CHAPTER IV

RESULTS

1. Incidence of *Staphylococcus aureus* (*S. aureus*) and methicillin-resistant *S. aureus* (MRSA) carriers

1.1 Nasal carriers in non-medical personnel

The incidence of coagulase-positive staphylococci *(S. aureus)* in nasal cavities of 147 non-medical personnel was studied. It was found that all of them carried bacteria in nasal cavities; 18 out of 147 personnel carried *S. aureus* which was 12.2% of the study population as shown in Table 5. All of the strains were found to be methicillin-sensitive *S. aureus* (MSSA). The other organisms found were coagulase-negative staphylococci (66.0%) and miscellaneous organisms (27.9%) such as *Pseudomonas* spp., *Bacillus* spp. and other gram-positive cocci.

1.2 Nasal and hand carriers in medical personnel

Incidence of microorganisms which were isolated from nasal cavities and hands of 115 medical personnel was shown in Table 6. It was found that not all of the medical personnel carried *S. aureus* in both sites studied. There were 20 out of 115 medical personnel (17.4%) carried *S. aureus* in nasal cavities only and 11 out of 115 medical

personnel (9.6%) carried this organism on hands only, while 20 out of 115 medical personnel (17.4%) carried this organism in both sites. Among these 51 medical personnel (44.3%) who carried *S. aureus*, 9 personnel (7.8%) carried MRSA and 42 personnel (36.5%) carried MSSA.

1.3 Nasal, hand and wound carriers in patients

a. Patients with wound infections

The incidence of organism isolated from nasal cavities, hands and wounds of the 101 patients with wound infections from Siriraj Hospital were studied as shown in Table 7. It was found that 47 out of 101 patients (46.5%) carried *S. aureus* and among these 47 patients, it was shown that 11 patients carried MRSA. Among this group, there were 2 patients (2.0%) whom MRSA was found only in nasal cavities. Another 2 patients (2.0%) were shown to carry MRSA only on hands and only one patient carry MRSA both in nasal cavity and on hand. In 6 patients who carried MRSA in wound, the organism was also recovered from the other site(s) studied. These included three patients (3.0%) with MRSA in both nasal cavities and wounds, two patients (2.0%) with MRSA both on hands and in wounds, and one patient (1.0%) with MRSA at all three sites.

It was also shown that about three-fourth of the patients who carry coagulase-positive staphylococci (36 out of 47) carried MSSA. The other organisms found in the patients with wound infections consisted of coagulase-negative staphylococci (57 cases), and other organisms

beside staphylococci (22 cases). There were 2 patients who did not carry any kind of organisms at all three sites.

b. Burn patients

The 51 cases of burn patients from three governmental hospitals in Bangkok were studied to determine the incidence of coagulase-positive staphylococci and MRSA infections. The incidence was shown in Table 8. Coagulase-positive staphylococci were isolated from 38 patients (74.5%), which 35 patients of these (68.6%) carried MRSA. No growth of any organism was observed in 1 patient. Among the 35 patients who carried MRSA, there were 3 patients (5.9%) of whom MRSA was found only in nasal cavities. Another 4 patients (7.8%) carried MRSA on hands only and 3 patients carried MRSA only in wounds. Patients that carried MRSA both in nasal cavities and on hands, in nasal cavities and wounds and on hands and in wounds were 2 (3.9%), 3 (5.9%) and 2 (3.9%), respectively. There were 18 patients (35.3%) of whom MRSA was found at three sites.

1.4 Comparative incidence study

Incidence of coagulase-positive staphylococci carriers in non-medical personnel, medical personnel, patients with wound infections and burn patients were compared as shown in Table 9. It was indicated that 56.9% of the burn patients were coagulase-positive staphylococci nasal carriers, while the percentage of nasal carriers in non-medical personnel was 12.2%, in medical personnel was

34.8% and in patients with other wound infections was 30.0%. The percentage of hand carriers in medical personnel, patients with other wound infections and burn patients were 27.0%, 17.8%, and 54.9%, respectively. Coagulase-positive staphylococci isolated from wounds were 26.7% of the patients with other wound infections and 52.9% of burn patients.

All of the coagulase-positive staphylococci were tested for susceptibility by paper disk method to detect MRSA. Incidence of MRSA that was isolated from nasal cavities, hands and wounds in all four study populations were shown in Table 10. No MRSA was isolated from the nasal cavities of non-medical personnel. It was shown that 8 out of 115 medical personnel (7.0%) carried MRSA in nasal cavities while 4 out of 115 (3.5%) medical personnel carried this organism on hands. In patients with other wound infections, 7 out of 101 (6.9%) of the patients carried MRSA in nasal cavities, 6 out of 101 (5.9%) carried on hands and 6 out of 101 (5.9%) carried in wounds. For the burn patients, 26 out of 51 (51.0%) carried MRSA in nasal cavities. Similar number of patients carried MRSA on hands and in wounds.

