
**“VARIATION IN OROPHARYNGEAL FLORA IN ICU
PATIENTS WITH NASOGASTRIC TUBE”-A ONE
YEAR PROSPECTIVE OBSERVATIONAL STUDY IN
KLES Dr. PRABHAKAR KORE HOSPITAL,
BELAGAVI”**

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Dr. PRABHAKAR KORE HOSPITAL, BELAGAVI” is a bonafide research work
done by REG NO: BE0120005.


Dr. B.P. BELALDAVAR M.S (ENT), D.L.O, Ph.D,
Professor & Head of Department
Department of Otorhinolaryngology
and Head & Neck Surgery
J. N. Medical College
Belagavi
Nehru Nagar, Belagavi -590010


Dr. (Mrs) N.S. MAHANTASHETTI M.D.(Peads)
Principal
J.N. Medical College,
Nehru Nagar,
Belagavi -590010

Date: 31/12/22
Place: Belagavi



Date: 02/01/23
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Accredited 'A+' Grade by NAAC (3rd Cycle)

Placed in Category 'A' by MHRD (GoI)



Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

0831 - 2471350



0831 - 2470759



www.jnmc.edu

principal@jnmc.edu

Ref No: MDC/PG/

Date: 25-11-2022

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Principal,
J. N. Medical College, Belagavi.

To,
Reg. No. BE0120005.
Postgraduate Student,
2020-21 Batch,
Department of ENT,
J. N. Medical College, Belagavi.

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K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH

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Accredited 'A' Grade by NAAC (2nd Cycle)

Placed in Category 'A' by MHRD (GoI)

**JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)**

Website: <http://www.jnmc.edu>

E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2472550

Principal: 2471701

Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/62

Date: 25/01/2021

To,

PG student in Otorhinolaryngology and Head & Neck Surgery,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled
**“VARIATION IN OROPHARYNGEAL FLORA IN ICU PATIENTS WITH
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research project has been cleared by the JNMC Institutional Ethics Committee on Human
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(Dr. Smita Sonoli)

Member Secretary

JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)

Chairman,

JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

LIST OF ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
ICU	Intensive Care Unit
CVA	Cerebrovascular Accident
SDH	Subdural Hemorrhage
SAH	Subarachnoid Hemorrhage
GB syndrome	Guillian-Barre syndrome
P. aeruginosa	Pseudomonas aeruginosa
K. pneumonia	Klebsiella pneumonia
spp	Species
CONS	Coagulase Negative Staphylococci
Strep.	Streptococci
Staph.	Staphylococci
C. albicans	Candida albicans
A. baumannii	Acinetobacter baumannii
Peptostrep.	Peptostreptococci
E. coli	Escherichia coli
H. influenza	Haemophilus influenza
N. meningitidis	Neisseria meningitidis
TNF	Tumor Necrosis Factor
MRSA	Methicillin Resistant Staphylococcus aureus

ABSTRACT

**Title: “Variation in oropharyngeal flora in ICU patients with nasogastric tube”-
A One Year Prospective Observational Study in KLES Dr. Prabhakar Kore
Hospital, Belagavi”**

Background: Oropharyngeal colonization by pathogenic organisms is usually prevented by chewing and swallowing, which is impaired in tubo-enterally fed ICU patients. Of lately, the raging menace of antibiotic resistance has taken over critically ill population during prolonged ICU stay, putting them at increased risk of nosocomial pneumonia, making it a tougher challenge for physicians to manage along with foregoing suffering patients. Hence, identifying bacterial flora, in respect to hospitalization will help in further management to prevent nosocomial infections.

Objective: Determining changes in bacterial flora in oropharynx of patients with nasogastric tube, admitted in ICU.

Methods: One year prospective observational study including 40 patients between 18 and 70 years, Group A 20 cases- with nasogastric tube in situ, Group B 20 controls including those without tube. Oropharyngeal swab taken on Day 0, 2 and 7 of ICU admission respectively.

Results: There was nearly equal distribution of gender, with 19 females and 21 males, majority in the age group of 35-74 years. Most of patients had no growth on day 0 (35% cases) but as the day of ICU admission progressed, there was increased growth of Gram negative bacteria like *Pseudomonas aeruginosa* (20%), *Klebsiella pneumonia* (25%) especially in cases group. However, 70% of the control group had no growth by day 2.

Conclusion: The need for consistent oral cleansing procedures, maintaining good oral hygiene and dental care in these prolonged tube-fed patients will help prevent predispositions to pathogen carriage at these sites and the subsequent risk of infection within the crucial 48 hours.

Keywords: Nasogastric tube, Oropharyngeal flora, Antibiotic resistance

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INTRODUCTION

Nasogastric tube insertion is commonly used for enteral feeding, mainly in ICU patients. It may cause mucosal inflammation, edema leading to stomatitis, gingivitis and glossitis. It can also cause blockage of sinuses, leading to nosocomial infections.¹

Pathogenic microbial colonisation of oropharynx is typically prevented by mastication and swallowing but this mechanism is absent in patients who are tube-fed, hence predisposing them to aspiration pneumonia with increased morbidity, especially in elderly patients.²

Three sections of Throat/Pharynx- Nasopharynx, Oropharynx and Laryngopharynx. A variety of microorganisms in oropharynx are eliminated from respiratory tract through mucociliary mechanisms together with saliva.³

Oropharyngeal microbiota serves as significant reservoir of infection, particularly respiratory tract infections, which can result in nosocomial pneumonia and pneumonia linked with mechanical ventilation.⁴

From gram positive streptococcal predominance to gram negative pseudomonal predominance, microbial ecology of patients admitted to ICU changes significantly. Due to presence of more virulent organisms, there is increase in patient's chance of developing nosocomial pneumonia.⁵

Nosocomial pneumonia is generally accepted to be a secondary endogenous infection.⁶

In this study, we will observe the variations in nasopharyngeal flora as well as the culture sensitivity profile for the same. This will further help us in identifying the bacterial flora present, the change in the flora with time, in respect to hospitalization as well as further management to prevent nosocomial infections.

OBJECTIVE

- To determine the changes in bacterial flora in the oropharynx of patients with nasogastric tube, admitted in the ICU.
- To evaluate the culture growth along with antibiotic sensitivity.

REVIEW OF LITERATURE

Enteral nutrition, as opposed to parenteral nutrition, is recommended route of nutritional support if gastrointestinal tract is still functioning. Aspiration is one of the biggest and most significant complication.^{7,8}

Development of nosocomial pneumonia, which typically follows micro-inhalation of potentially harmful microorganisms, depends on bacterial colonisation of the airway, particularly gram negative bacilli like *P. aeruginosa* and *K. pneumoniae*.^{9,10}

Clinical significance lies in identification of aspiration predictors since their prevention may reduce risk of aspiration pneumonia-related mortality.

Several risk factors have been linked to patients who receive enteral feeding: episodes of aspiration, low GCS, neurogenic cause, anatomical defect of aerodigestive tract, tracheostomy, puking, continuously high gastric residuals, and bed-ridden patients.

It should also be taken into account that inert surface like nasogastric tube might also help creating a setting favourable to gram negative bacteria colonisation.

Aspiration can also be caused by irregular meals, abdominal or thorax surgery or injury, delayed gastric digestion, bad dental hygiene, ageing, and insufficient nursing staff.

Pathogens enter the lungs mostly through aspiration from previously colonised oropharynx, which can result in aspiration pneumonia.

Airway defense mechanisms

They can be divided into 2 groups:

(1) Defenses against swallowing injuries brought on by anterograde aspiration

Crucial mechanisms include movement of epiglottis, vocal fold closure, and elevation of larynx. Tube-fed patients oropharynx may be lacking its natural defences due to lack of mastication and swallowing, changed salivary chemistry, decrease in larynx elevation, and malfunction in movement of epiglottis. Hence, oral clearance is important for prevention of pathogenic oropharyngeal colonization.

(2) Those opposed to retrograde aspiration, when gastric contents reflux into pharynx and airway.

Gastric reflux is reduced through secondary esophageal peristalsis, pharyngeal swallow, and by enhancing LES and UES functions.

Sara T. et al¹ discovered that there was a significantly higher incidence of gram-negative pathogens colonising oropharynx 48-72 hours after tube insertion than there was before intubation.

Leibovitz A et al.², conducted a study in frail and elderly patients and concluded that in older patients, tuboenteral feeding is linked to oropharynx pathogen colonisation. These findings, which are connected to risk of aspiration pneumonia, call for a re-evaluation of present practices for oral cleansing.

In a comparison of bacterial flora of nostril & oropharynx, Lemon et al³ discovered that oropharynx microbiota is more diverse than microbiota of nostril.

According to cultivation data, there are more Gram-negative bacteria in oropharynx than in nose, especially those from phylum Proteobacteria.

Although little is known about pneumococcus, a study by Ewan VC et al.⁴ of oropharyngeal microbiota in frail elderly patients found a major correlation between respiratory infection & earlier detection of pathogens in oropharynx, supporting this method of identifying cases of respiratory tract infection. Additionally, it has been discovered that in cases of COPD exacerbation, oropharyngeal samples are comparable to sputum samples.

Patients who were admitted to ICU and receiving acid-suppressing treatment were investigated for oropharyngeal flora by Frandah W et al.⁵ They discovered that *Micrococcus* spp., *Strep. viridans*, *Lactobacillus* spp., non-Group D non-haemolytic streptococci, Gram-positive cocci, *C. albicans*, *Neisseria non-meningitidis*, *Haemophilus parainfluenzae*, and diphtheroids were most regularly isolated pathogens from sample 1. Microorganisms more prevalent in sample 2 included *C. albicans*, CONS, *Actinomyces* species, *K. pneumoniae*, *Strep. dysgalactiae*, and *Strep. pneumoniae*. In this investigation, after adjusting for other potential confounding factors, patients taking PPI increased likelihood of abnormal oral flora. Nosocomial pneumonia is more frequently brought on by oropharyngeal colonisation than by gastric colonisation, according to research conducted by M. Garrouste-Orgeas et al.⁶ in adult ICU patients. In comparison to patients who were not yet colonised, patients who had oropharyngeal colonisation with *A. Baumannii* had an estimated 7.45-fold higher risk of pneumonia.

Aspiration and Aspiration Pneumonia

Tracheal aspiration: Gastric/ Pharyngeal secretions aspirated into larynx and lower respiratory tract, resulting in aspiration pneumonia, airway block, lung abscess, and chronic interstitial fibrosis etc.

The fluid aspirated might be oropharyngeal secretions, particle debris, or stomach material. Aspiration pneumonitis is an inhalational acute lung damage caused by aspiration of sterile stomach contents. According to an observational research, the probability of individuals hospitalised for community-acquired pneumonia acquiring aspiration pneumonia is around 14%. Depending on volume and nature of the aspirate, death rate from aspiration pneumonia may exceed 70%.¹¹

Etiology

The failure of natural defensive systems such as glottic closure and coughing raises aspiration risk. Major risk factors: unconsciousness, neurological conditions, abnormalities in gastric motility, projectile vomiting, and gastric outlet obstruction. Although Gram-negative bacilli, Streptococci, and Haemophilus are frequently mentioned as potential causes of community-acquired pneumonia, composition of aspirate plays crucial role in development of aspiration pneumonia. 3 anaerobes that were isolated most frequently in prospective study done were Bacteroides, Fusobacteria, and Peptostrep.. In hospital-acquired pneumonia, gram-negative pathogens, particularly *P. aeruginosa*, must be taken into account.¹²⁻¹⁴

Aspiration pneumonia may result from any of the following conditions:

- Drug overdose
- Stroke
- Head trauma
- General anesthesia
- Intracranial masses
- Alcoholism
- Seizures
- Strictures in esophagus
- GERD
- Tracheostomy
- Nasogastric tube

Pathophysiology

In normally healthy people, mucociliary system and alveolar macrophages work as defences to remove micro aspirations from oropharyngeal secretions. Aspiration pneumonia is a pathological condition that develops when a susceptible person's natural defences are compromised. TNF-alpha, interleukins, and pro-inflammatory cytokines are released as a result of fluid entering bronchus and alveoli, which triggers an anti-inflammatory response. Common flora species inoculated from oropharynx and oesophagus are what trigger infection. Mendelson first studied aspiration pneumonitis pathogenesis by giving stomach contents to rabbit lungs and comparing them to 0.1 N HCl.¹¹

Signs and symptoms

Various variables for aspirate affect signs and symptoms:

1. Volume (high vs. low)
2. Frequency
3. Nature (acidic vs. neutral pH; particle vs. non-particulate; contaminated vs. non-contaminated)
4. Host factors (ageing, immune system, underlying comorbidity)

Aspiration of pathogenic pharyngeal secretions is thought to cause aspiration pneumonia and main factors responsible include:

- A. Positive aspirate;
- B. Aspiration incidence
- C. Lung's inability to fight off infections.

