EMERGING TREND IN PYOGENIC WOUNDS IN ANDHRA PRADESH POPULATION
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ABSTRACT: The present study aims in contributing data toward the need for broad and judicious use of antibiotics to curtail and effectively treat the emerging trends of multi drug resistant strains of infection and in successful treatment of pyogenic infection. The present study will certainly help clinicians in the planning and management of pyogenic infections, both surgical and otherwise. Samples and swabs were taken from 500 patients admitted in our institute under the Intensive care units and the general wards limiting the age group of study to adults between 18 - 60 years of age. The organism preponderance, growth pattern were noted. Among 500 samples collected 94 were found to contain gram positive organisms and 369 samples were found to be positive for Gram negative organisms respectively. Among the gram positive organisms Staphylococcus aureus was found to have a higher level of incidence, with Pseudomonas aeruginosa being highest among gram negative organisms. Among the Gram positive organisms highest susceptibility was shown against Linezolid, Vancomycin and Amikacin. Among Gram Negative organism’s highest susceptibility was against imipenem, Amikacin and Piperacillin / tazobactam.

KEYWORDS: Pyogenic wounds, Andhra Pradesh, Microbiology, Intensive care.

INTRODUCTION: Pyogenic Infection is among the common causes of pyrexia. This is characterized by local inflammation, pus formation being among the signs of infection along with pyrexia. A break in the epithelium provides entry of surface bacteria into the body; they thrive in the moisture of the wound. While the bacteria begin multiplying they begin extending further into the wound and trigger a systemic reaction including release of leukocytes locally to prevent and resist pathogenic invasion⁴. Eventually, this process results in dead leukocytes and accumulation of infectious agent (thick and whitish liquid) commonly known as “Pus”⁵. The source of the infection can be either Endogenous or Exogenous.

Various studies around the world have so far indicated a predictable bacterial profile in pyogenic wound infections.⁶ The present study aims to categorize pyogenic wound infections into monomicrobial, poly microbial groups; attempt has been made to compare the patterns among other races and the population of Andhra Pradesh to verify if the bacterial profile matches the findings of other scholars.

MATERIALS AND METHODS: Wound samples were collected from 500 patients admitted with pyrexia, symptomatic of obvious pyogenic infections. The wound type included for sample collection ranged from boils, ulcers, abscesses, surgical wounds and burns.
The samples were screened for presence of organisms by direct microscopy using Grams staining and further analyzed using Nutrient Agar, Blood Agar, MacConkey’s agar to differentiate Gram positive and Gram negative organisms.

**RESULTS:**

| Organism         | Gram Negative Bacilli | Gram Positive Cocci | Total | Percentage |
|------------------|-----------------------|---------------------|-------|------------|
|                  |                       |                     |       | GNB        |
| Male             | 271                   | 64                  | 335   | 73.44      |
| Female           | 98                    | 30                  | 128   | 26.55      |
|                  | 369                   | 94                  | 463   | 68.08      |

Table 1

The Male Female Ratio among the Gram Negative Bacilli prevalence was found to be 2.77 while the Gram Positive Cocci was observed to be 2.13.

| Organism                               | Number | Percentage |
|----------------------------------------|--------|------------|
| Pseudomonas aeruginosa                 | 101    | 21.81      |
| Escherichia coli                       | 93     | 20.08      |
| Klebsiella pneumoniae                  | 74     | 15.98      |
| Citrobacter sp                         | 54     | 11.66      |
| Klebsiella oxytoca                     | 16     | 3.45       |
| Acinetobacter sp                       | 12     | 2.59       |
| Proteus mirabilis                      | 09     | 1.94       |
| Proteus vulgaris                       | 06     | 1.29       |
| Enterobacter sp                        | 02     | 0.43       |
| Providencia sp                         | 01     | 0.21       |
| Serratia sp                            | 01     | 0.21       |

Table 2

| Organism                              | Number | Percentage |
|---------------------------------------|--------|------------|
| Staphylococcus aureus                 | 61     | 13.17      |
| CONS (Coagulase Negative Staphylococci)| 28     | 6.04       |
| Enterococcus faecalis                 | 05     | 1.07       |

Table 3

Among the 500 samples taken 463 (335 males, 128 females) were culture positive isolates. The sex ratio of Culture positive isolates among males and females was found to be 2.6:1. Among 463 culture positive isolates, 369 was found to be Gram negative among which according to present study the frequency of prevalence can be listed as Pseudomonas aeruginosa (101), E. Coli (93), Klebsiella sp [(90) K. pneumoniae (74) and K. oxytoca(16)], Citrobacter sp (54),
Acinetobacter sp (12), Proteus sp [total(15) P.mirabilis – 9, P.vulgaris-6], Enterobacter sp (02), Providencia sp (01), Serratia sp (01) respectively in the order of prevalence.

