ORIGINAL ARTICLE

Comparison of clinico-bacteriological profile of pyoderma in children and adults

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ABSTRACT

Background: Pyodermas are frequently confronted skin infections by dermatologists. While treating them, recurrence and resistance to commonly used empirical antibiotics are the major concerns.

Materials and methods: The study includes a total of two hundred (divided into two groups of 100 each, children < 18 years and adults >18years) clinically diagnosed cases of pyodermas. Samples were collected with a sterile swab and sent for Gram staining, culture, and sensitivity.

Results: Among clinicallydiagnosed cases of primary pyodermas (72%), impetigo contagiosa was the most common clinical presentation (63%) in children, while folliculitis (29%) was seen most frequently in adults. Secondary pyodermas were observed in 28% patients, out of which infected scabies (47%) and infected tinea (57%) ranked the highest in children and adults respectively. *S. aureus* was the most common isolate in both children (92%) and adults (65%) among Gram positive organisms whereas among Gram negative organisms, *E. coli* (4%) was most common in children whearas *P. aeruginosa* (14%)in adults. Diabetes and poor hygiene were significantly associated with pyodermas.

Conclusions: Pyoderma is a common skin problem often because of therapeutic failure due to antibiotic resistance. Hence, the study of clinical diagnosis of pyoderma and correlation of bacteriological profile with antibiotic susceptibility testing can be helpful in tackling it.

KEY WORDS: Primary pyoderma, Secondary pyoderma, Impetigo contagiosa, Antibiotic susceptibility

INTRODUCTION

Pyoderma is one of the commonest conditions encountered in dermatological practice.[1] Among various skin diseases affecting school children, incidence of bacterial pyoderma is 64.4%.[2]

Dermatological infections need to be categorized to target successful therapy. Primary pyoderma is a pyogenic infection of the non-diseased skin and its appendages, and includes impetigo, folliculitis, furunculosis, carbuncle, ecthyma etc. Secondary pyoderma is pyogenic infection of previously diseased skin, including infected eczema, infected scabies, infected wounds, trophic ulcers etc. It can be classified as 'superficial' (epidermis and dermis) and 'deep' (in hypodermis, fascia and muscle).[3] It can be community acquired (CA) or hospital acquired/ nosocomial (HA) infection. The former usually involves a single pathogen, whereas the latter is often polymicrobial.

Various factors like poverty, malnutrition, overcrowding, and poor hygiene have been stated

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to be responsible for its higher incidence in the lower socio-economic class.[4]

The common gram-positive organisms responsible for pyodermas are *Staphylococcus aureus* and *Streptococcus pyogenes*. The gram-negative organisms isolated are *Escherichia coli*, Klebsiella spp., *Pseudomonas aeruginosa*, Enterobacter spp., and Proteus spp.[5,6]

Methicillin - resistant *Staphylococcus aureus* (MRSA) was recognized initially in the healthcare setup (1960's), followed by its spread in the community (1980's).[7] The incidence of MRSA is variable (1%-74%) among different geographic areas and in various communities in the different countries.[7]

It is important to differentiate as to whether the bacterium isolated on culture is a pathogen, colonizer of an abnormal skin surface, or part of the normal skin flora, prior to initiation of antimicrobial therapy. This informs not only the appropriate choice of topical, systemic, or dual therapy, but also helps in defining therapeutic goals.

The management of skin infections requires careful history taking and clinical examination. Majority of the superficial bacterial infections can be managed on an outpatient basis. Many cases these days do not respond to antibiotics, and this may be attributed to indiscriminate use of topical and systemic antibiotics. Hence, timely recognition, and prompt bacteriological diagnosis of the cases is very important for appropriate management and to check for any major complications, as well. Therefore, pus culture and sensitivity tests in pyoderma are highly recommended to identify the commonly prevalent pathogens and aid in the judicious use of cost - effective antibiotics, thereby preventing antimicrobial resistance. There must be an attempt to identify prevalent microorganisms causing bacterial infections of skin and the emerging antibiotic-resistance pattern in the community. In this regard, periodic collaborative works among all clinical departments, in association with microbiologists, would be helpful. This will help to chalk out effective management protocol for bacterial skin infections, keeping in mind the limited resources, especially in third world countries.

Antimicrobial resistance (AMR) is a global health and development threat. It requires urgent multisectoral action to achieve the Sustainable Development Goals (SDGs). WHO has declared that AMR is one of the top 10 global public health threats facing humanity. Misuse and overuse of antimicrobials are the main drivers in the development of drug-resistant pathogens. The cost of AMR to the economy is significant. In addition to death and disability, prolonged illness results in longer hospital stays, the need for more expensive medicines and financial challenges for those impacted. Without effective antimicrobials, the success of modern medicine in treating infections, including during major surgery and cancer chemotherapy, would be at increased risk.

