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Methicillin-resistant *Staphylococcus aureus* (MRSA) colonization in patients with spinal cord injury

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Methicillin-resistant *Staphylococcus aureus* (MRSA) colonization has been a problem in the Rancho Los Amigos Medical Center (RLAMC) since 1978. This study reviews the latest 2 years' use of a protocol to prevent the spread of MRSA while allowing spinal cord injured patients to continue to participate in the rehabilitation program. The protocol included management in a private room, bathing with hexachlorophene, monitoring positive sites and clearing patients after 3 weeks of negative cultures. Clusters of cases were investigated by obtaining nasal cultures from the personnel.

Sixty-seven of 584 (11%) SCI patients were colonized from July 1989 to July 1991. The prevalence of MRSA colonization was significantly greater in the pressure ulcer management service (PMS) 49/184 (27%) than in the rehabilitation spinal injury service (SIS) 18/400 (5%). The body sites colonized were wounds (58/67), nares (37/67), throat (30/67), urine (27/67) and perineum (17/67).

Oral therapy with combinations of sulfamethoxazole trimethoprim (SXT) or Novobiocin with rifampin together with topical antibiotics (nares and wound sites), used in nine patients with healing wounds or recent flap surgery, resulted in clearing of the colonization in all cases. Identification and treatment of carriers in the personnel and use of preadmission screening cultures for MRSA in patients with pressure ulcers resulted in reduced inpatient admission.

Keywords: methicillin-resistant *Staphylococcus aureus*; spinal cord injury.

Introduction

Within 2 years of the introduction of methicillin in 1959, the emergence of a previously unknown bacterial strain, methicillin-resistant *Staphylococcus aureus* (MRSA) was reported in Europe.[1–3] In the USA, the first large outbreak of MRSA was reported in 1968 by Barrett *et al.*[4] Similar outbreaks in acute care institutions[5,6] have been documented, and more recently MRSA in long term care facilities[7,8] including spinal cord injured patients[9] has been described.

At the Rancho Los Amigos Medical Center (RLAMC), a 450 bed Los Angeles County/university affiliated rehabilitation center, our first experience with MRSA was documented in 1982.[10] Earlier, in 1978, a protocol had been established to prevent the spread of MRSA while allowing the patients to continue participation in their prescribed rehabilitation program.

MRSA colonization has continued to be a problem at RLAMC. This study examines the most recent 2 years' use of the MRSA protocol, including the adaptations made recently to deal with the increasing numbers of patients with MRSA.

Methods

Since Rancho Los Amigos is a rehabilitation facility, most of the patients are referrals from other institutions. After discharge

from hospital many patients have been seen as outpatients in the various clinics.

For the purpose of this study, we have reviewed MRSA colonization and protocol effectiveness in two spinal injury services, the rehabilitation spinal injury service (SIS) and the pressure ulcer management service (PMS) which admitted patients with established pressure ulcers. Patients were admitted to SIS within a few weeks of their injury.

The SIS consisted of two wards each with approximately 30 patients. After admission to RLAMC, bladder drainage was managed by intermittent catheterization carried out by a team of technicians. Patients who developed reflex voiding used an external condom catheter connected to a drainage bag.

The PMS consisted of one ward with approximately 26 patients. Patients admitted to PMS were usually managed with indwelling catheters until the musculocutaneous flap wounds were healed.

Bacteriological cultures

Cultures of both nares, throat, perineum and wounds[11] were collected with cotton swabs (Culturette II; Marion Scientific, Kansas City, MO). Urine samples were obtained by clean-catch midstream collection or by catheterization.

Swabs and urine were initially cultured on mannitol salt agar and blood agar containing sheep blood (Clinical Standards Laboratories, Carson, CA). Isolates were identified on the basis of Gram stain, hemolysis, colonial morphology, catalase production, coagulase and/or Staphaurex (Wellcome Diagnostics, Greenville, NC), and DNase production (Clinical Standards Laboratories). Antibiotic susceptibility testing for methicillin was done by the Bauer-Kirby disk diffusion method using Mueller-Hinton agar containing 4% NaCl, as well as the agar overlay method. For all other antibiotics, Mueller-Hinton agar without salt was used. Incubation temperature of 35°C was used for methicillin susceptibility testing. Zone inhibition diameters were read after 18–24 hours of incubation.

