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ORIGINAL ARTICLE

MRSA Infection in Vascular Surgical Patients: The HKL Experience

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ABSTRAK

Jangkitan Methicillin-resistant Staphylococcus aureus (MRSA) kerap berlaku di kalangan pesakit yang menjalani pembedahan vaskular. Ianya boleh mengakibatkan kehilangan anggota atau kematian. Kami melaksanakan analisa retrospektif terhadap nota pesakit pembedahan vaskular di Hospital Kuala Lumpur untuk tempoh 2 tahun mulai Januari 2005 hingga Disember 2007. Ianya bertujuan mengamati corak jangkitan dan faktor-faktor yang mengakibatkan jangkitan ini. Seramai 999 pesakit menjalani pembedahan vaskular dalam rangkuman jangkamasa kajian ini. Dari jumlah ini, seramai 24 pesakit (2.4%) dikesan terjangkit oleh MRSA. Jangkitan ini didapati terjurus kepada pesakit yang merokok, pesakit diabetes melitus dan mereka yang terdahulunya pernah menjalani pembedahan vaskular. Kebanyakan jangkitan bercorak kemusnahan terhadap luka pembedahan dan berlaku dalam kategori pembedahan kecemasan. Sebanyak 54% dari kes jangkitan berakhir dengan kehilangan anggota atau pengeluaran graf vaskular atau kematian. Jangkitan MRSA mengakibatkan kesan klinikal yang buruk terhadap pesakit yang menjalani pembedahan vaskular. Langkah pencegahan yang intensif diperlukan bagi mengelakkan kesan buruk yang tidak diingini ini.

Kata kunci: jangkitan MRSA, pembedahan vaskular

ABSTRACT

Methicillin-resistant *Staphylococcus aureus* (MRSA) infection is important among vascular surgical patients. Its effect can be devastating resulting in limb amputation and mortality. We performed a retrospective patients record analysis to determine the pattern of MRSA infection among vascular surgical patients in Hospital Kuala Lumpur from January 2005 to December 2007. We also attempted to identify the factors associated with poor clinical outcome after such infection. There were 999 patients who underwent vascular surgeries in HKL within the analysis period. Of these 24 patients (2.4%) were detected to have MRSA surgical site infection. The infection was commoner among cigarette smokers, patients with diabetes melitus and those who

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had previous vascular surgery. Most infections occurred in the emergency surgery category and manifested as wound breakdown. Fifty-four percent of the infected patients ended with graft removal, amputations or death. MRSA infection complicating vascular surgery resulted in poor clinical outcome. This serious threat requires intensified preventive measures.

Key words: MRSA infection, vascular surgery

INTRODUCTION

Staphyloccocus aureus is the commonest cause of surgical site infection (SSI) and Methicillin Resistant *Staphylococcus aureus* (MRSA) is an important cause of SSI amongst vascular surgical patients**.** It is associated with poor outcome in the form of limb loss and mortality. Graft morbidity and mortality rates were recorded at 25% and 11% respectively (Surveillance of Surgical Site Infection in English Hospitals 1997-1999, 2000; Naylor et al. 2001).

Numerous factors have been attributed to the emergence of MRSA. These are advanced age, cigarette smoking and immunocompromised state such as diabetes melitus. Other pertinent surgical issues that may contribute to the overall outcome in MRSA patients include, the higher prevalence of peripheral vascular disease in the lower limbs, types of graft infected, long duration of surgery and the judicious use of pre-operative vancomycin prophylaxis.

An increasing trend of MRSA carrier and infection had been reported in the hospitals of Europe and the United States especially in emergency cases (Muralidhar et al. 2006). We postulate a similar increasing trend of MRSA carrier and infection in Malaysia as the numbers of emergency vascular cases are equally as much.

The aim of this study was to review the prevalence and outcome of MRSA infection in the vascular unit in Hospital Kuala Lumpur (HKL). In addition, we also reviewed the associated risk factors of MRSA infection and choices of antibiotics used to treat it.