So, the present study was conducted to compare the magnitude of different types of pyodermas, clinical types, the causative agents and their antibiotic susceptibility pattern in children and adults.

METHODS

A total of 200 (divided into two groups of 100 each, children<18 years and adults>18 years) clinically diagnosed cases of pyodermas attending outpatient (OPD) and inpatient (IPD) of Dermatology department of our hospital, were included in this study. Informed consent was ob-

tained from all participants included in the study. All the procedures were done as per ethical guidelines. Detailed history regarding,duration of disease, site of infection, and symptoms related to the disease was taken. Pus samples were collected and processed in the Department of Microbiology. Gram staining, and culture and sensitivity of all the samples was done. For sensitivity, OPD samples were processed manually while IPD samples were processed by automated method as per institutional protocol. Antimicrobial susceptibility testing was done using Kirby Bauer Disc diffusion method using Mueller Hinton agar as per the Clinical and Laboratory Standard Institute (CLSI) guidelines.[8] For comparing categorical data, Chi square ($\chi 2$) test was performed, and exact test was used when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant.

RESULTS

In our study, males outnumbered females with M:F ratio in children was 1.5:1, whereas in adults was 1.2:1. In children, there were 61% males and 39% females, whereas in adults, there were 56% males and 44% females. Mean age of incidence was 7.56 ± 5.24 years in children and 46.13 ±15.49 years in adults. There were 21% cases in adults of 2nd, 4th and 5th decade of life each, while majority of patients were seen in children of age group <10years (68%) followed by 11-18 years (32%). The most common sites affected were head & neck (56%) in children and trunk (42%) in adults, while genitalia were the least common site observed (Table 1). Erythematous (76%), pain (80%) and crusting (70%) was the predominant morphology in children contrasting to the pain (87%), erythematous (82%), oedematous (54%), oozing (30%) lesions in adults (Table 2). Poor hygiene (57%) and immunosupressioin (8%) were found to be associated with pyodermas in children. Whereas, poor hygiene (45%), diabetes mellitus (16%), & immunosuppression (9%) were seen in adults.

Among clinically diagnosed cases, primary pyodermas were observed in 144 (72%) and secondary pyodermas in 56 cases (28%). Among the primary pyodermas, the commonest entity seen was impetigo which accounted for 30% (n=43) cases, followed by folliculitis with 24% (n=24), furunculosis 16%(n=23) and abscess 13%(n=19). In children impetigo (63%) was common as compared to folliculitis (29%) in adults. (Fig. 1) Among secondary pyodermas, common types observed were infected scabies 30% (n=17), infected tinea 30% (n=17) and infected eczema 25% (n=14). Infected tinea (57%) and scabies (47%) were the most common secondary pyodermas in adults and children, respec-

Table 1 Distribution of site of involvement in children and adults

Sites involved	Child n (%)	Adult n (%)	Total n (%)
Head & neck	56(56%)	12(12%)	68(34%)
Upper limb	17(17%)	6(6%)	23(11.5%)
Trunk	17(17%)	42(42%)	59(29.5%)
Lower limb	10(10%)	38(38%)	48(24%)
Genitalia	0(0%)	2(2%)	2(1%)
Total	**100**	**100**	**200**

Table 2 Signs and symptoms of pyodermas in children and adults

Signs and symptoms	Child n (%)	Adult n (%)	Total n (%)
Erythema	76 (76%)	82(82%)	158(79%)
Pain	80 (80%)	87(87%)	167(83.5%)
Swelling	11(11%)	54(54%)	65(32.5%)
Crusting	70(70%)	32(32%)	102(51%)
Oozing	28(28%)	30(30%)	58(29%)

tively. (Fig. 2) Confirmation of the diagnosis was done by gram staining, which revealed that gram positive cocci were present in most pus samples collected from children whereas, gram-negative

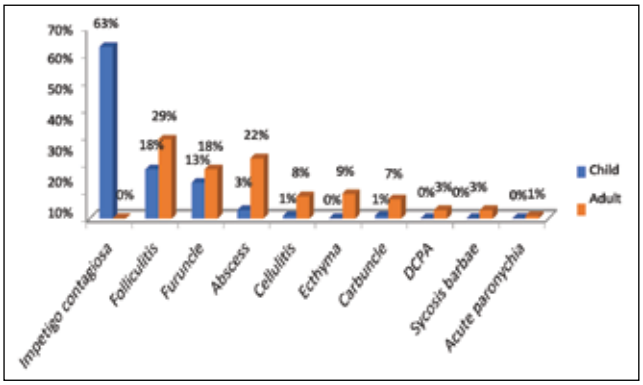

Fig. 1 Comparison of clinical sub-types of primary pyodermas in children and adults

