Paper

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Clinico-bacteriological profile of primary pyodermas in Kashmir: a hospital-based study

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ABSTRACT Pyodermas are a common group of infectious dermatological conditions on which few studies have been conducted. This study aimed to characterise the clinical and bacteriological profile of pyodermas, and to determine the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) infection in primary pyodermas in a dermatology outpatient department in Kashmir.
Methods We conducted a hospital based cross-sectional study in the outpatient Department of Dermatology, Sexually Transmitted Diseases and Leprosy of Shri Maharaja Hari Singh Hospital, Srinagar, Jammu and Kashmir, India. Patients presenting with primary pyodermas were included in the study. A detailed history and complete physical and cutaneous examination was carried out along with microbiological testing to find aetiological microorganisms and their respective antimicrobial susceptibility patterns. Antimicrobial susceptibility testing, including that for methicillin resistance, was carried out by standard methods as outlined in the current Clinical and Laboratory Standards Institute guidelines.
Results In total, 110 patients were included; the age of the study population ranged from 3 to 65 years (mean age 28 years); 62% were male. Poor personal hygiene was noted in 76 (69%). Furunculosis (56; 51%) was the most common clinical presentation. *Staphylococcus aureus* was isolated in 89 (81%) of cases, and MRSA formed 54/89 (61%) of *Staphylococcus aureus* isolates. All MRSA strains were sensitive to vancomycin.
Conclusion The prevalence of MRSA was high in this sample of community-acquired primary pyodermas. It is therefore important to monitor the changing trends in bacterial infection and their antimicrobial susceptibility patterns and to formulate a definite antibiotic policy which may be helpful in decreasing the incidence of MRSA infection

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INTRODUCTION

Pyodermas are among the most common clinical conditions encountered in dermatological practice.[1] The majority of pyodermas are caused by Gram positive cocci, particularly *Staphylococcus aureus* and *Streptococcus pyogenes*. Other organisms that may rarely cause pyodermas include coagulase negative staphylococci, Gram negative bacilli,[2,3] anaerobic bacteria, *Haemophilus influenzae* and *Bacillus cereus*.[4,5] Although most pyodermas are self-resolving, some may be complicated by glomerulonephritis, especially where *Streptococcus pyogenes* is the causative organism.[6]

Pyoderma may involve previously normal skin, when it is known as primary pyoderma, or may result from pyogenic infection of already diseased skin, known as secondary pyoderma. Primary pyoderma includes the conditions impetigo, furunculosis, carbuncles, folliculitis, sycosis and ecthyma. Environmental conditions such as malnutrition, overcrowding and poor hygiene contribute to a higher incidence of pyodermas.[7]

Pyodermas are usually treated empirically using antibiotics with adequate Gram positive coverage. Trends in antibiotic susceptibility are however continuously changing; indiscriminate use of antibiotics has led to the development of strains resistant to multiple antibiotics. Methicillin-resistant *Staphylococcus aureus* (MRSA) which was earlier considered important only in healthcare settings has emerged as an important cause of community-acquired pyodermas.

In a retrospective hospital-based study from Kashmir valley, the prevalence of pyodermas was found to be 9.1%.[8] An increasing prevalence of MRSA strains has been reported in other populations both within and outside India.[9–11] Although plenty of reports regarding hospital-acquired MRSA are available, there is a paucity of data regarding community-acquired MRSA from

TABLE 1 Hygiene score

Parameters		Score
Hand washing	<5 times a day	1
	5–10 times/day	2
	>10 times/day	3
Number of showers per week	<3	1
	3–6	2
	>6	3
Shared items	>2	1
	1–2	2
	None	3

Score <6 = poor personal hygiene practices

north India. The aim of this study was therefore to characterise the clinical and bacteriological profile of pyodermas and to determine the prevalence of MRSA infection in primary pyodermas in our dermatology outpatient department.

