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Original Research Article

Ophthalmic Manifestation of Methicillin Resistant Staphylococcus Aureus (MRSA) In a Tertiary Care Center, Patna, Bihar, India

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Abstract:

Objectives: The present study was to evaluate and compared the Ophthalmic manifestations of patients between methicillin resistant Staphylococcus aureus (MRSA) and methicillin sensitive Staphylococcus aureus (MSSA) in a tertiary care center, Patna, Bihar, India.

Methods: We determined susceptibility of the isolates to seven antibiotics (oxacillin, penicillin, erythromycin, clindamycin, trimethoprim/sulfamethoxazole, vancomycin and teicoplanin) using the disc diffusion method according to the Clinical and Laboratory Standard Institute (CLSI) standards for antimicrobial susceptibility testing. We used oxacillin to test for b-lactam antibiotic resistance. We reviewed patient charts to collect demographic and clinical information.

Results: Health exposure for ocular infection in MRSA patients was 11(36.66%) and in MSSA was 8(22.85%). It was not significant differences (p=0.22). Clinical Diagnoses Associated with Ocular MRSA and MSSA ocular had Keratitis 12(40%) and 15(42.85%) respectively, which was not significant differences (p=0.817). Conjunctivitis, lacrimal system disorder, wound infection, endophthalmitis, vision threatening disorder and others in MRSA and MSSA patients was not significant differences (p>0.05). But the lid disorder in MRSA and MSSA patients was significant differences (p=0.033). Erythromycin and clindamycin in MRSA and MSSA patient were highly significant differences (p=<0.0001). Penicillin and Sulfamethoxazole/Trimethoprim in MRSA and MSSA was significantly differences (p=0.057). MRSA was significantly more resistant than MSSA to several antibiotics including erythromycin, clindamycin, penicillin and sulfamethoxazole/trimethoprim. 83.33% of MRSA isolates were susceptible to sulfamethoxazole/trimethoprim.

Conclusions: All MRSA isolates are susceptible to vancomycin and teicoplanin. MRSA is common in ocular Staphylococcus aureus infection in our tertiary care centre. Hence, Infectious diseases may differ by regions in epidemiologic patterns, spectrum and severity of disease, and profiles of antibiotic susceptibility.

Key words: Ophthalmic manifestation, MRSA, MSSA.

Introduction

Staphylococcus aureus (SA) is a pertinent cause of common presentations to eye infection. Staphylococcus aureus is a leading cause of ocular infections include conjunctivitis, keratitis and endophthalmitis [1,2]. Traditionally, methicillin-resistant Staphylococcus (MRSA) was almost exclusively associated with hospitals or hospital associated healthcare facilities, but its prevalence has increased in otherwise healthy patients without identifiable risk factors, such as admission to a hospital, intravenous drug use, or prior antibiotic exposure [3, 4].

In any infection, identification of causative pathogens and determination of their antibiotic resistance profiles should ideally precede initiation of antibiotic therapy [5]. Although cultures are performed for vision-threatening ocular infections, they are seldom performed for routine eye infections, with physicians favouring empirical therapy to avoid treatment delays associated with the time required to obtain culture and sensitivity results and/or to avoid the costs of culturing [6,7]. In the absence of culture and sensitivity results, antibiotic resistance data from surveillance studies can inform the choice of initial or empirical treatment. However, regardless of how the treatment decision is made, antibiotic resistance remains an important consideration in the treatment of eye infections. The Ocular Tracking Resistance in US Today (Ocular TRUST) study [10,8, 9] was a nationwide surveillance program conducted from 2005 to 2008 to monitor antibiotic resistance specific to common ocular pathogens. Results showed high levels of methicillin resistance among staphylococci, with a

predominance of concurrent resistance to other antibiotic classes. The Antibiotic Resistance Monitoring in Ocular Microorganisms (ARMOR) study is a multicenter, nationwide, prospective surveillance study initiated in 2009 [11] and designed to extend on the Ocular TRUST study in surveying antibacterial resistance among clinically relevant isolates of Staphylococcus aureus, coagulase-negative staphylococci (CoNS), Streptococcus pneumoniae, Pseudomonas aeruginosa, and Haemophilus influenzae. Objectives of our study was to evaluate and compare the ophthalmic manifestation between the patients with methicillin resistant Staphylococcus aureus (MRSA) and methicillin sensitive Staphylococcus aureus (MSSA) in a tertiary care center, Patna, Bihar, India.

Material & Methods

The present study was conducted in the Department of Microbiology with the collaboration of Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar during a period from October 2023 to January 2024.

Data was collected with irrespective of age and sex. A total of 65 diagnosed cases of ocular infection patients were enrolled in the present study.