1.5 Comparative number of coagulase-positive staphylococci and MRSA isolates

The number of coagulase-positive staphylococci and MRSA isolated from nasal cavities, hands and wounds of the study populations were shown in Table 11. None of the

coagulase-positive staphylococci isolated from nasal cavities of non-medical personnel was MRSA. Among 43 strains of coagulase-positive staphylococci isolated from nasal cavities of medical personnel, 8 strains (18.6%) were MRSA while among 33 strains of coagulase-positive staphylococci isolated from hands, only 5 strains (15.2%) were MRSA. There were more than 1 but less than 3 strains of *S. aureus* that isolated from nasal cavities (3 medical personnel, 5 patients with wound infections and 1 burn patient), hands (2 patients with wound infections and 3 burn patients) and wounds (1 patient with wound infection and 2 burn patients)

For the patients with wound infections, 9 out of 36 (25.0%) strains of coagulase-positive staphylococci isolated from nasal cavities, 6 out of 22 strains (27.3%) from hands and 6 out of 29 strains (20.7%) from wounds were MRSA. Twenty six out of 30 coagulase-positive staphylococci (86.7%) isolated from nasal cavities of burn patients were MRSA while 28 out of 31 strains (90.3%) from hands and 28 out of 29 strains (96.6%) isolated from wounds were MRSA.

2. Antimicrobial susceptibility pattern of coagulase-positive staphylococci and MRSA

2.1 The susceptibility of 271 coagulase- positive staphylococci

The susceptibility of 271 coagulase-positive staphylococci to 18 antimicrobial agents was shown in Table 12. All of the tested strains were susceptible to

vancomycin (100%) while only 8.5% of the isolates were susceptible to penicillin and ampicillin. Similar results were observed with cloxacillin, methicillin, nafcillin, oxacillin and cefotaxime which showed that 57.2% of the isolates were susceptible to these groups of antimicrobial agents. The 59.8% of the isolates were susceptible to cephalothin and chloramphenicol, while only 40.6% were susceptible to tetracycline. The percentage of susceptible strains to norfloxacin, imipenem, trimethoprim-sulfamethoxazole, neomycin and clindamycin were 62.7%, 68.3%, 73.4%, 74.2% and 82.7%, respectively. For gentamicin and erythromycin, 53.5% of the isolates were susceptible to both agents.

2.2 The susceptibility pattern of 116 MRSA isolates

The susceptibility patterns of 116 MRSA isolates were summarized in Table 13. There were 28 susceptibility patterns or antibiograms observed when testing with 18 different antimicrobial agents.

2.3 Percentage of the susceptible MRSA isolates

Thirteen MRSA isolates from medical personnel were shown to be susceptible to cloxacillin, gentamicin, imipenem, cephalothin, chloramphenicol, neomycin, trimethoprim-sulfamethoxazole, clindamycin and vancomycin. The percentage of the susceptible isolates to antimicrobial agents were 7.7, 15.4, 30.8. 30.8, 30.8, 30.8, 38.5, 53.8 and 100, respectively. Among the twenty-one MRSA isolates

from patients with wound infections 4.8% of the isolates were susceptible to gentamicin and tetracycline, 9.5% to cephalothin, 14.3% to cloxacillin, cefotaxime and chloramphenicol, 19.0% to erythromycin, 33.3% to imipenem, 38.1% to norfloxacin, 42.9% to trimethoprim-sulfamethoxazole, 47.6% to neomycin, 71.4% to clindamycin and 100% to vancomycin. While within 82 MRSA isolates from burn patients 1.2% of the isolates were susceptible to cefotaxime and cephalothin, 2.4% to cloxacillin and erythromycin, 4.9% to norfloxacin, 6.1% to tetracycline 17.1% to neomycin, 18.3% to imipenem, 28.0% to chloramphenicol, 37.8% to trimethoprim-sulfamethoxazole, 71.9% to clindamycin and 100% to vancomycin (Table 14).

2.4 MRSA isolates from 51 burn patients with and without previous antimicrobial treatment

It was shown in Table 15 that 38 out of 51 burn patients had received previous antimicrobial treatment. Among these 29 patients (76.3%) carried MRSA while among 13 patients who did not receive any previous treatment, only 6 patients (46.2%) carried MRSA.

2.5 Beta-lactamase production

All the MRSA isolates were tested for beta-lactamase production. The results showed that all the strains tested were beta-lactamase positive strains (Table 16).

2.6 Minimal inhibitory concentrations (MICs) of methicillin against all MRSA isolates

It was shown in Table 16 that MICs of methicillin against all of MRSA isolated from burn patients were higher than 256 μg/ml.