METHODS

Setting and population

This was a hospital-based study conducted at the outpatient Department of Dermatology, Sexually Transmitted Diseases and Leprosy of Shri Maharaja Hari Singh Hospital, Srinagar, Jammu and Kashmir. The Kashmir valley is bounded by a natural wall of mountains and is situated about 6,000 feet above sea level. The population of the valley is around 6 million with the rural population forming about 57% of the total population. Nearly 21% of the total population live below the poverty line. A household survey of socioeconomic conditions and quality of life in Kashmir indicated that the lower socioeconomic groups, especially the rural population, are exposed to poor sanitation in the form of poor latrine and drainage conditions.

Patients with primary pyodermas attending the outpatient department over a period of six months (February 2013–July 2013) were included in the study. Patients with secondary pyodermas and those who had received prior topical or systemic antibiotics (topical mupirocin, fusidic acid and oral cephalosporins, azithromycin) were excluded from the study. Ethical committee clearance was sought and written informed consent was taken from all patients before the study.

Data collection

A detailed history including demographic data, socioeconomic status, duration of complaint, family history of similar complaints, any drug history and any comorbidity was recorded. The patients' level of personal hygiene was determined by using a hygiene score based on the frequency of hand washing, number of showers per week and number of shared items (Table 1). Socioeconomic class was determined based on household income, earner's education and occupation.[12] A complete physical examination was carried out and body mass index was calculated in all patients. Cutaneous examination to determine the morphology, and number and distribution of skin lesions was carried out. Routine investigations including complete blood count, liver function tests, kidney function tests and blood glucose, were carried out in all patients.

TABLE 2 Baseline details of study population (n=110)

Mean age (years) (SD)	28 (11)
Male sex (%)	68 (62)
Rural dwelling (%)	63 (57)
Low socioeconomic class (%)	68 (62)
Poor personal hygiene (score <6) (%)	76 (69)
Recurrent disease (%)	37 (34)
Family member also affected (%)	10 (9)
Body mass index >=30 kg/m^2 (%)	17 (15)
Hypertension (%)	9 (8)
Diabetes mellitus (%)	7 (6)
Chronic kidney disease (%)	1 (1)
Rheumatoid arthritis (%)	1 (1)

Sterile cotton swabs were used to collect pus or exudates from the lesions after thoroughly cleaning the wound with sterile saline. All specimens received in the lab were subject to standard microbiological procedures, including Gram stain and qualitative culture for aerobic bacteria.[13] The specimens were inoculated on both non-selective enriched and selective media (blood agar and MacConkey agar plates) and incubated overnight in air at 37°C. Pure bacterial growths obtained after overnight incubation were subjected to one or more identification tests (including Gram stain, catalase, slide coagulase, tube coagulase, DNase, oxidase, bile esculin, bacitracin test, indole, methyl red, Voges–Proskauer, citrate, urease, triple sugar iron, phenylalanine deaminase and sugar fermentation) as dictated by the presumptive identifications.[13] Any growth that did not correlate with the Gram stain findings was not processed further and reported as probable contamination.

Antimicrobial susceptibility testing was carried out by the Kirby-Bauer disc diffusion method with the following set of antibiotics: penicillin, cefoxitin, azithromycin clindamycin, cephazolin, ciprofloxacin, moxifloxacin, gentamicin, trimethoprim-sulfamethoxazole, vancomycin and linezolid, in accordance with Clinical and Laboratory Standards Institute guidelines.[14] A cefoxitin (30 mcg) disk was used as a surrogate marker for predicting methicillin-resistance in *Staphylococcus aureus*. An

