"EPIDEMIOLOGY AND CLINICAL PROFILE OF CHILDREN MANAGED WITH CPAP AND MECHANICAL VENTILATION IN A TERTIARY CARE HOSPITAL"

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CHENGALPATTU MEDICAL COLLEGE

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CERTIFICATE

This is to certify that the dissertation titled "**EPIDEMIOLOGY AND CLINICAL PROFILE OF CHILDREN MANAGED WITH CPAP AND MECHANICAL VENTILATION IN A TERTIARY CARE HOSPITAL"** is a bonafide work done by **Dr.G.FATIMA SHIRLY ANITHA,** post graduate student of the Department of Paediatrics , Chengalpattu Medical College, Chengalpattu, during the academic year 2012-2015. This work has not previously formed the basis for award of any degree.

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DECLARATION

I, **Dr.G.FATIMA SHIRLY ANITHA,** solemnly declare that the dissertation titled, "**EPIDEMIOLOGY AND CLINICAL PROFILE OF CHILDREN MANAGED WITH CPAP AND MECHANICAL VENTILATION IN A TERTIARY CARE HOSPITAL"** is a bonafide work done by me at Chengalpattu Medical College, during the year 2012-2015 under the guidance and supervision of **Dr.S.Lakshmi M.D.DCH;** Professor, Department of Paediatrics, Chengalpattu Medical College, Chengalpattu. The dissertation is submitted to The Tamil Nadu Dr. M.G.R. Medical University, towards partial fulfillment of requirement for the award of **M.D. (Paediatrics) (Branch-VII).**

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Date :

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I bow my head in respect before God Almighty.

Date : Signature of the Candidate

Place : Chengalpattu Name: Dr.G.Fatima Shirly Anitha

INSTITUTIONAL ETHICS COMMITTEE

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APPROVAL OF ETHICAL COMMITTEE

To

Dr.G.Fatima Shirly Anitha
Post Graduate
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Dear Dr.

The Institutional Ethical Committee of Chengalpattu Medical College reviewed and discussed your application to conduct the clinical / dissertation work entitled

EPIDEMIOLOGY AND CLINICAL PROFILE OF CHILDREN MANAGED WITH CPAP AND MECHANICAL VENTILATION IN A TERTIARY HOSPITAL

On 13.11.2013

The following documents reviewed

a. Trial protocol, dated _____version no
b. Patient information sheet and informed consent form in English and / or vernacular language.
c. Investigators Brochure, dated _____version
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The following members of the Ethics committee were present at the meeting held on

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Approved _____ Chairman Ethics Committee

13/11/13
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Name of each member with designation

Clinical Members

1. Dr.G.Raja Billy Graham MS.,
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4. Dr.P.Parasakthi MD
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5. Member from Nongovernmental
   Voluntary Organisation : Mr.T.Durairaj

6. Philosopher : Mr.K.S.Ramprasad

7. Lawyer : Lr. I. M. Karimala Basha

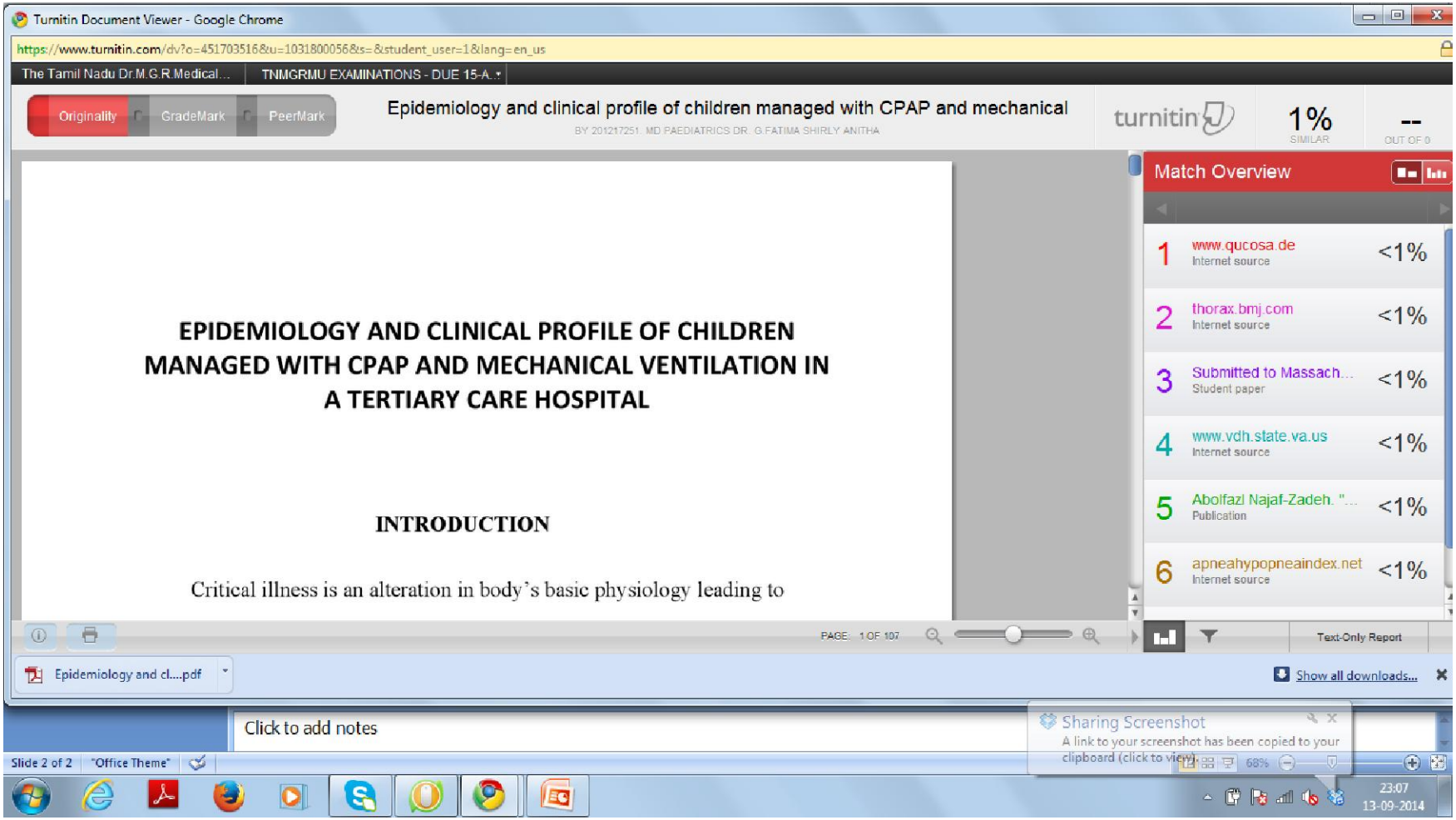
8. Layperson : Mr.Dilli

We approve the clinical trial to be conducted in its presented form

The Institutional Ethics Committee expects to be informed about the progress of the study and any SAE occurring in the course of the study, any changes in protocol and patient information / informed consent and asks to provide copy of final report.

Yours sincerely

Member secretary, Ethics Committee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Critical illness is an alteration in body's basic physiology leading to
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ABBREVIATIONS

PICU	Paediatric Intensive Care Unit.
NIV	Non Invasive Ventilation.
CPAP	Continuous Positive Airway Pressure.
ALOC	Altered Level Of Consciousness.
FRC	Functional Residual Capacity.
IPAP	Inspiratory Positive Airway Pressure
EPAP	Expiratory Positive Airway Pressure
APL	Adjustable Pressure Limiting Valve
ICP	Intracranial Pressure
CHD/RHD	Congenital Heart Disease / Rheumatic Heart Disease
PEEP	Positive End Expiratory Pressure
RSI	Rapid Sequence Intubation
VAP	Ventilator Associated Pneumonia
SIRS	Systemic Inflammatory Response Syndrome
CCF	Congestive Cardiac Failure

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ABSTRACT

Background:

Majority of critically ill children require either invasive or non-invasive ventilation. The clinical profile and management of children with such respiratory support in developing countries with limited resources is entirely different. In our study we have observed that flow inflating device- Jackson-Rees/Bain circuit can effectively provide CPAP –continuous positive airway pressure in an indigenous way, in settings without NIV machines. We have also studied the profile and outcome of children managed with invasive ventilation.

Methods:

An observational study was undertaken in the Paediatric intensive care unit of Chengalpattu medical college hospital, during a one year period from November 2013-September 2013. All children who required CPAP/ invasive ventilation in the age group 1 month -12 years of both sexes were included. The demographic profile, symptomatology, clinical assessment of the children were recorded. They were started on CPAP through flow inflating device / mechanical ventilation based on clinical assessment, and the duration and outcome were recorded.

Results:

We studied 325 children, of which 69.2% were managed with direct invasive ventilation. CPAP alone was successful in 89.7% of cases and the most successful clinical condition with CPAP was bronchiolitis accounting to 93.7%.CPAP failure was noted in 10.3% of cases, and the major risk factor observed was pneumonia with septic shock. The major complications with invasive ventilation were upper lobe atelectasis and ventilator associated pneumonia (VAP). Comorbidity predisposed to direct invasive ventilation and increased mortality. The mortality in our study population was 14.8%.

Conclusion:

This study highlights that flow inflating device can effectively provide CPAP in an indigenous way in public sector settings without access to conventional NIV machines. The profile and outcome of children on invasive ventilation were analysed. Children in such settings, can be successfully managed with a background of good clinical skills and vigilant monitoring of clinical parameters.

KEYWORDS

Jackson-Rees circuit, Bain circuit,CPAP, bronchiolitis, atelectasis

INTRODUCTION

Critical illness is an alteration in body's basic physiology leading to organ dysfunction, long term morbidity and even death if there is no appropriate and timely intervention. Recognition and management of critical illness among children is a challenge, as unlike adults, children present with subtle signs, rapidly deteriorate due to limited compensatory mechanisms, and a narrow period for therapeutic intervention. Paediatric intensive care unit (PICU) plays a crucial role in the management of such critically ill children with timely resuscitation and stabilisation of vitals.

