

**ORIGINAL ARTICLE****BACTERIOLOGY OF CHRONIC RHINOSINUSITIS**Shivani<sup>1</sup>, Bimla Devi<sup>2</sup>, Karan Sharma<sup>3</sup>, Pushpa Devi<sup>4</sup>, Rupali<sup>5</sup>, Gagan deep<sup>6</sup>

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**ABSTRACT:**

**Objectives:** to isolate and identify the types of bacteria causing chronic rhinosinusitis in a tertiary care hospital and to study the antimicrobial susceptibility pattern of culture positive isolates. **Material and Methods:** The present study was conducted over a period of 18 months (December 2013 to June 2015) and comprised patients of all age groups and either sex presenting with features of chronic rhinosinusitis. Specimens were collected by maxillary antral aspiration using sterile techniques, endoscopic guided middle meatus swab/aspiration, sinus tissue culture during endoscopic sinus surgery, nasal discharge and excised nasal polyp. **Results:** There were 216 specimens out of which 145 bacterial species were isolated. Aerobic culture positivity was 50.46%. In this study gram negative bacteria were more common than gram positive. Common aerobes were *Pseudomonas aeruginosa* (25.69%) followed by *Klebsiella* spp (16.51%), Coagulase negative staphylococcus (14.68%) and *Staphylococcus aureus* (10.09%). In this study anaerobic isolates were (16.66%). The most common isolate was *Peptostreptococcus* (36.11%) followed by *Bacteroids* (27.77%), *Clostridium* sp (11.11%) and *Fusobacterium* (11.1%). **Conclusion:** Gram negative organisms play a more important role than gram positive organisms. The causative pathogens of rhinosinusitis should be studied continuously because rapid progress in the development of new antimicrobial agents has a significant impact on their bacteriological profile.

**Key words:** Chronic rhinosinusitis, bacteriological study, gram negative isolates.

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**I**NTRODUCTION

Rhinosinusitis is group of disorders characterized by inflammation of the nose and the paranasal sinuses. It is classified as Acute (7days to <4 weeks), Subacute (4 weeks to 12 weeks), Recurrent acute ( $\geq 4$  episodes of acute sinusitis per year) and Chronic sinusitis ( $\geq 12$  weeks). The etiology of bacterial rhinosinusitis may be rhinogenic or odontogenic. There are number of factors that play a role in the development of rhinosinusitis which could be classified into host, agent and environmental factors<sup>1</sup>. It is a common disease affecting 135 per 1000 population and is a significant healthcare

problem resulting in a large financial burden on society<sup>2</sup> and affecting approximately 20% of the population at some time of their lives<sup>3</sup>. The widespread irrational use of antimicrobial agents has been associated with the emergence of new bacterial strains or rather resistant strains which can cause complications. Use of corticosteroids by some practitioners has been associated with the emergence of opportunistic infectious organism.

**MATERIAL AND METHODS**

The present study was conducted over a period of 18 months (December 2013 to June 2015) and comprised patients of all age groups and either sex

presenting with features of chronic rhinosinusitis and 216 samples were collected from outpatient department of Ram Lal Eye and ENT Hospital attached to Government Medical College Amritsar. The Patients were recruited in the study after an informed consent based on following inclusion and exclusion criteria and approval of ethical committee was taken.

#### INCLUSION CRITERIA

1. Patient belonging to all age group and either sex.
2. Patient presenting to outpatient department of ENT presenting with blockage/congestion, discharge, anterior/posterior nasal drip, facial pain/pressure for >12 weeks.
3. Patients who will undergo endoscopic sinus surgery or maxillary antral puncture or endoscopic-guided culture in department of ENT.

#### EXCLUSION CRITERIA

1. Patients with clinical, radiological or histopathological evidence of any benign or malignant tumors of nose or paranasal sinus.
2. Patients with history of facial or head and neck trauma.
3. Patient on concurrent anti-retroviral therapy, chemotherapy or radiotherapy.

#### SAMPLE COLLECTION AND TRANSPORT

The indications for obtaining specimens for culture are according to the standard recommendations and guidelines.<sup>4</sup> Antibiotics were withheld one week prior to the operations. The specimens were collected by:

1. Maxillary antral aspiration using sterile techniques
2. Endoscopic guided middle meatus swab/aspiration
3. Sinus tissue culture during endoscopic sinus surgery
4. Nasal discharge and excised nasal polyp.