From the microbiologic laboratory database, we identified all the patients with an ocular specimen, collected by ophthalmologists, sent for bacterial culture and positive for S. aureus. We included no more than one isolate per patient. We determined susceptibility of the isolates to seven antibiotics (oxacillin, penicillin, erythromycin, clindamycin, trimethoprim/sulfamethoxazole, vancomycin and teicoplanin) using the disc diffusion method according to the Clinical and Laboratory Standard Institute (CLSI) standards for antimicrobial susceptibility testing. We used oxacillin to test for b-lactam antibiotic resistance. We reviewed patient charts to collect demographic and clinical information. Based on the structures involved, we classed ocular infections into one of seven diagnoses: conjunctivitis, keratitis, lid disorder, lacrimal system disorder, wound infection, endophthalmitis and other (e.g., blebitis, buckle or implant infection and sclera ulcer). If the chart showed more than one diagnosis, we chose the primary pathology or the more severe diagnosis. If the patients had either: (1) a MRSA infection identified after 48 hours of admission to a hospital; (2) a history of hospitalization, surgery, dialysis, or residence in a long-term care facility within six months of the MRSA culture date; (3) a permanent indwelling catheter or percutaneous medical device present at the time of culture; or (4) a known positive culture for MRSA prior to the study period, they were thought to have healthcare exposure [12].

Statistical Analysis

Data was analysed with the help of SPSS software. Mean and standard deviations were calculated. P-value was taken less than or equal to 0.05 for significant differences ($p \leq 0.05$).

Observations & Results

Staphylococcus aureus was isolated from 65 patients. Among them, 30 were MRSA and 35 were MSSA. Ratew of prevalence of MRSA was 46.15%. Mean age of ocular MRSA was 42.54 ± 28.23 years. And the mean age of ocular MSSA infection was 34.78± 26.54 years. It was not significant differences (p=0.258). In the MRSA, 18 cases were females and 12 cases were males. In MSSA, 14 cases were females and 21 cases were males. There was laterality similar eye involvement in MRSA and MSSA patients. In MRSA patients, eye involvement was right: 17, left: 9 and bilateral :7. In MSSA patients, eye involvement was right: 19, left: 11 and bilateral: 5. Health exposure for ocular infection in MRSA patients was 11(36.66%) and in MSSA was 8(22.85%). It was not significant differences (p=0.22). Patients with MRSA was not differed significantly from MSSA patients in the presence of underlying comorbidities (p=0.133).

Table 1: Comparison of demographic profile of ocular infection in MRSA and MSSA patients.

Variables	MRSA (N=30)	MSSA (35)	p-value
Age	42.54 ± 28.23	34.78± 26.54	0.258
Health exposure	11(36.66%)	8(22.85%)	0.22
Comorbidities	10(33.33%)	6(17.14%)	0.133

In the present study, there was no change in other demographics of both MRSA and MSSA groups between the study periods. Clinical Diagnoses Associated with Ocular MRSA and MSSA ocular had Keratitis 12(40%) and 15(42.85%) respectively, which was not significant differences (p=0.817). Conjunctivitis, lacrimal system disorder, wound infection, endophthalmitis, vision threatening disorder and others in MRSA and MSSA patients was not significant differences (p>0.05). But the lid disorder in MRSA and MSSA patients was significant differences (p=0.033).

Table 2: Comparison of clinical diagnoses associated with ocular MRSA and MSSA patients.

Diagnosis	MRSA (N=30)	MSSA (N=35)	P-value
Keratitis	12(40%)	15(42.85%)	0.817
Lid disorder	10(33.33%)	4(11.42%)	0.033
Conjunctivitis	7(23.33%)	8(22.85%)	0.963
Lacrimal system disorder	5(16.67%)	7(20%)	0.732
Wound infection	2(6.67%)	1(2.85%)	0.467
Endophthalmitis	2(6.67%)	1(2.85%)	0.467
Vision-threatening disorder	14(46.67%)	18(51.43%)	0.704
Others	1(3.33%)	2(5.71%)	0.650

In the present study, table 3 shows the antibiotic susceptibility in MRSA and MSSA group patients. Erythromycin and clindamycin in MRSA and MSSA patient were highly significant differences (p=<0.0001). Penicillin and Sulfamethoxazole/ Trimethoprim in MRSA and MSSA was significantly differences (p=0.057). MRSA was significantly more resistant than MSSA to several antibiotics including erythromycin, clindamycin, penicillin and sulfamethoxazole/ trimethoprim. 83.33% of MRSA isolates were susceptible to sulfamethoxazole/ trimethoprim. All MRSA and MSSA isolates were susceptible to vancomycin and teicoplanin.

Table 3: Antibiotic susceptibility of MRSA and 245 MSSA for ocular infections.

Antibiotics	MRSA (N=30)	MSSA (N=35)	P-value
Erythromycin	2(6.67%)	24(68.57%)	<0.0001
Clindamycin	3(10%)	26(74.29%)	<0.0001
Penicillin	0(0)	4(11.43%)	0.057
Vancomycin	30(100%)	35(100%)	-
Teicoplanin	30(100%)	35(100%)	-
Sulfamethoxazole/Trimethoprim	25(83.33%)	34(97.14%)	0.057

Discussions

MRSA is a common cause of hospital-acquired infections [13]. Now more than half of all skin and soft tissue infections worldwide are due to the community-acquired MRSA strain [14,15]. Ocular MRSA infections can be aggressive and cause severe ophthalmic disease including blindness [16]. Frequently inadequate antibiotic coverage is prescribed for ophthalmic MRSA infections due to unfamiliarity with both the presentation of these infections and with appropriate antibiotic coverage [2]. Resistance among ocular pathogens is increasing in parallel with the increase among systemic pathogens [17,18]. Data on MRSA antibiotic sensitivity solely from ophthalmic sources has generally been limited to reports from single institutions and retrospective case series [19,20,18]. However, recent antibiograms from the US and abroad showed that CA-MRSA strains tended to be susceptible to a wide range of non-blactam antibiotics [21,22].