Respiratory emergencies account for most of the PICU admissions. Although majority of the cases are self limited, some of them require respiratory support either in the form of invasive or non-invasive ventilation. Invasive mechanical ventilation, used in critical care unit, is under continuous evolution with introduction of various new modes of ventilatory support. Although life saving it is associated with complications especially if ventilatory care is prolonged, and also with the drawback of limited resources for mechanical ventilation in intensive care units of developing countries.

Non invasive ventilation (NIV) is an emerging popular concept, being increasingly used now a days, which provides respiratory support

without endotracheal intubation. It avoids complications of invasive ventilation, and has limited resource utilisation. NIV can be delivered either as bilevel positive airway pressure or CPAP- continuous positive airway pressure. In settings with guarded resources for NIV machines, CPAP can be provided through various indigenous means. Providing continuous positive airway pressure ,serves as a 'missing link' between conventional modes of oxygen support and invasive ventilation(1). Flow inflating device –Jackson-Rees circuit (JR) is an excellent mode for providing CPAP in an indigenous way. It can be used for the initial management of children in settings without immediate access to mechanical ventilation(2) . CPAP through Jackson-Rees has been used for respiratory distress due to various etiologies like bronchiolitis, pneumonia, cardiogenic pulmonary edema etc and has shown dramatic improvement. Early initiation of CPAP has even decreased the need for mechanical ventilation, but when the need for invasive ventilation arises (CPAP failure) intubation should not be delayed. Hence vigilant monitoring of children on CPAP through JR is essential.

Respiratory support either through mechanical ventilation or through CPAP is usually the major intervention in PICU, apart from management of shock, ALOC, envenomation, poisoning etc. The various epidemiological factors involved in the assessment of children managed

with such respiratory support, include age, weight, socio-economic status, parental education, place of stay: urban/rural, time to reach tertiary level care from referral centre etc. Such epidemiological factors give us an idea of the common age group that requires ventilatory assistance NIV/invasive; the role of nutritional status in outcome , and also to know if delayed reach to tertiary care from primary care support has adverse effects on outcome. The course of management of such children also depend on clinical parameters like hemodynamic instability, associated co-morbidity, indication and duration for CPAP / mechanical ventilation and the various complications of such management.

STUDY JUSTIFICATION

Respiratory diseases in children account for most of the out-patient visits, ward and emergency admissions. Respiratory emergencies are the common reasons for admissions to PICU (3), presenting either as respiratory distress or failure, and are managed with CPAP / invasive ventilation. The strength of a good critical care unit depends on skilled intensivists, trained nursing care, well equipped facilities, etc. Respiratory support either by CPAP or mechanical ventilation requires exclusive intensive care. The profile of children managed with such support in developed countries is entirely different as they often have adequate resources for NIV machines, mechanical ventilators and nursing care.

The scenario is entirely different in developing countries. Here many critically sick children do not have an immediate access to tertiary care level. Due to limited resources there are only few mechanical ventilators than needed. Although the concept of NIV is emerging, such NIV machines can be established in the public sector only in the long run.

In developing countries, with limited resources, there is a need to resort to indigenous ways for providing CPAP. For example, providing

bubble CPAP, in an indigenous way, was successful in swine flu pandemic in Pune. Flow inflating device- Jackson –Rees circuit, is also an indigenous way of providing CPAP (2) . It helps to alleviate the respiratory distress in many primary pulmonary disorders, and cardiogenic shock due to various etiologies. Despite its benefits, Jackson –Rees is not an alternative for mechanical ventilation, when the child deteriorates and if the need for intubation arises, timely intervention is needed.

Mechanical ventilation , a life saving intervention accounts for 30-64% of PICU management (4). It has its own complications, which are usually due to prolonged ventilatory support. The outcome depends on various confounding factors.

The paediatric intensive care unit of Chengalpattu medical college hospital is 6 bedded with an annexe of 20 beds to care for children post stabilisation. Our annual PICU admissions are around 800 cases, of which around 130 cases require mechanical ventilation and about 220 cases require CPAP support.

Although many studies have been done in the past on the profile of PICU admissions, on NIV and invasive ventilation , both together and individually, I have taken this study to stress the importance of

Jackson-Rees circuit as an indigenous way of providing CPAP, its indications, outcome and various factors affecting the clinical profile of such children. The epidemiological factors assessed in this study helps us to find the age wise incidence and mortality, the importance of parental education and economic status in care of sick children and if delayed reach to tertiary level affects outcome (5).

AIMS AND OBJECTIVES

1. The aim of this study is to assess the epidemiological factors and clinical profile of children managed with continuous positive airway pressure through flow inflating device and mechanical ventilation in Chengalpattu medical college hospital.
2. The importance of Jackson-Rees circuit as an indigenous way of providing CPAP is stressed in this study.
3. The clinical conditions which can be exclusively managed by providing indigenous CPAP, through flow inflating device are analysed.
4. Predictive factors and the clinical conditions of CPAP failure are studied.
5. With regard to invasive ventilation, the common indications and duration of support are analysed.
6. The complications of ventilator support are studied, to find out the common complications in patients managed with invasive respiratory support, the knowledge of which, will help to take preventive measures in future.
7. The role of underlying co-morbid factors, and hemodynamic compromise- septic shock, in the course of management of children requiring such respiratory support are also analysed.

REVIEW OF LITERATURE

Paediatric intensive care unit plays a crucial role in the stabilisation and management of sick children. Recent advances in paediatric critical care medicine has revolutionised the outcome of various paediatric emergencies by early recognition of illness and protocol based step wise management. Invasive and non invasive ventilation play a major role in any paediatric critical care unit.

Epidemiological factors among children managed with CPAP and Mechanical ventilation:

Age:

The assessment of age as a variable helps to find out the common age group requiring respiratory support in critical care unit as well as its relation with outcome, duration of stay etc.

A study was done by Clara Abadesso et al in Portugal on NIV in children. A total of 151 cases with NIV support were studied and infants less than 6 months of age accounted for (84.7%) (6).

Younger age group was associated with CPAP failure (7). A study done by Tanıl Kendirli et al in Turkey showed that 75% of mechanically ventilated patients were under 5 years (4).

Sex:

Sex of children is taken into account to know the pattern of distribution, and it can be analysed with the outcome.

Nutritional status:

Malnutrition is a lethal factor in sick children. It reduces body cell mass, causes fatigue of respiratory muscles, reduces maximum inspiratory pressure and leads to acute respiratory failure (8) (9) (10)

Malnutrition influences the prevalence as well as the intensity of respiratory failure. A study done by 'Elaine Martins Mota' on the influence of malnutrition on mechanically ventilated children found out that the prevalence of malnutrition among mechanically ventilated children was 36.8% compared to 17.6% in well nourished children. The study concluded that malnutrition affects only the morbidity ,as it is associated with prolonged duration of invasive ventilation and thereby prolonged ICU stay especially in children < 1 year and those admitted with primary respiratory illness (11). No association was found between poor nutrition and mortality in ventilated children.

Parental education & socio-economic status:

These variables were taken into account to know if poverty and literacy level of parents, influence the outcome of children requiring

respiratory support in critical care unit. A study done by Tobias Tritschler et al in an intensive care unit in Switzerland found out that social factors and professional status do not affect PICU mortality, duration of ICU stay etc (12). Such factors only play a role in illness prior to admission as poverty and illiteracy force parents to delay visits to health care or resort to harmful native medications.

Distance to tertiary care:

A study was done by David JP O'Callaghan to know whether delayed admission to intensive care has adverse effects on outcome. In this study delayed admission was defined as >3 hours from referral centre to tertiary care. This study concluded that patients in delayed group required more invasive ventilatory support, especially intubation in the first 24 hours, and for a longer duration. No difference was observed in duration of ICU stay or mortality (5). The incidence of delayed admission was 9.3% in this study. A study by Chalfin DB, Trzeciak S et al in North America, defined delayed admissions as > 6 hours, and concluded that the delay group had prolonged hospital stay and increased mortality (13). These were studies done on adult patients, and as such, data in paediatric population is meagre, we have included delayed admissions in our study, to know its impact in outcome of children admitted in intensive care.

Profile of critically ill children in PICU:

Children are admitted to intensive care unit with respiratory, cardiovascular, neurological emergencies, poisoning, envenomation, traumatic injuries etc. The various respiratory illness deserving admission to critical care include bronchopneumonia, bronchiolitis, aspiration pneumonitis, status asthmaticus, non-cardiogenic pulmonary edema etc. The cardiovascular emergencies include tet spell, hypertensive emergencies, arrhythmias, cardiogenic shock due to underlying structural heart disease, myocarditis, cardiomyopthies, sepsis etc. Status epilepticus, raised intracranial tension, encephalitis, meningitis etc are some of the neurological emergencies.Whatever be the disease etiology, the common presentation is usually with respiratory distress, respiratory failure and hemodynamic instability.

Recognition & management of respiratory distress and respiratory failure:

The major cause of cardiac arrest in children are due to respiratory conditions (14) whereas it is usually due to primary cardiac disease in case of adults. Infants and children have a higher frequency of acute respiratory failure when compared to adults (15). Early identification of such critical respiratory illness is essential as children rapidly deteriorate

from respiratory distress to failure and finally to cardiac arrest. Resuscitating a child from respiratory arrest has a good outcome when compared to cardiac arrest (14).

Respiratory distress is characterised by tachypnea and abnormal respiratory efforts in the form of increased work of breathing, or inadequate respiratory efforts. The increased efforts are to maintain adequate gas exchange in the presence of underlying disease. The clinical signs of respiratory distress include tachypnea, tachycardia, increased respiratory efforts, pallor, cold peripheries, anxiety and agitation. When respiratory function deteriorates despite increased efforts, respiratory failure sets in, which is the end stage of respiratory distress.

Critical respiratory diseases in children usually have a narrow period for therapeutic intervention and are characterised by rapid deterioration . Early recognition and management of respiratory distress can prevent progression to failure, but when there are inadequate respiratory efforts, respiratory failure sets in without obvious signs of distress. Respiratory failure results from inadequate ventilation, oxygenation or both and is an emergency which requires timely intervention to prevent progression to cardiac arrest. The clinical signs to recognise failure include an unstable airway, marked tachypnea or

bradypnea , decreased respiratory efforts, apnea, cyanosis, bradycardia, lethargy etc.