Definitions

Definitions of colonization (used interchangeably with carriage) and nosocomial acquisitions of MRSA have not changed since 1978.[10] Patients were considered colonized with MRSA when two or more consecutive cultures of any body sites were positive for MRSA. Colonization was considered to be nosocomial (RLAMC-acquired) if MRSA-positive culture was reported greater than 7 days after admission, and was considered to be community-acquired if identified within the first week of admission or if the patient had a previously positive culture from the transferring facility. Clustering was considered to occur when two or more nosocomial cases were identified on the same ward.

Epidemiological measures

The first protocol outlining control measures was introduced at RLAMC in 1978.[10] The plan of action included active surveillance for all MRSA isolates, recommendations for type of isolation, and cultures to be obtained from body sites potentially colonized. Body sites cultures are shown in Table I.

All colonized or infected patients were isolated in private rooms. Patients were cohorted in rooms with up to six patients when clustering occurred. A procedure-oriented isolation system, category 1, 2, 3 and 4[12] developed by Donna Gilmore, RN, MPH, CIC at RLAMC has been used in our facility since 1985. The majority of MRSA patients were on category 2 isolation (glove and gowns are used with direct patient contact). Patients continued with physical

Table I Potentially colonized body sites cultured for MRSA

Nose (bilateral nares)
Throat
Perineum
Urine
Wounds (open or healed)
GT sites
Tracheostomy sites
Tracheal aspirate

and occupational therapy. Colonized patients were separated from other patients in the group therapy areas. Equipment used by patients in these areas was cleaned with a phenolic disinfectant. The personnel in these areas were instructed to carry out isolation precautions.

Daily hexachlorophene bathing was recommended for all colonized patients.[13] The use of hexachlorophene for open wounds was avoided. All personnel, excluding pregnant women, washed their hands with hexachlorophene soap after direct contact with patients.

Body sites found to be positive for MRSA were cultured weekly. These cultures were obtained only after patients had discontinued all antibiotics. The patient remained in isolation until three consecutive negative cultures taken weekly were obtained.

If clustering of cases was identified in a multipatient room, cultures were obtained from all patients in the room. Also in the event of clustering of cases in any ward, nasal cultures were obtained from personnel. Personnel that were nasal carriers were made aware of their status and treated by the Employee Health Service. No restrictions were placed on colonized personnel regarding areas where they could work. Cultures of nose, throat and perineum were taken from personnel at initial visit. Topical bacitracin or mupirocin to bilateral nares and bathing with hexachlorophene was recommended for 7 days. If personnel were colonized in the throat, a combination of oral antibiotics for 10 days was recommended depending on antibiotic susceptibility of MRSA.

Results

Sixty-Seven patients with SCI were colonized. Frequency of positive body sites in all SCI patients colonized with MRSA were wounds (58/67), nares (37/67), throat (30/67), urine (27/67) and perineum (17/67) (Table II). The prevalence of MRSA colonization was significantly greater on the PMS 49/184 (27%) than on the SIS 18/400 (5%).

Sixty-seven of 584 (11%) SCI patients were colonized from July 1989 to July 1991. In the previous year we had 24 SCI patients (8%) infected or colonized with MRSA. Because of an increase in the number of colonized patients in September 1989 a combination of measures was introduced to deal with the problem. From July 1989 to July 1991 two outbreaks of nosocomial acquisition were identified. The first occurred on the SIS in September 1989 and the second on PMS between March and October 1990 (Fig 1). The first involved an unidentified index case. Both involved nasal carriage among personnel.

Results of outbreak investigation

The index case for the first outbreak on the SIS was identified when a tracheal aspirate culture from this patient was positive for MRSA. Further culturing of this previously unidentified patient revealed colonization in multiple body sites. Within 1 week a second case was identified in the same room as the index case. The factors involved in this spread were unclear but may have included the frequent tracheal suctioning required by the patient. Further control measures instituted at this time included cohorting of patients in the room with the index case, and culturing of all patients in the room with the index case. Culture results showed four of five patients were colonized with MRSA.