In the present study, rate of prevalence of MRSA was 46.12%. Increasing prevalence of MRSA ophthalmic infections has been much ballyhooed in both the peer-reviewed ophthalmology as well as the non-peer-reviewed ophthalmology ‘‘throwaways’’. Asbell et al. [17] reported increasing prevalence of multi-drug-resistant MRSA in serious ocular infections based on the rate of increase in a national surveillance program monitoring evolving patterns of antimicrobial susceptibility for pathogens requiring diagnostic testing. The Surveilllance Network (TSN) retrieved data from over 580,000 isolates of S. aureus from 2000 to 2005 and found methicillin resistance increased in S. aureus isolates regardless of specimen source. The MRSA prevalence rate increased 12.1% during the 5-year period (from 29.5% in 2000 to 41.6% in 2005) [23].

In the present study, greater number of the patients with MRSA ocular infections had healthcare exposure than those with MSSA ocular infections. However, it is noteworthy that two thirds of the patients (19/30, 63.33%) with MRSA ocular infections had no healthcare exposure, which meant the isolates were potentially community associated. MRSA was once associated with healthcare facilities, but more recent reports showed an increasing frequency of isolates from community associated MRSA infections [24, 25]. Since most ophthalmologic patients are seen and treated as outpatients instead of inpatients, community-associated MRSA may play an important role in MRSA ocular infections.

In the present study, the most common presentation of ocular MRSA infections was keratitis (40%), followed by lid disorder (33.33%) and conjunctivitis (23.33%). And 46.67% patients of ocular MRSA infections were vision-threatening. However, previous large case series studies showed that the most common manifestation of ophthalmic MRSA

infection was conjunctivitis [8,10] or lid disorder [9]; vision-threatening infections were relatively uncommon [26, 1]. Our results may have differed due to selection bias, because there were more severe cases in our hospital. Also, physicians may differ in which cases they sent for diagnostic testing; some may tend to culture only the most serious cases. Third, we may exclude some patients with ocular infections, while the cultures were not done by ophthalmologists. MRSA is believed to cause a more severe disease than MSSA, but this observation has not reached consensus [27]. Our results were not shown that MRSA caused more severe ocular diseases than MSSA; this agrees with Freidlin's study, which reported MRSA and MSSA caused similar eye disease [1]. We were found that patients with MRSA were more likely to have lid infections. In addition, the rate of lid disorder caused by MRSA significantly increased. Community associated MRSA has a reported predilection for causing skin and soft tissue infections [12,29]. And we were also found that lid and lacrimal system disorders were more common, but keratitis, endophthalmitis and wound infection were less common among community associated MRSA cases than healthcare associated MRSA cases [30]. Thus, 63.33% of patients with MRSA ocular infections were community-associated and the paralleled significant increase in the rate of the MRSA patients without healthcare exposure (i.e. community-associated MRSA.

According to antibiotic susceptibility profiles, vancomycin and teicoplanin were the most active agent against ocular MRSA isolates, whereas sulfamethoxazole/trimethoprim retained some degree of activity against MRSA, but was less effective than in previous studies [2, 1]. Although vancomycin retains extremely high efficacy against MRSA, S. aureus with reduced susceptibility to vancomycin was identified [31]. Since prior vancomycin use is a risk factor for MRSA with reduced vancomycin susceptibility [32] and no convincing evidence shows that routine vancomycin prophylaxis is effective in elective cataract surgery [33]. We recommend that ophthalmologists follow guideline of the Centers for Disease Control and Prevention [34] and the American Academy of Ophthalmology [36] against the routine use of vancomycin for prophylaxis to halt the spread of resistance. Several recent studies have reported that MRSA has a high rate of in vitro resistance to fluoroquinolones, including new generation ones, the most popular empiric therapy in ocular infections [2,1,10,36,37,38]. We were not tested fluoroquinolones in our study because they were not included in the recommended list of antibiotics published by the CLSI. In Taiwan, National data from 2000 (TSAR program) has demonstrated 40% S. aureus (including MSSA and MRSA) in vitro resistance to ciprofloxacin [39]. We may extend the antibiotic susceptibility profiles to include commonly used topical antibiotics in future studies.

Conclusions

The present study concluded that the all-MRSA isolates are susceptible to vancomycin and teicoplanin. MRSA is common in ocular Staphylococcus aureus infection in our tertiary care centre. Hence, Infectious diseases may differ by regions in epidemiologic patterns, spectrum and severity of disease, and profiles of antibiotic susceptibility.

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