The etiology of respiratory distress or failure can be due to

- ✓ Upper airway obstruction : croup, foreign body, anaphylaxis
- ✓ Lower airway obstruction : bronchiolitis, acute asthma
- ✓ Parenchymal lung disease : pneumonia (infectious, chemical, aspiration) ,non cardiogenic and cardiogenic pulmonary edema
- ✓ Disordered control of breathing : raised ICP, neuromuscular weakness, CNS infections, metabolic disorders (14).

Parenchymal lung diseases and lower airway obstruction are among the common emergencies which present to the emergency department. CPAP, non invasive ventilation and mechanical ventilation play an important role in such conditions along with appropriate antibiotics, nebulisation etc.

Continuous positive airway pressure (CPAP) – as a respiratory support:

CPAP is a missing link between conventional forms of oxygen therapy like simple face mask, non-rebreathing mask, oxygen hood etc and the highest form of respiratory support –invasive ventilation.

Physiology of CPAP mechanism in various diseases:

Functional residual capacity (FRC) is the volume of air that is retained in the lungs following normal expiration, which is balanced by the elastic recoil of chest wall and lungs,the forces of which are equal but opposite. At a normal FRC, there is no exertion of the muscles of respiration or diaphragm. When the lungs are diseased, functional residual capacity is either increased or decreased.

Common obstructive lung diseases in children include bronchiolitis and asthma .They are characterised by increased residual volume, air trapping and hyperinflation. Normally for gas flow to occur during inspiration, the upper airway pressure should be higher than the alveolar positive end expiratory pressure. The work done by the inspiratory muscles to drop the baseline alveolar positive end expiratory pressure to a level lower than the upper airway pressure is called ‘threshold work’. Alveolar pressure is normally zero before gas flow during inspiration occurs. CPAP increases the airway pressure and decreases the exertion needed to initiate inspiration. When work of breathing is reduced , it leads to clinical improvement ,as there is a fall in PaCo2 and respiratory rate (2).

Parenchymal lung diseases like pneumonia, cardiogenic pulmonary edema, ARDS are characterised by atelectasis, with reduction in functional residual capacity. When alveoli are collapsed, oxygenation is impaired and deoxygenated blood is shunted to the heart which is called intra-pulmonary shunting. This causes increase in airway resistance with reduction in lung compliance which together results in increase in work of breathing. CPAP when used in such conditions decreases intra-pulmonary shunting and airway resistance. It improves lung compliance and functional residual capacity. When FRC improves, there is recruitment of alveoli and adequate perfusion to the recruited alveoli improves oxygenation, which in turn decreases the work of breathing.

CPAP in cardiogenic pulmonary edema:

Cardiogenic pulmonary edema presents as an acute heart failure with respiratory distress and decreased oxygenation. The pathogenesis behind it is that, there is an increase in systemic vascular resistance, with systolic dysfunction of left ventricle and exudation of intravascular fluid into alveoli and lung interstitium (16). Pulmonary congestion and impaired oxygenation lead to hypoxia to the myocardium. It also causes pulmonary vasoconstriction, with resultant increase in right ventricular pressure, which in turn compromises the effective function of left ventricle .This occurs by ventricular interdependence mechanism(17).

The alveolar edema causes hypoxemia, decreases diffusing capacity and lung compliance. Apart from this , the respiratory muscles have to produce large negative intrathoracic pressures to initiate inspiration and maintain the pressure volume characteristics of the lung (18). This increases both the preload and after-load and aggravates pulmonary edema (19) (20). Respiratory distress in this condition does not correlate directly with the level of hypoxemia , hence oxygen administration alone, cannot reverse it (21).

Continuous positive airway pressure in cardiogenic pulmonary edema helps by the following mechanisms :

- ✓ Prevents collapse of alveoli
- ✓ Opens up flooded alveoli
- ✓ Overcomes intrinsic PEEP
- ✓ Decreases dead space

In this way it improves ventilation to the alveoli (22)(23). CPAP also increases the flow and pressure during both inspiration and expiration, which leads to an increase in tidal volume, thereby unloading inspiratory muscles (24). It causes a reduction in left ventricular transmural pressure, increases intrathoracic pressure, which causes a reduction in preload and afterload ,thereby improving cardiac output. CPAP also helps to alleviate the tachycardia associated with respiratory

distress. The mechanism behind it is that the lung inflation caused by CPAP, increases the parasympathetic tone which causes a reduction in heart rate (25).

Various modes of providing CPAP :

- **Stand-alone CPAP machines**
- **CPAP mode in ventilator**
- **Bubble CPAP :**

Most commonly used in neonates where it is extremely useful in respiratory distress syndrome. Level of insertion of expiratory limb in water determines the PEEP. The continuous bubbling produces positive pressure oscillations which help in gas exchange (1).

- **NIV machines :**

Non invasive ventilation is the mode of providing ventilator support by means of external interfaces, through the patients upper airway (26). It does not bypass the upper airway which usually occurs in endotracheal intubation, laryngeal mask and tracheostomy. It provides positive pressure in a non invasive way and avoids the complications associated with mechanical ventilation. NIV provides both continuous positive airway pressure (CPAP) and bi-level pressure (inspiratory positive airway pressure – IPAP and expiratory positive airway pressure –

EPAP(26) . NIV is an emerging popular trend and is increasingly used in developed countries and the private sector of developing countries, and is beneficial in treatment of acute respiratory failure in children.

Indigenous way of providing CPAP:

- **Indigenous bubble CPAP :**

The materials needed include ICD bag or bottle with water, humidifier, tubing , oxygen source , nasal prongs as interface. It is a cost effective method in settings with limited resources. It can be used for respiratory distress in neonates and also in infants with mild to moderate respiratory distress, eg: bronchiolitis. Bubble CPAP can be used with a maximum age cut off, of upto 10 kg .

Indigenous bubble CPAP was effectively used in a swine flu pandemic in Pune. Here the median age group was 18 months and the mean duration of CPAP was 2 days (27) .

Flow inflating device:

Jackson- Rees circuit and paediatric Bain circuit, can also be used to provide CPAP. These anaesthesia circuits devised by Mapleson, can be used in intensive care settings, with the benefits of providing 100% oxygen as well as continuous positive airway pressure. In public sector with poor resources, where it would take years to implement NIV

machines, flow inflating device has been extremely useful . This was supported by Sanabria et al who observed that CPAP provided with Mapleson D circuit (Bain circuit) can successfully provide non invasive ventilation for children with acute respiratory failure (28).

CPAP interfaces :

- Oro-nasal or nasal masks
- Nasopharyngeal tubes
- Nasal prongs
- Nasal cannula
- Endotracheal tube

Basic physics behind flow inflating ventilation device :

Semi-closed breathing circuits were devised by Mapleson . They are of five types: Type A, B,C,D ,E. Type F- Jackson-Rees circuit was later added to the classification.

Bain circuit - modified Mapleson D :

It is a co-axial circuit with inner and outer tubes. The inner tube is for delivery of fresh gas. Exhaled gases come out through the outer tube. In this way there is no mixing of fresh gas and expired air (29). The adjustable pressure limiting valve (APL) is near the breathing bag. Fresh

gas flow should be 2.5 times the minute volume when it is used for spontaneous ventilation.

