Original Article

PREVALENCE STUDY OF GROUP A STREPTOCOCCI AND ITS ANTIMICROBIAL SENSITIVITY PATTERN IN UPPER RESPIRATORY TRACT INFECTIONS OF ALL AGE GROUPS IN A TERTIARY HEALTH CARE CENTRE IN CHENGALPET DISTRICT

Susmita Patra [1*], Dr. Chockalingam Meenakshisundaram [2], Dr. K. V Leela [3]

[1] Postgraduate, Department of Microbiology, SRM Medical College Hospital and Research Centre, Faculty of medicine and Health Sciences, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur 603203.Chengalpattu, Chennai, TN, India.

[2] Associate Professor, Department of Microbiology, SRM Medical College Hospital and Research Centre, Faculty of medicine and Health Sciences, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur 603203. Chengalpattu, Chennai, TN, India.

[3] Professor and Head, SRM Medical College Hospital and Research Centre, Faculty of medicine and Health Sciences, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur 603203. Chengalpattu, Chennai, TN, India.

Email: susmitapatra032@gmail.com[1], meenaksc@srmist.edu.in[2], dr.k.v.leela@gmail.com[3]

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Abstract

Introduction: Streptococcus pyogenes is a medically significant member of the Streptococci. This bacterial illness affects the people frequently. It also results in toxin-related reactions, life-threatening soft tissue infections, and a range of suppurative diseases on the skin and in the respiratory system. The disease primarily affects children between 5 to 15 years old. **Aim:** To find the prevalence and antibiotic sensitivity pattern of Streptococcus pyogenes in upper respiratory tract infections in a tertiary health care centre. **Materials and methods:** A prospective study, it was carried out between August 2021 and March 2022. The research was carried out in a tertiary medical facility close to Chengalpattu, Tamil Nadu, India. The Institutional Scientific and Ethical Committees have given their prior consent. Throat swabs were collected from all age groups having upper respiratory tract infections as per standard protocols. Streptococcus pyogenes were isolated through throat swabs using conventional culture methods phenotypically and by resistance pattern were examined by using Statistical Package for the Social Sciences(SPSS) software version 24.0. **Results:** Out of 50 throat swabs from patients processed bacteriologically, 8 (40%) were Streptococcus pyogenes which shows the prevalence was relatively low in a period of the global covid 19 pandemic. A majority of cases occurred between 5 to 15 years of age, followed by 17(34%), 13(26%) between 16 to 30 and 31 to 45 years of age, and 5 (10%) between 46 to 60. Streptococcal infection was observed to harm men more frequently (58%) than women. Chloramphenicol and Erythromycin are 100% resistant, Cotrimoxazole is 37.5% resistant, Ofloxacin is 12.5% resistant and Bacitracin, Cefepime, Ceftriaxone, Cefazolin, Penicillin, Tetracycline, Linezolid, Vancomycin are found to be sensitive towards Streptococcus pyogenes. **Conclusion:** It was concluded that the prevalence of Streptococcus pyogenes is relatively low among the study population in a period of the global covid 19 pandemic. Antibiotics Chloramphenicol and Erythromycin were found to be resistant and Bacitracin, Cefepime, Ceftriaxone, Cefazolin, Penicillin, Tetracycline, Linezolid, Vancomycin were found to be sensitive for Streptococcus pyogenes.

Keywords: Streptococcus pyogenes, Antimicrobial resistance pattern, Throat swab.

INTRODUCTION

The *Streptococcus* genus is important medically in the family of *Streptococcaceae*[1]. Species *S. pyogenes* are classified under group A *Streptococci.* They are GPC, which appear in pairs or long chains measuring 0.6- 1.0 µm in diameter and are nonmotile, and nonsporing [2]. The main difference between *Staphylococci* and *Streptococcus* is that they cannot produce catalase[1].

In the late twentieth century, Streptococcal species were classified using hemolysis and biochemical assays. Categorization based on carbohydrate antigens found in cell-wall extracts of *Streptococcus pyogenes* was developed by Rebecca

Lancefield. It has serogroups A, B, C etc which correspond to the species. Regardless of hemolytic patterns, Pyrogenic *Streptococci* have one of the Lancefield antigens, which has an adequate virulent section of the Streptococcal genus[3].