3. Plasmid profile analysis

3.1 Type of plasmid profile based on relative size

Plasmid DNA of MRSA, which were discriminated by electrophoresis, were classified into sixteen different profiles as shown in Table 17. The relative size of each plasmid as compared to the standard size of plasmid (Lambda HindIII) was shown to be between 9.9, 9.7, 7.7, 5.3, 4.8, 4.5, 4.4, 4.0, 3.5, 3.1, 2.9, 2.4, 2.2, 2.0, 1.9, 1.7, 1.4, 1.2, 1.1, 1.0 and 0.9 kb, respectively. One hundred and ten strains which were typed as profile 1 to 11 obtained a 3.1 kb plasmid. One of MRSA strains had no apparent plasmid DNA and was classified as profile 16.

3.2 Plasmid profile and antibiograms

In Table 18, the correlation between the antibiograms and the plasmid profile were summarized. It was shown that the most common plasmid profile of MRSA included profile 5, 9, 3 and 1, accordingly.

3.3 Plasmid profile of MRSA in the study population

3.3.1 Plasmid profile pattern of MRSA strains from nasal cavities, hands and wounds of medical personnel, patients with wound infections and burn patients

Plasmid profile pattern of MRSA strains from nasal cavities, hands and wounds of medical personnel, patients with wound infections and burn patients were presented in Table 19, 20 and 21, respectively. It was shown that 3 medical personnel carried MRSA with plasmid profile profile 9 in nasal cavities but only one person carried this profile on hand. The other MRSA profiles found in nasal cavities of medical personnel were profile 7 (2 persons), profile 3 and 5 (1 person, each). The MRSA found on hands of medical personnel were profile 1, 3, 5, 7, 9 and 16. There were 4 medical personnel who carried MRSA both in nasal cavities and on hands (Table 19).

It was found that 3 patients with other wound infections carried MRSA profile 1 in their wounds only. The rest of patients carried profile 3, 5, 9 and 15 respectively as shown in Table 20. There were 2 patients who carried the same plasmid profile (profile 1) in nasal cavities, on hands and in wounds. The rest of patients carried plasmid profile included profile 3, 5, 10, 11 and 13 in their nasal cavities. They were five different patterns of plasmid profile on hands of the patients included profile 1, 6, 12, 13 and 14.

For the burn patients at Siriraj Hospital, the most common profile found in wounds was profile 5 (14 out of 22 isolates) while the most common profile found in patients at Police General Hospital was profile 9 (6 out of 11). In 2 patients from Bhumipol Adulyadej Hospital, only profile 1 was found in wounds. For nasal cavities, patients from Siriraj Hospital carried profile 5 (10 out of 22), profile 3 (2 out of 22), profile 9 (2 out of 22), profile 2 (1 out of 22) and profile 8 (1 out of 22) while 6 out of 22 patients did not carry MRSA in their nasal cavities. The most common profile found in nasal cavities of patients from Police General Hospital was profile 9 (5 out of 11). There were 3 patients carried profile 1 and only one patient carried profile 4 while 2 patients did not carry MRSA in their nasal cavities. For the two patients from Bhumipol Adulyadej Hospital, 1 out of 2 carried profile 1 in both nasal cavity and hand while the other one did not carry MRSA either in nasal cavity or on hand.

The plasmid profile of MRSA isolated from hands of the patients from Siriraj Hospital was similar to those found in wounds and nasal cavities. They were profile 5 (12 out of 22), profile 9 (2 out of 22), profile 3 (2 out of 22) and profile 8 (1 out of 22). Only 5 out of 22 patients did not carry MRSA on their hands. For the patients from Police General Hospital, 5 out of 11 carried profile 9 on their hands, 2 out of 11 carried profile 1, 1 out of 11 carried profile 4 and 3 out of 11 did not carry

MRSA on their hands.

It was also shown that 9 out of the 22 patients from Siriraj Hospital carried MRSA with the same plasmid profile (profile 5, 8, 9) in all three sites (nasal cavities, hands and wounds) while 5 out of 11 patients from Police General Hospital carried the same plasmid profile (profile 1 and 9) at all sites. One of the 2 patients from Bhumipol Adulyadej Hospital carried plasmid profile 1 at all three sites (Table 21).

3.3.2 Comparative plasmid profile of MRSA in medical personnel and burn patients

Only one medical personnel from Police General Hospital carried MRSA in both sites studied with plasmid profile 7 while 5 out of 11 burn patients carried profile 9 in all three sites as shown in Table 22. Five out of eight medical personnel from Siriraj Hospital carried MRSA with the same plasmid profile in nasal cavities as the ones found in burn patients. They were profile 5, 9 and 3. It was also shown that 3 out of eight medical personnel carried MRSA profile 5, 9 and 3 on their hands (Table 23).

Table 5: Incidence of Staphylococci, MRSA and other bacteria isolated from nasal cavities of 147 non-medical personnel.

