**ORIGINAL ARTICLE**

**Comparative Study of *Staphylococcus aureus* isolates in Pus and Nasal Swabs among patients in Lahore**

Hamama Islam Butt¹, Hafiza Nida Shahzadi¹, Yusra Hussain¹, Hafiz Muhammad Azeem¹, Shahzad Nadeem², Kashif-ur-Rehman³, Ahmad Bakhsh³, Shahzad Bashir³, Farah Deeba⁴*

¹. School of Medical Lab Technology, Minhaj University, Lahore.
². Riphah International University Islamabad Lahore campus.
³. School of Biochemistry, Minhaj University, Lahore.
⁴. Department of Biochemistry & Biotechnology, The Women University Multan.

**Abstract**

*Staphylococcus aureus* predominately found in nasal and pus samples is one of the major causes of skin infections and invasive diseases like endocarditis, pneumonia, and osteomyelitis. The current study was performed over the 3 months period, from April 2022 to June 2022. A total of 368 participants’ nasal and pus swab specimens were included in this study and were collected from the different hospitals in Lahore. The objective of the study was to discern the relative prevalence of *Staphylococcus aureus* isolates in pus and nasal swabs among patients in Lahore. All the collected samples were cultured in sterile conditions on Blood agar, Chocolate agar, Mannitol salt agar, and MacConkey agar according to the standard laboratory guidelines. *S. aureus* culture plates were identified based on the colonial morphology after 48hrs. Furthermore, isolated bacteria were characterized based on Gram stain, and differential biochemical analyses like the Catalase test, Coagulase test, Indole test, Motility agar test, Oxidase test, Triple sugar iron and Urease test that was performed to reconfirm *S. aureus* presence in the given pus and nasal specimens. The modified Kirby Bauer disc diffusion method is a widely used technique for testing the susceptibility of microorganisms to antimicrobial agents. In this method, the zone sizes around the antibiotic discs are measured and interpreted according to the guidelines provided by the Clinical and Laboratory Standard Institute (2020). From a total of 368 bacterial samples, 283 were pus swabs and 85 were nasal swabs, whereas the most frequently isolated organism was Gram-positive *Staphylococcus aureus* which accounts for 90% (330) of the total samples. MRSA prevalence is on the rise due to irrational use...

**Keywords**

Antibiotic Resistance; Gram positive; Lahore; MRSA; *Staphylococcus aureus*

**Correspondence**

Farah Deeba
Department of Biochemistry & Biotechnology, The Women University Multan.
E-mail: farah.9003@wum.edu.pk

Received: 14-9-2023
Accepted: 15-12-2023
Published: 30-12-2023

DOI: 10.52700/jmmg.v4i3.120
of antibiotics without prior cultural reports, lack of antimicrobial situation programs in hospitals, and failure to manage infections effectively. Healthcare professionals need to be mindful of these issues to prevent the spread of MRSA.

1. INTRODUCTION

Staphylococci is a Gram-positive bacterium that is categorized as, non-motile, catalase-positive, and facultative anaerobes (Tong et al., 2015). They are predominately found as oral flora of mucous membranes and as normal flora of human skin, respectively (Couto et al., 2001; Javadpour et al., 2010). These Gram-positive bacteria are the 3rd most prevalent cause of communal causative mediator of Nosocomial infections in humans (Al Tayyar et al., 2015). The members of the Staphylococcus genus i.e. S. epidermidis, S. aureus, and S. hominis are among the most prevalent bacteria spp. residing in the nasal passages of children. From the Staphylococci family, S. aureus is the most commonly identified bacteria in nasal and pus specimens and also a causative agent for invasive diseases and skin infections such as pneumonia, endocarditis, and osteomyelitis. Previous researches have explained its transmission via person-to-person by direct contact (cross-infection or colonization) and indirect contact (aerosol, secretions, dust, fomites, and food). However, they have gradually considered pathogens as they may cause nosocomial infections in hospital-admitted patients (Stryjewski and Corey, 2014).

Resistance pattern of various strains of S. aureus spp has been reported to almost all classes of antibiotics (Lindsay et al., 2006). It is important to note that the Gram-positive bacteria S. aureus has the ability to colonize humans either pathogenically or non-pathogenically, as noted by Bassetti et al. (2009). In fact, research suggests that approximately 35% of S. aureus colonizes the nasal passages and has been identified as a significant antibiotic-resistant bacterium since 1960, according to El Kholy et al. (2003). One of the main contributors to the development of antibiotic resistance is the incorrect use of these medications. This study aims to evaluate the multi-drug resistant bacteria susceptibility pattern among patients in Lahore to decrease the disease incidence related to S. aureus in the nasal cavity and wounded tissue. Thus, to achieve this, the isolation and identification of bacteria was done from human nasal and pus samples. Furthermore, prevalence of multidrug-resistant Staphylococcus species was evaluated among patients in Lahore.