Since the early 1980s, there has been a comeback of severe streptococcal infections and increasing mortality because of streptococcal sepsis, despite an overall drop in the occurrence of serious *S. pyogenes* infections since the mid-nineteenth century. The upper respiratory tract is the most prevalent location of *Streptococcus pyogenes* entrance. It can transmit from one individual to another via airborne droplets. Not every individual infected by *Streptococcus pyogenes* develops clinical symptoms of infection. The infecting *Streptococci* may persist in the convalescent patients for a few weeks after an acute upper respiratory tract infection. School children carry more infections than adults and it may be more before or during an epidemic[4].

Streptococcus pyogenes are found on the skin and most commonly in the throat which causes tonsillitis popularly known as strep throat[5]. It is a human pathogen causing bacterial pharyngitis, and cellulitis these are pyogenic infections and it also causes scarlet fever[2]. Pharyngitis is the bacterial cause and is most popularly caused by *Streptococcus pyogenes*. Symptoms are sore throat and febrile condition. On inspection, pharyngitis and tonsillitis were detected, often with a yellow discharge supported by painful cervical lymph nodes. A strawberry tongue is seen in the infecting *Streptococci* which build erythrogenic toxin and the host lacks antitoxin[6].

Oral penicillin V is administered twice or three times daily to children weighing less than 27 kg, and adults receive 500 mg twice daily for 10 days. Penicillin V or Benzathine penicillin may also give in place of Amoxicillin. For Penicillin-allergic patients Erythromycin, Clindamycin, Azithromycin, Cephalexin, and Cefadroxil was the standard alternative agent, According to the most recent treatment recommendations released by the Food and Drug Administration and the American Heart Association's infectious illnesses database for the community of America, Penicillin G is still strongly advised for *S. pyogenes*[7].

Among children, sore throat is still the most prevalent ailment in densely populated areas and the spreading of *Streptococcus pyogenes* infections may be significantly more. From 4.2% to 13.7% in India *Streptococcus pyogenes* isolation rates vary in children with pharyngitis, which is similar to reported rates in wealthier countries. 43 per cent of the children were diagnosed with acute pharyngitis from May 2016 to April 2017 at Naresuan University Hospital in Phitsanulok and GAS was found in 7 per cent of the children by throat swab. In Chennai, the east zone (17.07 per cent) had the greatest percentage of GAS (carrier and tonsillitis isolates), followed by the west zone (16.21 per cent) in Tamil Nadu, Guindy, Chennai: Dr M.G.R. Medical University [8,9,10].

The present study aims to provide the prevalence of *Streptococcus pyogenes* in upper respiratory infections from throat swabs and their antibiotic sensitivity pattern at Tertiary health care centre.

MATERIALS AND METHODS

A prospective study, it was carried out between August 2021 and March 2022. The IEC of SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India, authorised the current study. 2893/IEC/2021 is the ethical approval number.

INCLUSION CRITERIA: *Streptococcus pyogenes* isolated from throat swabs were included.

EXCLUSION CRITERIA: All pathogens other than *Streptococcus pyogenes* were excluded.

PROCEDURE:

Identification: Throat swabs should be firmly tough to the posterior pharynx and tonsillar areas. Somewhat purulent exudate should also be sampled. Swab collections should be acquired in an aseptic way, processed following microbiological procedures, and transferred to the laboratory in a sterile tube or container[7]. The samples were taken and the quadrant streaked on the blood agar plate is kept incubated at 37^{0}C for a day in a candle jar with 5% CO_2 [11]. Small white to grey colonies are produced, and the blood agar has a clear zone of beta-hemolysis [2]. Bacteriological properties were used to phenotypically identify GAS (including beta hemolysis in the blood agar, Gram-positive cocci in chains, catalase-negative, bile esculin-

negative, around a disc with 0.04 units of bacitracin, growth is inhibited and PYR is positive, within a minute of adding the reagent, it changed to a deep cherry red). The identification of *S. pyogenes* was confirmed by the Lancefield grouping (LK06–HiStrep^{TM}Latex Test Kit) which shows visible agglutination with latex particles observed in the circle labelled A, indicating a positive outcome [7,12].

Antibiotic Susceptibility Testing (AST): The Kirby Baeur Disk diffusion method was used to assess antibiotic susceptibility on Mueller Hinton agar with 5% sheep blood. The CLSI guidelines for 2021 were used to interpret the zone sizes. The following antibiotic disc were used Bacitracin(0.04Units), Chloramphenicol(30 microgram), Cotrimoxazole(23 microgram),Cefazolin(30 microgram), Ceftriaxone(30 microgram),Cefepime(30) microgram, Vancomycin(30 microgram), Tetracycline(30 microgram), Ofloxacin(5 microgram), Penicillin(10 microgram),Erythromycin(15 microgram), Linezolid(30 microgram). Plates are then incubated at 37 ^{0}C for a day in a candle jar with 5% CO_2 and zone size was determined [13].