Organisms	No.of positive personnel(%)
1. Staphylococci	
:coagulase-positive staphylococci	18+ (12.2)
MRSA	0 (0.0)
MSSA	18 (12.2)
:coagulase-negative staphylococci	97 (66.0)
2. Other bacteria	41 (27.9)

+ Coagulase-negative staphylococci were also isolated form 9 out of 18 personnel.

Table 6: Incidence of Staphylococci, MRSA and other bacteria isolated from nasal cavities and hands of 115* medical personnel.

Organisms	No. of persons from which organisms were isolated from (%)			
	Nasal cavity	Hand	Nasal cavity & hand	Total
1. Staphylococci				
:coagulase-positive staphylococci	20 (17.4)	11 (9.6)	20 (17.4)	51+ (44.3)
MRSA	5 (4.3)	1 (0.9)	3 (2.6)	9 (7.8)
MSSA	15 (13.0)	10 (8.7)	17 (14.8)	42 (36.5)
:coagulase-negative staphylococci	29 (25.2)	12 (10.4)	62 (53.9)	103 (89.6)
2. Other bacteria	9 (7.9)	17 (14.8)	21 (18.3)	47# (40.9)

* One personnel carried no bacteria in both nasal cavity and hand.
\+ Coagulase-negative staphylococci were also isolated from all personnel.
\# Coagulase-negative staphylococci were also isolated from 36 out of 47 personnel.

Table 7: Incidence of Staphylococci, MRSA and other bacteria isolated from nasal cavities, hands and wounds of 101* patients with wound infections.

Organisms	No.of patients from which organisms were isolated from (%)							
	n	h	w	n+h	n+w	h+w	n+h+w	Total
1.Staphylococci :coagulase-positive	8 (7.9	6 5.9	7 6.9	5 5.0	13 2.5	3 3.0	5 5.0	47+ 46.5)
MRSA	2 (2.0	2 2.0	0 0.0	1 1.0	3 3.0	2 2.0	1 1.0	11 10.9)
MSSA	6 (5.9	4 4.0	7 6.9	4 4.0	10 9.9	1 1.0	4 4.0	36 35.6)
:coagulase-negative	6 (5.9	5 5.0	2 2.0	35 34.7	0 0.0	1 1.0	8 7.9	57 56.4)
2.Other bacteria	2 (2.0	3 3.0	9 8.9	4 4.0	1 1.0	2 2.0	1 1.0	22 21.8)

* Two patients carried no bacteria in all nasal cavities, hands and wounds.

\+ Coagulase-negative staphylococci were also isolated from 27 out of 47 patients.

n = nasal cavity, h = hand and w = wound

Table 8: Incidence of Staphylococci, MRSA and other bacteria isolated from nasal cavities, hands and wounds of 51* burn patients.

Organisms	No.of patients from which organisms were isolated from (%)							
	n	h	w	n+h	n+w	h+w	n+h+w	Total
1.Staphylococci :coagulase-positive	4 (7.8	4 7.8	3 5.9	3 5.9	3 5.9	2 3.9	19 37.3	38+ 74.5)
MRSA	3 (5.9	4 7.8	2[+1] 5.9	2 3.9	3 5.9	2 3.9	18 35.3	35 68.6)
MSSA	1 (2.0	0 0.0	1 2.0	1[+1] 2.0	0 0.0	0 0.0	0 0.0	3 5.9
:coagulase-negative	8 (15.7	7 13.7	0 0.0	18 35.3	1 2.0	2 3.9	1 2.0	37 72.5)
2.Other bacteria	3 (5.9	2 3.9	7 13.7	1 2.0	1 2.0	1 2.0	4 7.8	19[#] 37.3)

[+1] = One person with MRSA in wound and MSSA in nasal cavity and hand

* One person carried no bacteria in all nasal cavities, hands and wounds.

\+ Coagulase-negative staphylococci were also isolated from 30 out of 38 patients.

\# Coagulase-negative staphylococci were also isolated from 7 out of 19 patients.

n = nasal cavity, h = hand, w = wound

Table 9: Incidence of *S. aureus* isolated from nasal cavities, hands and wounds of non-medical personnel, medical personnel, patients with wound infections and burn patients.

Study groups	No. of subject	No. of persons from which *S.aureus* strains were isolated from (%)		
		Nasal cavity	Hand	Wound
1.Non-medical personnel	147	18 (12.2)	ND	ND
2.Medical personnel	115	40 (34.8)	31 (27.0)	ND
3.Patients with wound infection	101	30 (30.0)	18 (17.8)	27 (26.7)
4.Burn patients	51	29 (56.9)	28 (54.9)	27 (52.9)

ND = Not done

Table 10: Incidence of MRSA in non-medical personnel, medical personnel,patients with wound infections and burn patients.