2. METHODOLOGY

At the Biochemistry Laboratory of Minhaj University Lahore, Pakistan, a descriptive cross-sectional study was conducted as panning from April 2022 to June 2022. The study obtained ethical approval from the ethical committee of Minhaj University Lahore (Ref: 121565565). To identify the presence of S. aureus in collected isolates, we used analytical-grade chemicals and culture media (Sigma and Ovoid, USA). The study was performed from April 2022 to June 2022.

Total 368 nasal and pus swab samples were collected from the general population living in Lahore. All collected samples were cultured in sterile conditions on Blood agar, Mannitol salt and MacConkey agar moreover plates were incubated aerobically at 37°C for 24hrs. The organisms were identified based on colonial morphology, Gram staining and biochemical analysis like Catalase test, Coagulase test (both bound and free coagulase), Oxidase test, Triple sugar iron, and Urease test. Antibiotic susceptibility tests that were performed using Kirby Bauer’s disc diffusion method using 0.5% (v/v). Drugs used for Gram positive isolates were clindamycin, amikacin, erythromycin, gentamycin, vancomycin, amoxicillin, ciprofloxin and oxacillin as 2, 30, 15, 30, 30, 30, 5 and 1 μg, respectively. The Clinical and Laboratory Standards Institute guidelines 2020 were used for the interpretation of zone sizes (Satlin et al., 2020; Kosikowska et al., 2020).

3. RESULTS

Total 368 isolates were collected and processed for the purpose of assessing the prevalence of Staphylococcus aureus, a Gram-positive bacterium. Among these isolates, 283 were obtained from pus swabs and 85 were obtained from nasal
Staphylococcus aureus in pus and nasal swabs of Lahore patients

swabs. The most common isolated organisms were Gram-positive Staphylococcus aureus 330 (90%) followed by Pseudomonas spp 8 (2%), Streptococcus 1 (0.27%), E. coli 5 (1%), Klebsiella spp. 1 (0.27%) and Candida spp. 1 (0.27%) respectively as shown in Table 1. *Staphylococcus aureus* isolated from pus swabs accounts (74.84%) and (25.15%) for nasal samples (Table 2).

**Table 1:** Prevalence of bacterial isolates in pus and nasal swabs.

<table>
<thead>
<tr>
<th>Organisms</th>
<th>No. of isolates</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candida spp.</td>
<td>1</td>
<td>0.27%</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>1</td>
<td>0.27%</td>
</tr>
<tr>
<td>No Growth</td>
<td>22</td>
<td>6%</td>
</tr>
<tr>
<td>Pseudomonas spp.</td>
<td>8</td>
<td>2%</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>330</td>
<td>90%</td>
</tr>
<tr>
<td>Streptococcus</td>
<td>1</td>
<td>0.27%</td>
</tr>
<tr>
<td>Total</td>
<td>368</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Table 2:** Number of bacterial isolates from different specimens.

<table>
<thead>
<tr>
<th>Source</th>
<th>No. of S. aureus isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pus</td>
<td>247</td>
</tr>
<tr>
<td>Nasal</td>
<td>83</td>
</tr>
<tr>
<td>Total</td>
<td>330</td>
</tr>
</tbody>
</table>

In pus swabs, S. aureus exhibited a high drug resistance pattern to clindamycin 23.49%, erythromycin 21.82%, amoxicillin 16.59%, Oxacillin 10.12%, amikacin 8.96%, gentamycin 8.92% ciprofloxacin 6.47 %, and vancomycin 3.63%, respectively (Figure 1). In nasal swab samples, S. aureus displayed a high drug resistance to oxacillin 19.27%, ciprofloxacin 14.45%, amoxicillin 13.26%, clindamycin 13.25%, gentamycin 12.04%, erythromycin 10.84%, amikacin 8.46%, and vancomycin 8.43% as shown in Table 3.