RESULTS

Identification: From 23 isolates *K. pneumoniae* 10(43.47%), *S. pyogenes* 8(40%), *Moraxella spp.* 2(8.69%), Methicillin-resistant *Staphylococcus aureus*, *S. aureus* and *Candida Albicans* 1 (4.34%)[Graph 1] [Table 1].Out of 8(16%) *S. pyogenes*, 3(37%) were males and 5(63%) were females Graph 2] [Table 2]. A majority of cases occurred between 5 to 15 years of age, followed by 17(34%), 13(26%) between 16 to 30 and 31 to 45 years of age, and 5(10%) between 46 to 60 [Graph 3] [Table 3]. *S.pyogenes* was isolated from throat swabs and was identified by culture, biochemical testing and AST. Throat swabs were inoculated in blood agar and *S.pyogenes* produces small white to grey colonies, with a clear zone of beta-hemolysis [Figure 1]. Catalase-negative, bile esculin- negative, around a disc with 0.04 units of bacitracin the growth is inhibited and PYR is positive. The identification of *S. pyogenes* was confirmed by the Lancefield grouping (LK06–HiStrep^{TM}Latex Test Kit) which shows visible agglutination with latex particles observed in the circle labelled A, indicating a positive outcome. The prevalence of *S.pyogenes* 8(16%)was relatively low [Graph 4] [Table 4].

Antibiotic Susceptibility Testing(AST): According to the CLSI guidelines 2021 the zone sizes were interpreted. Chloramphenicol and Erythromycin were 100% resistant, Cotrimoxazole is 37.5% resistant, Ofloxacin is 12.5% resistant and Bacitracin, Cefepime, Ceftriaxone, Cefazolin, Penicillin, Tetracycline, Linezolid, Vancomycin are found to be sensitive towards *Streptococcus pyogenes* [Graph 5] [Table 5].

GRAPH: 1 Distribution of the number of isolates n=23

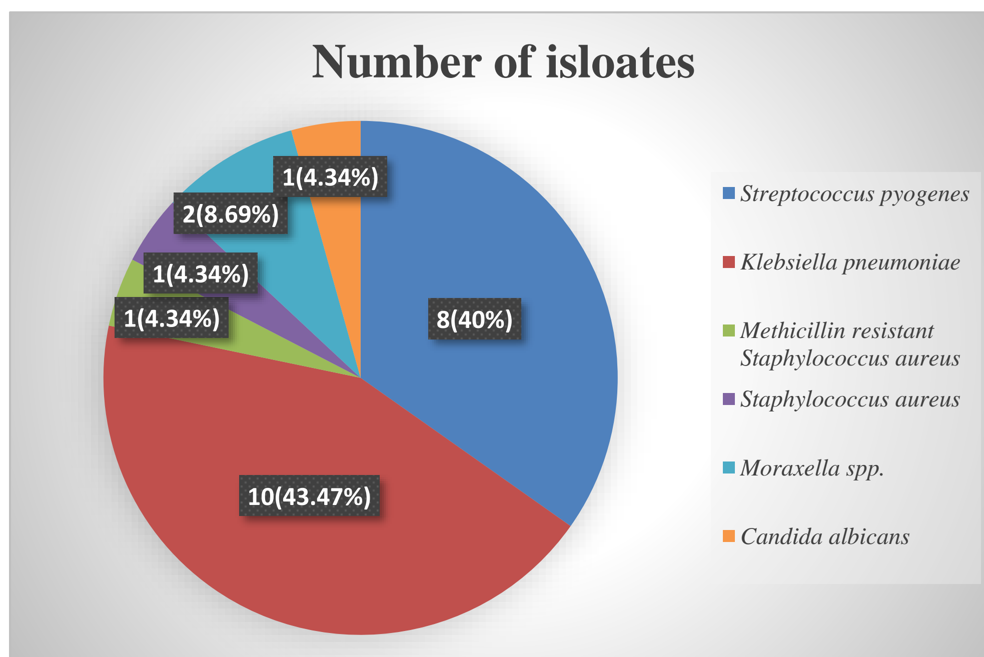


TABLE 1 Distribution of the number of isolates n=23

Isolates	Number of isolates	Percentage
Streptococcus pyogenes	8	40%
Klebsiella pneumoniae	10	43.47%
Methicillin-resistant *Staphylococcus aureus*	1	4.34%
Staphylococcus aureus	1	4.34%
Moraxella spp.	2	8.69%
Candida albicans	1	4.34%
Total samples	23	100%