Study group	No.of subject	No. of persons from which MRSA strains were isolated from (%)		
		Nasal cavity	Hand	Wound
1.Non-medical personnel	147	0	ND	ND
2.Medical personnel	115	8 (7.0)	4 (3.5)	ND
3.Patients with wound infection	101	7 (6.9)	6 (5.9)	6 (5.9)
4.Burn patients	51	26 (51.0)	26 (51.0)	26 (51.0)

ND = Not done

Table 11: Comparison of numbers of *S. aureus* (SA) and MRSA isolated from nasal cavities, hands and wounds in non-medical personnel, medical personnel, patients with wound infections and burn patients.

Study groups	No. of strains of *S.aureus* (SA) and MRSA					
	Nasal cavity		Hand		Wound	
	SA	MRSA	SA	MRSA	SA	MRSA
1.Non-medical personnel	18	0	ND	ND	ND	ND
2.Medical personnel	43	8	33	5	ND	ND
3.Patients with wound infection	36	9	22	6	29	6
4.Burn patients	30	26	31	28	29	28
Total strains	127	43	86	39	58	34

ND = Not done

Table 12: Antimicrobial susceptibility pattern of 271 *S. aureus* isolated from healthy personnel and patients.

Antimicrobial Agents	No.of susceptible strains	% of Susceptibility
1.Penicillin	23	8.5
2.Ampicillin	23	8.5
3.Cloxacillin	155	57.2
4.Methicillin	155	57.2
5.Nafcillin	155	57.2
6.Oxacillin	155	57.2
7.Imipenem	185	68.3
8.Cefotaxime	155	57.2
9.Cephalothin	162	59.8
10.Chloramphenicol	162	59.8
11.Gentamicin	145	53.5
12.Neomycin	201	74.2
13.Clindamycin	224	82.7
14.Norfloxacin	170	62.7
15.Erythromycin	145	53.5
16.Tetracycline	110	40.6
17.Trimethoprim/ Sulfamethoxazole	199	73.4
18.Vancomycin	271	100.0

Table 13: Summary of the antimicrobial susceptibility patterns of 116 MRSA.

Pattern	Susceptible antimicrobial agents												No.of isolates
1	Va	STX	CC	Ne	Im	CR	CTX	Nx	C	Cx			1
2	Va	STX	CC	Ne	Im	CR	CTX	Nx		Cx	T	Gm	1
3	Va	STX	CC	Ne	Im	CR			C			Gm	1
4	Va	STX	CC	Ne	Im	CR							2
5	Va	STX	CC	Ne	Im			Nx	C		E		1
6	Va	STX	CC	Ne	Im			Nx			E		2
7	Va	STX	CC	Ne		CR		Nx	C		E		1
8	Va	STX	CC	Ne				Nx			E		1
9	Va	STX	CC						C				13
10	Va	STX	CC										9
11	Va	STX							C		T		5
12	Va	STX							C				1
13	Va	STX											13
14	Va		CC	Ne				Nx			E		1
15	Va		CC	Ne									4
16	Va		CC	Ne	Im			Nx		Cx			1
17	Va		CC	Ne	Im								9
18	Va		CC		Im		CTX	Nx	C	Cx			1
19	Va		CC		Im					Cx			1
20	Va		CC		Im								3
21	Va		CC						C				5
22	Va		CC										19
23	Va			Ne		CR	CTX						1
24	Va			Ne								Gm	1
25	Va			Ne									1
26	Va				Im	CR			C				1
27	Va				Im			Nx	C				1
28	Va												16

Cx = cloxacillin Im = imipenem CTX = cefotaxime
CR = cephalothin C = chloramphenicol Gm = gentamicin
Ne = neomycin CC = clindamycin Nx = norfloxacin
E = erythromycin T = tetracycline Va = vancomycin
STX= trimethoprim-sulfamethoxazole

Table 14: Antimicrobial susceptibility pattern of 116 MRSA isolated from medical personnel and patients.

Antimicrobial Agents	No. (%) of susceptible strains			Total (%)
	Medical personnel	Patients with wound infection	Burn patients	
Penicillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ampicillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cloxacillin	1 (7.7)	3 (14.3)	2 (2.4)	6 (5.2)
Methicillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Nafcillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Oxacillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Imipenem	4 (30.8)	7 (33.3)	15 (18.3)	26 (22.4)
Cefotaxime	0 (0.0)	3 (14.3)	1 (1.2)	4 (3.4)
Cephalothin	4 (30.8)	2 (9.5)	1 (1.2)	7 (6.0)
Chloramphenicol	4 (30.8)	3 (14.3)	23 (28.0)	30 (25.9)
Gentamicin	2 (15.4)	1 (4.8)	0 (0.0)	3 (2.6)
Neomycin	4 (30.8)	10 (47.6)	14 (17.1)	28 (24.1)
Clindamycin	7 (53.8)	15 (71.4)	59 (71.9)	81 (69.8)
Norfloxacin	0 (0.0)	8 (38.1)	4 (4.9)	12 (10.3)
Erythromycin	0 (0.0)	4 (19.0)	2 (2.4)	6 (5.17)
Tetracycline	0 (0.0)	1 (4.8)	5 (6.1)	6 (5.17)
Trimethoprim/ Sulfamethoxazole	5 (38.5)	9 (42.9)	31 (37.8)	45 (38.8)
Vancomycin	13(100.0)	21(100.0)	82(100.0)	116(100.0)

Table 15: Incidence of MRSA in 51 burn patients with and without history of receiving antimicrobial treatment prior to the study.