These specimens were transported to the microbiology lab within 2 hours in a screw capped container using sterile techniques. For anaerobic culture sample was collected in thioglycolate broth. Specimens were inoculated onto 5% Sheep's

Blood agar, Chocolate agar and Mac Conkey agar plates for the growth of aerobic and facultative organisms. The plates were incubated at 37°C aerobically (Mac Conkey) or under 5% carbon dioxide (5% sheep's blood and chocolate) and examined at 24 and 48 hours. For anaerobes the material was inoculated onto anaerobic blood agar plate containing colistin and nalidixic acid from thioglycolate broth and incubated at 37°C in anaerobic jars (Gas Pak jars) and examined at 48 hours and 96 hours. Culture isolates were identified on the basis of colony, morphological, staining characteristics, motility (hanging drop method or by growing them in semisolid agar medium), pigment production, odour and by subjecting them to various biochemical tests.

**Antibiotic sensitivity testing** Antimicrobial susceptibility testing was performed on Mueller Hinton Agar (MHA) by Kirby Bauer disc diffusion method as per CLSI guidelines<sup>5</sup>.

#### RESULTS

In this study out of 216 samples culture positive were 145(67.12%). In 145 culture positive 109(50.46%) had aerobic growth and 36(16.66%) had anaerobic growth. Both aerobic and anaerobic growths were found in 12(5.55%) specimens. In this study gram negative bacteria 65(59.63%) were more common than gram positive 44(40.36%). Among the aerobes *Pseudomonas aeruginosa* 28(25.69%) was the most common isolate followed by *Klebsiella spp* 18(16.51%), *Coagulase negative staphylococcus* 16(14.68%) and *Staphylococcus aureus* 11(10.09%). Other aerobes isolated were *Streptococcus pneumoniae* 9(8.26%) *Streptococcus viridians* 8(7.34%), *Acinetobacter spp* 6(5.50%), *Citrobacter spp* 5(4.59%), *Enterobacter* 3(2.75%), and *Moraxella catarrhalis* 5(4.59%)..

In this study anaerobic isolates were 36 (16.66%). The most common isolate was *Peptostreptococcus* 13(36.11%) followed by *Bacteroids* 10(27.77%), *Clostridium sp* 4(11.11%) and *Fusobacterium* 4(11.1%). Other species isolated were *Eubacterium* 3(8.33%) and *Prevotella Melaninogenicus* 2(5.56%).

**Table 1:** Distribution of sample collection in patients of chronic sinusitis

| Types of samples   | No of samples | Percentage |
|--|---------------|------------|
| Nasal discharge through swab from middle meatus without endoscopy      | 70            | 32.40      |
| Endoscopically guided samples of intranasal antrostomy from right side | 62            | 28.70      |
| Endoscopic guided samples of intranasal antrostomy from left side      | 44            | 20.38      |
| Endoscopic guided samples polypoidal mass                              | 24            | 11.11      |
| Endoscopic guided middle meatus aspiration                             | 16            | 07.41      |
| Total  | 216           | 100.00     |

**Table 2:** Distribution of aerobic bacterial isolates in clinical cases of chronic sinusitis

| Type of bacterial isolate       | No. of Cases | Percentage |
|---------------------------------|--------------|------------|
| <b>Pseudomonas aeruginosa</b>   | 28           | 25.69      |
| <b>Klebsiella spp</b>           | 18           | 16.51      |
| <b>Coagulase negative staph</b> | 16           | 14.68      |
| <b>Staphylococcus aureus</b>    | 11           | 10.09      |
| <b>Streptococcus pneumonia</b>  | 09           | 08.26      |
| <b>Streptococcus viridians</b>  | 08           | 07.34      |
| <b>Acinetobacter spp</b>        | 06           | 05.50      |
| <b>Citrobacter spp</b>          | 05           | 04.59      |
| <b>Enterobacter</b>             | 03           | 02.75      |
| <b>Moraxella catarrhalis</b>    | 05           | 04.59      |
| <b>TOTAL</b>                    | 109          | 100.00     |