According to North American consensus summit on aspiration in critically sick patients, it's categorised as possible, probable and definitive:

- *Possible pneumonia*: Acute symptoms, New/expanding infiltrate on chest xray, and history of pneumonia but no quantitative culture on bronchoscopy
- *Probable pneumonia*: Added positive bronchoscopy samples, quantifiable culture by broncho-alveolar lavage or protected sample brush
- *Definitive pneumonia*: Positive lung fluid culture results, fast formation of lung infiltrate on CT scan, and histopathologic evidence on biopsy or autopsy

Because it could reach respiratory system and induce aspiration pneumonia, nature of pharyngeal secretions is crucial. Even while saliva has a higher concentration of germs, majority bacteria are not pathogenic, hence aspirating such substances doesn't lead to aspiration pneumonia per se. Nasogastric tube makes it more likely that Gram-negative bacteria will contaminate pharyngeal secretions, which, if inhaled, could contaminate lower tract. Thus, individuals who aspirate thin liquids and develop pneumonia actually have polluted pharyngeal secretions to blame.

Pathogenic bacteria found in both hospitals & home, affect a patient's oral and pharyngeal flora. It is a widespread clinical perception that patients receiving tube feeding generally neglect mouth care. Additionally, the severity of the underlying condition raises the likelihood of bacterial colonisation.

Further research should be done to determine the connection between aspiration pneumonia risk and oropharyngeal pathogenic colonisation in patients receiving prolonged tube feeding. It is necessary to emphasise the importance that oral care plays in keeping critically ill ICU patients from developing pneumonia.

MATERIALS & METHODS

Source of data: Patients aged between 18 and 70 years of age, admitted in ICU, with nasogastric tube in situ, in KLES Dr. Prabhakar Kore Hospital and MRC, Belagavi, between 1st Jan 2021 - 31st Dec 2021 over period of one year.

Study design: A Prospective Observational study.

Study period: 1st Jan 2021 to 31st December 2021

Study population: Patients of both sexes between the age group of 18 - 70 years who are admitted in ICU, with nasogastric tube in situ, in KLE Dr. Prabhakar Kore Hospital.

Inclusion Criteria: Patients of both sexes, conscious as well as unconscious, who are admitted in ICU, with nasogastric tube in situ, in KLE Dr. Prabhakar Kore Hospital, and

- Aged between age group of 18-70 years
- Give consent to take high oropharyngeal swab
- Nasogastric tube in situ for minimum 48 hrs
- After excluding certain patients mentioned under exclusion criteria

Exclusion Criteria: Following patients are excluded:

- Planned or undergoing naso or oropharyngeal surgery
- Having pre-existing clinical infection in ear, nose or throat and those diagnosed with community acquired pneumonia

Sample size (n): 2 Comparison groups, cases and controls, consisting of 20 samples each.

METHODOLOGY:

- After taking informed consent from the patients, detailed clinical history was obtained.
- All patients were clinically examined with examination of ear, nose and throat.
- 2 comparison groups were taken, one cases group including 20 patients with nasogastric tube that was retained for more than 48hrs for enteral feeding, and second controls group, including patients that don't need nasogastric tube.
- Using a standard bacteriologic throat swab technique, in cases group, high oropharyngeal swabs were taken from the lateral and posterior pharyngeal walls before inserting the nasogastric tube (Sample A). A second swab was taken from the region after 48 -72 hrs (Sample B). Another sample was taken on day 7 of admission (Sample C).
- Similarly, in controls group, high oropharyngeal swabs was taken at day 0, day 2 and day 7 of admission. Both the sets of specimens were processed within 30 min to 1 hr of the sample collection.
- Each specimen were inoculated onto culture plates. MacConkey plates were incubated aerobically while blood and chocolate agar plates were placed in candle extinction jar. After overnight incubation at 37°C, the plates was examined.

Statistical Analysis: The study is focused on comparison of two groups. For the continuous quantitative variables mean and standard deviation were calculated. Suitable statistical procedures were used. The minimum sample size formula based on two proportions is

$$n = \frac{(z_{\alpha} + z_{\beta})^2 \bar{p}(1-\bar{p})}{d^2} \text{ where } p_1 \text{ and } p_2 \text{ are proportions of 2 groups.}$$

$\bar{p} = \frac{p_1 + p_2}{2}$ and $d = p_1 - p_2$ z_{α} is level of significance and z_{β} is power of test. For 5% level of significance $z_{\alpha} = 1.96$ and $z_{\beta} = 0.84$ for 80% power of test. So, taking proportion of success, $p_1 = 81.93\%$ and $p_2 = 21.43\%$ the sample size obtained is 11. Making study more confirmative, the sample size was raised to 20 in each group.

To compare the continuous variables between groups. Using the student's paired t test, two quantitative variables within a group were compared.

Rates, ratios, and percentages were used to express the categorical data. Using the Chi-square test or Fisher's exact test, the relationship between the result, clinical, and demographic factors was examined.

Discrete variables were represented by median.

Nonparametric tests were used for comparing discrete variables.

The comparison was represented using the appropriate graphs.

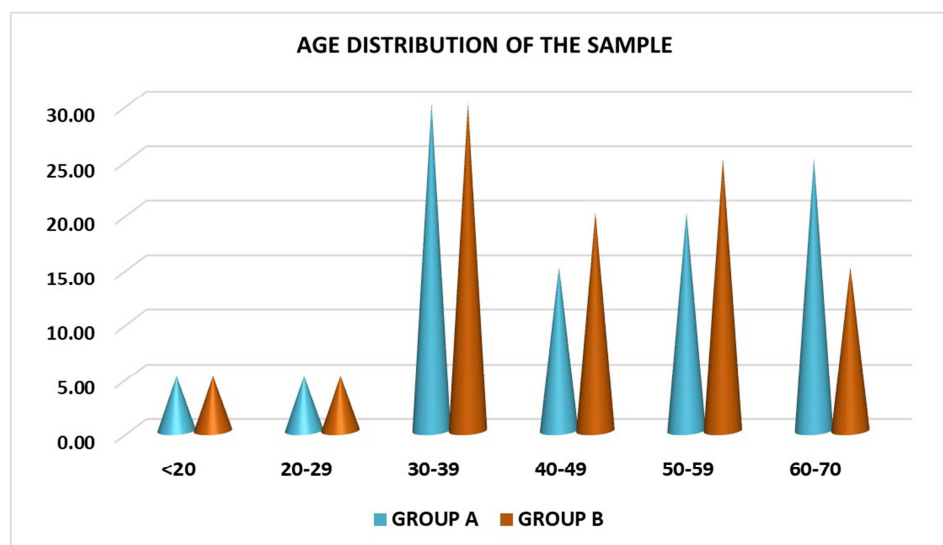
The value of p less than 5% (0.05) was deemed significant for all tests.

RESULTS

After taking informed consent, study included total 40 patients. 20 were divided into group A and 20 into group B. Majority of patients in current study were in 30- to 70-yr-old age range, and there was no discernible difference in age distribution across groups. Nearly equal distribution of gender is noted in present study, with 19 female patients and 21 male patients.

Table 1: Showing Age-wise distribution

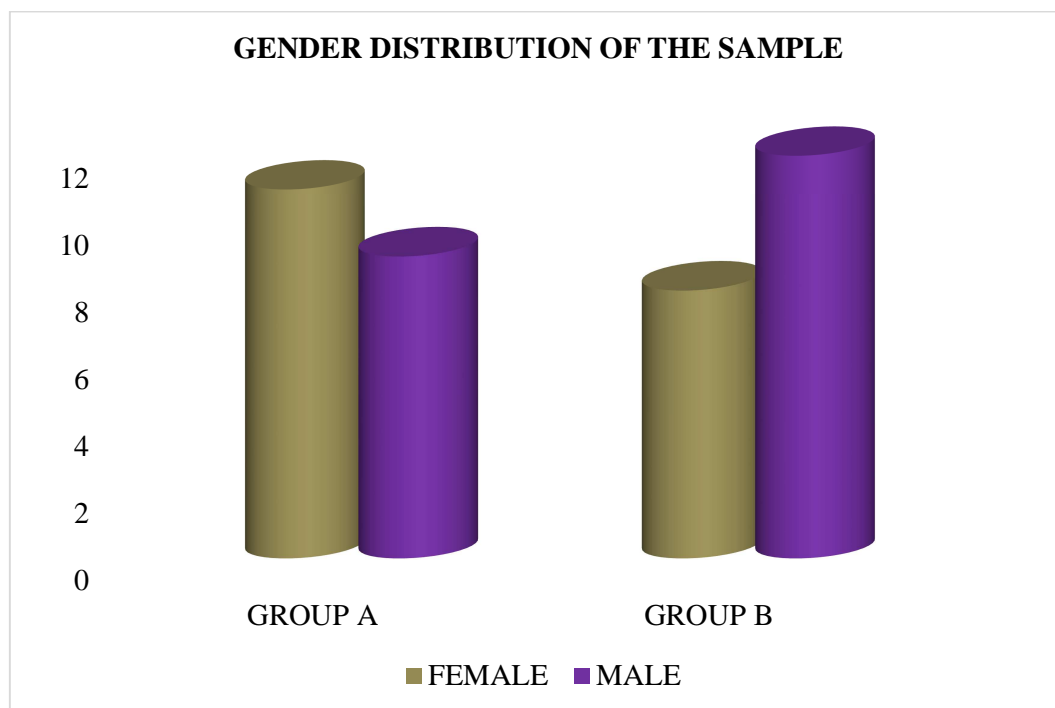
Age (yrs)	Group A		Group B	
	Number	%	Number	%
<20	1	5.00	1	5.00
21 - 29	1	5.00	1	5.00
30 - 39	6	30.00	6	30.00
40 - 49	3	15.00	4	20.00
50 - 59	4	20.00	5	25.00
60 - 70	5	25.00	3	15.00
TOTAL	20	100.00	20	100.00



Graph 1: Showing Age-wise distribution

Table 2: Gender distribution

Gender	Group A		Group B	
	Number	%	Number	%
Female	11	55.00	8	40.00
Male	9	45.00	12	60.00
Total	20	100.00	20	100.00