Among the 94 samples that have tested positive for Gram Positive Organisms, 61 isolates were observed positive for Staphylococcus aureus, 28 were Coagulase Negative Staphylococci and 5 were seen to be Enterococcus faecalis.

| Antibiotic | Staphylococcus aureus (n=61) | CONS (n=28) | Enterococci (n=5) |
|------------|----------------------------|-------------|------------------|
|            | Sensitive (%) | Resistant (%) | Sensitive (%) | Resistant (%) | Sensitive (%) | Resistant (%) |
| Ampicillin | 11 (18.03)    | 50 (81.96)   | 6 (21.42)      | 22 (78.57)    | 3 (60)        | 2 (40)        |
| Oxacillin  | 38 (62.29)    | 23 (37.70)   | 12 (42.85)     | 16 (57.14)    | 2 (40)        | 3 (60)        |
| Cefixime   | 6 (9.83)      | 55 (90.16)   | 5 (17.85)      | 23 (82.14)    | 2 (40)        | 3 (60)        |
| Azithromycin | 25 (40.98)   | 36 (59.01)   | 13 (46.42)     | 15 (53.57)    | 2 (40)        | 3 (60)        |
| Ofloxacin  | 54 (88.52)    | 7 (11.47)    | 22 (78.57)     | 6 (21.42)     | 3 (60)        | 2 (40)        |
| Amikacin   | 55 (90.16)    | 6 (9.83)     | 25 (89.28)     | 3 (10.71)     | 4 (80)        | 1 (20)        |
| Vancomycin | 56 (91.80)    | 5 (8.19)     | 25 (89.28)     | 3 (10.71)     | 3 (60)        | 2 (40)        |
| Clindamycin | 51 (83.60)   | 10 (16.39)   | 14 (50)        | 14 (50)       | 2 (40)        | 3 (60)        |
| Amoxicillin+ Clavulanic acid | 33 (54.09) | 28 (45.90)   | 20 (71.42)     | 8 (28.57)     | 5 (100)       | 0 (0)         |
| Piperacillin+ tazobactam | 54 (88.52) | 7 (11.47)    | 21 (75)        | 7 (25)        | 4 (80)        | 1 (20)        |
| Linezolid  | 57 (93.44)    | 4 (6.55)     | 25 (89.28)     | 3 (10.71)     | 5 (100)       | 0 (0)         |

Table 4

| Antibiotic                        | E.coli (n=93) | Klebsiella sp. (n=90) |
|-----------------------------------|---------------|-----------------------|
|                                   | Sensitive (%) | Resistant (%)         | Sensitive (%) | Resistant (%) |
| Ampicillin                        | 1 (1.07)      | 92 (98.93)            | 1 (1.11)      | 81 (98.88)    |
| Cephatoxime                       | 4 (4.30)      | 89 (95.69)            | 15 (16.66)    | 75 (83.33)    |
| Cefixime                          | 3 (3.22)      | 90 (96.77)            | 8 (8.88)      | 82 (91.11)    |
| Cotrimoxazole                     | 22 (23.65)    | 71 (76.34)            | 15 (16.66)    | 75 (83.33)    |
| Ofloxacin                         | 18 (19.35)    | 75 (80.64)            | 33 (36.66)    | 57 (63.33)    |
| Gentamicin                        | 44 (47.31)    | 49 (52.69)            | 68 (75.55)    | 22 (24.44)    |
| Amikacin                          | 67 (72.04)    | 26 (27.95)            | 61 (67.77)    | 29 (32.22)    |
| Amoxicillin+ Clavulanic acid      | 3 (3.22)      | 90 (96.77)            | 9 (10)        | 81 (90)       |
| Cefoperazone+ Sulbactam           | 38 (40.86)    | 55 (59.13)            | 27 (30)       | 63 (70)       |
| Piperacillin+ tazobactam          | 56 (60.21)    | 37 (39.78)            | 43 (47.77)    | 47 (52.22)    |
| Imipenem                          | 77 (82.79)    | 16 (17.20)            | 81 (90)       | 9 (10)        |
| Aztreenam                         | 9 (9.67)      | 84 (90.32)            | 11 (12.22)    | 79 (87.77)    |

Table 5
**DISCUSSION:** Pyogenic Infection generally caused by pyogenic bacteria causing multiple abscesses, Empyema and other such complications. Jeffrey et al 1997 in a study concluded that a mixture of both aerobic and anaerobic bacteria with an average involvement of 5-6 organisms in any infective wound.\(^4\) This conclusion varies from the present study, as the present study indicates 3.2% of the positive samples showing more than one organism and none of the collected samples showing more than two causative organism.