GRAPH 2 Gender wise distribution for *Streptococcus pyogenes* n=8

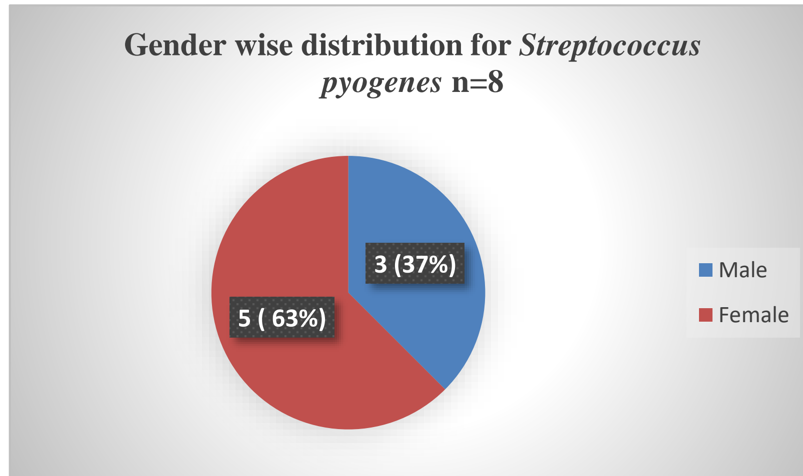


TABLE 2 Gender wise distribution for *Streptococcus pyogenes* n=8

Gender	TOTAL	Percentage
Male	3	37%
Female	5	63%
Total	8	100%

GRAPH 3 Demographic distribution for *Streptococcus pyogenes n*=8

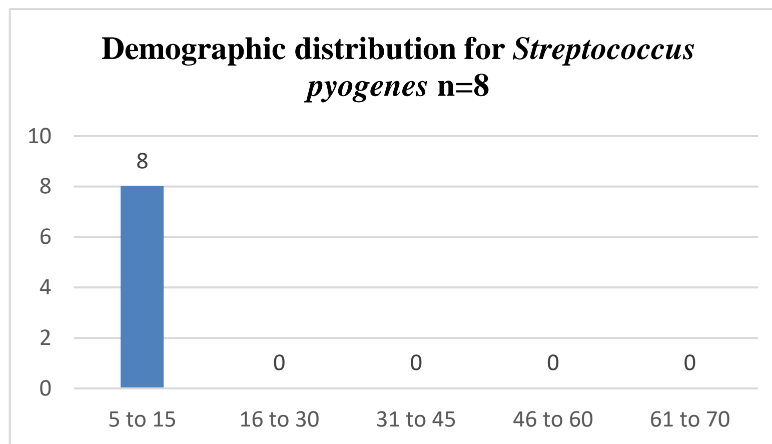
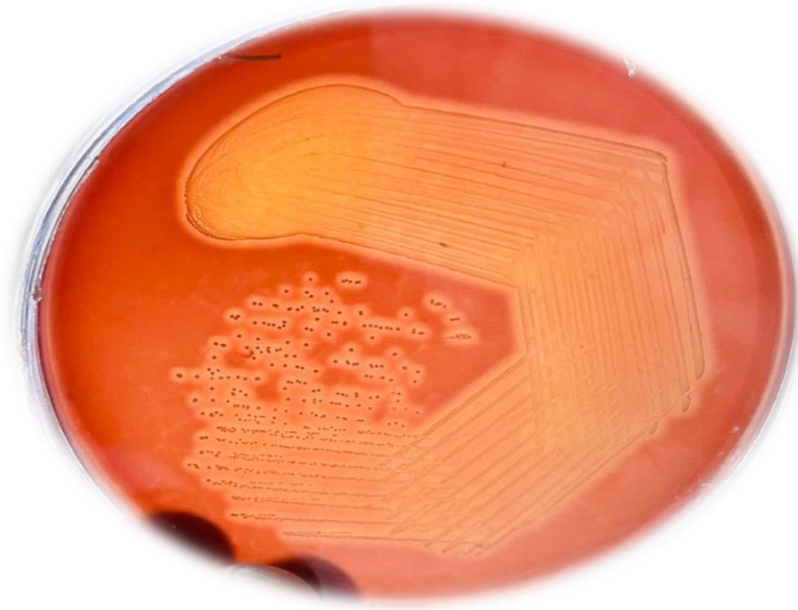