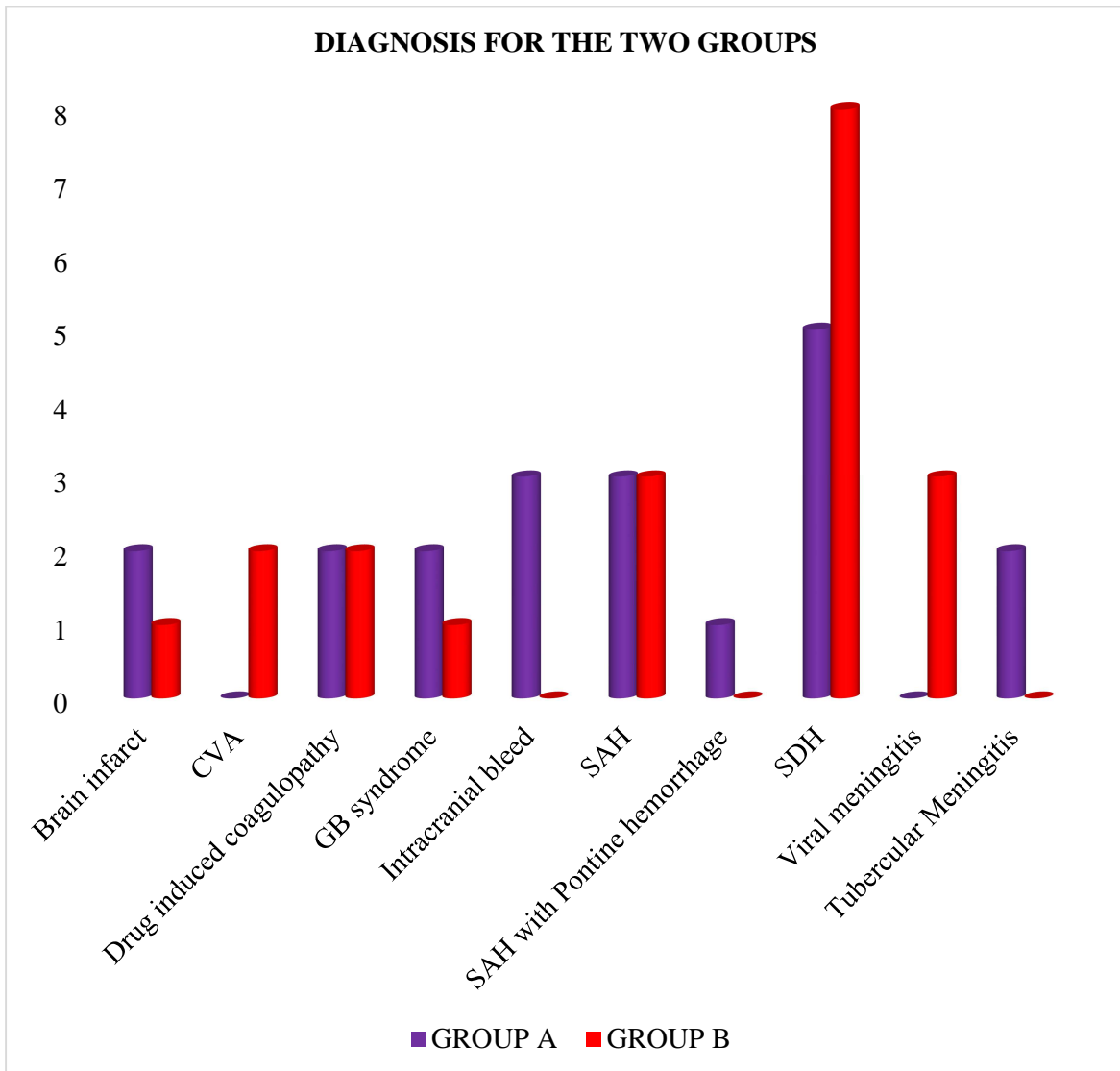


Graph 2: Gender distribution

Table 3: Various diagnosis of the patients at presentation

DIAGNOSIS	Group A		Group B	
	Number	%	Number	%
Brain infarct	2	10.00	1	5.00
CVA	0	0.00	2	10.00
Drug induced coagulopathy	2	10.00	2	10.00
GB syndrome	2	10.00	1	5.00
Intracranial bleed	3	15.00	0	0.00
SAH	3	15.00	3	15.00
SAH with Pontine hemorrhage	1	5.00	0	0.00
SDH	5	25.00	8	40.00
Viral meningitis	0	0.00	3	15.00
Tubercular Meningitis	2	10.00	0	0.00
TOTAL	20	100.00	20	100.00

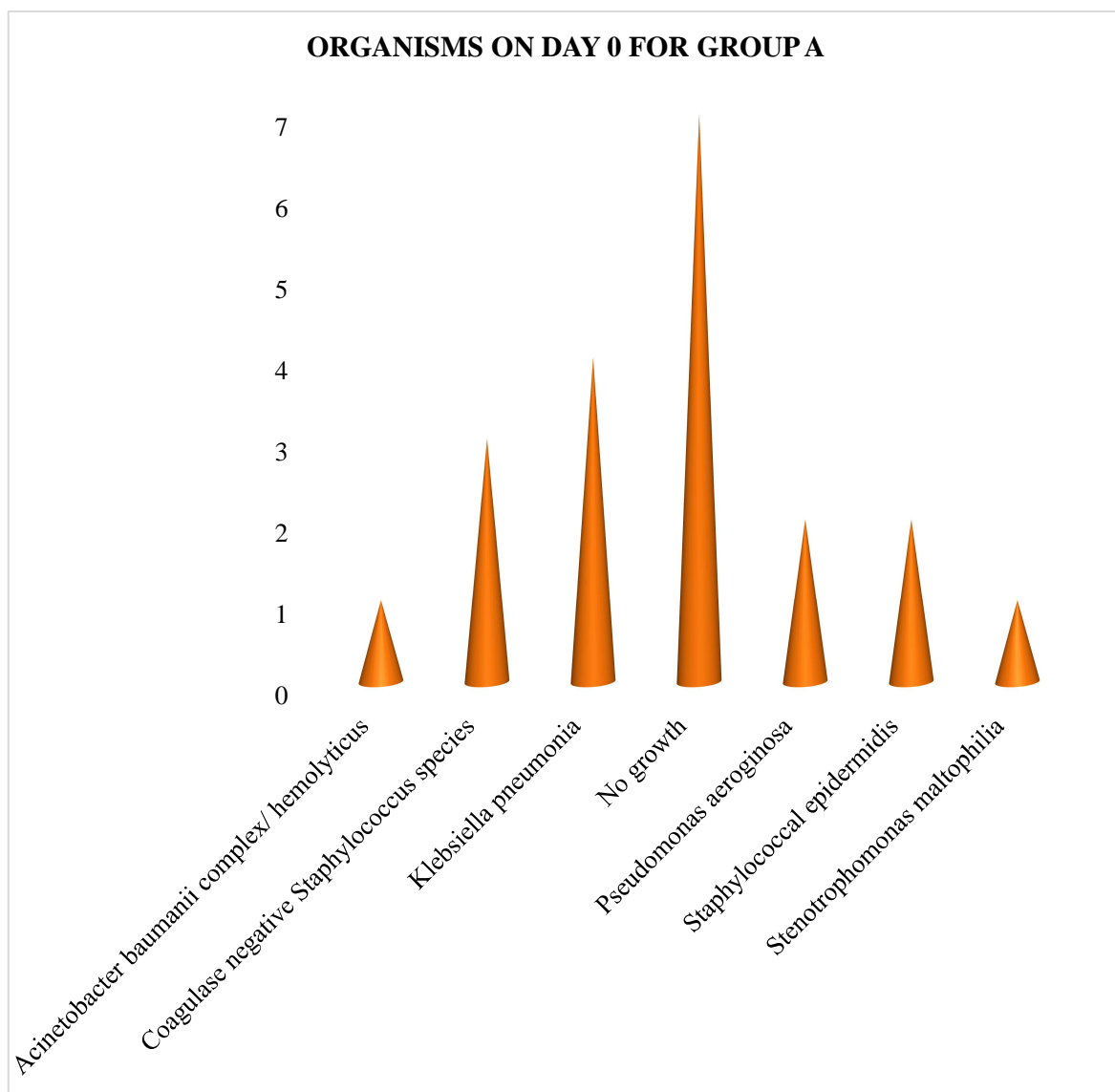
The patients admitted in ICU were of varied diagnosis, mainly SDH, SAH along with intracranial bleeds.



Graph 3: Various diagnosis of the patients at presentation

Table 4: Culture sensitivity of the organism in group A on day 0.

Organism	Culture Sensitivity	Number	%
A. baumannii complex/ hemolyticus	Amox/ K clav Amikacin Cefepime Ampicillin Rifampicin Gentamycin Vancomycin Piperacillin Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol Imipenem	1	5.00
CONS species	Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	1	5.00
CONS species	Amox/ K clav Amikacin Cefepime Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	1	5.00
CONS species	Trimeth/ Sulfa	1	5.00
K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	1	5.00
K. pneumonia	Amikacin Gentamycin Vancomycin Imipenem	1	5.00
K. pneumonia	Resistant to all	2	10.00
No growth	Nil	7	35.00
P. aeruginosa	Amikacin Cefepime Levofloxacin Gentamycin Meropenem	1	5.00
P. aeruginosa	Gentamicin Piperacillin Levofloxacin Meropenem Imipenem	1	5.00
Staph. epidermidis	Ciprofloxacin	1	5.00
Staph. epidermidis	Rifampicin	1	5.00
Stenotrophomonas maltophilia	Levofloxacin	1	5.00
		20	100.00

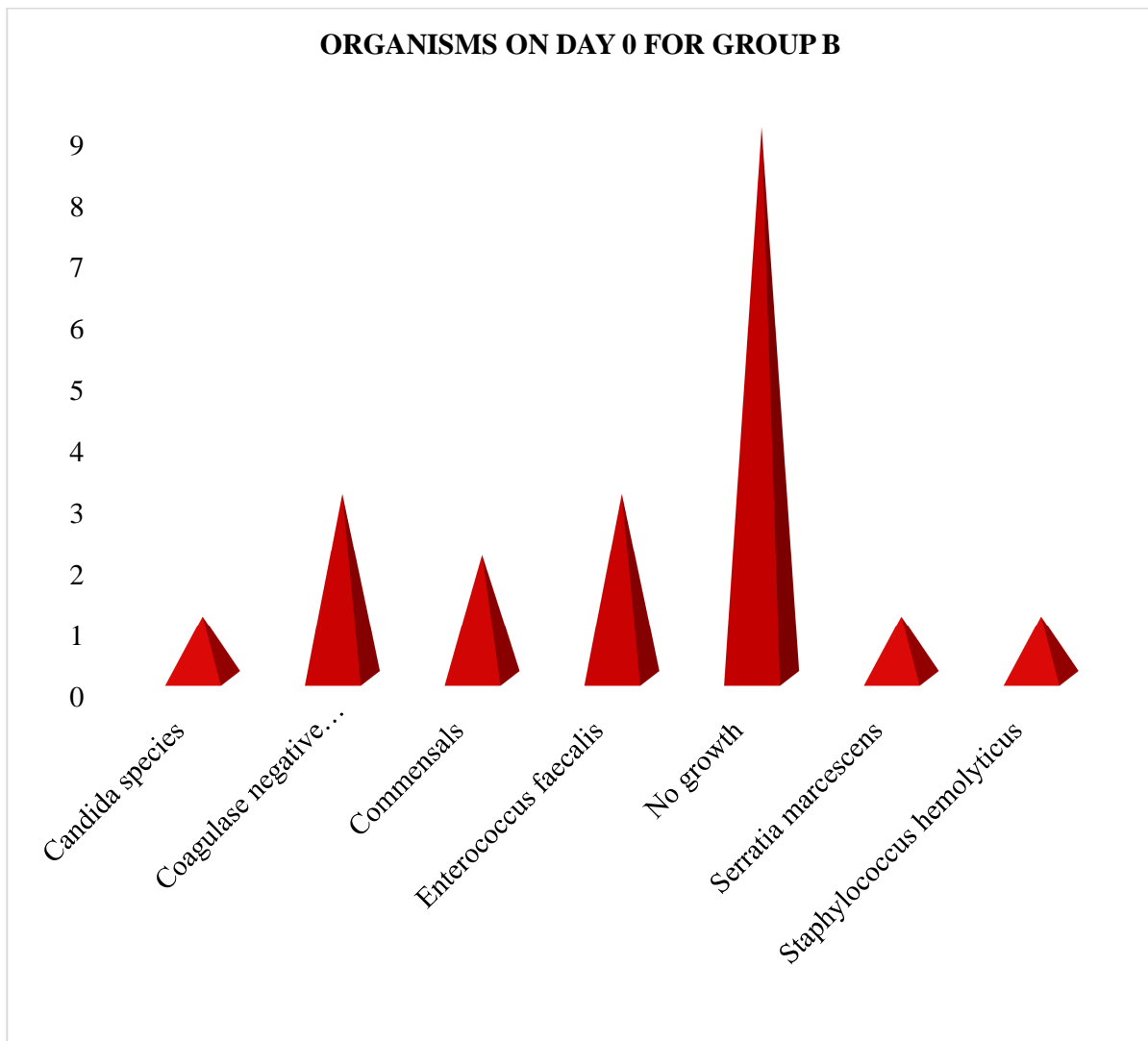


Graph 4: Culture sensitivity of the organism in group A on day 0.