**Table 3:** Prevalence of antibiotic resistance in S. aureus from pus and nasal swabs.

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>% of resistant antibiotics in S. aureus from pus samples</th>
<th>% of Resistant antibiotics in S. aureus from nasal samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>8.96</td>
<td>8.46</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>16.59</td>
<td>13.26</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>6.47</td>
<td>14.45</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>23.49</td>
<td>13.25</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>21.82</td>
<td>10.84</td>
</tr>
<tr>
<td>Gentamycin</td>
<td>8.92</td>
<td>12.04</td>
</tr>
<tr>
<td>Oxacillin</td>
<td>10.12</td>
<td>19.27</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>3.63</td>
<td>8.43</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

The prevalence of S. aureus in female patients seemed to be colonized at an earlier age as compared to male patients. The highest S. aureus prevalence in both females and males was observed in 21-40 years age group (Figure 2).
*Staphylococcus aureus* in pus and nasal swabs of Lahore patients

![Graph](image)

**Figure 1**: Percentage of antibiotic resistance of *S. aureus* isolated from pus and nasal samples.

![Bar chart](image)

**Figure 2**: Number of isolates by Age groups.
4. DISCUSSION

*Staphylococcus aureus* (*S. aureus*), is one of the primordial known bacteria and is the commonest causes of infectious agent in human (Sami et al., 2023). In the current study, we observed 90% prevalence rate of *S. aureus* among collected isolates, which is lower than the similar study accomplished by (Bouchami et al., 2011). Moreover, research indicated *S. aureus* prevalence rate of 30.4%, whereas a study by Gitau et al. (2018) showed a prevalence rate of 14.4%, respectively. Likewise, varied studies also revealed similar results globally. *S. aureus* is a commensal organism of the skin that can easily breach the skin barrier via abrasions, lacerations, burns, surgical incisions, and intravenous catheters, leading to the development of pyogenic infections. Our recent study revealed that 74.84% of *S. aureus* isolates were obtained from pus swabs, while 25.15% originated from nasal swabs, demonstrating their significant role in pyogenic infections. Furthermore, these isolates displayed resistance to several antibiotics, thus underscoring the pressing need for the development of alternative treatment strategies.

It is noteworthy that the occurrence rate of *S. aureus* isolation in pus specimens is higher than in other parts of the human body, a trend that has been observed in Nepal and other regions globally. Antimicrobial resistance is a worldwide concern, with an increasing number of drug-resistant cases reported annually. *S. aureus*, a Gram-positive bacterium, has developed resistance to several commonly used antibiotics, and the prevalence of resistant cases is on the rise, a concerning trend (Khalid et al., 2018). MRSA has emerged as a significant human pathogen with a high degree of antibiotic resistance. The global prevalence of MRSA varies significantly across different regions of the world. Previous reports from Nepal have shown a prevalence rate of 21.1-69.1% for MRSA, while our study found a prevalence rate of 77% among patients in Lahore. In our study, we notice many reasons for the prevalence of MRSA in this respective area such as malpractices of medical and paramedical staff in the prescription of beta-lactam drugs without prior culture reports of the respective swabs, and also patients do not complete the antibiotic time course as prescribed to them by health practitioner. According to prior research conducted in Nepal, no resistance to glycopeptides and linezolid have been documented. However, the study done by (Pahadi et al., 2014) exhibited increased vancomycin MIC among MRSA. While in our study cases of the nasal sample, oxacillin represents high resistance against MRSA, whereas, clindamycin represents high resistance in the pus sample, respectively. It is of utmost importance to preserve antibiotics like glycopeptides and linezolid for future use in treating MRSA infectious cases among patients in Lahore. By doing so, we can ensure that these antibiotics remain effective and available for use in the future.

5. CONCLUSION

The present study establishes *S. aureus* as a common infective agent to causes respiratory tract and wound infections. There is a constant increase in antibiotic resistance to *S. aureus*. The excessive use of antibiotics without prior cultural reports especially without health specialist prescription, poor hygienic conditions in the hospitals, malpractices of medical and paramedical staff lead to the several acquired *Staphylococcus* infections. Thus, the regular screening of the hospitals and personnel, especially judicious selection of antibiotics by medical specialists, and completion of antibiotics courses for the treatment of nasal and pus MRSA infection can be helpful in the reduction of prevalent cases of MRSA infections nationally and internationally.

**Competing interests**

The authors have no competing interests.

6. REFERENCES


*PMID: 26885328*
Staphylococcus aureus in pus and nasal swabs of Lahore patients

DOI: https://doi.org/10.1016/S0924-8579(09)70544-8


DOI: https://doi.org/10.1093/jac/dkg101


DOI: https://doi.org/10.1038/s41598-020-68161-5

DOI: https://doi.org/10.1128/jb.188.2.669-676.2006

PMID: 26982895


Staphylococcus aureus in pus and nasal swabs of Lahore patients

DOI: https://doi.org/10.1093/cid/ciaa121

DOI: https://doi.org/10.1093/cid/cit613

DOI: https://doi.org/10.1128/cmr.00134-14