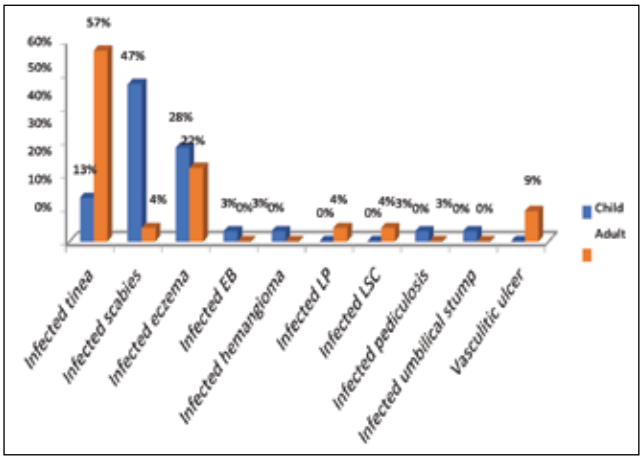

Fig. 2 Comparison of clinical sub-types of secondary pyoderma in children and adults

bacilli were predominant in adults. Out of 200 samples, growth was observed in 174 and no growth in 26 samples. In 162 (82%) pus samples, monomicrobial growth was obtained, polymicrobial growth (isolated two organisms per sample) was seen in 12 pus samples thus a total of 186 isolates were obtained. The most common gram-positive isolate was *S. aureus* in both children (92%) as well as in adults (65%). In contrast, *E. coli* (4%) in children and *P. aeruginosa* (14%) in adults were the most common gram-negative isolates. (Table 3)

In children, *S. aureus* was resistant to penicillin (38%), ciprofloxacin (28%), erythromycin (25%) while in adults, resistance was 66%, 53%, 26%, respectively. MRSA was obtained in 3% children and 5% adults. (Fig. 3) β-haemolytic streptococci showed complete resistance to cotrimoxazole, penicillin, gentamycin, clindamycin and ciprofloxacin in adults. Whereas, in children it was 100% sensitive to these antibiotics. Thus, it was inferred that resistance of gram-positive organisms to most of the drugs was more prevalent in adults as compared to children.

All *E. coli* isolates were resistant to ciprofloxacin in children whereas in adults it was reported to be 67%. (Fig. 4) In our study, *P. aeruginosa* isolates in adults showed resistance to ciprofloxacin & cefoperazone sulbactam (17% each), to amikacin, gentamicin and piperacillin + tazobactam (8% each) whereas *P. aeruginosa* isolate in children was 100% resistant to all antimicrobial agents. (Fig. 5) Thus, it was concluded that resistance of gram-negative organisms to most of the drugs

Table 3 Comparison of organisms isolated in pus samples of pyodermas in children and adults

Gram staining	Organism	Child	Adult	Total
		n (%)	n (%)	n (%)
Gram positive 151 (80%)	*S. aureus*	88(92)	58(65)	146(78.5)
	Enterococcusspp	2(2)	1(1)	3(2)
	β-haemolytic streptococci	1(1)	1(1)	2(1)
Gram negative 35(20%)	*E. coli*	4(4)	9(10)	13(7)
	P. aeruginosa	1(1)	12(14)	13(7)
	K. pneumoniae	0(0)	2(2)	2(1)
	Enterobacterspp	0(0)	2(2)	2(1)
	Citrobacterspp	0(0)	2(2)	2(1)
	Proteus mirabilis	0(0)	1(1)	1(0.5)
	Proteus vulgaris	0(0)	1(1)	1(0.5)
	Acinetobacter baumannii	0(0)	1(1)	1(0.5)
	Total	**96 (100)**	**90(100)**	**186(100)**

was more frequent in children as compared to adults.