In group A patients on day 0, 35% of the patients showed no growth on culture report and 65% were positive. Among the organism, 20% with K. pneumonia, followed by CONS species, P. aeruginosa and Staph. epidermidis.

Table 5: Culture sensitivity of the organism in group B on day 0.

Organism	Culture Sensitivity	Number	%
Candida species	Nil	1	5.00
CONS species	Amox/ Kclav Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Chloramphenicol	2	10.00
CONS species	Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	1	5.00
Commensals	Nil	2	10.00
Enterococcus faecalis	Linezolid Levofloxacin Vancomyci	1	5.00
Enterococcus faecalis	Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Ampicillin Chloramphenicol	1	5.00
Enterococcus faecalis	Amox/ Kclav Ciprofloxacin Levofloxacin Piperacillin Tetracycline Linezolid Chloramphenicol	1	5.00
No growth	Nil	9	45.00
Serratia marcescens	Cefexime Amikacin Gentamicin Ciprofloxacin Levofloxacin Meropenem	1	5.00
Staph. hemolyticus	Cefixime Chloramphenicol Gentamycin Linezolid Vancomycin	1	5.00
		20	100.00

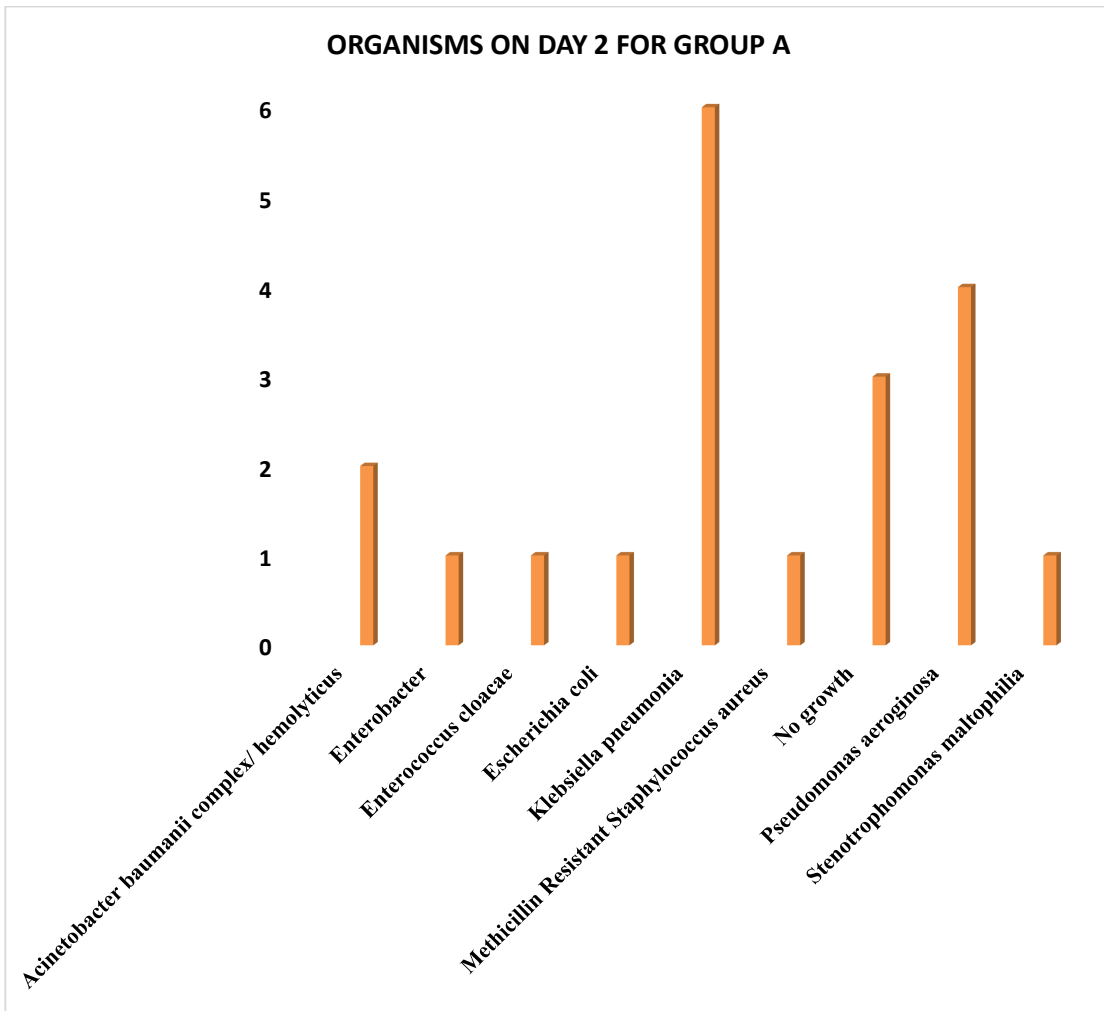


Graph 5: Culture sensitivity of the organism in group B on day 0.

In group B patients on day 0, 45% of patients showed no growth on culture report and 55% were positive for organism. Among the species, 15% were positive for CONS species, Enterococcus faecalis, followed by commensals and other organisms.

Table 6: Culture sensitivity of the organism in group A on day 2 sample.

Organism	Culture Sensitivity	Number	%
A.baumannii complex/ hemolyticus	Resistant to all	2	10.00
Enterobacter	Tigecycline	1	5.00
Enterococcus cloacae	Amox/ K clav Cefepime Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	1	5.00
E. coli	Resistant to all	1	5.00
K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	2	10.00
K. pneumonia	Amikacin Gentamycin Vancomycin Imipenem	1	5.00
K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	1	5.00
K. pneumonia	Tigecycline Vancomycin	1	5.00
K. pneumonia	Resistant to all	1	5.00
Methicillin Resistant Staph. aureus	Trimeth/ Sulfa	1	5.00
No growth	Nil	3	15.00
P. aeruginosa	Amikacin Cefepime Levofloxacin Gentamycin Meropenem	1	5.00
P. aeruginosa	Resistant to all	2	10.00
P. aeruginosa	Amikacin Gentamycin Piperacillin	1	5.00
Stenotrophomonas maltophilia	Levofloxacin	1	5.00
		20	100.00



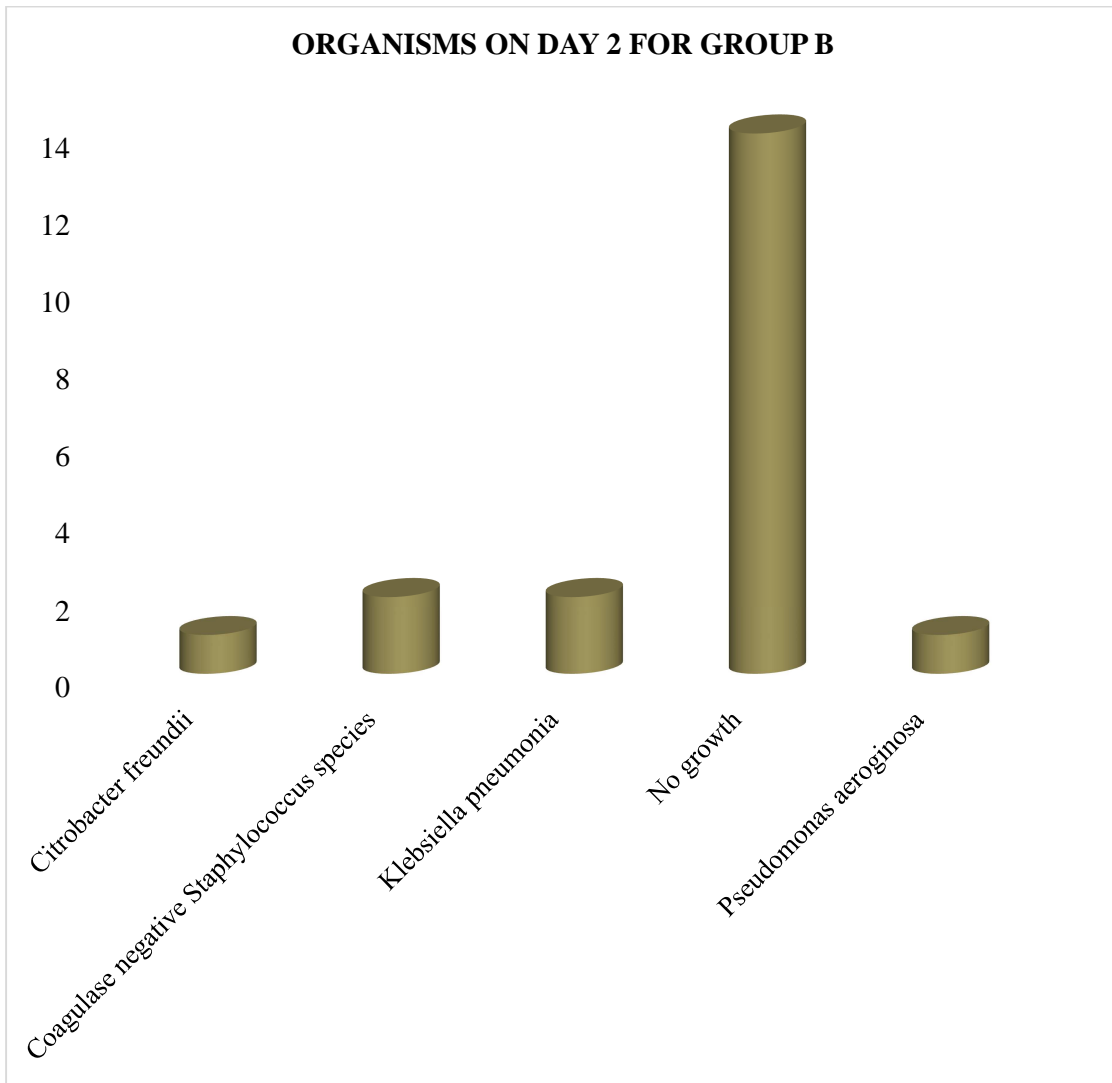
Graph 6: Culture sensitivity of the organism in group A on day 2 sample.

In group A patients on day 2, 15% of the patients showed no growth on culture report.

Among the rest, majority was K. pneumonia, followed by P. aeruginosa.

Table 7: Culture sensitivity of the organism in group B on day 2 sample.