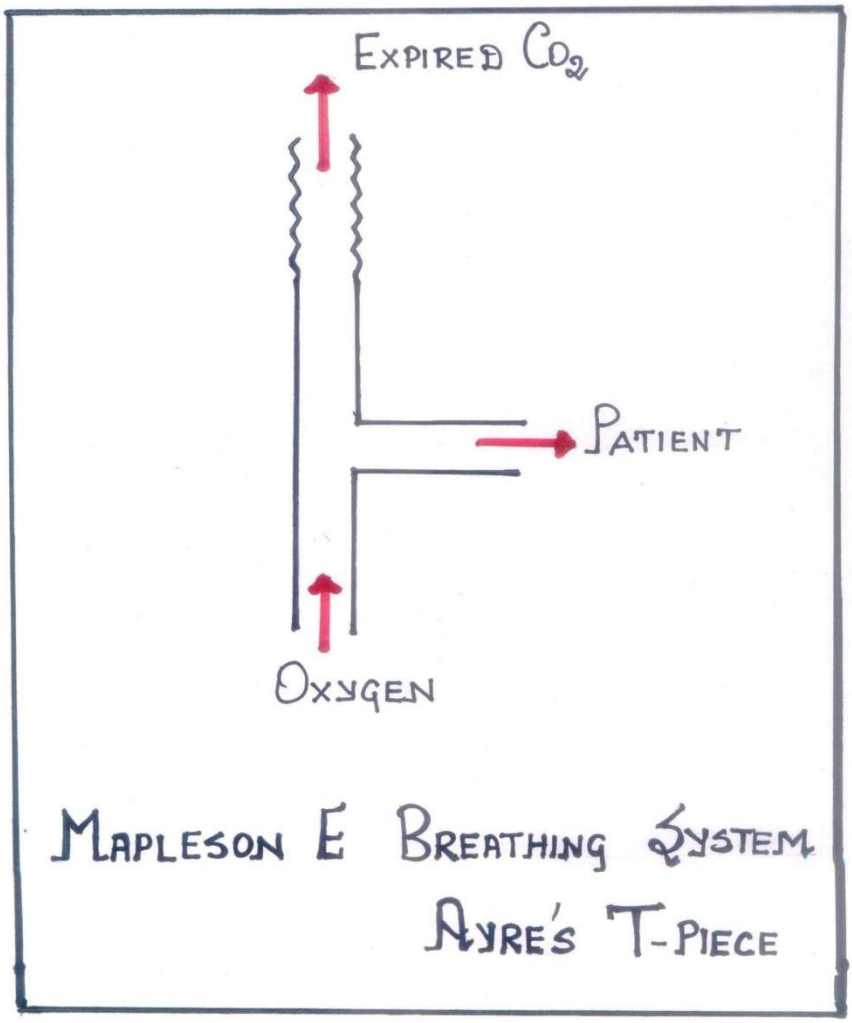
Jackson –Rees circuit: Mapleson F

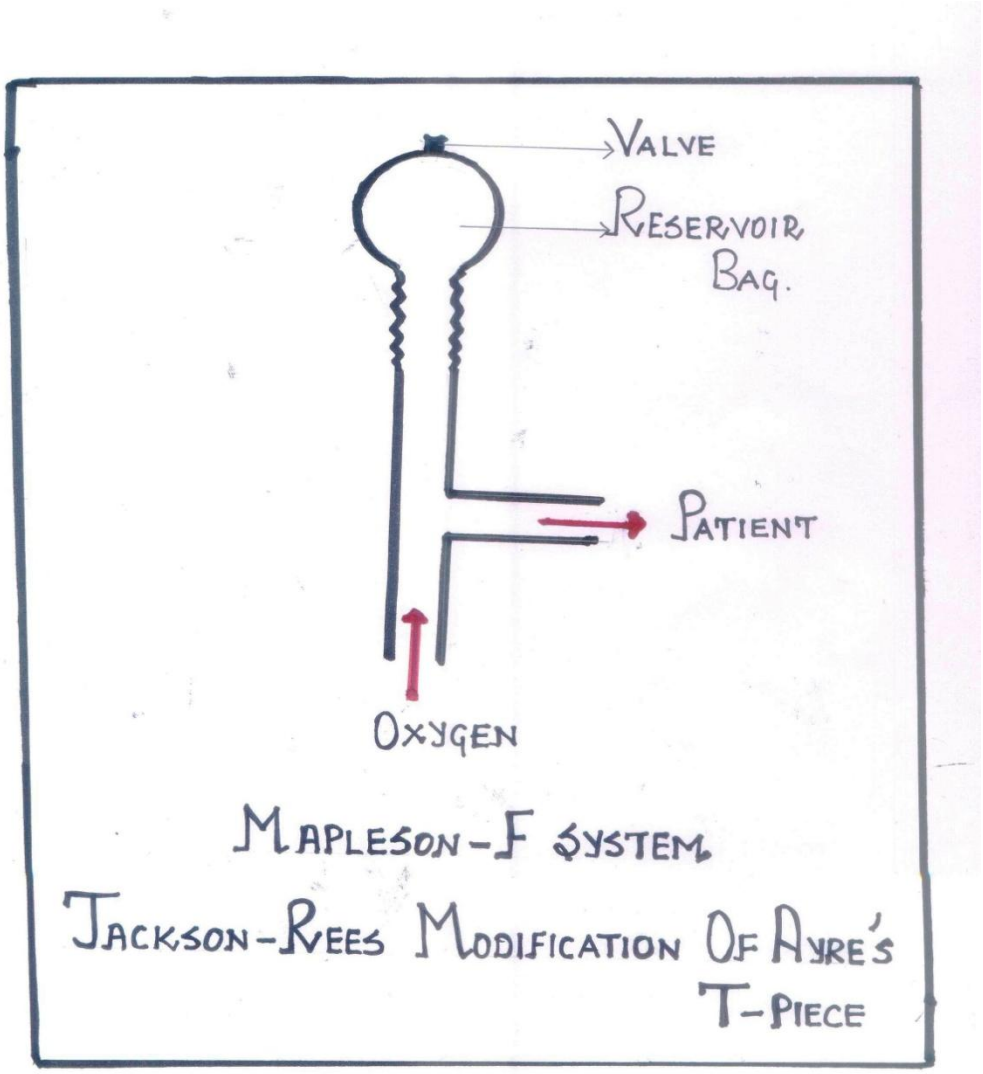
Most commonly used paediatric circuit. Used in children of age < 6 years and weight < 20 kg. It is a modification of type E circuit , by attaching a breathing bag. For spontaneous ventilation to take place , the fresh gas flow is atleast 2.5 times the minute volume, and for controlled ventilation, 1.6 times the minute volume (29).Usually a valveless circuit. Some of the F circuits are provided with the adjustable pressure limiting valve- expiratory valve, which permits the exhaled gas to be removed safely.

How does a Jackson-Rees circuit provide CPAP?

Gordon Jackson-Rees, a paediatric anaesthetist modified Mapleson circuit E, by attaching a double ended bag to the expiratory limb. A double ended bag is one with openings at each end. There is an adjustable expiratory valve at the end of the bag. During controlled ventilation, this valve can be manually adjusted to regulate PEEP as well as the amount of inspiratory pressure delivered. Partial closure of this valve along with simultaneous compression of the bag, delivers positive pressure

ventilation. During spontaneous ventilation, partial closure of this valve provides continuous positive airway pressure - CPAP (30).





Parts of a flow inflating ventilation device:

- **Face mask :**

Should have a good air tight seal covering nose and mouth with an inflatable rim. Should be transparent, which helps to recognise the mist which forms during exhalation, to identify regurgitation, profuse secretions, colour of the lips, and froth which indicates the setting of pulmonary edema during fluid resuscitation.

- **Adjustable pressure limiting valve (APL):**

This when kept partially open, allows escape of exhaled air, and avoids rebreathing.

- **Reservoir :**

250ml : neonates & infants

500 ml : < 5 years

1000 ml : older children

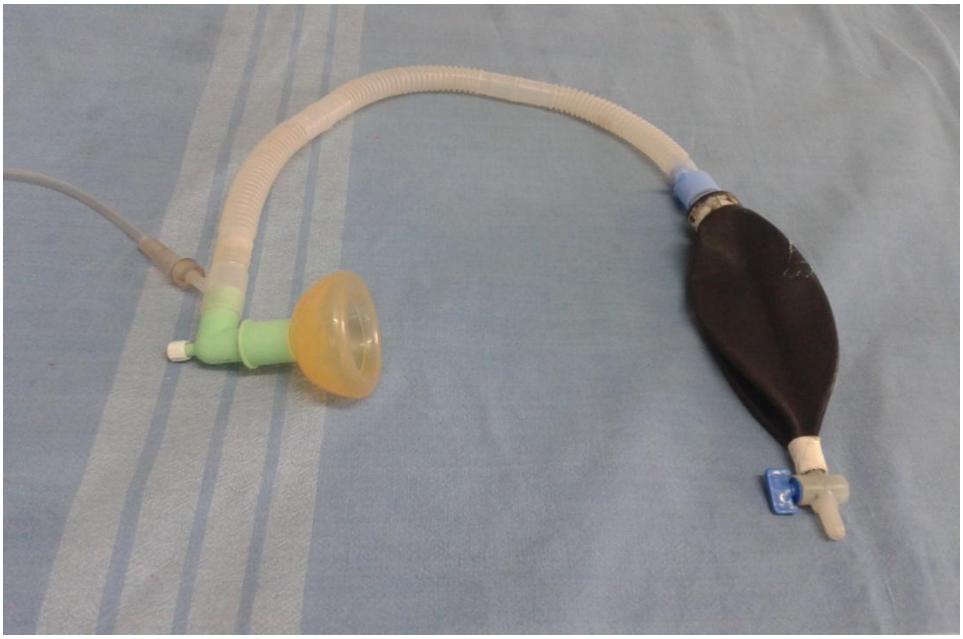
The reservoir should remain inflated, and moves in and out during ventilation. It can be compressed to assist ventilation.

- **Tubing :**

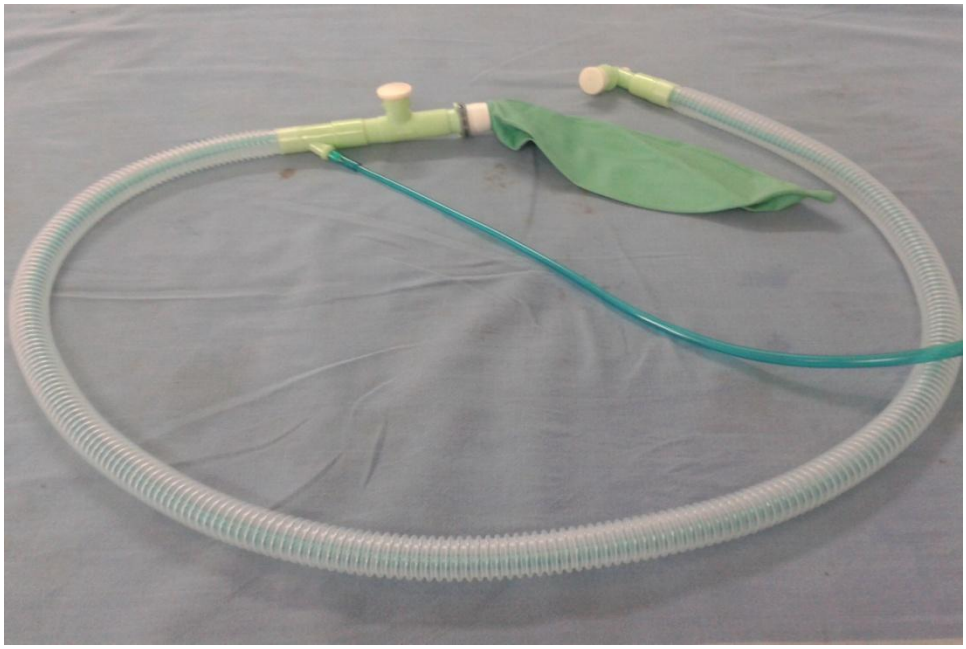
This connects the device to oxygen source and provides the continuous gas flow which is needed.

- **Corrugated tube :**

Connects the reservoir end with face mask.



Jackson –Rees circuit



Bain circuit

Steps to consider while using flow inflating device- Jackson – Rees circuit (2) **:**

- Should be used in children with spontaneously maintainable airway.
- The mask should provide an air tight seal and should be transparent
- Caretaker should be taught to hold the mask, such that the reservoir is completely inflated at all times.
- The expiratory valve should be partially open.
- Continuous oxygen flow should be ensured.
- Children with severe hypoxia are irritable with incessant cry. Posturing is noted when the mask is initially held. Continuing to hold the mask firmly, helps to resolve hypoxia, and tolerance improves.