	No.(%) of MRSA positive/Total patients	
1. Patients who received previous antimicrobial treatment		
: with positive MRSA	29/38	(76.3)
: with negative MRSA	9/38	(23.7)
2. Patients who did not received previous antimicrobial treatment		
: with positive MRSA	6/13	(46.2)
: with negative MRSA	7/13	(53.8)

Table 16: Comparison of numbers of MRSA isolation in non-medical personnel, medical personnel and patients

Tests group	No. of MRSA carriers (strains)	No. of beta-lactamase +ve MRSA strains	MIC (μg/ml)
1.Non-medical personnel	0	ND	ND
2.Medical personnel	9 (13)		
:Nurse (S.)	4 (6)	6	>256
:Physician(S.)	4 (5)	5	>256
:Nurse (P.)	1 (2)	2	>256
3.Patients with wound infection	11 (21)	21	>256
4.Burn patients	35 (82)		
:Siriraj	22 (54)	54	>256
:Police	11 (24)	24	>256
:Bhumipol	2 (4)	4	>256

ND = Not done
S. = Siriraj Hospital
P. = Police General Hospital
B. = Bhumipol Adulyadej Hospital

Table 17: Plasmid profiles based on relative size.

Plasmid Profile	relative size of plasmids (Kb)	No.of bands
1	5.3, 4.8, 4.0, 3.1, 2.9, 2.4, 2.0, 1.4	8
2	5.3, 4.0, 3.1, 2.9, 2.4, 2.0, 1.4	7
3	5.3, 4.0, 3.1, 2.4, 2.0, 1.4	6
4	4.8, 4.0, 3.1, 2.4, 2.0, 1.4	6
5	5.3, 4.8, 3.1, 2.9, 2.0, 1.4	6
6	5.3, 4.8, 4.0, 3.1, 2.9, 2.4	6
7	4.8, 4.0, 3.1, 2.4,	4
8	5.3, 4.0, 3.1, 2.4,	4
9	5.3, 3.1, 2.0, 1.4	4
10	7.7, 3.1, 1.7	3
11	5.3, 3.1	2
12	9.9, 4.4, 1.2,1.1,1.0,0.9	6
13	4.5, 2.2, 1.4	3
14	3.5, 1.9	2
15	9.7	1
16	no band	

Table 18: Correlation between plasmid profiles and antimicrobial susceptibility patterns.

Plasmid profile	Antibiogram (Susceptible)	Strain code No.
1	Va	BB(1,2,3,9), SI(118,120,121)
	Va CC	SN139
	Va STX	PB(95-101)
	Va STX CC	SN126, SI(416,430,432), SB498
	Va CC Ne	SI155
2	Va STX C T	SB496
3	Va STX	SB244, SI(421,422,423)
	Va STX C	SR80
	Va STX C T	SB(515,519,522,553)
4	Va STX	PB(84,86)
5	Va STX CC	SB(182,186,188), SI415
	Va CC Ne	SI420, SB(470,471)
	Va CC Im	SB(478,479,480)
	Va CC	SB(497,499,501,503,505,507,509, 510,511,513,517,520,521,545,546, 547)
	Va Ne	SB495
	Va CC Im Cx	SB465
	Va CC Ne Im	SB(481-484,486,488,490,492,493)
	Va STX CC Ne Im CR	SR(7,8)
	Va STX CC Ne Nx E	SB469
	Va CC C Im CTX Cx Nx	SB472
	Va STX CC C Ne CR Nx E	SB468
6	Va CC Im Cx Ne Nx	SI411
7	Va	PN(50,51)
	Va Ne Gm	SN250
8	Va CC C	SB(189,191,194)
9	Va	SR99,SB(299,461,463,475-477)
	Va CC	PB(91,92)
	Va CC C	SN(135,137)
	Va STX CC C	PB(1,5,7,8,13,15,16,25,26,31, 34,35,45)
	Va Ne CR CTX	SI122
	Va STX CC C Im Ne CR Gm	SR96
10	Va STX CC Im Cx Ne CR CTX Nx Gm T	SI428

Table 18 (continued)

Plasmid profile	Antibiogram (Susceptible)	Strain code No.
11	Va C Im Nx	SI151
12	Va CC Ne Nx E	SI286
13	Va STX CC Im Ne Nx E	SI(105,106)
14	Va STX CC C Im Cx Ne CR CTX Nx	SI87
15	Va STX CC C Im Ne Nx E	SI88
16	Va C Im CR	SN15