TABLE 3 Clinical and bacteriological characteristics of different pyodermas

Type of primary pyoderma	Furunculosis	Impetigo	Folliculitis	Sycosis barbae	Carbuncle	Ecthyma
n (%)	56 (51)	23 (21)	21 (19)	6 (5)	3 (3)	1 (1)
Most common site involved	Lower extremities	Head and neck	Head and neck	Head and neck	Lower extremities	Lower extremities
No. with recurrent lesions (%)	22 (39)	4 (18)	8 (38)	3 (50)	0 (0)	0 (0)
No. with affected family members (%)	6 (11)	4 (17)	0 (0)	0 (0)	0 (0)	0 (0)
Staphylococcus aureus alone (%)	46 (82)	16 (70)	18 (86)	3 (50)	2 (67)	1 (100)
Streptococcus pyogenes alone (%)	1 (2)	2 (9)	0 (0)	0 (0)	0 (0)	0 (0)
S.aureus and *S. pyogenes* (%)	2 (4)	0 (0)	0 (0)	0 (0)	1 (33)	0 (0)
Ps.aeruginosa (%)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No growth (%)	6 (11)	5 (22)	3 (14)	3 (50)	0 (0)	0 (0)

inhibition zone size of <21 mm around a 30 mcg cefoxitin disk was considered as MRSA.[8] *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 were used as quality control strains. Our practice was to treat patients with oral cephalosporins, azithromycin, amoxicillin/cloxacillin or amoxicillin/clavulanate. For single or localised lesions, topical mupirocin or fusidic acid was used.

We generated descriptive statistics for both clinical and bacteriological characteristics of our population. Statistical comparison of categorical variables was undertaken using the Chi-Square test and a p value of <0.05 was considered significant.

RESULTS

A total of 110 patients were included in the study, aged from 3 to 65 years. Table 2 gives details of demographics, socioeconomic and clinical features of the study population.

Table 3 shows details of the clinical and bacteriological characteristics of the pyodermal lesions. Of 110 patients, 93 (85%) had multiple lesions, and multiple sites were involved in 26 (24%). Culture of pus or exudate revealed no growth in 17 (16%) patients. Results of microbiological investigation in the other 93 patients are shown in Table 3. Among the 89 *Staphylococcus aureus* isolates, methicillin resistance was found in 54/89 (61%) cases. Among the MRSA strains isolated, all were sensitive to vancomycin and linezolid, 49 (91%) were sensitive to amikacin, 45 (83%) to clindamycin, 38 (70%) to co-trimoxazole, 32 (59%) to azithromycin and 18 (33%) to gentamycin. All methicillin sensitive *Staphylococcus aureus* isolates were sensitive to vancomycin, 26 (74%) were sensitive to amikacin, 18 (51%) to cephazolin and 7 (20%) to benzylpenicillin.

The frequency of methicillin resistance among *Staphylococcus aureus* isolates was compared between patients with first episode of pyoderma and those with recurrent episodes. Similar comparison was made between patients with and without associated comorbidities. The results of these comparisons are shown in Table 4. Patients with comorbidities appeared to have a higher isolation rate of MRSA as compared to those without any comorbidity but this did not reach statistical significance.

The most common complication of pyodermas seen was local abscess formation especially in patients with furunculosis. Cellulitis was also associated with furunculosis in a few patients and in a single case of impetigo. No systemic complications were seen in any patient and most of the lesions resolved within a time span of 1–2 weeks.

DISCUSSION

Pyodermas constitute a sizeable proportion of cases in dermatology clinics worldwide.[1] The male pre-ponderance in our series has been noted in previous studies.[15,16] Factors such as poverty, malnutrition, overcrowding and poor hygiene have been stated to be responsible for the higher incidence of pyodermas,[7] and a high prevalence of poor hygiene and low socioeconomic status was seen in our series. These

TABLE 4 Association of recurrence and co-morbidities with MRSA prevalence

Patient characteristics	Total number of *S. aureus* isolates (n)	MRSA n (%)	MSSA n (%)	p*
First episode	63	35 (56)	28 (44)	0.12
Recurrent episode	26	19 (73)	7 (27)	
Comorbidity present	18	12 (67)	6 (33)	0.56
No comorbidity	71	42 (59)	29 (41)	

MRSA: Methicillin-resistant *Staphylococcus aureus*; MSSA: Methicillin-sensitive *Staphylococcus aureus*
*by Chi-square test

factors could also be responsible for the slight preponderance of rural dwellers in our study. In our study, 34% of patients gave a history of recurrent pyodermas, comparable to that seen by Mathews et al.[17] who reported past history of recurrence in 54% of their patients. In our study, 9% of patients reported a family history of similar lesions, which is lower than reported elsewhere.[2] Although cutaneous infections, including MRSA, are more common in those with an elevated body mass index, few of our patients were obese, in keeping with the norms for our population.