Contraindications to the use of flow inflating device- Jackson – Rees circuit:

- Apneic child
- Depressed level of consciousness- pain responsive/ unconscious
- Decompensated shock- a sign of imminent arrest.
- Fixed upper airway obstruction

- Inability to protect airway
- Copious respiratory secretions
- Undrained pneumothorax
- Facial trauma
- Recent facial, upper airway or upper GI surgery

Caution:

- **Reservoir :**

The reservoir should move in and out during respiration. It should just be fully inflated indicating adequate gas exchange. Over distension of the reservoir indicates either excessive gas flow or closure of the pressure release valve. A deflated reservoir indicates inadequate seal of the interface or reduced gas supply.

- **APL valve :**

When the expiratory valve is closed or blocked, there is accumulation of exhaled gas. This causes increase of pressure and volume within the system , thereby increasing the intrathoracic pressure which in turn leads to air leaks, and increases ICP in patients with cerebral edema (2).

- **Oxygen flow :**

An adequate flow of oxygen is essential to flush out the expired CO_2. Inadequate oxygen supply causes hypercarbia, which increases ICP and predisposes to arrhythmias.

Basic conditions warranting use of Jackson –Rees / Bain circuit:

- In spontaneously breathing children who present with respiratory distress in conditions, where positive pressure through CPAP helps to alleviate distress.
- For assisted ventilation following intubation.
- During fluid resuscitation in children with myocardial dysfunction due to various etiologies , to tide over pulmonary edema.

Various clinical conditions where flow inflating device can be used :

- Bronchiolitis
- Bronchopneumonia
- Septicaemia/ septic shock
- Scorpion sting with myocardial dysfunction
- Management of cyanotic spell
- Kerosene- aspiration pneumonitis
- Congestive cardiac failure – CHD /RHD

Implementing CPAP through Jackson Rees / Bain circuit:

- Based on clinical decision. ABG not mandatory
- The care taker should be taught the correct method of holding the mask, and reassurance to be given, regarding tolerance to the mask as hypoxia improves.
- Bedside care by intensivist and nursing personal , monitoring the movement and inflation of the reservoir indicating adequate ventilation.
- Initial period is labour intensive, and so is the entire period of indigenous CPAP, which requires meticulous monitoring to prevent delayed intubation.

Monitoring a child on flow inflating ventilation:

Cardiac monitor and pulse oximetry are used as in any critically sick child. Children need vigilant monitoring, as it is essential to identify CPAP failure at the earliest, and proceed with invasive ventilation. Clinical monitoring of vital signs and regular bedside cardiopulmonary cerebral assessment would suffice. We resorted only to clinical assessment for monitoring such children, which is also supported by the study done by Lucy et al in an intensive care unit in Malaysia(31) .We did not perform blood gas analysis in our patients. This was also

concluded by Bernet et al in their study , as they did not find alterations in blood gas analysis as a factor to predict failure of CPAP (32).

Advantages with indigenous CPAP through flow inflating device:

- Avoids the risks associated with intubation
- Decreases nosocomial pneumonia
- Decreases the need for sedation
- Reduces the length of ICU and hospital stay
- Cost effective particularly in settings with limited resources
- Handy equipment and easy to handle
- Intermittent breaks for procedures like nebulisations.

Drawbacks with flow inflating device:

- Laborious for caretaker, to manually hold the mask firmly especially for young children.
- Frequent displacement of mask by an agitating hypoxic child, during initial period of application , until tolerance improves.
- Risk of aspiration
- Requires vigilant monitoring for timely intubation, when a child slips into respiratory failure, for delayed intubation significantly increases mortality.
- Amount of PEEP and FiO_2 cannot be titrated as it is an indigenous way of providing CPAP.

Complications:

- Nasal and pharyngeal dryness
- Local skin irritation from pressure due to mask
- Aspiration
- Air leaks

Criteria to discontinue CPAP:

- A child with severe agitation – fighting the mask
- Profuse secretions
- Depressed level of consciousness during the course
- Progression from compensated to decompensated shock
- Worsening clinical condition

Reasons for failure:

- Severity of underlying disease
- Disease progression
- Frequent interruptions of the interface- inadequate CPAP support

Mechanical ventilation:

It is the highest form of respiratory support in a critical care unit. It is a life saving intervention to support the cardio respiratory status, until the underlying disease is cured. Although a major intervention, it has its

own complications. Studies report that among the conditions that need management in intensive care, more than 50% complications are attributed to ventilatory support ,especially if ventilator care is prolonged (33) (34).The percentage of mechanical ventilation in PICU ranges from 30-64% (4). Invasive ventilation is under continuous evolution, with various new modalities in ventilator support being introduced. Pressure modes are commonly used in children. The job of a physician does not end with intubation and connecting the patient to ventilator support alone; as invasive ventilation is not a treatment per se. The underlying disease warranting this respiratory support should be identified and treated. A favourable outcome requires good nursing care and meticulous management of an intensivist. The child should be assessed clinically regarding the tolerance to extubation everyday, to minimise the complications associated with prolonged ventilator support.

Indications:

Respiratory diseases are among the common indications for respiratory support. One third to half of PICU admissions are respiratory illnesses; and one third of these require ventilator support. Apart from respiratory pathology, there are various other conditions which warrant ventilator support. Kendirli et al in his study classified the indications for ventilator support into four groups(4).

(a) Respiratory failure :

The underlying causes can be bronchiolitis, pneumonia, upper airway obstruction, asthma etc.

(b) Cardiovascular failure :

Cardiogenic shock due to underlying heart disease, myocardial dysfunction due to sepsis, scorpion envenomation etc, circulatory failure with refractory shock.

(c) CNS disease :

Child may need ventilator support for refractory status epilepticus, coma, raised ICP etc.

(d) Safety airway :

Septicemia , decompensated metabolic acidosis.

Thus it is clearly evident that mechanical ventilation is one of the major indications deserving admission to critical care unit(35). Kendirli et al in their study, in a paediatric intensive care unit in Turkey, observed that the commonest indication warranting mechanical ventilation, was acute respiratory failure , which was observed in 64.8% of their ventilated patients; and the common underlying diagnosis was pneumonia (4). Farias et al in their study stated that the main indication for

mechanical ventilation in developing countries was acute pulmonary disease, whereas in developed countries , it was postoperative state (36).

Complications:

Despite the unquestionable benefits of mechanical ventilation, it bears its own morbidity and mortality risks. The complications of invasive ventilation can be as follows:

(a) Procedure of intubation :

This can be due to laryngeal trauma, mucosal injury and bleeding during intubation. Complications can also arise from the drugs used for intubation, as in RSI – rapid sequence intubation.

(b) Complications with ventilatory support :

Positive pressure support through mechanical ventilation, has various physiological and mechanical adverse effects. The physiological side effects are mostly due to high mean airway pressure, which decrease cardiac output and venous return. Air leaks are dangerous life threatening complications, which should be recognised immediately and managed aggressively for favourable outcome. The side effects due to prolonged ventilation include VAP- ventilator associated pneumonia, atelectasis, upper airway obstruction etc. This warrants the benefits of early extubation , once the underlying disease condition improves.

(c) Mechanical misadventures:

These include endotracheal tube block due to secretions, disconnection of ventilator tubings, unplanned extubation, malfunction of ventilator etc. These are largely preventable by continuous monitoring of patient and machine.

Incidence of complications in few studies:

Kendirli et al in their study, in a paediatric critical care unit in Turkey, observed a complication rate of 42.8% among mechanically ventilated children . Of this , the individual complication rate due to various conditions were as follows(4) ;

- ✓ VAP – ventilator associated pneumonia – 17.5 %
- ✓ Atelectasis - 26.3%
- ✓ Pneumothorax – 13.1%
- ✓ Tracheal edema – 4.3 %
- ✓ Bleeding – 5.4%
- ✓ Chronic lung disease – 2.1 %

Wang et al in their study reported that out of 31.9% patients mechanically ventilated, VAP and atelectasia attributed to 13.8% each (37). Tullu et al , reported 27.4% VAP cases among 59 mechanically ventilated children (38).

Thus the use of mechanical ventilation should be balanced in such a way, to gain its benefits and minimise complications. The emerging concept of use of NIV, helps to avoid the risks and side effects of invasive ventilation. NIV has been found to have a definite role in acute care setting in children as evident from studies done so far.NIV machines are now commonly used in developed countries, and is also being increasing used in the private sector of developing countries. Indigenous ways of CPAP are an alternative in public sector of limited resource areas, until the establishment of NIV machines in the long run. One such way is providing continuous positive airway pressure through flow inflating device- Jackson-Rees circuit, which when used in the properly selected child, leads to improvement and even reduces the need for mechanical ventilation.

Hemodynamic instability in children on CPAP & invasive ventilation:

Early recognition and management of shock is a key to successful resuscitation in sick children. Shock results from impaired tissue perfusion, inadequate oxygen delivery to tissues and subsequent cellular hypoxia. The resultant metabolic derangements and compensatory hemodynamic changes which take place initially are reversible if timely intervention is done.

The types of shock are:

- Hypovolemic shock
- Distributive shock
- Cardiogenic shock
- Obstructive shock

Of these types, hypovolemic shock rarely requires respiratory support in the form of invasive or non invasive ventilation. Adequate fluid resuscitation is sufficient in such cases.

Children on NIV / mechanical ventilation usually have distributive or cardiogenic shock with sepsis as the major detrimental factor in these cases, causing myocardial dysfunction, maldistribution and hypoperfusion.

Clinical features to recognise shock:

Tachycardia, tachypnea, respiratory distress, cool peripheries, prolonged CRT, weak/bounding pulse, mottling, pale/dusky/cyanosed peripheries.

Compensated shock:

Here body adapts by redistribution of blood to vital organs, increased oxygen consumption for metabolic demands with resultant

reduced oxygen saturation of venous blood. Here blood pressure is maintained.

Decompensated shock :

Also referred as hypotensive shock. Indicates severe myocardial dysfunction. A sign of imminent arrest.

Sepsis/septic shock in children on CPAP and invasive ventilation:

Systemic inflammatory response syndrome (SIRS) (39) :

Cardinal clinical signs:

- Fever / hypothermia
- Tachynea : RR > +2 SD
- Tachycardia : HR > +2 SD

Other features :

- Leucocytosis / leucopenia
- Band count > 10%

Infection:

- Suspected infection by any pathogen
- Proved infection- organism identified by culture or antigen detection

- Clinical picture highly suggestive of infection – skin changes: petechiae, mottling , purpura etc , leucocytosis in sterile third space fluid , evidence of pneumonia in CXR(39) .