MATERIALS AND METHODS

We conducted a review of post-surgical vascular cases complicated by MRSA infection in the Vascular Surgical Unit in Hospital Kuala Lumpur (HKL) from 1st January 2005 to 31st January 2007. MRSA infections were clinically diagnosed and confirmed by microbiological study from local wounds, nasal swabs, infected grafts and blood cultures. The strains with oxacillin (≥1µg) zone diameter <13mm diameter and/or the strains with oxacillin minimum inhibitory concentration (MIC) value ≥4µg/ml were described as Methicillin-Resistant. The risk factors studied were patients' demography, co-morbidities and cigarette smoking habits. Previous hospitalization, surgery, and the use of broad-spectrum antibiotics were taken as within one year prior to the primary surgery performed. Other features examined were the type and the anatomical site of specimen taken, patients' location of where the samples were taken and the antibiotics sensitivity results. Operative factors were the urgency of the surgery, the types of operation and the types of grafts used. We classified post-operative vascular graft infection by using the Szilagyi's classification which categorizes the grades of infection according to the ana

tomical layer.

The outcome measured were length of hospital stay, incidence of sepsis, amputation rate and mortality. Prolonged hospitalization was defined as hospital stay of 24 days or more from the first day of MRSA positive swab until patients were discharged or succumbed. The complications and outcomes were taken as those occurred within the same hospital stay. Complications such as wound breakdown, graft dehiscence, graft thrombosis and pseudo-aneurysm were also reviewed.

Statistical analysis was performed using the SPSS version 12.0 and tests such as Chi-square and Fisher's Exact Test whenever appropriate. The P value of less than 0.05 was considered significant.

RESULTS

In total, there were 999 vascular surgeries in HKL within the study period. Of these, 24 patients (2.4%) were complicated by MRSA infection. The male to female ratio was 2:1 with the median age of 60 years old.

Diabetes melitus was found in 11 patients infected with MRSA, while previous history of peripheral vascular disease was seen in 8 patients. Twelve patients (50.0%) were chronic cigarette smokers at the time of hospitalization.

Multiple hospitalizations with previous surgery were characteristic of MRSA infection in 10 of these patients (41.7%). Fifteen patients (62.5%) had previous broad-spectrum antibiotic usage and 15 patients (62.5%) had history of previous hospitalization (Table 1).

The sites of positive cultures were from various sources. However, there was no positive culture detected in any of the vascular grafts used. In addition, the lower limbs yielded the highest rate of positive MRSA culture.

As for the location of the patients, majority of the positive MRSA swabs were obtained from the general wards (70.8%), followed by the isolation rooms (16.7%) and ICUs (12.5%).

There was a higher prevalence of infection in emergency cases with forty-six percent of the infected cases were done as emergency surgery compared to 37.5% elective and 16.7% urgent cases. The breakdown of each type of vascular surgery performed is shown in Table 2.

In two-thirds of the MRSA infected cases, vascular grafts were used. The breakdown of the types of grafts is shown in Table 2. Of these, higher infection rate was seen in patients using prosthetic graft (5 Dacron, 4 PTFE) as compared to those with venous graft (n=5). Two other cases used composite graft. However, the presence of vascular graft did not predict poor outcome of MRSA infection (p=0.679).

Of the 24 MRSA infected patients, 14 patients (58.3%) developed wound infection (5 superficial, 6 deep, 3 exposing grafts). In addition, one case had superimposed graft dehiscence and a pseudoaneurysm respectively. Prolonged hospitalization was recorded in one-third of the patients (n=8). These tend to develop complications (p=0.006) and have poorer outcome (p=0.033) such as limb loss and mortality.

As for the treatment of MRSA infection, five patients were treated with Vancomycin alone, and 10 patients were treated with both Vancomycin and surgery such as wound debridement, graft removal, sartorius flap usage or amputation. The remaining patients (n=7) were neither treated with Vancomycin nor surgical treatment but were given other types of antibiotics such as Teicoplanin or Rifampin according to culture and sensitivity result; Mupirocin for nasal carriage.

Table 1: Patient's Factors for MRSA Infection in Vascular Surgery.

MRSA Infection in Vascular Surgical Patient	Frequency (n=24)	Percentage (%)
Patient's Risk factor		
a) Previous hospitalization	15	62.5
b) Previous antibiotic usage	15	62.5
c) Smoking	12	50.0
d) Diabetes melitus	11	45.8
e) Previous surgery	10	41.7
f) Previous vascular surgery	8	33.3
Sources of Positive MRSA Cultures Taken		
a) Local wound	19	79.2
b) Nasal swab	5	20.8
c) Blood	4	16.7
Anatomical Sites of Cultures		
a) Lower Limb	13	54.2
b) Abdomen	3	12.5
c) Head and Neck	2	8.3
d) Chest	2	8.3
e) Groin	2	8.3
f) Upper Limb	1	4.2
g) Perineum	1	4.2
Total	**24**	**100.0**

Table 2: Surgical Factors for MRSA Infection in Vascular Surgery.