TABLE: 3 Demographic distribution for *Streptococcus pyogenes n*=8

Age	Total	Percentage
5-15	8	100%
16-30	0	0%
31-45	0	0%
46-60	0	0%
61-70	0	0%
Total	8	100%

Figure: 1 Hemolysis in blood agar



GRAPH 4 Incidence of *Streptococcus pyogenes*

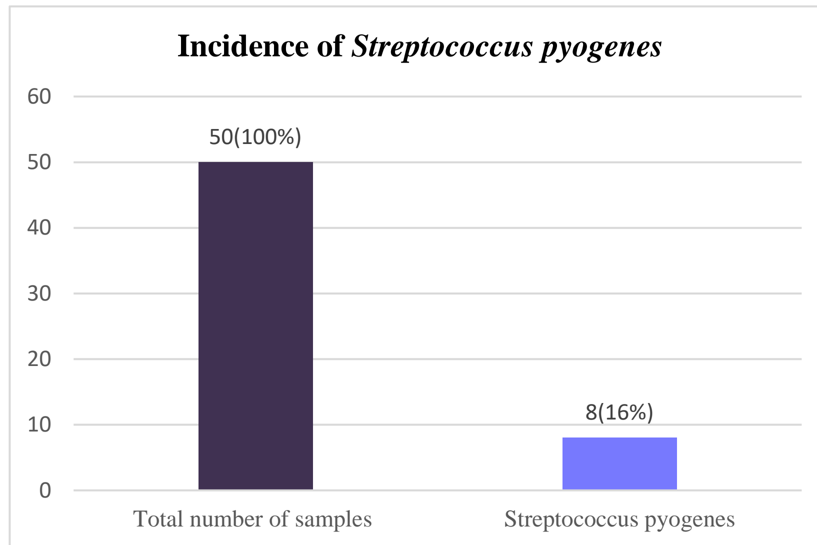


TABLE 4 Incidence of *Streptococcus pyogenes*

		Percentage
Streptococcus pyogenes	8	16%

Total number of samples	50	100%

GRAPH 5 Antibiogram for *Streptococcus pyogenes* n= 8

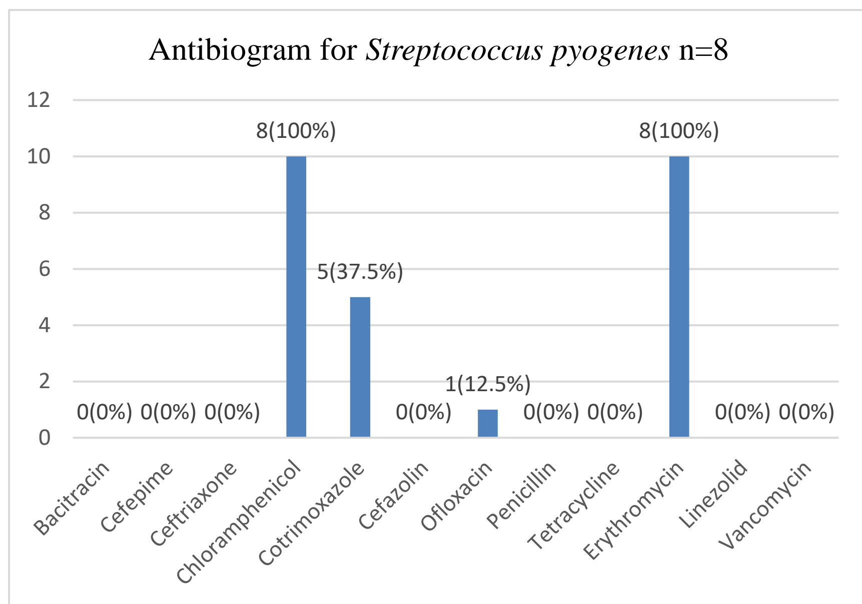


TABLE 5 Antibiogram for *Streptococcus pyogenes* n= 8

Antibiotics	**Resistant**	**Percentage**
Bacitracin	0	0%
Penicillin	0	0%
Cefazolin	0	0%
Ceftriaxone	0	0%
Cefepime	0	0%
Erythromycin	8	100%
Vancomycin	0	0%
Ofloxacin	1	12.5%
Linezolid	0	0%
Tetracycline	0	0%

Cotrimoxazole	3	37.5%
Chloramphenicol	8	100%
Total	8	100%

DISCUSSION

S. pyogenes is a GPC and a clinically significant member of the *Streptococci*. The presence of a Lancefield Group A antigen and beta-hemolysis on blood agar is also known as Group A *Streptococci*. The common *Streptococcus pyogenes* infection is pharyngitis also called Strep throat. Pharyngitis is characterised by acute, purulent swelling of the posterior oropharynx and tonsillar areas[14,15].