Sepsis:

SIRS + infection

Severe sepsis:

Sepsis + organ dysfunction

Either cardiovascular or respiratory or 2 or more other systems.

Septic shock:

Sepsis and myocardial dysfunction **.**

Septicemia and associated septic shock are to diagnosed only on clinical grounds. Sepsis is a major detrimental factor in sick children. The early signs of septic shock in children are subtle and there is usually a narrow period for therapeutic intervention. When such early signs are overlooked, shock resuscitation becomes difficult. Isolation of the organism or laboratory parameters are needed only to know the disease course and to modify treatment and not for establishing a diagnosis of sepsis/septic shock. It is estimated that septic shock occurs in 5 – 30 % of sick children with sepsis(40).

Early intervention with fluid therapy plays a major role in stabilising such children with shock. Caricillo, et al in his study documented a favourable outcome in children who were resuscitated with fluids in the first hour(41).

A study in an intensive care unit in Pakistan by Muhammad Rehan Khan et al concluded that sepsis was present in 17.3 % of the admitted cases. 18 months was identified as the median age and infants occupied the major proportion of the group(42). Watson et al in his study also found that 48% of cases identified as sepsis occurred in infants < 1 year of age (43). Wolfler and Silvani in their studies found a male preponderance of 55-59% (44).

Sepsis in children is associated with significant mortality as evident from studies done so far. Studies in early 1980s and 1990s in children with septic shock showed a 50% mortality (45)(46). Stoll et al in 1998 reported that infant sepsis mortality rate was 21 % (47). A recent report from United Kingdom showed a mortality rate of 17% among children with septic shock in intensive care (48). Sepsis related deaths account for 80% of the mortality in children less than 4 years which is evident from WHO statistics (49).

MATERIALS AND METHODS

Study place:

Paediatric intensive care unit - Department of Paediatrics, Chengalpattu medical college hospital.

Study design:

Observational study

Study period:

November 2013 – September 2014

Study population:

Children admitted to paediatric intensive care unit, in the age group 1 month to 12 years who required either continuous positive airway pressure (CPAP) or mechanical ventilation.

Sampling:

Sample size was calculated based on the assumption that Level of confidence at 95% and success rate of CPAP from previous studies is 70%. So the sample size is 323 and it is rounded to 325.

Inclusion criteria:

Critically sick children admitted to PICU, who require respiratory support in the form of CPAP through flow inflating device and

mechanical ventilation, of any etiology, including both sexes in the age group 1month – 12 years.

Exclusion criteria:

Neonates were excluded from the study as the cause of respiratory distress and pathophysiology in them is entirely different.

Consent:

An informed consent was obtained from parents of the children included in the study. The aims and objectives of the study were explained to them. They were reassured that ,children would get the form of respiratory support that their clinical condition demands, which under no circumstances will be altered for the sake of the study. The ethical clearance for the study was obtained.

Proforma:

We had a pre-designed proforma to record data for each child. It included the various epidemiological parameters, symptomatology, clinical examination and vital signs on admission, shock correction, investigations, the indications and duration of CPAP and mechanical ventilation, complications and outcome.

Methodology:

The demographic profile of admitted children requiring either CPAP or invasive ventilation was recorded.

Epidemiological factors:

Age:

Age was divided into 4 groups**:** 1) 1 month-1yr 2) >1-3yrs 3) >3-8yrs 4) > 8-12 yrs. We divided in this way, as previous studies have shown more CPAP use in infancy followed next by toddler age group. It also helps to find out the age group with favourable and adverse outcome.

Weight:

It is classified as

1) normal
2) Grade 2 malnutrition - IAP classification- weight for age 61-70% of expected.
3) Grade 3 & Grade 4 malnutrition - IAP classification
   - Grade 3: weight for age 51-60 % of expected.
   - Grade 4: weight for age < 50 % of expected.

Socio-economic status:

Socio economic status was taken into account as per modified Kuppusamy's scale of classification.

Parental education:

This was to find out whether illiteracy resulted in delay to seek health care advice leading to unfavourable outcome.

Place:

This was to identify the background of critically sick children. It helps to assess the distribution of health care services , as better facilities in urban areas may lead to early identification and management of illness thereby preventing its progression to a critical stage.

Distance to tertiary care:

This is the time taken to reach our intensive care unit from the place of referral. A study done by David O' Callaghan classified the time delay as < 3 hours and >3 hours from the place of referral to admission in tertiary care centre (5). We have further included a < 1 hour duration to find out if early admission favours a good outcome.

Clinical assessment:

The cardinal symptoms of admitted children were recorded. The cardiopulmonary cerebral assessment was done for all children and vital signs were recorded. The clinical parameters are defined as follows:

Respiratory distress:

Defined as open and maintainable airway, tachypnea with respiratory rates more than the normal cut-off for age, increased work of breathing with subcostal/intercostal retraction, flaring of alar nasi, grunt , tachycardia with a normal to irritable sensorium.

Respiratory failure:

Here the airway is not maintainable, the respiratory efforts are either severe or shallow, either tachycardia or progression to bradycardia, presence of cyanosis, with a pain responsive to unresponsive sensorium.

Circulatory failure: Shock

Clinically characterised by disproportionate tachycardia, cool peripheries, weak pulse, colour being pale, dusky or cyanosed along with effortless tachypnea or respiratory distress.

Severity of shock :

Compensated shock – here blood pressure is maintained.

Decompensated shock – presents with hypotension

In children, commonly distributive and cardiogenic shock present with respiratory distress and failure warranting CPAP or ventilator support.

Comorbidity:

The underlying comorbid factors , are taken into account , to know their influence on duration and outcome of CPAP and mechanical ventilation.

The cardiopulmonary cerebral assessment was performed for each child following which , it was decided whether the child can be managed with CPAP alone or requires mechanical ventilation. We did not have any scoring system to start CPAP / invasive ventilation, but resorted only to clinical assessment of the child's physiological status .

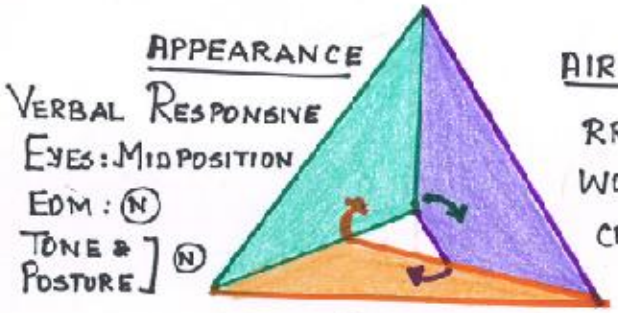
Indications for CPAP through flow inflating device –Jackson-Rees/ Bain circuit:

CPAP was initiated on clinical grounds based on the Paediatric assessment triangle as follows :

- Children who present with a maintainable airway and respiratory distress/ failure with verbal responsive sensorium.
- Respiratory distress with compensated shock with underlying CHD, sepsis etc.
- In scorpion myocardial dysfunction, CPAP was initiated even in a conscious/alert child when they present with respiratory distress, as here positive end expiratory pressure (PEEP) through CPAP helps to tide over pulmonary edema.

Respiratory Distress

Bronchiolitis/Broncho Pneumonia



Appearance

Verbal Responsive
Eyes: Mid Position
EDM: (N)
Tone & Posture] (N)

Airway

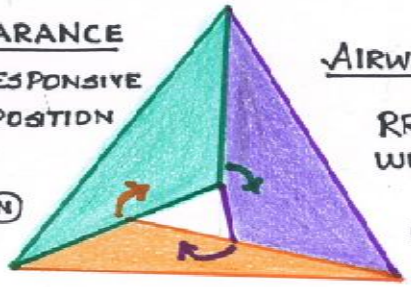
RR ↑
Work of Breathing ↑
Crepts/Wheeze

Circulation

HR (N)/↑
Perfusion: (N)
Liver span: (N)
BP: (N)

Respiratory Distress With Compensated Shock

Broncho Pneumonia With Septic Shock



Appearance

Verbal Responsive
Eyes: Mid Position
EDM: (N)
Tone Posture] (N)

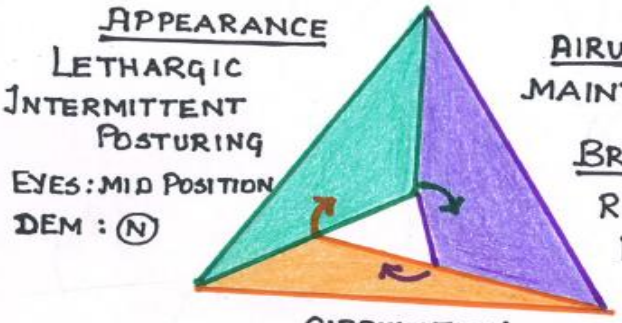
Airway

RR ↑
Work of Breathing ↑
Crepts (+)/(-)

Circulation

HR ↑
Perfusion: ↓
Liver Span N/↑
BP: (N)

Cardiogenic Shock : Underlying CHD



Appearance
Lethargic
Intermittent
Posturing
Eyes: Mid Position
DEM : (N)

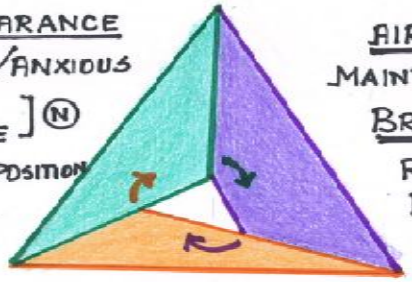
Airway
Maintainable

Breathing
RR ↑, Grunt
Retractions
Rales, Cyanosis

Circulation
HR ↑
Perfusion ↓
Liver span ↑
BP (N)

Cardiogenic Shock

Scorpion Sting : Myocardial Dysfunction



Appearance
Alert/Anxious
Tone
Posture] (N)
Eyes: Midposition
EOM: Full

Airway
Maintainable

Breathing
RR ↑
Retractions (+)
Crepts (+)

Circulation
HR ↑
Perfusion ↓
Liver span ↑
BP (N)

Clinical conditions which benefit from flow inflating device:

The individual clinical conditions which benefit from CPAP are defined as follows:

Bronchiolitis:

It is defined as a respiratory illness in children in the age group of 1 month to 2 years, presenting with cough, rhinitis, tachypnea, increased work of breathing , wheeze, crepts, with or without fever ,with xray evidence of hyperinflation, sail sign etc, without consolidation .