During this time nasal cultures of personnel identified three nasal carriers, two of whom had antibiograms identical to the index case. All cultures were confirmed by screening cultures (nose, throat and perineum) taken by the Employee Health Service. One of three also had a positive perineal culture. All employees responded to decolonization with bacitracin ointment and daily hexachlorophene baths. While these employees were being treated they continued to work with patients and thus no loss of time occurred.

Nosocomial acquisition subsided on the SIS once unknown carriers in both patients and personnel were identified and treated. One nosocomial case was identified during this time on a different SIS ward. The isolate from this patient did not appear to be epidemiologically linked to the outbreak.

Order sheets outlining the current hospital protocol for management of patients

Table II Body sites colonized with MRSA

Site	PMS ($n = 49$)	SIS ($n = 18$)
Nose (bilateral nares)	24 (49%)	13 (72%)
Throat	21 (43%)	9 (50%)
Perineum	10 (20%)	7 (39%)
Urine	20 (41%)	7 (39%)
Wounds	46 (94%)	12 (67%)

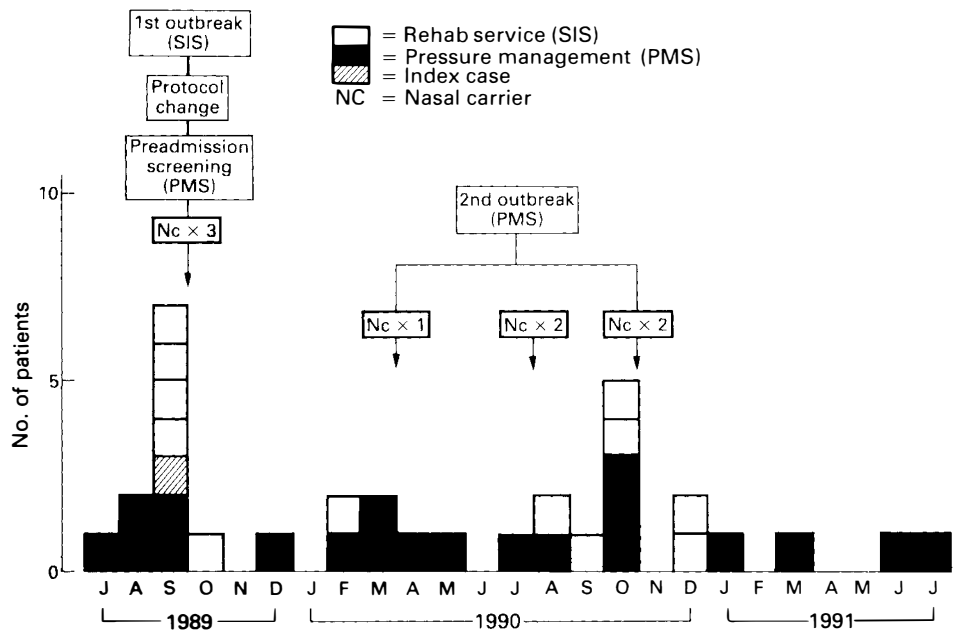

Figure 1 Number of spinal cord injury patients with nosocomial acquired methicillin-resistant *Staphylococcus aureus* (MRSA) from July 1989 to July 1991 identified on the rehabilitation spinal injury service (SIS) and pressure management service (PMS).

with MRSA were approved by the hospital infection committee (HIC) and introduced in September 1989 (during the first outbreak of this study) (Fig 1). To increase efficacy and reduce confusion among care providers the protocol has been printed directly onto the physician's order sheet, clearly and conveniently outlining the protocol procedures. The sheets were placed on each patient's chart as they were identified as MRSA positive.