Furunculosis (Figure 1) was the predominant pyoderma seen in our study followed by impetigo (Figure 2). Patil et al.[18] and Chopra et al.[19] reported furunculosis in 33% and 24% of their patients, respectively. Folliculitis (59%) was the most common pyoderma seen in the study conducted by Patil et al.[18] whereas Chopra et al.[19] reported impetigo (31%) as the most common pyoderma in their study.

The most common sites affected by pyodermas in our study were the lower extremities followed by the head and neck. One previous study found that the lower extremities were most commonly affected,[20] although most studies[2,17,21] report that the face is most commonly affected. The more common occurrence of pyodermas over these sites could be attributed to the proximity to body orifices which are believed to be important sites of bacterial colonisation, especially MRSA.[22,23]

Of the 110 samples cultured, no growth was obtained in 15.5% of samples – a similar rate to previous reports.[16,18] *Staphylococcus aureus* and *Streptococci* are considered to be the main etiological agents of cutaneous bacterial infections and these have been isolated in different proportions of cases in different studies. *Staphylococcus aureus* was also the most common causative organism in most previous studies.[15,24–26]

FIGURE 1 Furunculosis

FIGURE 2 Impetigo

The most striking finding from our series is the high prevalence of MRSA in our study population – much higher than reported in most other studies.[18,20,27] One further study from Pakistan reported a similarly high isolation rate of 83% MRSA from pus samples.[11] Similar to our findings, two previous studies on MRSA in pyoderma[18,28] found that all strains were found to be sensitive to vancomycin. Though there are only limited data on community-acquired MRSA from our area, a few studies conducted in recent years from north India report a lower incidence of MRSA compared to our study.[28,29]

This study had limitations in that it was a single centre study and included a limited geographical area. Information on previous antibiotic exposure in individual patients was limited, and thus the impact of prior antibiotic exposure as a driver of the occurrence of MRSA cannot be ascertained in our study population. However, the high prevalence of MRSA could be the result of indiscriminate use of broad spectrum antibiotics for other diseases.

What are the lessons for practice from our case series? First, monitoring antibiotic resistance patterns is a key first step in modifying practice. Second, the high rates of MRSA seen in our population require further investigation, in particular the use of broad spectrum antibiotics in human and animal medicine are key drivers in other geographical areas, and require formulation of appropriate local antibiotic policies that minimise exposure to broad spectrum agents while accounting for local resistance patterns. Despite the high rate of resistance, most of our patients recovered well – a reminder that uncomplicated primary pyodermas may be managed without the use of oral antibiotics which have in fact been shown to have only a moderate effect on clinical outcome. Finally, the high rates of poor personal hygiene remind us that hygiene measures have proved to be successful in controlling community-acquired outbreaks and should be taught more extensively in communities to prevent the occurrence of such lesions.

CONCLUSION

Pyodermas, especially when recurrent, are an important health problem causing significant morbidity to patients. Environmental, socioeconomic and nutritional factors may have a compounding effect on development of pyoderma. In this study a male preponderance was seen and the lower socioeconomic group was affected more frequently. Furunculosis and impetigo were the two most common primary pyodermas seen, with *Staphylococcus aureus* being the most common isolated organism. An alarmingly high prevalence of MRSA in primary pyodermas was seen, which warrants frequent monitoring of susceptibility patterns of MRSA and the formulation of a definite antibiotic policy which may be helpful in decreasing the incidence of MRSA infection.

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