

Different Sources of Isolation and Some Determinants of Pathogenicity of Multidrug-Resistant *Staphylococcus aureus* Strains

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Abstract: *Staphylococcus aureus* expresses a variety of extracellular proteins and polysaccharides, some of which are correlated with virulence. The aims of study were to identify of multidrug-resistant *S. aureus* (MDRSA) strains isolated from different sites of patients, to determine their pathogenicity factors, enzymes, ability of carbohydrate fermentation. Study results show that some determinants of pathogenicity (plasma coagulase, catalase, urease, lecithinase production, hemolysis, proteolysis), also carbohydrates and mannitol fermentation in aerobic and anaerobic conditions are characterized high activity in MDRSA strains. The most common was isolation of these strains from patients with oral cavity infections, a few cases - from peritoneal liquid and phlegmon.

Keywords: *S. aureus*, multidrug-resistance, enzymes, carbohydrate fermentation, oral cavity, peritoneal liquid, phlegmon.

1. Introduction

Although advances in medical research and treatments, infectious diseases are among the leading causes of death worldwide. In addition to the discovery of new pathogens, old infectious disease agents are “re-emerging”. Natural genetic variations, recombinations and adaptations allow new strains of known pathogens to appear [9]. Therefore, the leading institutions research plans and priorities include developing new strategies to control diseases that are re-emerging due to drug resistance also [14].

Staphylococcus aureus is among the most prevalent causes of clinical infections globally and has attention due to increasing mortality associated with multidrug resistance [12]. Due to these reasons, it named as a “superbug” [6]. *S. aureus* is the most commonly isolated human bacterial pathogen and is an important cause of skin and soft tissue infections, endovascular infections, pneumonia, septic arthritis, endocarditis, osteomyelitis, foreign-body infections and sepsis [11]. *S. aureus* is now the leading overall cause of nosocomial infections and as more patients are treated outside the hospital setting, is an increasing concern in the community [10]. This bacterium is a common cause of infections in patients in intensive care and in many countries often are multidrug-resistant *S. aureus* (MDRSA) i.e. it is resistant to most antibiotics. There were considerable variations among patients from different geographical regions [7]. Hence, the knowledge of current trend of MDRSA in hospital environment as well as in the community is necessary [3,12].

One of the reasons for the success of this human pathogen is its great variability, occurring at different periods and places with diverse clonal types and antibiotic resistance patterns within regions and countries [1].

Aim of study: to identify of MDRSA strains isolated from various sites of patients with different infections, to determine enzymes which are correlated with virulence also.

2. Materials and Methods

There were studied 279 clinical isolates of MDRSA. They were identified by the corresponding methods [2,4]. *S. aureus* strains were provided by the Clinic “Aversi”, Eliava Scientific Research Institute of Microbiology, Virology and bacteriology and V. Bochorishvili Sepsis Center (Tbilisi, Georgia). Strains were examined according to morphological (colonies), microscopical (cell), tinctorial (Gram staining) parameters. Cultivation of *S. aureus* were performed on meat-peptone agar, meat-peptone broth, 5% blood agar, egg yolk-salt agar, milk-salt agar of Eikman; also studied cultivation ability on low (15°C) and high (45°C) temperatures. Biochemical properties have been analyzed on results of carotenoid pigment formation, carbohydrate fermentation in aerobic and anaerobic conditions, urease, catalase, hemolytic, coagulase, lecithinase, proteolytic activities and novobiocin susceptibility tests. The study of antibiotic resistance were performed by using of automated microbial identification system (VITEK2 Biomerieux analyzer) and disc diffusion method [4,8].

3. Results

As seen in table 1, the greater number of MRSA strains were isolated from oral cavity – 19.35±2.98%, from the pharynx and wound infection – 14.44±2.93% from each. There were a few cases of isolation of strains from peritoneal liquid and phlegmon. In other cases number of isolated strains varied according to the site of isolation.

Frequency of MRSA strains isolated from different human sites

Table 1

Source of Isolation	Abs.	%
Oral cavity	54	19.35±2.98
Pharynx	40	14.44±2.93
Ear	11	3.94±1.87
Eye	13	4.65±2.01
Nose	24	8.60±2.55
Trachea	11	3.94±1.87
Skin	17	6.09±2.25
Tropic ulcer	16	5.73±2.10
Wound	40	14.44±2.93
Blood	12	4.30±1.94
Urine	10	3.58±1.79
Peritoneal liquid	6	2.15±1.42
Phlegmon	6	2.15±1.42
Vagina	11	3.94±1.87
Prostatic secret	8	2.86±1.62

There were studied some biochemical characteristics of MRSA strains (n=50) which are one of the pathogenicity determinants of these strains. Lecithinase active and urease-positive were 96.0±2.77% strains. Proteolytic activity (production of H₂S) and carbohydrate fermentation in aerobic conditions detected in 94.0±3.35% cases. Mannitol fermentation in anaerobic conditions revealed in 92.0±3.83% of strains. Plasma coagulase activity and ability of carbohydrate fermentation in anaerobic condition, hemolytic activity (hemolysis) revealed in all strains - 100%.

Some Determinants of Pathogenicity of MRSA strains (n=50)

Table 2

Identity Marks	Abs.	%
Hemolysis	50	100
Plasma coagulase positive	50	100
Catalase positive	50	100
Urease positive	48	96.0±2.77
Lecithinase activity	48	96.0±2.77
Production of H ₂ S	47	94.0±3.35
Carbohydrate fermentation	47	94.0±3.35
Mannitol fermentation in anaerobic condition	46	92.0±3.83

4. Conclusion

Most frequently MRSA strains were isolated from patients oral cavity – 19.35±2.98% and from the pharynx and wound infections – 14.44±2.93% from each; only a few cases were of isolation of these strains from peritoneal liquid and Phlegmon. In other cases number of isolated strains varied according to the site of isolation.

Some determinants of pathogenicity (plasma coagulase, catalase, urease, lecithinase production, hemolysis, proteolysis), also carbohydrates and mannitol fermentation in aerobic and anaerobic conditions are characterized with high activity in MDRSA.

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