Nosocomial acquisition was arbitrarily considered to have occurred when colonization was reported greater than 7 days after admission. Colonization of patients may have occurred weeks to months prior to detection of MRSA. Because of the potential for unrecognized MRSA colonization of wounds, preadmission screening of all patients on PMS was begun in September 1989 (Fig 1). A number of patients being transferred to PMS from extended care facilities were identified with MRSA at multiple body sites greater than 7 days after admission. Because we suspected that these patients were colonized prior to admission, preadmission screening was introduced. The use of preadmission screening between September 1989 and July 1991 resulted in identification of 17 patients colonized with MRSA.

In March 1990 the second outbreak began

which lasted through October 1990 (Fig 1). In March, July and October 1990 nasal cultures of nursing personnel were obtained. Nasal carriers were identified in March (one person), July (two persons), and October (two persons including a surgeon). All five employees had MRSA with identical antibiograms similar to new cases. One of the five employees also had a positive culture of the throat, and another had a positive perineal culture. All were treated with bacitracin or mupirocin ointment and daily hexachlorophene baths, with four or five clearing. The treatment failure was an employee who was also colonized in the throat. This employee later cleared after a 10 day treatment with SXT and rifampin.

Nosocomial acquisition fell after October 1990 (Fig 1) after identification of the nasal carriers.

During the study some patients were treated for 7–10 days with combinations of SXT or Novobiocin with rifampin if colonization persisted. Susceptibility of 57 MRSA isolates to Novobiocin and rifampin was 100% and to SXT was 65%. Oral therapy together with topical antibiotics (nares and wound sites) used in nine patients with healing wounds or recent musculocutaneous flaps, resulted in clearing of colonization in all cases. Few of these patients have spontaneously cleared during their stay without treatment of infection or colonization.

Discussion

Because of the nature of our institution, management of MRSA has been difficult because patients have stayed for long periods of time and new patients colonized with MRSA have been continually admitted from other facilities. At RLAMC we have used a protocol for the management of patients with MRSA since 1978. In 1982 we concluded that this protocol was of use in preventing the spread of colonization while permitting patients to take part in rehabilitation programs. In 1989, in response to a record number of new MRSA patients, a protocol outlining the management of MRSA patients was placed on the chart of each patient colonized with MRSA. The protocol outlined the type of isolation necessary, the screening cultures, orders for daily hexachlorophene bathing and hexachlorophene hand-washing for nonpregnant personnel. The protocol outlined the management of these patients so that they could attend therapy or go to scheduled appointments. The protocol clarified control measures to manage patients with MRSA.

Because increasing numbers of patients colonized with MRSA were admitted to PMS unrecognized, preadmission screening (nose, throat, wounds and urine from a collection device) of all patients on this service was introduced in September 1989. Screening identified 17 patients prior to admission and assisted in the planning of admissions so that control measures could be instituted promptly on admission.

Elimination of MRSA carriage with either oral or local antibiotics, or a combination of both, has been used in patients with SCI[9] and in patients or personnel in acute hospitals and long term care facilities.[14–17] In the only other study of patients with SCI, colonization with MRSA cleared in six of seven patients treated with antibiotics with adequate follow up. The MRSA isolated from our patients were susceptible to Novobiocin and rifampin while only 65% were susceptible to SXT. We used combinations of these agents to treat patients. Treatment of colonization was addressed on all SIS patients after screening culture results were obtained. Of the 18 patients colonized, nine were treated and cleared, six were discharged prior to treatment. Treatment of two patients resulted in negative cultures but these patients were discharged prior to clearing and were lost to follow up, and one patient refused treatment. On the PMS, attempts at treating colonization were not addressed until the patients' wounds had healed (superficial) or after flap surgery. Treating colonization with oral and topical antibiotics on the PMS resulted in clearing of all nine patients. Few of these patients have spontaneously cleared during their stay in hospital without treatment of infection or colonization.

Treatment of colonization of hospital personnel with topical antibiotics resulted in the clearing of seven of eight personnel.

Oral antibiotics were effective in one employee who was a throat carrier.

Prompt control measures upon admission, identification of new cases, treatment of colonization in patients when appropriate, and eradication of colonization in employees have all contributed to controlling colonization in patients with SCI.

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