Here CPAP through Jackson-Rees circuit is useful in children where respiratory distress does not respond to nebulisations and conventional methods of oxygen therapy as it helps in unloading of respiratory muscles.

Pneumonia:

It is characterised by fever, cough, respiratory distress with suggestive radiographic evidence.

Here CPAP support helps in children with moderate to severe retractions, and grunt, where early CPAP even helps to prevent intubation.

Septicaemia / septic shock:

Septicaemia is defined as features of SIRS + infection. Septic shock is sepsis with myocardial dysfunction(39).

Scorpion sting with myocardial dysfunction:

Cardiac dysfunction and pulmonary edema, a dreaded complication of scorpion envenomation is due to excess release of catecholamines. Here providing PEEP in an indigenous way through flow inflating device, helps to alleviate respiratory distress.

Other conditions :

Kerosene ingestion –Aspiration pneumonitis

CHD/ RHD- Carditis / CCF

Bronchial asthma etc

Duration of CPAP:

It is divided as follows: a) 24-48 hours b) 48-96 hours c) > 96 hours.

This division is supported by the study done by Clara Abadesso et al, where the mean duration of NIV was 48 hours (6) . A study done in Mehta's children hospital showed > 48 hours as the maximum time for CPAP support. We have split that as 48-96 hours and > 96 hours in our study.

CPAP success:

CPAP alone as a respiratory support was considered successful when there was clinical improvement in respiratory distress, with decrease in respiratory rate, work of breathing, heart rate, without a deterioration in sensorium.

CPAP failure:

CPAP failure was considered when children had worsening respiratory distress or shallow breathing with apneic spells, hypotensive shock, with deterioration in sensorium either as pain responsive or unresponsive .Such children had to be subsequently intubated and started on invasive ventilation.

CPAP failure to mechanical ventilation:

In cases which failed CPAP through flow inflating device, we have divided the initial period of CPAP support as a) < 12 hours b) 12-24 hours c) > 24 hours. The initial 12 hour period was taken into account based on the study by Clara Abadesso et al, where in the NIV failure group , the duration was divided as < 1 hour, 1-12 hours, > 12 hours (6).The other two time durations were randomly assigned, as most of the cases which failed CPAP were either less than or more than 24 hours.

Mechanical ventilation indications:

a. Respiratory failure

b. Imminent arrest

c. Refractory/hypotensive shock

d. Status epilepticus

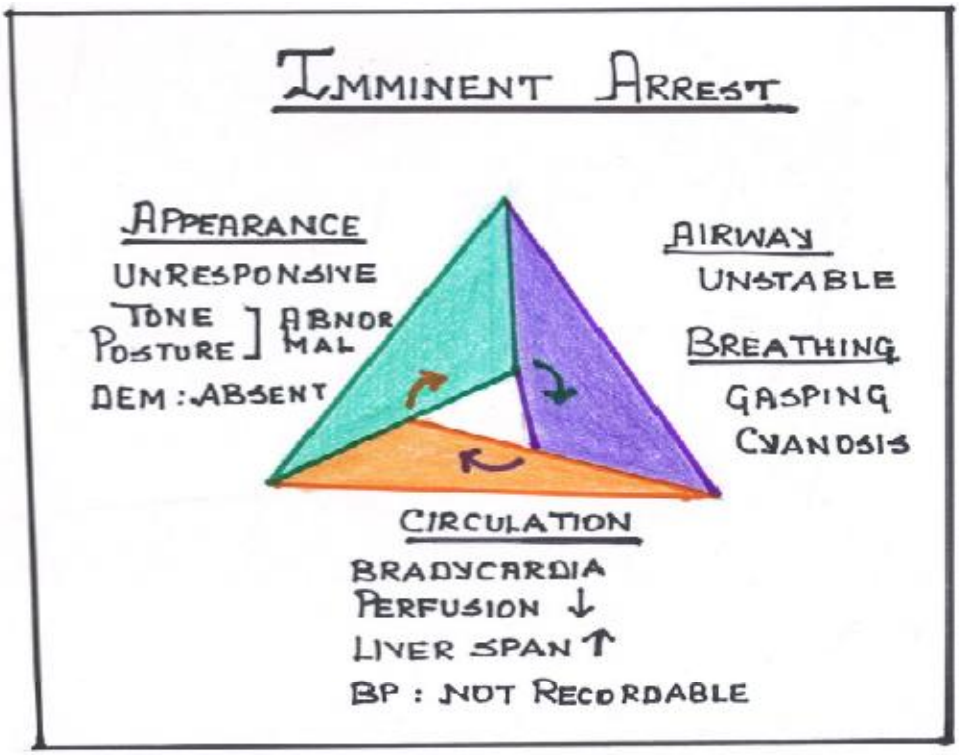
e. Anaphylaxis

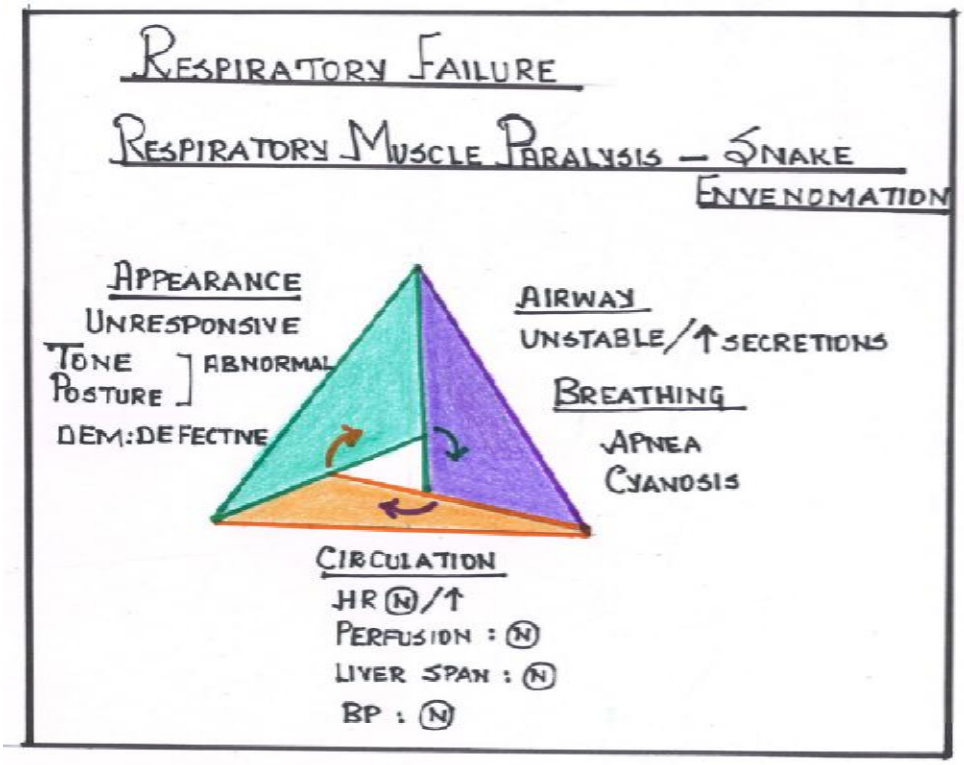
f. Coma

g. Pulmonary edema

h. Increased ICP

i. Cardiogenic shock





Mechanical ventilation duration:

It was divided as < 72 hours and > 72 hours based on a Haryana study which had 72 hours as the maximum duration of invasive ventilation (50).

Extubation & Reintubation :

We divided the cases as after spontaneous and planned extubation and also analysed the causes of reintubation.

Complications:

The individual complications of CPAP and mechanical ventilation were studied.

Ventilator associated pneumonia (VAP) :

It is a hospital acquired pneumonia, which develops 48 hours after initiation of mechanical ventilation.

Post intubation stridor:

Defined as the stridor that develops following extubation , due to edema of glottis ,which can be due to prolonged intubation or larger size endotracheal tube used.

Upper lobe collapse:

Common following extubation, in the right upper lobe. It is defined as a triangular opacity, with loss of lung volume, crowding of ribs, tracheal shift to same side, elevation of hemidiaphragm. It usually clears with good chest physiotherapy .

Statistics Analysis:

The Categorical variables were expressed as Frequency and percentage. The Quantity variables were expressed as mean $\pm$ standard deviation. Descriptive statistics were used to evaluate baseline characteristics.

The group comparisons for the categorical variables were analysed using Chi square test and within group, comparison of quantity variables were analysed using independent t test.

The p value of less than 0.05 was considered as statistically significant. The statistical analysis was carried out using statistical software SPSS 19.

RESULTS AND OBSERVATION

This was an observational study done during a period of one year to determine the epidemiological factors and clinical profile of children managed with indigenous CPAP through flow inflating device and mechanical ventilation.

The epidemiological factors were analysed based on the common age group, nutritional status, socio-economic status, literacy level of parents, time to reach tertiary level care etc. The clinical profile of the common indications , duration, outcome and complications of children managed with CPAP and invasive ventilation were analysed.