Organism	Culture Sensitivity	Number	%
Citrobacter freundii	Amox/ Kclav Ciprofloxacin Levofloxacin Piperacillin Tetracycline Linezolid Chloramphenicol	1	5.00
CONS species	Amox/ Kclav Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Chloramphenicol	1	5.00
CONS species	Cefoxitin	1	5.00
K. pneumonia	Gentamicin	1	5.00
K. pneumonia	Resistant to all	1	5.00
No growth	Nil	14	70.00
P. aeruginosa	Imipenem Tigecycline	1	5.00
		20	100.00

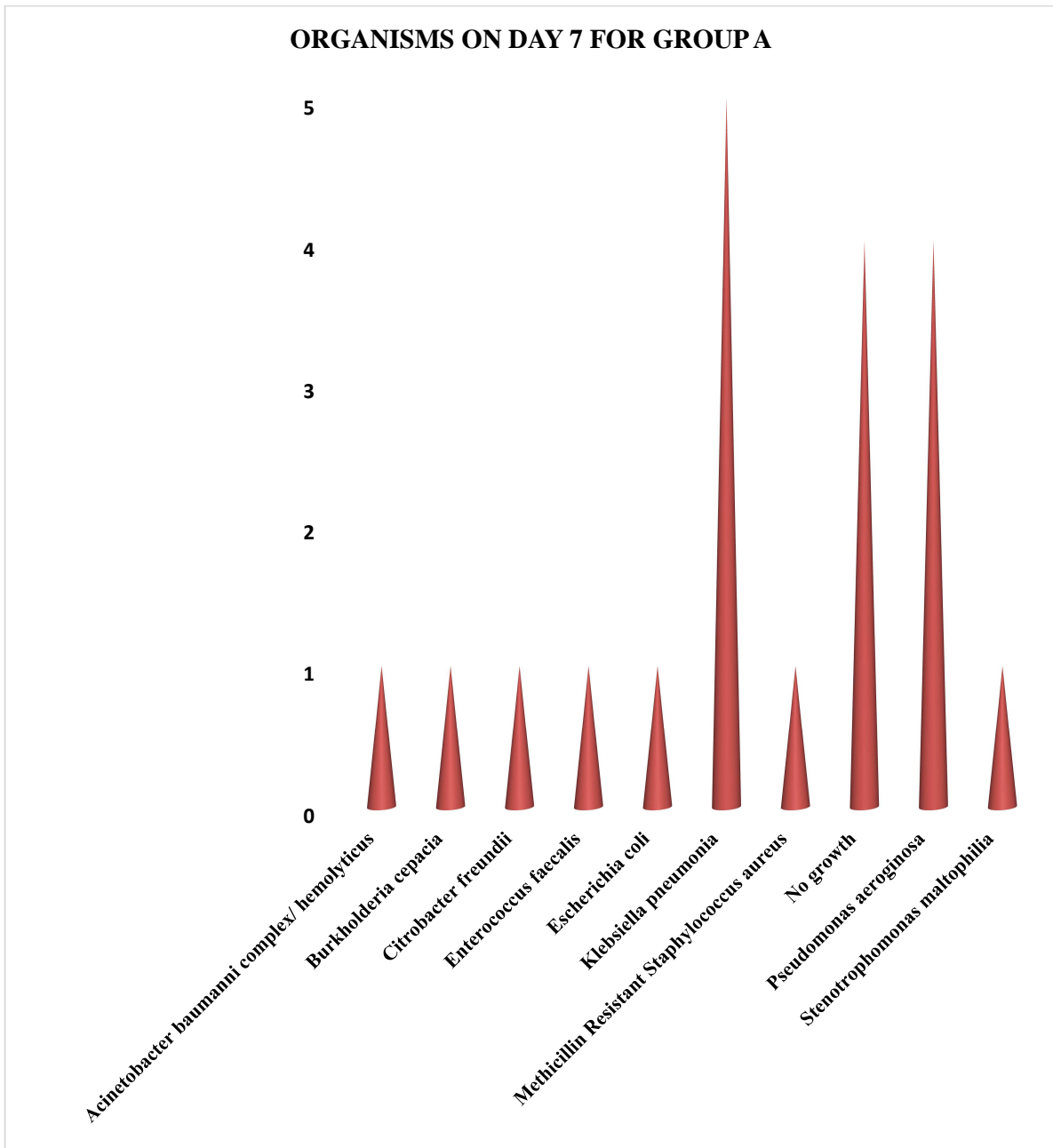


Graph 7: Culture sensitivity of the organism in group B on day 2 sample.

In group B patients on day 2, 70% of the patients showed no growth on culture report and 30% were positive. Among the positive organisms, 10% were positive for CONS species, K. pneumonia.

Table 8: Culture sensitivity of the organism in group A on day 7 sample.

Organism	Culture Sensitivity	Number	%
A.baumannii complex/ hemolyticus	Resistant to all	1	5.00
Burkholderia cepacia	Meropenem	1	5.00
Citrobacter freundii	Amikacin Gentamycin Piperacillin Imipenem	1	5.00
Enterococcus faecalis	Resistant to all	1	5.00
E. coli	Resistant to all	1	5.00
K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	1	5.00
K. pneumonia	Resistant to all	3	15.00
K. pneumonia	Vancomycin	1	5.00
Methicillin Resistant Staph. aureus	Resistant to all	1	5.00
No growth	Nil	4	20.00
P. aeruginosa	Resistant to all	3	15.00
P. aeruginosa	Ciprofloxacin Amikacin Imipenem	1	5.00
Stenotrophomonas maltophilia	Resistant to all	1	5.00
		20	100.00

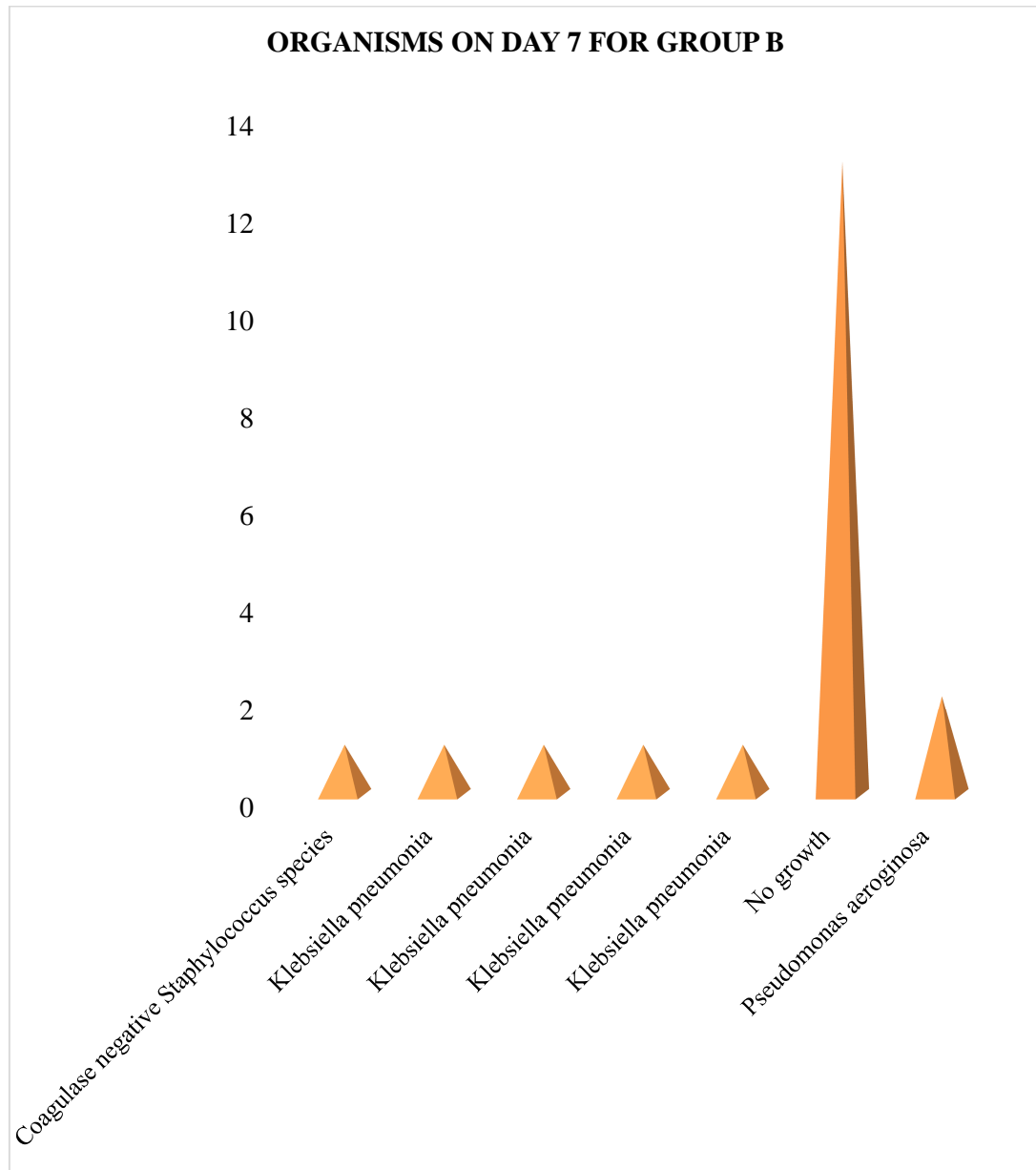


Graph 8: Culture sensitivity of the organism in group A on day 7 sample.

In group A patients on day 7, 20% of the patients showed no growth on culture report. Among the 80% rest, 25% were positive for K. pneumoniae, followed by 20% with P. aeruginosa

Table 9: Culture sensitivity of the organism in group B on day 7 sample.

Organism	Culture Sensitivity	Number	%
CONS species	Cefoxitin	1	5.00
K. pneumonia	Gentamicin Chloramphenicol	1	5.00
K. pneumonia	Tigecycline	1	5.00
K. pneumonia	Gentamicin	1	5.00
K. pneumonia	Resistant to all	1	5.00
No growth	Nil	13	65.00
P. aeruginosa	Resistant to all	2	10.00
		20	100.00

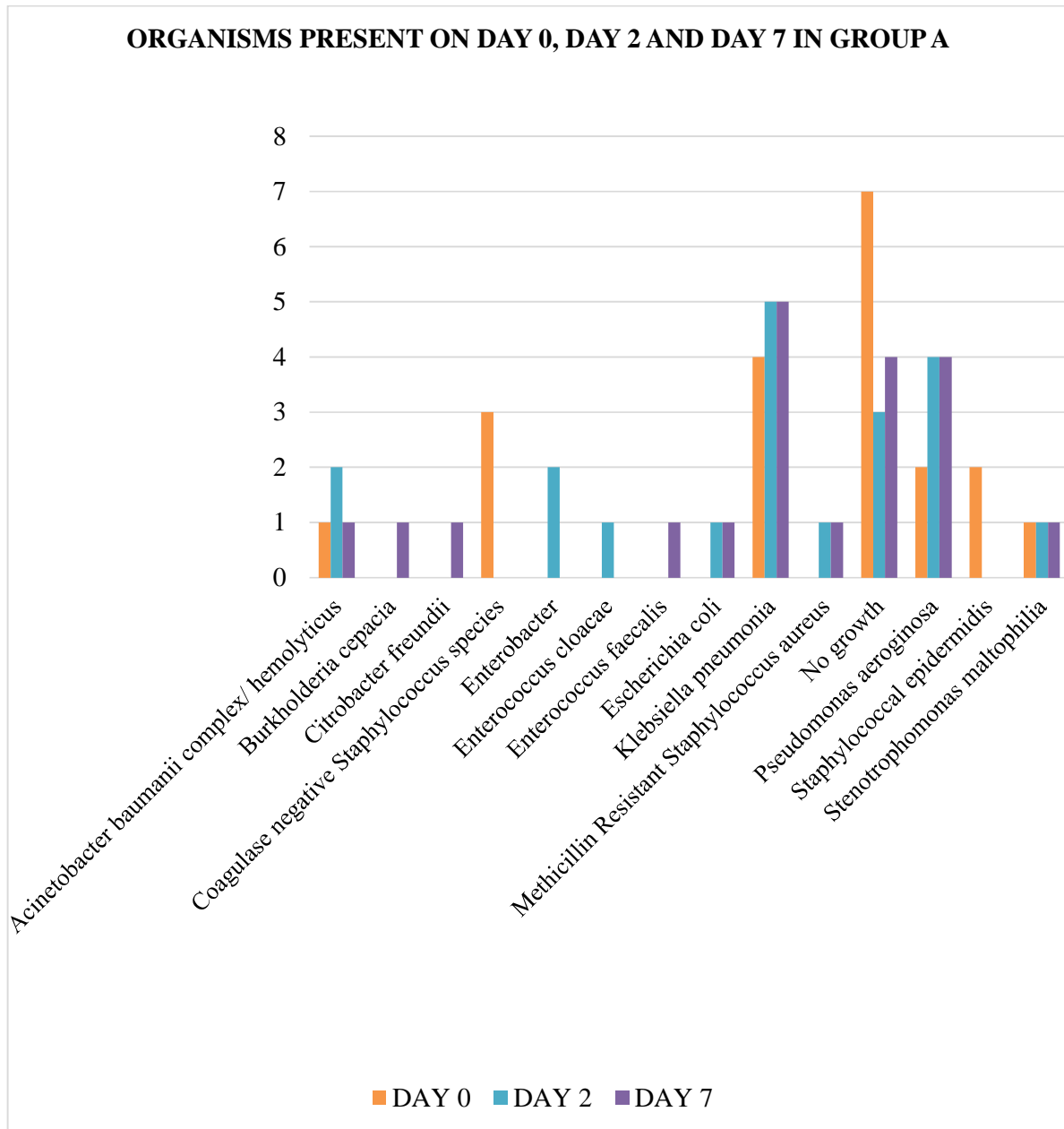


Graph 9: Culture sensitivity of the organism in group B on day 7 sample.