S. pyogenes is a common pathogen in the upper respiratory tract and is present in 3-5% of adults and 10% of children. The primary mode of transmission is droplet dispersion. Some people get pharyngitis/tonsillitis, while others are asymptomatic, and just a few become Group A *Streptococcus* carriers in the throat[16].

Females were found to have a high prevalence of *Streptococcus pyogenes* than males, corresponding results were observed by Nirmal Kushwaha et.al in their study (2014) and Getnet Tesfaw et.al from south-west etopia. It could be because parents offer less attention to their daughters than they do to their sons [17,18].

Ages 5 to 15 were the range for the isolation of the *S. pyogenes*. Zephania Saitabau Abraham et.al 2019 from Tanzania and Sanjeeb sharma et.al from Manipur (2014) found similar results[10,35]. Irene Nayiga et.al from Uganda(2017) in their study the prevalence was 16% which is relatively low between the age group of 5 -15 years[19]. Anupam et.al in south Karnataka(2019) in contrast to their study stated that the prevalence was seen high in patients above 18 years which was 52.38% and 47.6% below 18 years[20].

In my study, out of 50 throat swabs, 8 (16%) are *Streptococcus pyogenes* which relatively had a low prevalence. This is similar to what was done by Moirangthem A et.al from Sikkim India and Zephania Saitabau et.al in 2019 from Tanzania where the prevalence rate (23.63%) was found to be quite low in Sikkim India and Tanzania where 120 bacteria were isolated in which *Staphylococcus* prevalence was higher, that is 41.7% and *Streptococcus pyogenes* prevalence was slightly low (40%)[21,10]. There is a contrast to our study where the prevalence rate was high in the study done by Anupam Berwal et.al in 2019 from South Karnataka. This may be due to seasonal variations[20].

Chloramphenicol and Erythromycin were (100%) resistant followed by Cotrimoxazole (37.5%), Ofloxacin (12%) and Bacitracin, Cefepime, Ceftriaxone, Cefazolin, Penicillin, Tetracycline, Linezolid, Vancomycin were found to be sensitive towards *Streptococcus pyogenes*. Babaiwa U.F. et.al in 2013 in Nigeria showed variations where it was susceptible to Ciprofloxacin (85 percentage), Cotrimoxazole (69 percentage), Gentamicin (60 percentage), and Erythromycin (38 percentage), but resistant to Amoxicillin and its combination with Clavulanic acid. Here, Erythromycin was used as a choice of treatment for patients allergic to Penicillin [23]. Purva Mathur et.al in 2014 from New Delhi had some similarities to my study where it showed resistance to Tetracycline(73 percentage), Erythromycin(34.5 percentage), Chloramphenicol(13.5 percentage) and sensitivity to Ceftriaxone, Penicillin, Tetracycline, Linezolid, Vancomycin. As the study shows resistance to Tetracycline(73 percentage), and Erythromycin(34.5 percentage) commonly, therapeutic techniques for Streptococcal infections must be reformulated [24]. Tintu Abraham et.al 2016 found that it was susceptible to Bacitracin (97.71 percentage), similar to our study as its findings suggest the value of the Bacitracin sensitivity test, even as a preliminary test for screening *Streptococcus pyogenes*[25].

CONCLUSION

The present study shows the prevalence of *Streptococcus pyogenes* which is relatively low among the study population, age, gender and antibiotic resistance pattern and in these times of covid 19. *Streptococcus pyogenes* were resistant to

Chloramphenicol, Erythromycin(100%) and Bacitracin, Cefepime, Ceftriaxone, Cefazolin, Penicillin, Tetracycline, Linezolid, Vancomycin are found to be sensitive. Antibiotic susceptibility testing is important for starting the empirical treatment of *Streptococcus pyogenes* to avoid resistance or overuse of the drug. The studies done should be shared with hospital infection control so that they can take measures to control the infections and rational use of the antibiotics can be carried out for treatment. More epidemiology studies are required to determine the treatment options for these infections.

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