



CHAPTER I

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the most frequent agents for nosocomial infection. There has been a steady increase in the incidence of this type of infection throughout the world in recent years (Danchaivijitr, 1992, Vorachit, 1988, Bacon et al., 1987, Walsh et al., 1987). Although MRSA strains have not been shown to be more virulent than other strains of *S. aureus*, the multiple antimicrobial resistances of these isolates make them responsible for high mortality rate, particularly in compromised patients. In addition, MRSA infections lead to the complication in the treatment, the prolong hospitalization, and the high cost of medical care (Cooke and Marples, 1985, Locksley, 1982, Klimek et al., 1976).

Reports from the United States were initially sporadic. By 1979, 37% of 62 hospital centers reported nosocomial bacteremia due to MRSA and this problem has reached epidemic proportions by the early 1980s (Center for Disease Control, 1981). It has also been reported that the predominance of MRSA infections in large American hospitals was due to the large numbers of patients at high risk of infection (Haley et al., 1982) and the spread of the

organism by patients, hospital personnel and environment factors (Cooksan *et al.*, 1989).

For the MRSA infections in Thailand, the high incidence of MRSA strains have emerged in large governmental supported hospital for about a decade ago. At Ramathibodi hospital, the incidence of MRSA infections had increased from 5% in 1984 to 16% in 1987 which was the year that an epidemiologic spread of MRSA in pediatric ward was reported (Vorachit, 1988). Recently, the report from the Burn units at Siriraj hospital indicated that 66% of burn patients were infected with MRSA (Danchaivijitr, 1992).

In order to reduce the number of MRSA infections, the early detection and eradication of the sources of the organisms including the interruption of their path to patients are needed. To attain these goals, it depends upon the appropriate techniques for characterizing epidemic MRSA and distinguishing them from resident strains (Zuccarelli, *et al.*, 1990).

At the present time, there have been a number of techniques for the epidemiologic study of MRSA. Among these techniques, antibiogram and phage typing are commonly used to characterize MRSA in hospital epidemiologic studies. However, it has been shown that antibiogram were frequently inadequate to accomplish the differentiation between MRSA strains. The phage typing technique required an inventory

of bacteriophages which were unavailable at most hospital. In addition, it was often uninformative and too slow for epidemiological work (Archer *et al.*, 1983 and Locksley *et al.*, 1982). It requires reagents that are not commercially available, the data are not particularly reproducible, and the isolates to be compared must be tested simultaneously. The difficulty in the interpretation of results from phage typing occur when related strains exhibit phage patterns that are similar but do not correlate exactly (Clin. Microbiol. Newsl, 1981). In addition, the discriminatory power of phage typing is often poor; furthermore approximately 30% of *S. aureus* isolates are nontypable, making comparisons with those isolates impossible.

The recent reports indicate that plasmid analysis is more useful, reproducible than antibiogram and phage typing in identifying both methicillin-susceptible *S. aureus* (MSSA) and MRSA and in defining the outbreak of the organisms (Archer *et al.*, 1983 and Hartstein *et al.*, 1989). Plasmid analysis, the first DNA-based technique, has been used in the study of *S. aureus* since 1979 (McGowan *et al.*, 1979). From that time on, although, there is a limitation of this method. The isolates that carry no plasmid DNA or relatively few plasmids could not be typed by this method (Stull *et al.*, 1989). It was also found that the plasmid profile may not be stably expressed under certain environmental or culture conditions (Wachsmuth, 1985) and may vary under the pressure of antibiotic use in the

hospital setting. However, this method has still been accepted as one of the most useful method for the study on the organisms that carry multiple or unique plasmids (Mulligan and Arbeit, 1991).

Despite of the limitations described, the plasmid DNA analysis has still been accepted as a valuable tool in tracing MRSA strains and defining epidemiologic patterns of MRSA transmission because this method is readily available, technically simple and inexpensive. In addition, it could provide a good discriminatory power and reproducible result (Mulligan and Arbeit, 1991, Zuccarelli et al., 1990, Kozarsky et al., 1986).

From the previous studies of MRSA infections, more information on the epidemiology of MRSA in Thailand are needed for determined the major reservoirs of MRSA, particularly in hospitals and interrupting the transmission of these organisms. Among the MRSA infections, it has been shown that the most serious cases occurred in burn patients (Danchaivijitr, 1992). In order to control MRSA infections, the study on the epidemiology of MRSA in this group of patients should be essential.

Therefore, three main purposes of this study were: First, the incidence of *S. aureus* carriers with emphasis on MRSA carrier in three groups of population included; healthy (non-medical) personnel, medical

personnel and patients with infectious wound (burn and other skin infections) were investigated in order to determine the source of these organisms. Second, the antimicrobial susceptibility pattern of all *S. aureus* isolates were determined. This included the disk susceptibility test for all isolates and minimal inhibitory concentration (MIC) of methicillin against all MRSA isolates. The result obtained would be further evaluated on the possible use of the antibiogram observed as one of the epidemiologic marker for MRSA and the use of antimicrobial agents in the treatment of MRSA infections. Third, the plasmid profile of all MRSA isolates was analyzed in order to use as the epidemiologic marker of MRSA isolates, particularly the isolates from the burn patients and medical personnel.

Finally, all results obtained from this study should provide updated information on the route of MRSA transmission emphasis in the serious burn infection in Thailand. In addition, the molecular technique concerning plasmid analysis in this study should be useful for those who would like to perform further study in this particular aspect.