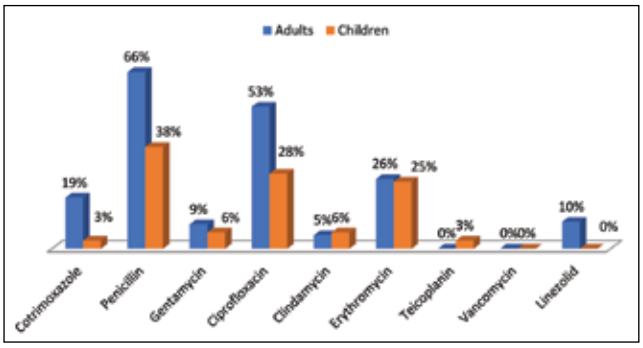

Fig. 3 Comparison of antimicrobial resistance of *S. aureus* in children and adults

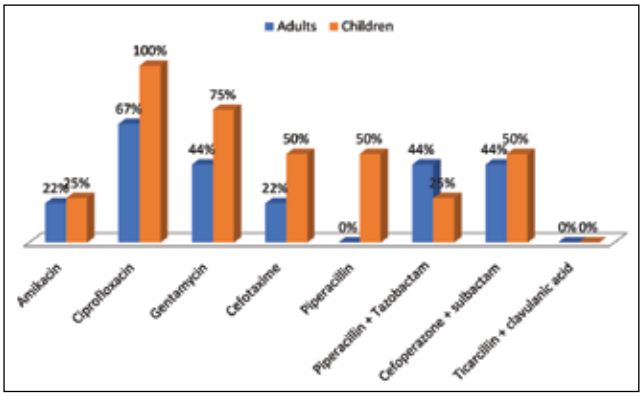

Fig. 4 Comparison of antimicrobial resistance of *E. coli* isolates in children and adults

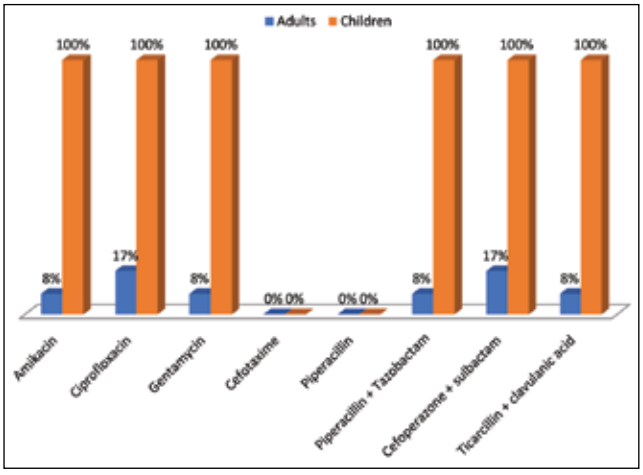

Fig. 5 Comparison of antimicrobial resistance of *P. aeruginosa* in children and adults

DISCUSSION

On account of the high prevalence of pyodermas, changing pattern of causative microorganisms, and the indiscriminate use of antibiotics leading to altered antibiotic susceptibility pattern, there is a constant need to obtain more information about etiological agents, predisposing factors, modes of transmission, and effective methods of control. Various studies have been carried out in India and abroad on epidemiology, clinical and bacteriological aspects of pyodermas, and antibiotic sensitivity patterns.

The comparative study was undertaken to highlight the clinico-bacteriological correlation and antimicrobial susceptibility in children and adults with pyodermas. Therefore, the knowledge of the pattern of bacterial isolates and their antimicrobial susceptibility pattern is useful for prompt treatment of the patients.

Pyodermas can affect any age group. In the present study of 200 clinically diagnosed cases of pyodermas, the age of patients ranged from 2 months to 86 years (mean age being 7.56 years in children and 46.13 years in adults). There were 21% cases in adults of 2nd, 4th and 5th decade of life each while majority of patients were seen in children of age group <10 years (68%) followed by 11-18 years (32%) which correlate well with study done by Gandhi et al.,[9] which can be explained by the fact that preschool and school going children are prone to minor trauma caused mainly by insect bite. In our study male preponderance was seen in both children and adults which is in concordance with other studies.[10-12] Overall results of our study showed head and neck (34%) as the major site for pyodermas lesions, in contrast to the studies done by Ashokan etal. and Paudelet al.[10,12] They observed that the lower limb was the commonly involved site.[10,12] The study showed that pain (80%), erythematous (76%), and crusting (70%), was the predominant presentation in children as compared to the pain

(87%), erythematous (82%), oedematous (54%), oozing (30%) lesions in adults which is incontrast to the study by Ashokan et al., where oozing (85.30%) was more commonly seen, followed by pain (66.10%), and crusting (16.30%).[12] Diabetes, immunosuppression and poor hygiene were the predisposing factors associated with pyodermas similar to the other studies.[11]