In group B patients on day 7, 65% of the patients showed no growth. Rest showed similar growth as Group A with K. pneumonia and P. aeruginosa, amongst others.

Table 10: Culture isolates in group A patients across different day sample

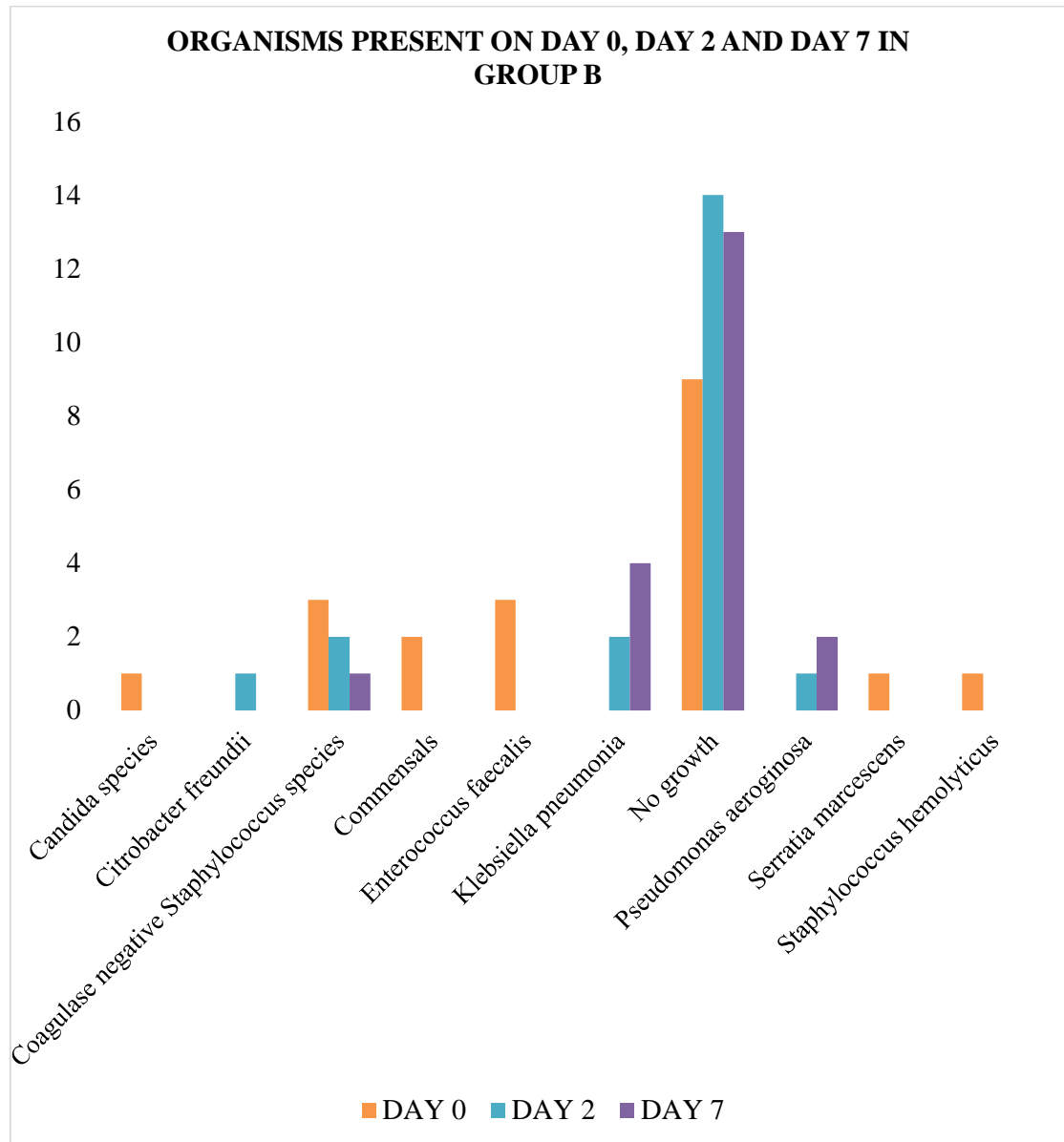
ORGANISM	Day 0	%	Day 2	%	Day 7	%
A. baumannii complex/ hemolyticus	1	5.00	2	10.00	1	5.00
Burkholderia cepacia	0	0.00	0	0.00	1	5.00
Citrobacter freundii	0	0.00	0	0.00	1	5.00
CONS species	3	15.00	0	0.00	0	0.00
Enterobacter	0	0.00	2	10.00	0	0.00
Enterococcus cloacae	0	0.00	1	5.00	0	0.00
Enterococcus faecalis	0	0.00	0	0.00	1	5.00
E. coli	0	0.00	1	5.00	1	5.00
K. pneumonia	4	20.00	5	25.00	5	25.00
Methicillin Resistant Staph. aureus	0	0.00	1	5.00	1	5.00
No growth	7	35.00	3	15.00	4	20.00
P. aeruginosa	2	10.00	4	20.00	4	20.00
Staph. epidermidis	2	10.00	0	0.00	0	0.00
Stenotrophomonas maltophilia	1	5.00	1	5.00	1	5.00
	20	100.00	20	100.00	20	100.00



Graph 10: Culture isolates in group A patients across different day sample

Table 11: Culture isolates in group B patients across different day sample

Organism	Day 0	%	Day 2	%	Day 7	%
Candida species	1	5.00	0	0.00	0	0.00
Citrobacter freundii	0	0.00	1	5.00	0	0.00
CONS species	3	15.00	2	10.00	1	5.00
Commensals	2	10.00	0	0.00	0	0.00
Enterococcus faecalis	3	15.00	0	0.00	0	0.00
K. pneumonia	0	0.00	2	10.00	4	20.00
No growth	9	45.00	14	70.00	13	65.00
P. aeruginosa	0	0.00	1	5.00	2	10.00
Serratia marcescens	1	5.00	0	0.00	0	0.00
Staph. hemolyticus	1	5.00	0	0.00	0	0.00
	20	100.00	20	100.00	20	100.00



Graph 11: Culture isolates in group B patients across different day sample

Table 12: Comparison of the organism isolated between groups on day 0 sample

Group A Organism	N	%	Group B Organism	N	%
A. baumannii complex/ hemolyticus	1	5.00	Candida species	1	5.00
Burkholderia cepacia	0	0.00			
Citrobacter freundii	0	0.00	Citrobacter freundii	0	0.00
CONS species	3	15.00	CONS species	3	15.00
Enterobacter	0	0.00	Commensals	2	10.00
Enterococcus cloacae	0	0.00	Enterococcus faecalis	3	15.00
Enterococcus faecalis	0	0.00			
E. coli	0	0.00			
K. pneumonia	4	20.00	K. pneumonia	0	0.00
Methicillin Resistant Staph. aureus	0	0.00			
No growth	7	35.00	No growth	9	45.00
P. aeruginosa	2	10.00	P. aeruginosa	0	0.00
Staph. epidermidis	2	10.00	Serratia marcescens	1	5.00
Stenotrophomonas maltophilia	1	5.00	Staph. hemolyticus	1	5.00

Table 13: Comparison of the organism isolated between groups on day 2 sample

Group A Organism	N	%	Group B Organism	N	%
A. baumannii complex/ hemolyticus	2	10.00	Candida species	0	0.00
Burkholderia cepacia	0	0.00			
Citrobacter freundii	0	0.00	Citrobacter freundii	1	5.00
CONS species	0	0.00	CONS species	2	10.00
Enterobacter	2	10.00	Commensals	0	0.00
Enterococcus cloacae	1	5.00			
Enterococcus faecalis	0	0.00	Enterococcus faecalis	0	0.00
E. coli	1	5.00			
K. pneumonia	5	25.00	K. pneumonia	2	10.00
Methicillin Resistant Staph. aureus	1	5.00			
No growth	3	15.00	No growth	14	70.00
P. aeruginosa	4	20.00	P. aeruginosa	1	5.00
Staph. epidermidis	0	0.00	Serratia marcescens	0	0.00
Stenotrophomonas maltophilia	1	5.00	Staph. hemolyticus	0	0.00

Table 14: Comparison of the organism isolated between groups on day 7 sample

Group A Organism	N	%	Group B Organism	N	%
A. baumannii complex/ hemolyticus	1	5.00	Candida species	0	0.00
Burkholderia cepacia	1	5.00			
Citrobacter freundii	1	5.00	Citrobacter freundii	0	0.00
CONS species	0	0.00	CONS species	1	5.00
Enterobacter	0	0.00	Commensals	0	0.00
Enterococcus cloacae	0	0.00			
Enterococcus faecalis	1	5.00	Enterococcus faecalis	0	0.00
E. coli	1	5.00			
K. pneumonia	5	25.00	K. pneumonia	4	20.00
Methicillin Resistant Staph. aureus	1	5.00			
No growth	4	20.00	No growth	13	65.00
P. aeruginosa	4	20.00	P. aeruginosa	2	10.00
Staph. epidermidis	0	0.00	Serratia marcescens	0	0.00
Stenotrophomonas maltophilia	1	5.00	Staph. hemolyticus	0	0.00

DISCUSSION

Pathogenic bacterial colonisation of the oropharynx is typically prevented by mastication and further food-transit but in tubo-enterally feeding patients, this mechanism is absent. Hence, predisposing them to aspiration pneumonia with increased morbidity, especially in elderly patients.² The oropharynx is exposed to various microbes, which are cleared by mucociliary mechanisms.³

From gram positive streptococcal predominance to gram negative pseudomonal predominance, microbial ecology of patients admitted to ICU changes significantly. Due to presence of more aggressive organisms, there is increased chance of developing nosocomial pneumonia.⁵

Oropharynx is home to several anaerobic bacteria, including Strep., Haemophilus, Neisseria and Staph.¹⁵ Strep. pneumoniae, Strep. pyogenes, H. influenzae, N. meningitidis, Moraxella catarrhalis, and Staph.aureus are just a few of key human pathogens carried there.¹⁵⁻¹⁷

Present prospective observational study is conducted among the patients aged between 18 and 70 years of age, admitted in ICU, with nasogastric tube in situ, in KLES Dr.Prabhakar Kore Hospital and MRC, Belagavi, between 1st Jan 2021 - 31st Dec 2021 over period of one year.

Current study sought to understand changes in bacterial flora of oropharynx of nasogastric tube patients admitted to ICU.

Total of 40 patients were included in the study and grouped into two groups with 20 patients in each group. Cases group (group A) included 20 patients with nasogastric tube that was retained for more than 48hrs for enteral feeding, and controls group (group B) included 20 patients that don't need nasogastric tube. High oropharyngeal swabs were taken at day 0, day 2 and day 7 of admission and compared for the culture growth and sensitivity.