Cx = cloxacillin Im = imipenem CTX = cefotaxime
CR = cephalothin C = chloramphenicol Gm = gentamicin
Ne = neomycin CC = clindamycin Nx = norfloxacin
E = erythromycin T = tetracycline Va = vancomycin
STX = trimethoprim-sulfamethoxazole
BB = Bhumipol Adulyadej burn patients
PB = Police General burn patients
PN = Police General nurses
SB = Siriraj burn patients
SI = Siriraj patients with wound infection
SN = Siriraj nurses
SR = Siriraj residents

Table 19: Plasmid profile pattern of MRSA from nasal cavities and hands of 9 medical personnel

Medical personnel (code no.)	Plasmid profile		Source of MRSA
	Nasal cavity	Hand	
7	-	16	Siriraj Hospital
50	1	-	Siriraj Hospital
52	9	1 & 9	Siriraj Hospital
76	7	-	Siriraj Hospital
R 2	5	5	Siriraj Hospital
R20	3	3	Siriraj Hospital
R24	9	-	Siriraj Hospital
R25	9	-	Siriraj Hospital
P14	7	7	Police Hospital

- = No MRSA was isolated.

Table 20: Plasmid profile pattern of MRSA from nasal cavities, hands and wounds of 11 patients with wound infections.

Patient No.	Plasmid profile			Source of MRSA
	Nasal cavity	Hand	Wound	
34	-	14	15	Siriraj Hospital
42	13	13	-	Siriraj Hospital
49	1	1	1 & 9	Siriraj Hospital
54	11	-	1	Siriraj Hospital
90	-	12	-	Siriraj Hospital
120	-	6	5	Siriraj Hospital
121	-	1	-	Siriraj Hospital
123	5	-	-	Siriraj Hospital
125	3	-	3	Siriraj Hospital
126	10	-	-	Siriraj Hospital
127	1	-	1	Siriraj Hospital

- = No MRSA was isolated.

Table 21: Plasmid profile pattern of MRSA from nasal cavities, hands and wounds of burn patients

Patient No.	Plasmid profile			Source of MRSA
	Nasal cavity	Hand	Wound	
B 1	1	1	1	Bhumipol Hospital
B 2	-	-	1	Bhumipol Hospital
P 1	9	9	9	Police Hospital
P 2	-	9	9	Police Hospital
P 3	9	9	9	Police Hospital
P 6	9	-	9	Police Hospital
P 8	9	9	9	Police Hospital
P 11	-	9	-	Police Hospital
P 23	4	4	-	Police Hospital
P 24	9	-	9	Police Hospital
P 27	1	-	-	Police Hospital
P 28	1	1	1	Police Hospital
P 29	1	1	1	Police Hospital
S 44	-	9	-	Siriraj Hospital
S 60	5	5	5	Siriraj Hospital
S 61	8	8	8	Siriraj Hospital
S 73	-	3	-	Siriral Hospital
S151	9	-	9	Siriraj Hospital
S152	-	-	5	Siriraj Hospital
S153	5	-	-	Siriraj Hospital
S154	5	5	5	Siriraj Hospital
S155	9	9	9	Siriraj Hospital
S156	-	-	5	Siriraj Hospital
S157	-	5	5	Siriraj Hospital
S160	5	5	5	Siriraj Hospital
S161	2	1&5	5	Siriraj Hospital
S162	-	5	5	Siriraj Hospital
S163	5	5	5	Siriraj Hospital
S164	5	5	5	Siriraj Hospital
S165	5	5	-	Siriraj Hospital
S167	5	5	5	Siriraj Hospital
S168	3	5	5	Siriraj Hospital
S169	5	3	3&5	Siriraj Hospital
S170	3	-	-	Siriraj Hospital
S171	5	5	5	Siriraj Hospital

- = No MRSA was isolated.

Table 22: Comparison of plasmid profile of MRSA between medical personnel (MP) and burn patients from Police General Hospital

No.	Plasmid profile		
	Nasal cavity	Hand	Wound
P 14 (MP)	7	7	ND
P 1	9	9	9
P 2	-	9	-
P 3	9	9	9
P 6	9	-	9
P 8	9	9	9
P 11	-	9	-
P 23	4	4	-
P 24	9	-	9
P 27	1	-	-
P 28	1	1	1
P 29	1	1	1

ND = Not done
- = No MRSA was isolated.