MRSA Infection in Vascular Surgical Patient	Frequency (n=24)	Percentage (%)
Types of Vascular Surgery Performed		
a. Infrainguinal bypass	7	29.1
b. Open AAA repair	6	25.0
c. Amputation	6	25.0
d. Femoral embolectomy	1	4.2
e. HSVL with MSA	1	4.2
f. Angiogram	1	4.2
g. AVF creation	1	4.2
h. Wound debridement	1	4.2
Total	**24**	**100.0**
Types of Graft		
a. Venous	5	31.2
b. Prosthetic		
i Dacron	5	31.2
ii PTFE	4	25.0
c. Composite (PTFE + Vein)	2	12.5
Total	**16**	**100.0**

Poor outcome was recorded in 13 out of 24 patients (54.2%). Of these, 4 patients (16.7%) died of MRSA infection while the other 9 patients developed multiple complications such as graft removal (4 out of 9 patients, 44%), and sepsis (5 out of 9 patients, 56%). Out of these 9 patients, 6 required lower limb amputation.

DISCUSSION

Our results revealed the debilitating effects of MRSA infection in vascular patients. The prevalence of MRSA infection in vascular patients was low at 2.4% over a period of two years. This low rate could be attributed to the preventive measures, which included prophylactic antibiotic used in selected high risk patients, barrier nursing and universal precaution.

However, a high percentage of chronic cigarette smokers and patients with diabetes melitus were obvious in this subset of patients. Smokers and diabetics are found to be predictors of harbouring MRSA infection (Scott et al. 2005)**.** This trend seemed to be similar in another report by Thompson (2006).

With regards to the anatomical sites of positive culture, lower limb swabs usually reflects local wound infection of an ischemic wound and is often described in patients with prolonged hospitalization. The significance of a positive culture is not great to warrant local wound treatment with debridement and dressing. This is contrary to abdominal or groin wound infections that are actually surgical site infections.

The most prominent finding in this study is the poor outcome in MRSA infected patients. The mortality rate was 16.7% and these patients mostly died of septicaemia eventually, as a complication of MRSA infection. On the other hand, serious morbidity was encountered in 37.5 % of the infected patients in the form of limb amputation and graft removal. In other

words, more than half of these patients were at risk of either mortality or serious complications. Gassel et al (2002) reported 17.0% mortality, which was similar to our study.

The mortality will depend on the source and site of infection, with aortic MRSA infection recorded nearly 100.0% mortality. Murphy et al concluded that graft infection posed a catastrophic complication with mortality reaching up to 56.0% in aorto-illiac reconstruction (Murphy et al. 2001). This brings us to the importance of preventive measures that must be taken seriously to avoid such morbidities caused by MRSA infection. Serious complications with 25.0% resulting in major amputation and 11.0% mortality rate (Gemmel et al. 2006).

The rationale behind various treatment modalities can be grouped into patient or operative factors. Patients with co-morbid, for instance, uncontrolled diabetes melitus and peripheral vascular disease would progress to poorer or delayed wound healing. Timing of surgery accounts for higher rates of MRSA infection in emergency cases whereby inadequate antibiotic prophylaxis, and lack of time for careful pre-operative assessment and planning, contributed in one way or another. Thus, treatment option depends on patient-to-patient basis and good surgical skills. Generally, daily dressing with wider antibiotic coverage is the initial therapy before aggressive treatment with graft removal or amputation intervention. However, the reverse may be life saving. This happens in gangrenous limbs, especially wet gangrene whereby amputation is the treatment of choice. Infected graft unresponsive to antibiotics will eventually need a graft revision. However, this depends on the site of the initial graft as reoperation at the abdominal aortic aneurysm (AAA) or the inguinal region can be devastating secondary to its highly infected-prone area and patient's age, co morbidities and risks of deep vein thrombosis or pulmonary embolism. A re-operation of AAA can achieve near 100% mortality and should be borne in mind.

CONCLUSION

In conclusion, our small study has proven that MRSA infection brings about unfavorable outcome to vascular patients. Preventive measures need to be upgraded to battle the increasing trend of MRSA infection. In our attempt to seek for the factors affecting MRSA infection, we failed to identify specific predictors. This is largely attributed to the small sample size that we reviewed. Defined predictors for MRSA infection is yet to be established but several co-morbidities such as diabetes melitus, chronic smoking, multiple previous hospitalization and previous broad-spectrum antibiotics used tend to be more prevalent in MRSA infection.

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