Age and Sex Distribution

The distribution of gender within the categories did not differ significantly. There was nearly equal distribution of gender, with 19 female patients and 21 male patients. Age group wise distribution was also similar between the groups. The majority of the patients were in the 35–74 age range. In a study by Ewan⁴, the average age of the patients included was 82.9 years, and 59% of them were female and 41% were male. While 110 patients (45 percent of them were women) with an average age of 49 yrs were included in study by Frandah W et al.⁵ Similar to this, 86 individuals (62 males and 24 women) ranging in age from 19 to 89 yrs old were included in study by Garrouste-Orgeas M et al⁶

Culture isolates on Day 0

In our study, group A patients on day 0, 35% of the patients showed no growth on culture report and 65% were positive. Among the organism, 20% with *K. pneumoniae*, followed by 15% were positive for *CONS* species, 10% with *P. aeruginosa*, *Staph. epidermidis* and 5% with *Acinetobacter baumannii* complex/*hemolyticus*, *Stenotrophomonas maltophilia*. In group B patients on day 0, 45% of patients showed no growth on culture report and 55% were positive for organism.

Among the species, 15% were positive for CONS species, *Enterococcus faecalis*, 10% with commensals and 5% with candida species, *Serratia marcescens* and *Staph. hemolyticus*.

This was different from the results of study done by Frandah W et al.⁵, where most prevalent bacteria that were isolated on 1st sample were *Strep. Viridans*, *Micrococcus spp.* non-Group D non-haemolytic strep with *Lactobacillus spp.* and *N. non-meningitidis*.

Pathogenic flora were isolated from 74% gastric samples and 69% oropharynx specimens in study by Segal R et al.²¹ In gastric juice, *Proteus spp.* and *E. coli* were most prevalent isolates, whereas *Proteus spp.* and *Pseudomonas spp.* were most prevalent in oropharynx. Mostly, a similarity between oropharynx and gastric flora makeup was seen. This study was similar with respect to *Pseudomonas* bacterial growth in oropharynx.

The patients showing positive culture growth were sensitive to almost all empirical antibiotics like Amox/clav, Clindamycin, Chloramphenicol and Penicillins.

Culture isolates on Day 2

Our study showed that in group A patients on day 2, 15% of the patients had no growth on culture report and 85% were positive. Among the organisms, 25% with *K. pneumonia*, followed by 20% with *P. aeruginosa*, 10% with *Acinetobacter baumannii* complex/ hemolyticus, *Enterobacter* and 5% with *Enterococcus cloacae*, *E. coli*, Methicillin Resistant *Staph. aureus* and *Stenotrophomonas maltophilia*. In group B patients on day 2, 70% of the patients showed no growth on culture report and 30%

were positive. Among the positive organism, 10% were positive for CONS species, *K. pneumoniae* and 5% with *Citrobacter freundii* and *P. aeruginosa*.

In study by Frandah W et al.,⁵ most often isolated organisms on sample 2 were *Strep.viridans*, non-Group D non-haemolytic strep, *Micrococcus* spp. with *C. albicans* and *Lactobacillus* spp. Gram-positive cocci, *Actinomyces* spp., *C. albicans*, CONS, *K.pneumoniae*, *Strep.dysgalactiae*, and *Strep.pneumoniae* were some microorganisms that were more prevalent in 2nd sample. Although the bacterial growth was different but the few patients showing *Acinetobacter* and *Pseudomonas* growth, were resistant to all the antibiotics. This matched the study conducted by Frandah et al.

Similar study by Thomas et al.¹ showed a predominance of *P.* and *K.* growth but the culture sensitivity was not mentioned for the same.

Culture isolates on Day 7

In our study, on day 7, 20% of the patients showed no growth on culture report and 80% were positive. Among the organism, 25% were positive for *K. pneumoniae*, followed by 20% with *P. aeruginosa* and 5% with *Acinetobacter baumannii* complex/hemolyticus, *Burkholderia cepacia*, *Enterococcus faecalis*, *Citrobacter freundii*, *E. coli*, MRSA, *Stenotrophomonas maltophilia*. In group B patients on day 7, 65% of the patients showed no growth on culture report and 35% were positive. Among the positive organism, 20% positive for *K. pneumoniae* followed by 10% with *P. aeruginosa* and 5% with CONS species. Most of the patients were resistant to all the antibiotics, especially the patients showing positive growth for *Klebsiella* and *P. aeruginosa*.

These findings were consistent with a research by Leibovitz A et al. ² which showed that feeding via a tube had a higher incidence of possibly pathogenic isolations: 81% in nasogastric group and 51% in feeding by percutaneous enterogastric tube, against 17.5% in feeding via oral means. 31% of those in nasogastric group and 10% of those receiving percutaneous enterogastric tube feeding, had *P. aeruginosa* grown from them but none of the people receiving oral feeding showed any growth. Majority of *Klebsiella* and *Proteus* identifications came from nasogastric subjects.

In a study by Garrouste-Orgeas M et al. ⁶ samples from oropharynx and stomach from 54% and 32% patients, respectively, were used to culture bacteria. In oropharyngeal samples, colonisation with *Enterobacteriaceae*, *Pseudomonas* sp., *Staph. aureus*, or *Enterococcus* sp. was shown and in gastric samples, there was lesser growth. Without a dominating site of colonisation, yeast colonisation was found in 51 patients upon admission

Long-term use may cause greater influence on pathological colonisation of sinuses, resulting in chronic sinusitis, which serves as breeding ground for dangerous bacteria. Our findings suggest that current dental cleaning techniques for extended tube-fed patients should be re-evaluated, as well as there should be dire need for new decontamination techniques.

CONCLUSION

The present study demonstrates a higher prevalence of the pathogenic isolates from the nasogastric tube inserted patients compared to the ones without. On 7th day, 80% of the patients in the nasogastric tube in-situ group were positive for the pathogenic organism and in group without the tube were positive in 35% of patients. Common and highly pathogenic bacteria isolate on day 7th in nasogastric tube in-situ group was 25% were positive for *K. pneumonia*, followed by 20% with *P. aeruginosa* and in the group without the tube, culture was 20% positive for *K. pneumonia* followed by 10% with *P. aeruginosa*.

Our outcomes support that mechanical cleaning brought about by appropriate mastication and swallowing provides chief protection against bacterial adulteration of oral cavity.

SUMMARY

Present prospective observational study is conducted among the patients aged between 18 and 70 years of age, admitted in ICU, with nasogastric tube in situ, in KLES Dr.Prabhakar Kore Hospital and Medical Research Centre, Belagavi, between 1st Jan 2021 - 31st Dec 2021 over period of one year.

Our current study aimed at identifying variations in bacterial flora in patients with nasogastric tubes who were admitted to ICU

Total of 40 patients included in the study and grouped into two groups with 20 patients in each group. Cases group (group A) included 20 patients with nasogastric tube that was retained for more than 48hrs for enteral feeding, and controls group (group B) included 20 patients that don't need nasogastric tube. High oropharyngeal swabs were taken at day 0, day 2 and day 7 of admission and compared for the culture growth and sensitivity.

- Distribution of gender in groups did not differ significantly. 19 female patients and 21 male patients made up the study's gender distribution, which was almost equal. Distribution of ages among groups was also similar. Majority of them were between the ages of 35 and 74.

Day 0

- In group A patients on day 0, 35% of the patients showed no growth on culture report and 65% were positive. Among the organism, 20% with *K. pneumonia*, followed by 15% were positive for Coagulase Negative Staphylococci species,

10% with *P. aeruginosa*, *Staph. epidermidis* and 5% with *Acinetobacter baumannii* complex/ hemolyticus, *Stenotrophomonas maltophilia*.

- In group B patients on day 0, 45% of patients showed no growth on culture report and 55% were positive for organism. Among the species, 15% were positive for Coagulase Negative Staphylococci species, *Enterococcus faecalis*, 10% with commensals and 5% with candida species, *Serratia marcescens* and *Staph. hemolyticus*.

Day 2

- In group A patients on day 2, 15% of the patients showed no growth on culture report and 85% were positive. Among the organism, 25% with *K. pneumonia*, followed by 20% with *P. aeruginosa*, 10% with *Acinetobacter baumannii* complex/ hemolyticus, *Enterobacter* and 5% with *Enterococcus cloacae*, *E. coli*, Methicillin Resistant *Staph. aureus* and *Stenotrophomonas maltophilia*.
- In group B patients on day 2, 70% of the patients showed no growth on culture report and 30% were positive. Among the positive organism, 10% were positive for Coagulase Negative Staphylococci species, *K. pneumonia* and 5% with *Citrobacter freundii* and *P. aeruginosa*.

Day 7

- In group A patients on day 7, 20% of the patients showed no growth on culture report and 80% were positive. Among the organism, 25% were positive for *K. pneumonia*, followed by 20% with *P. aeruginosa* and 5% with *Acinetobacter baumannii* complex/ hemolyticus, *Enterococcus faecalis*, *E. coli*, MRSA, *Burkholderia cepacia*, *Citrobacter freundii*, *Stenotrophomonas maltophilia*.

- In group B patients on day 7, 65% of the patients showed no growth on culture report and 35% were positive. Among the positive organism, 20% positive for *K. pneumonia* followed by 10% with *P. aeruginosa* and 5% with Coagulase Negative Staphylococci species.

Our study showed significant relationship between oropharyngeal pathogenic colonization in prolonged tubeenterally fed patients and risk of aspiration pneumonia. Hence, devising new methods of decontamination, along with the existing oral hygiene protocol, will help prevent the emergence of pan-resistant organisms.

Thus, proper, consistent cleansing & care of the oral and dental structures goes in a long way in reducing morbidity and mortality of tube-fed ICU patients.

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ANNEXURE I

INFORMED CONSENT

“VARIATION IN OROPHARYNGEAL FLORA IN ICU PATIENTS WITH NASOGASTRIC TUBE”-A ONE YEAR PROSPECTIVE OBSERVATIONAL STUDY IN KLES Dr. PRABHAKAR KORE HOSPITAL

PRINCIPAL INVESTIGATOR:

Dr.

Post Graduate Student

Department of Otorhinolaryngology and Head and Neck Surgery.

CO-INVESTIGATOR:

Dr.

Professor

Department of Otorhinolaryngology and Head and Neck Surgery.

INTRODUCTION AND PURPOSE: The purpose of the study is to determine the changes in bacterial flora in the oropharynx of patients with nasogastric tube, admitted in the ICU in KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi. You are requested to participate in the study and your participation is completely voluntary.

PROCEDURE: If you agree to participate in this study, the relevant data will be collected as per the proforma and the final diagnosis will be confirmed. After getting inducted in the study, you will be evaluated for presence of bacterial flora in the oropharynx, based on the high oropharyngeal swab taken.

BENEFITS: Subject will not be eligible for any kind of monetary benefits or any free services.

RISKS: Methods applied to do the study are safe.

COST OF PARTICIPATION: The cost of the Investigation will be borne by the Study Subject. The other indirect expenses will be borne by the Investigator.

PRIVACY AND CONFIDENTIALITY: The results of the study may be published in journals for scientific purposes. However, your identity will not be revealed. All information collected will be coded so that no one other than the investigator will know your identity.

WITHDRAWAL FROM THE STUDY: You can withdraw from the study at any time if you wish to do so.

AUTHORIZATION TO PUBLISH THE RESULTS: The researcher may use the information gathered from this study for presentation in scientific meetings. However, your identity will not be revealed.

QUERIES AND CONTACT: If you have any queries regarding the study, you can contact Dr. _____ without any hesitation on Mobile no: _____ and the guide Dr. _____. If you have any questions about rights as a research participant you can contact **Dr. Harsha Hegde**, Chairperson, JNMC, IEC & Scientist D, ICMR, National Institute of Traditional Medicine, Belagavi on Mobile No. 9480422500.

