients. Despite the very high incidence of MRSA carriage in our patients we did not have any case of MRSA mediastinitis in the carrier group. There was, however, one case of MRSA mediastinitis in the control group. Both the groups had one superficial wound infection each with MRSA. The difference in their incidence did not acquire statistical significance.

CONCLUSION

Pre-operative MRSA carriers, undergoing elective cardiac surgery, in the study, did not have a statistically significant higher incidence of post operative MRSA wound infections, compared with non-carrier group. MRSA wound infections appear to be more common in diabetic patients.

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