**Table 3:** Distribution of anaerobic bacterial isolates in clinical cases of chronic sinusitis

| Type of bacteria            | No of cases | Percentage |
|-----------------------------|-------------|------------|
| <b>1. Peptostreptococci</b> | 13          | 36.11      |
| <b>2. Bacteroids</b>        | 10          | 27.78      |
| <b>3. Clostridium spp</b>   | 04          | 11.11      |
| <b>4. Fusobacterium</b>     | 04          | 11.11      |
| <b>5. Eubacterium</b>       | 03          | 08.33      |
| <b>6. Prevotella</b>        | 02          | 05.56      |
| <b>Melaninogenicus</b>      |             |            |
| <b>Total</b>                | 36          | 100.00     |

Antibiotic susceptibility showed that Linezolid and Vancomycin were the most effective drugs in gram positive isolates followed by Cefoxitin and Amikacin. Methicillin resistant *Staphylococcus aureus* was seen in 9.09% cases. Among gram negative isolates most effective drugs were Imipenem, Piperacillin-tazobactam, Sulbactam-Ceftazidime, Ceftriaxone and Amikacin. Maximum resistance was seen to Gentamicin, Cefalexin and Ampicillin in most of the isolated gram positive strain and in gram negative isolates maximum resistance was seen to Ceftazidime, Gentamicin and Ciprofloxacin. Metronidazole was sensitive in all anaerobic isolates.

## DISCUSSION

The percentage of positive aerobic culture in this study is 50.46%. These findings are similar to the study done by Pongsakorn et al who found positivity rate of 50.6%<sup>6</sup>. Jiang RS et al (2000) study the rate of positive culture in sinusitis with or without secretion seen in middle meatus and found 44-53% positive in middle meatus without secretion and 51-70% in middle meatus with secretion<sup>7</sup>. The rate of positive culture may increase by improving the handling process of specimens to the laboratory such as excessive dryness of specimens or a short period of time from the outpatient department to the

microbiology department. The predominant aerobic bacteria in this study were *Pseudomonas aeruginosa*, *Klebsiella spp*, *Coagulase negative staphylococcus* and *Staphylococcus aureus*. This study correlates with the study of Bolger who reported *Pseudomonas aeruginosa*, *Coagulase negative staphylococcus* and *staphylococcus aureus* as the predominant organisms<sup>8</sup>. The high rate of gram negative bacteria in this study can be explained by the fact that the majority of cases were chronic which needed surgery. It is possible that gram negative bacteria are found frequently in the refractory cases. In this study anaerobes isolates were 36 (16.66%) which is similar to the study done by Murat A et al in which anaerobes were isolated in 14.2% of cases. The most common isolate was *Peptostreptococcus* 13(36.11%) followed by *Bacteroids* 10(27.77%)<sup>9</sup>. The results are similar to the study done by T Pongsakorn et al where common anaerobes isolated were *Peptostreptococcus spp* (30.8%), *Bacteroides fragilis* (23.1%) and *Fusobacterium spp* (15.45%)<sup>6</sup>. Some studies reported that the prevalence of anaerobe was as high as 90%. One of the important factor for less positivity rate of anaerobes in our study was pre-surgical medical treatment which was used. Such a treatment may increase the drainage of the purulent material may sufficiently oxygenate the sinuses to eliminate the anaerobes. Antibiotic susceptibility showed that Linezolid and Vancomycin were the most effective drugs in gram positive isolates and Imipenem, Piperacillin-tazobactam, Sulbactam-Ceftazidime, Ceftriaxone were effective drugs in gram negative isolates. MRSA was seen in 9.09% cases. All the anaerobes isolated were sensitive to Metronidazole, so this drug should be co-prescribed along with other antibiotics for effective treatment of chronic maxillary sinusitis cases.

## CONCLUSION

It can be concluded that a chronic sinusitis can be satisfactorily alleviated if proper treatment is given after isolating various microorganisms and treating with antimicrobials according to their sensitivity. The gold standard for obtaining reliable specimens for culture is the antral aspiration, however it is difficult to perform and not acceptable by most patients. So there is a need for other methods to provide some clues. It is true that surveillance study of pathogenic bacteria in

bacterial rhinosinusitis is rare. Routine collection would at least provide a monitoring system of the bacterial pattern in rhinosinusitis in that locality which would facilitate more appropriate antimicrobial selection for the treatment of rhinosinusitis. However in the endoscopic era, the proper specimen for culture from the sinus via endoscopic-guided swab/ aspiration has been proven to have good correlation with the antral aspiration. The emerging role of gram negative bacteria as a cause of chronic sinusitis should be recognized, and a surveillance study of common responsible bacteriology and mycology should be done continuously.

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