CONSENT SUMMARY:

I have been explained all the contents of this consent form in my local language and having understood and clarified all my queries about the study to the best of my knowledge, I hereby give my voluntary consent for participation in the study. I do sign the informed consent form in front of an eyewitness whom I recognize.

Name and Signature/ left thumb impression of the participant:

Name and Signature/ left thumb impression of the Legally Authorised Relative:

Name and Signature/ left thumb impression of the eyewitness (Relative):

Name and Signature of the interviewer:

Signature of the guide:

Date:

ANNEXURE II

PROFORMA

“VARIATION IN OROPHARYNGEAL FLORA IN ICU PATIENTS WITH NASOGASTRIC TUBE”- A ONE YEAR PROSPECTIVE OBSERVATIONAL STUDY IN KLES Dr. PRABHAKAR KORE HOSPITAL.

Date:

O.P. No:

Name:

Occupation:

Age:

Phone No:

Sex:

Address:

CLINICAL PROFILE:

Chief Complaint:

History of Present Illness:

Past History:

Personal History:

Family History:

I) General Physical Examination -

Blood Pressure:

Pulse:

Respiratory Rate:

Pallor

Icterus

Clubbing

Cyanosis

Lymphadenopathy

Oedema

II) ENT Examination

1. EAR EXAMINATION:

Right

Left

Pinna

Pre auricular area

Post auricular area

External auditory canal

Tympanic membrane

TUNING FORK TESTS:

Rinne's test: 256 Hz

512 Hz

1024 Hz

Weber's test:

Absolute Bone Conduction test:

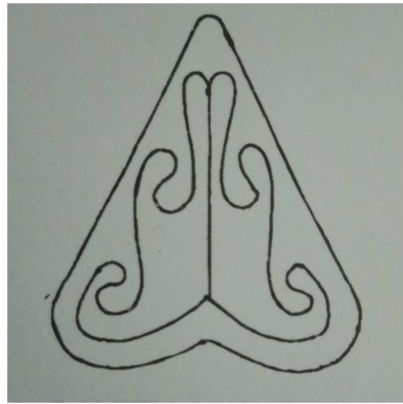
2. NOSE EXAMINATION:

External appearance

- Root
- Bridge
- Dorsum
- Alae
- Tip
- Columella

Cold spatula test

Anterior Rhinoscopy



Posterior Rhinoscopy

Paranasal Sinus Examination

3. THROAT EXAMINATION:

Oral cavity:

- Lips
- Labial and buccal mucosa
- Gingivolabial and gingivobuccal sulci
- Gingiva
- Teeth
- Hard palate
- Floor of mouth
- Anterior 2/3rd of tongue
- Retromolar trigone

Oropharynx:

- Soft palate
- Uvula
- Anterior pillar
- Tonsils
- Posterior pillar
- Posterior and lateral pharyngeal wall

4. NECK EXAMINATION:Cases Group: With the nasogastric tube

	<u>SAMPLE-A</u> (Before inserting the tube) Day 0	<u>SAMPLE-B</u> (After inserting the tube) Day 2	<u>SAMPLE-C</u> Day 7
<u>Organisms isolated:</u>			
<u>Culture Sensitivity:</u>			
Ampicillin			
Amikacin			
Amoxyclav			
Aztreonam			
Ciprofloxacin			
Ceftriaxone			
Doxycycline			
Gentamycin			
Meropenem			
Chloramphenicol			
Levofloxacin			
Piperacillin Tazobactam			
Tetracycline			
Cefipime			
Imipenem			

Controls Group: Without the nasogastric tube

	<u>SAMPLE-A</u> Day 0	<u>SAMPLE-B</u> Day 2	<u>SAMPLE- C</u> Day 7
<u>Organisms isolated:</u>			
<u>Culture Sensitivity:</u>			
Ampicillin			
Amikacin			
Amoxyclav			
Aztreonam			
Ciprofloxacin			
Ceftriaxone			
Doxycycline			
Gentamycin			
Meropenem			
Chloramphenicol			
Levofloxacin			
Piperacillin Tazobactam			
Tetracycline			
Cefipime			
Imipenem			

ANNEXURE III**KEY TO MASTER CHART**

M	Male
F	Female
CVA	Cerebrovascular Accident
SDH	Subdural Hemorrhage
SAH	Subarachnoid Hemorrhage
GB	Guillian-Barre syndrome
P. aeruginosa	Pseudomonas aeruginosa
K. pneumonia	Klebsiella pneumonia
spp	Species
CONS	Coagulase Negative Staphylococci
C. albicans	Candida albicans
A. baumannii	Acinetobacter baumannii
Peptostrep.	Peptostreptococci
E. coli	Escherichia coli
H. influenza	Hemophilus influenza
N. meningitidis	Neisseria meningitidis
MRSA	Methicillin Resistant Staphylococcus aureus
Amox/ Kclav	Amoxicillin/ clavulanic acid

ANNEXURE IV
MASTERCHART

WITH THE NASOGASTRIC TUBE								
Sr. No.	AGE/SEX	DIAGNOSIS	Day 0		Day 2		Day 7	
			Culture Growth	Culture Sensitivity	Culture Growth	Culture Sensitivity	Culture Growth	Culture Sensitivity
1	67/F	SDH	Stenotrophomonas maltophilia	Levofloxacin	Stenotrophomonas maltophilia	Levofloxacin	Stenotrophomonas maltophilia	Resistant to all
2	70/F	Drug Induced Cougulopathy	CONS species	Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	K. pneumonia	Ciprofloxacin Levofloxacin Linezolid
3	30/M	GB Syndrome	No growth	Nil	Methicillin Resistant Staph. aureus	Trimeth/ Sulfa	Methicillin Resistant Staph. aureus	Resistant to all
4	23/F	SAH	No growth	Nil	Acinetobacter baumannii complex/hemolyticus	Resistant to all	Acinetobacter baumannii complex/hemolyticus	Resistant to all
5	61/M	SAH with Pontine hemorrhage	Acinetobacter baumannii complex/hemolyticus	Amox/ K clav Amikacin Cefepime Ampicillin Rifampicin Gentamicin Vancomycin Piperacillin Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol Imipenem	K. pneumonia	Amikacin Gentamicin Vancomycin Imipenem	K. pneumonia	Resistant to all
6	63/F	SDH	CONS species	Amox/ K clav Amikacin Cefepime Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	No growth	Nil	No growth	Nil

7	55/M	Brain Infarct	K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	K. pneumonia	Ciprofloxacin Levofloxacin Linezolid	No growth	Nil
8	66/F	Tubercular Meningitis	P. aeruginosa	Amikacin Cefepime Levofloxacin Gentamicin Meropenem	P. aeruginosa	Amikacin Cefepime Levofloxacin Gentamicin Meropenem	Burkholderia cepacia	Meropenem
9	53/M	SDH	K. pneumonia	Amikacin Gentamicin Vancomycin Imipenem	K. pneumonia	Amikacin Gentamicin Vancomycin Imipenem	No growth	Nil
10	51/F	Intracranial bleed	No growth	Nil	P. aeruginosa	Resistant to all	P. aeruginosa	Resistant to all
11	44/M	Drug induced coagulopathy	K. pneumonia	Resistant to all	P. aeruginosa	Amikacin Gentamicin Piperacillin	Citrobacter freundii	Amikacin Gentamicin Piperacillin Imipenem
12	48/F	GB syndrome	CONS species	Trimeth/ Sulfa	E. coli	Resistant to all	K. pneumonia	Resistant to all
13	42/M	SDH	No growth	Nil	Enterococcus cloacae	Amox/ K clav Cefepime Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	No growth	Nil
14	18/F	Brain infarct	Staph. epidermidis	Ciprofloxacin	P. aeruginosa	Resistant to all	P. aeruginosa	Resistant to all
15	31/F	Intracranial bleed	No growth	Nil	No growth	Nil	P. aeruginosa	Ciprofloxacin Amikacin Imipenem
16	33/M	Tubercular Meningitis	Staph. epidermidis	Rifampicin	Enterobacter	Tigecycline	Enterococcus faecalis	Resistant to all

17	56/F	SAH	No growth	Nil	No growth	Nil	P. aeruginosa	Resistant to all
18	35/M	Intracranial bleed	No growth	Nil	K. pneumonia	Tigecycline Vancomycin	K. pneumonia	Vancomycin
19	31/F	SDH	P. aeruginosa	Gentamicin Piperacillin Levofloxacin Meropenem Imipenem	Acinetobacter baumannii complex/ hemolyticus	Resistant to all	E. coli	Resistant to all
20	36/M	SAH	K. pneumonia	Resistant to all	K. pneumonia	Resistant to all	K. pneumonia	Resistant to all

WITHOUT THE NASOGASTRIC TUBE								
Sr. No.	AGE/SEX	DIAGNOSIS	Day 0		Day 2		Day 7	
			Culture Growth	Culture Sensitivity	Culture Growth	Culture Sensitivity	Culture Growth	Culture Sensitivity
1	58/M	SDH	No growth	Nil	No growth	Nil	No growth	Nil
2	70/F	SAH	Commensals	Nil	No growth	Nil	No growth	Nil
3	59/F	Brain infarct	Enterococcus faecalis	Linezolid Levofloxacin Vancomycin	No growth	Nil	No growth	Nil
4	36/M	Viral meningitis	Staph. hemolyticus	Cefixime Chloramphenicol Gentamycin Linezolid Vancomycin	No growth	Nil	No growth	Nil
5	66/M	SDH	CONS species	Amox/ Kclav Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Chloramphenicol	CONS species	Amox/ Kclav Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Chloramphenicol	No growth	Nil
6	31/F	GB Syndrome	No growth	Nil	CONS species	Cefoxitin	CONS species	Cefoxitin
7	46/M	SDH	No growth	Nil	No growth	Nil	No growth	Nil
8	67/M	SDH	Candida species	Nil	No growth	Nil	No growth	Nil
9	44/F	Drug Induced Couguloopathy	No growth	Nil	Citrobacter freundii	Amox/ Kclav Ciprofloxacin Levofloxacin Piperacillin Tetracycline Linezolid Chloramphenicol	K. pneumonia	Gentamicin Chloramphenicol
10	53/M	SDH	No growth	Nil	No growth	Nil	No growth	Nil

11	47/F	Viral meningitis	CONS species	Amox/ Kclav Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Chloramphenicol	No growth	Nil	No growth	Nil
12	56/M	SDH	No growth	Nil	No growth	Nil	K. pneumonia	Tigecycline
13	33/M	SAH	Serratia marcescens	Cefexime Amikacin Gentamicin Ciprofloxacin Levofloxacin Meropenem	K. pneumonia	Gentamicin	K. pneumonia	Gentamicin
14	19/F	Viral meningitis	Enterococcus faecalis	Clindamycin Ciprofloxacin Erythromycin Levofloxacin Trimeth/ Sulfa Tetracycline Linezolid Ampicillin Chloramphenicol	P. aeruginosa	Imipenem Tigecycline	P. aeruginosa	Resistant to all
15	55/M	CVA	No growth	Nil	No growth	Nil	No growth	Nil
16	31/F	SDH	CONS species	Ciprofloxacin Erythromycin Levofloxacin Tetracycline Linezolid Chloramphenicol	No growth	Nil	No growth	Nil
17	30/M	SAH	Commensals	Nil	No growth	Nil	No growth	Nil
18	38/F	CVA	Enterococcus faecalis	Amox/ Kclav Ciprofloxacin Levofloxacin Piperacillin Tetracycline Linezolid Chloramphenicol	K. pneumonia	Resistant to all	K. pneumonia	Resistant to all
19	23/M	SDH	No growth	Nil	No growth	Nil	P. aeruginosa	Resistant to all
20	42/M	Drug Induced Couguloopathy	No growth	Nil	No growth	Nil	No growth	Nil