Table 23: Comparison of plasmid profile pattern of MRSA between medical personnel (MP) and burn patients from Siriraj Hospital

No.	Plasmid profile		
	Nasal cavity	Hand	Wound
S 7 (MP)	-	16	ND
S 50 (MP)	1	-	ND
S 52 (MP)	9	1 & 9	ND
S 76 (MP)	7	-	ND
R 2 (MP)	5	5	ND
R 20 (MP)	3	3	ND
R 24 (MP)	9	-	ND
R 25 (MP)	9	-	ND
S 44	-	9	-
S 60	5	5	5
S 61	8	8	8
S 73	-	3	-
S151	9	-	9
S152	-	-	5
S153	5	-	-
S154	5	5	5
S155	9	9	9
S156	-	-	5
S157	-	5	5
S160	5	5	5
S161	2	1 & 5	5
S162	-	5	5
S163	5	5	5
S164	5	5	5
S165	5	5	-
S167	5	5	5
S168	3	5	5
S169	5	3	3 & 5
S170	3	-	-
S171	5	5	5

ND = Not done
- = No MRSA was isolated.

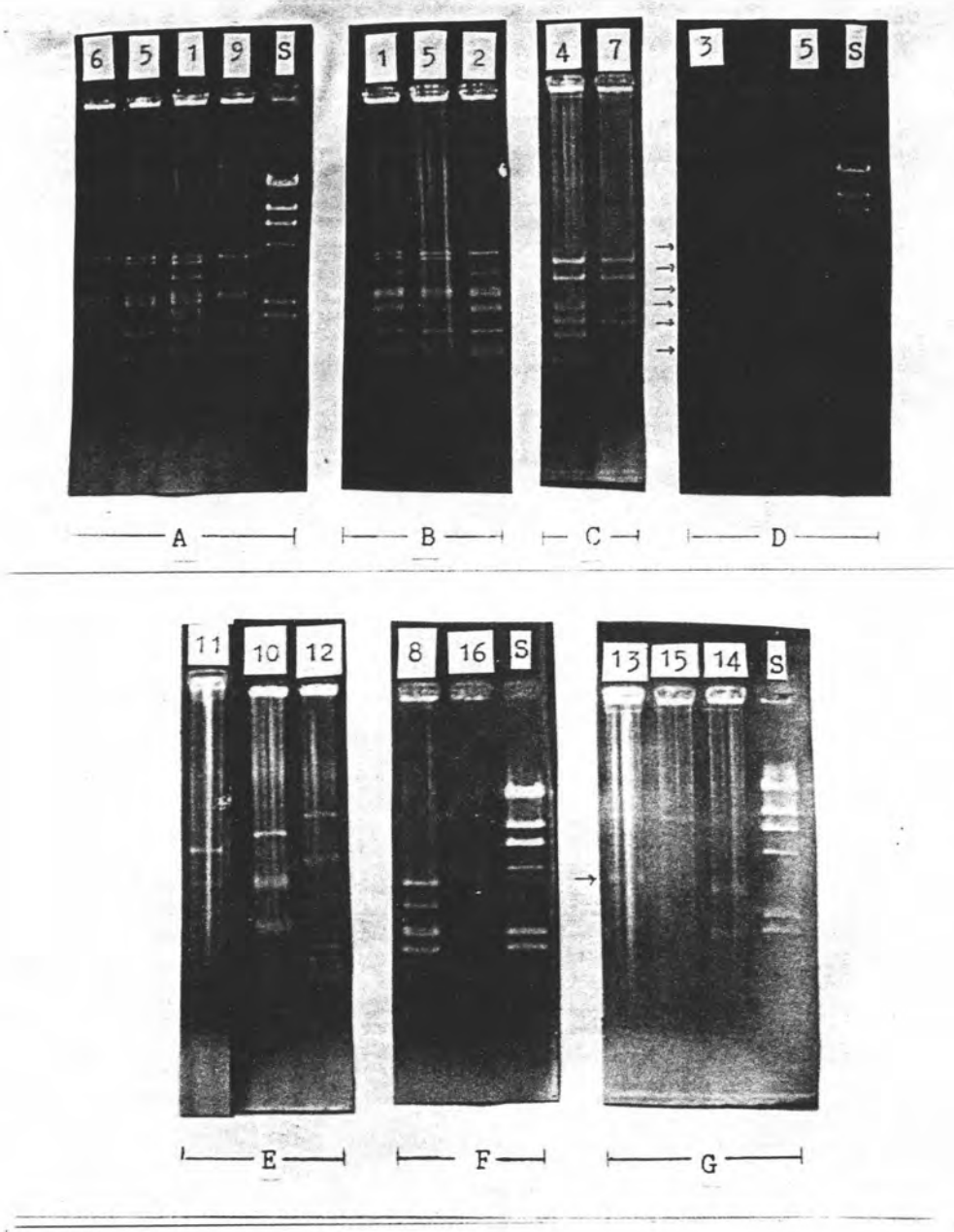

Figure 1: Gel electrophoresis in 0.8% agarose of 16 MRSA plasmid DNA as compared to Lambda HindIII (S); A: Plasmid profiles 6, 5, 1 and 9, B: profiles 1, 5 and 2 , C: profiles 4 and 7, E: profiles 11, 10 and 12, F: profiles 8 and 16, and G: profiles 13, 15 and 14.