Primary pyodermas (72%) were more common than secondary pyodermas (28%). Similar findings were seen in many studies except the study by Malhotra et al.[10-14] The overall pattern of primary pyodermas observed in our hospital showed impetigo as the single largest group which accounted for 30% cases, followed by folliculitis (24%), furunculosis (16%), andabscess (13%) etc. This corresponds to the findings of Mohan et al., Harshita etal.[13,15] Whereas, a study by Ashokan et al.[12] had furunculosis (45.3%) as the commonest clinical diagnosis. Secondary pyodermas in our study constituted 28% cases. The common types observed in them were infected scabies (30%), infected tinea (30%) and infected eczema (25%) etc, whereas in the study by Harshita et al.,[15] infected eczema (50.46%) was commonest. *S. aureus* pyodermas occur mostly in individuals who are nasal carriers of the organisms, which when translocated onto the skin, is able to gain infections. There has been an increasing trend in the isolation of *S. aureus* as an etiological agent in pyodermas over the years. In our study, gram-positive organisms (*S. aureus*- 78.5%) were the commonest isolate from pyodermas, also observed by various authors in their studies.[11-13] MRSA was isolated in 3% children and 5% adults, which is in contrast to the studies by Harshita et al. (42.20%) and Ashokan et al. (47%).[12,15] Hospital staff and inpatients are important sources of MRSA. Hand washing and strict infection control guidelines are required. Eradication should be attempted in all medical and ancillary personnel and in those patients whose main complaint is non-dermatological. Among gram negative bacilli, *E. coli* (4%) in children and *P. aeruginosa* (14%) in adults were most commonly isolated which is comparable to thestudies by Singh et al. and Ashokan et al.[11-12] Antibiotic susceptibility testing was done for pus samples which revealed that *S. aureus* was resistant to penicillin in 49% cases in our study whereas in the study by Harshita et al., it was resistant in 84.29%.[15] *S. aureus* showed resistance to penicillin (66%) and ciprofloxacin (53%) in adults whereas in children, it was seen to penicillin (38%) and ciprofloxacin (28%). The most effective topical treatment for nasal colonization is mupirocin in a paraffin base, applied to the anterior nares three times daily for 5 days. There is an increasing resistance to mupirocin, secondary to prolonged and frequent use for eradication *E. coli* was resistant to ciprofloxacin (77%) followed by gentamycin (54%) which is in contrast to the study by Harshita et al.[15] where it was partially resistant to ciprofloxacin (37.50%) followed by gentamycin (25%), amikacin and piperacillin+tazobactam in 6.25% cases each. Resistance to fluoroquinolone antibiotics in *E. coli*, is widespread. There are countries in many parts of the world where this treatment is now ineffective in more than half of patients. In ourstudy, *P. aeruginosa* showed resistance to ciprofloxacin (23%), amikacin (15%), piperacillin+ tazobactam (15%) and gentamycin (15%), consistent to the study by Harshita et al.[15]

Antibiotic prescribing needs to be monitored by consultants and pharmacy. A specified time pe-

riod needs to be predetermined prior to initiation of therapy. If there is no clinical improvement after an appropriate length of time, then stop the treatment, reculture and await sensitivity patterns. Surveillance programmes of the resistance patterns of the bacteria on skin infections are very important. Greater innovation and investment is required in operational research, and in research and development of new antimicrobial medicines, vaccines, and diagnostic tools especially those targeting the critical gram-negative bacteria such as carbapenem-resistant Enterobacteriaceae and *Acinetobacter baumannii*.

World Antimicrobial Awareness Week (WAAW) is a global campaign that aims to raise awareness of antimicrobial resistance worldwide and encourage best practices among the general public, health workers and policy makers to slow the development and spread of drug-resistant infections. The Tripartite Executive Committee decided to set all future WAAW dates as 18th to 24th November, starting with WAAW 2020. The overarching slogan used for the last 5 years was "Antibiotics: Handle with Care." This has been changed to "Antimicrobials: Handle with Care" in 2020.

CONCLUSION

Pyodermas are frequently encountered in day-to-day clinical practice. Their management is complicated by the emergence of multidrug resistance amongst the commonly isolated etiological agents, thus limiting treatment options. With knowledge of the likely causative organisms and their resistance patterns, proper antibiotic therapy can be given, thus avoiding unnecessary medication with drugs known to be resistant and also keeping newer antibiotics in reserve for use only against strains that are resistant to the common antibiotics. Hence, timely recognition, and prompt bacterial diagnosis and antibiotic susceptibility testing is very important for the management of pyoderma and also to check for major complications. Local guidelines have to cater for the prevalent resistance patterns for that area. Clinicians should work closely with the microbiology departments of the hospitals and when required with the Public Health Laboratories. Access to rapid diagnostic methods and resistance patterns is vital for our understanding, patient management and the choice of the appropriate antibiotic for the appropriate length of time. Strengthening appropriate clinical trial data for practice in the treatment of infection is an important goal for the future.

Conflict of Interest: None declared

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