Among other studies, the commonly isolated organisms recorded have been Staphylococcus aureus, Klebsiella sp, Pseudomonas sp, E.coli, Proteus sp, Enterococci sp, (Krige, J.E.J 2001). The present study commonly showed the presence of Staphylococcus aureus (13.17%) to be the most common among Gram Positive Organisms followed by Coagulase Negative Staphylococci (6.04%) and Enterococcus faecalis (1.07%) and among the Gram Negative Organisms Pseudomonas aeruginosa to be found 21.81%. We also observed the second most commonly found cause to be E. coli at 20.08% followed by Klebsiella sp (19.43%), Citrobacter sp (11.66%), Acinetobacter sp (2.59%), Proteus sp (3.23%) Enterobacter sp (0.43%), Providencia sp (0.21%) and Serratia sp (0.21%). These statistics correlated with a few studies that have been conducted by Krige et al, 2001\(^5\) with respect to the gram positive organisms while it differed in the incidence of the gram negative organisms. The present study correlated with the study conducted by Tiwari P et al, 2010\(^6\) and Lee C.Y et al 2009\(^7\). The GNB dominance supported the study conducted by Gosh et al (2009) among hospitalized inpatients and Zubair M et al (2011) among diabetic foot patients irrespective of if admitted or as outpatients in North India. The prevalence and increased incidence of Pseudomonas aeruginosa was similar to the study conducted by Basu S et al (2009)\(^8\) among chronic outpatient wounds.

The presence of pus is multi factorial. This has been supported by various authors among their studies. Kandemir et al 2007\(^9\); Olsen et al., 2008\(^10\); listed Chronic course of wound, frequency of hospital admission and visits and finally most importantly inappropriate drug use.

| Antibiotic                  | Pseudomonas aeruginosa (n=101) |
|-----------------------------|--------------------------------|
|                            | Sensitive (%)                  | Resistant (%)                |
| Cefixime                   | 6 (5.94)                       | 95 (94.05)                   |
| Ceftazidime                | 41 (40.59)                     | 60 (59.40)                   |
| Cefipime                   | 39 (38.61)                     | 62 (61.38)                   |
| Cotrimoxazole              | 29 (28.71)                     | 72 (71.28)                   |
| Ciprofloxacin              | 66 (65.34)                     | 35 (34.65)                   |
| Gentamicin                 | 53 (52.47)                     | 48 (47.52)                   |
| Amikacin                   | 67 (66.33)                     | 34 (33.66)                   |
| Polymyxin B                | 85 (84.15)                     | 16 (15.84)                   |
| Cefoperazone + Sulbactam   | 52 (51.48)                     | 49 (48.51)                   |
| Piperacillin + tazobactam  | 73 (72.27)                     | 28 (27.72)                   |
| Imipenem                   | 79 (78.21)                     | 22 (21.78)                   |
| Aztreonam                  | 39 (38.61)                     | 62 (61.38)                   |

Table 6
Bowler C et al 2001 importantly also included the increasing microbial virulence as a factor in his study.\(^{(11)}\)

Among the Gram positive organisms highest susceptibility was shown against Linezolid (93.44%), Vancomycin (91.80%) and Amikacin (90.16%). Among Gram Negative organisms’ highest susceptibility was against Imipenem (82.79%), Amikacin (72.04%) and Piperacillin/tazobactam (60.21%). Pseudomonas aeruginosa shows highest susceptibility to Polymyxin B (84.15%), followed by imipenem (78.21%) and piperacillin/tazobactam (72.27%).

**CONCLUSION:** The present study concludes that all the factors mentioned by the previous studies hold true among the present study group of Andhra Pradesh population. The prevalence of surgical site infections is emerging as a challenge to clinicians battling with higher frequency of multi drug resistance patterns. Initial treatment with judicious selection by using the resistance and sensitivity pattern will help in curbing the emergence of drug resistance strains in the future and help in effective clinical management.

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