The results are as follows :

Table 1: Age distribution of study population

	Total	**%**
1 month – 1 year	245	**75.4**
> 1 year- 3 years	49	15.1
>3 years- 8 years	21	6.5
>8 years- 12 years	10	3.1
Total	**325**	

Chart 1:

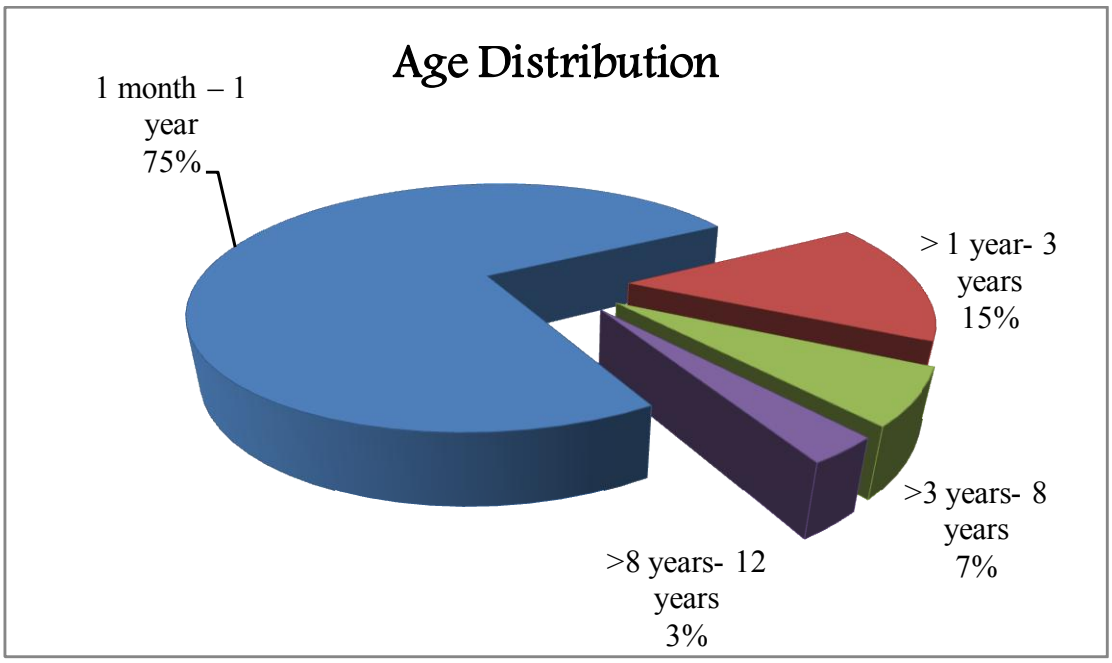


Table 2: Gender distribution

Male	180	55.4 %
Female	145	44.6 %
Total	325	

Table 3: Distribution based on nutritional status

	Total	**%**
Normal	289	89.8
Grade 2 malnutrition	33	**10.2**
Total	322	

Table 4: Socio Economic Status

	Frequency	**Percent**
Upper Middle	2	.6
Lower Middle	41	12.6
Upper Lower	212	**65.2**
Lower	70	21.5
Total	325	100.0

Table 5: Parental Education

	Frequency	**Percent**
Literate	103	31.7
Iliterate	222	**68.3**
Total	325	100.0

Table 6: Urban/ rural background of study population

	Frequency	**Percent**
Urban	89	27.4
Rural	236	**72.6**
Total	325	100.0

Table 7: Distribution of Time to reach Tertiary Care from referral centre

Time to Tertiary Care	Total	Percent
< 1 hour	25	7.7
1 hour – 3 hours	225	**69.2**
>3 hour	75	23.1

Epidemiological profile:

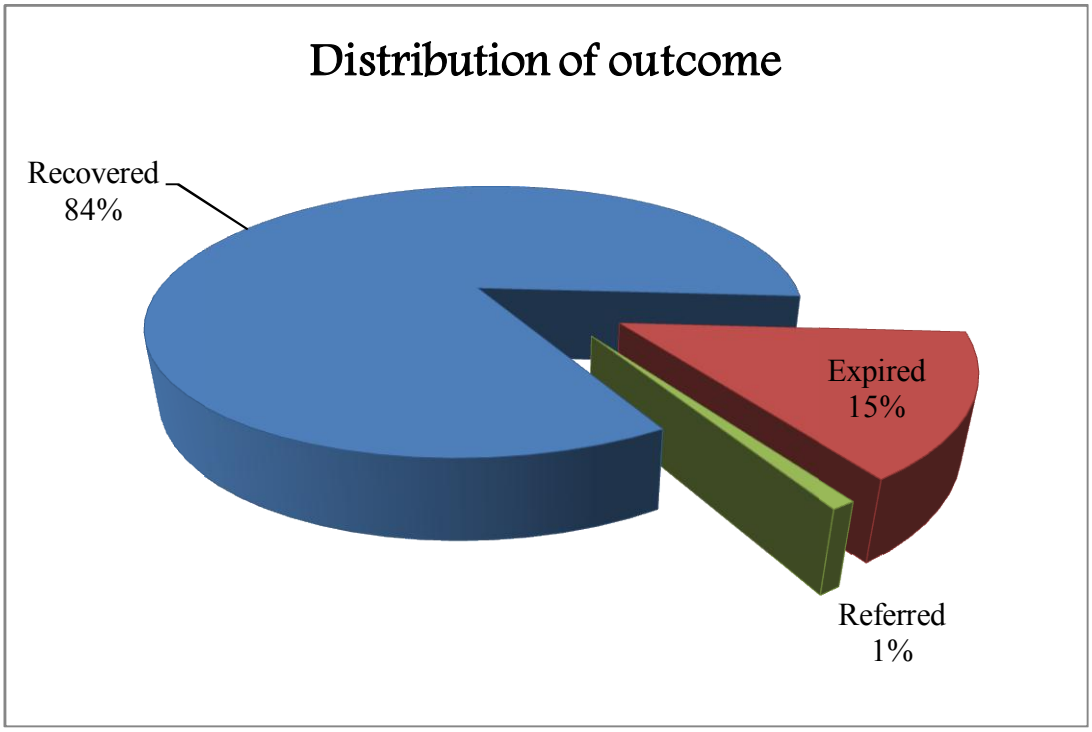
Our study included 325 children managed with CPAP and mechanical ventilation.

Infants constituted the majority of the study population [table1, chart 1]. Male children were marginally more than female children [table2]. Children with grade 2 malnutrition contributed to 10.2% of the study population. We did not have any children with grade 3&4 malnutrition in our study [table 3]. Majority of our children were from upper lower socio economic status 65.2%, with illiterate parents 68.3% and from rural areas 72.6% [tables 4,5,6]. A small proportion of the study population , 7.7% reached tertiary level care within one hour [table 7].

Table 8: Distribution of outcome

Recovered	274	84.3%
Expired	48	**14.8 %**
Referred	3	0.9 %
Total	325	

Chart 2:



Overall outcome of study population:

The overall mortality of our study population was estimated to be around 14.8% [table8, chart 2].

Table 9: Age distribution with respiratory support

	CPAP Alone	MV Alone	CPAP Failure	Total
1 month – 1 year	150 (61.2%)	76 (31.0%)	19 (7.8%)	**245**
> 1 year- 3 years	32 (65.3%)	15(30.6%)	2 (4.1%)	49
>3 years- 8 years	8 (38.1%)	12 (57.1%)	1 (4.8%)	21
>8 years- 12 years	2 (20.0%)	8 (80.0%)	0	10

Chart 3:

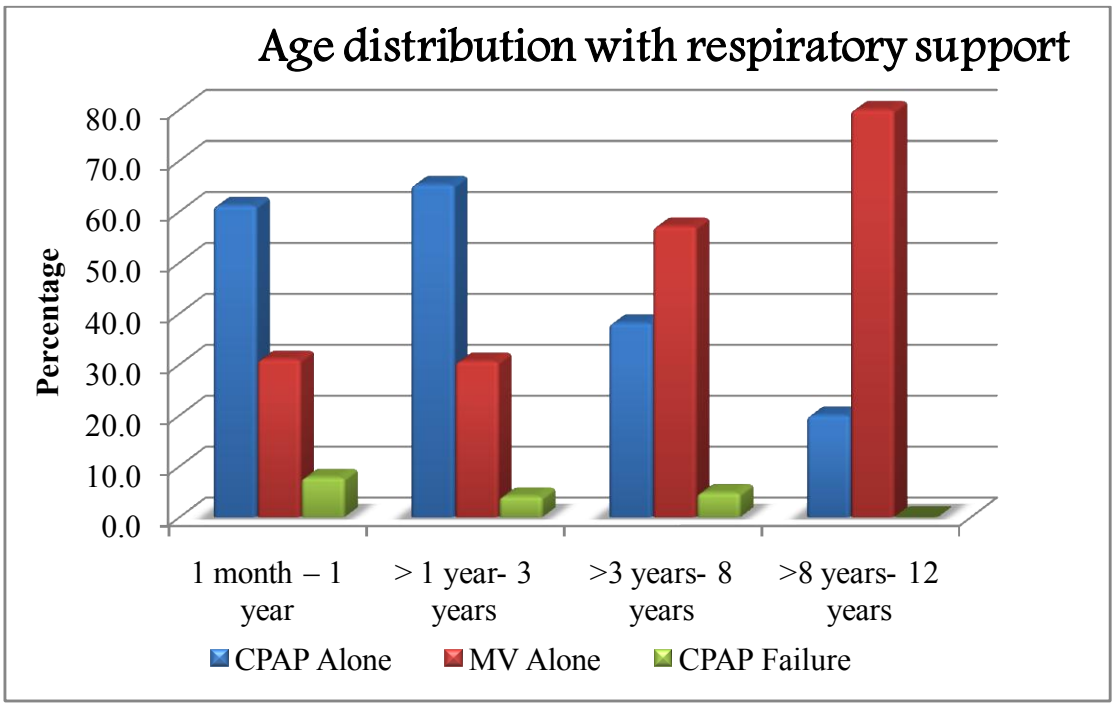


Table 10: Comparison of Age and respiratory support

	CPAP Alone	**MV Alone**	**CPAP Failure**
1 month – 1 year	150 (**78.1**%)	76 **(68.5%)**	19 (86.4%)
> 1 year- 3 years	32 (16.7%)	15 (13.5%)	2 (9.1%)
>3 years- 8 years	8 (4.2%)	12 (10.8%)	1 (4.5%)
>8 years- 12 years	2 (1.0%)	8 (7.2%)	0
Total	192	111	22

P=0.011

Table 11: Comparison of Age and Outcome

	Recovered	**Expired**	**Referred**	**Total**
1 month – 1 year	209 (85.3%)	35(14.3%)	1(0.4%)	245
> 1 year- 3 years	46 (93.9%)	3 (6.1%)	0	49
>3 years- 8 years	14 (66.7%)	5 **(23.8%)**	2 (9.5%)	21
>8 years- 12 years	5 (50.0%)	5 **(50.0%)**	0	10

P=0.001

Chart 4:

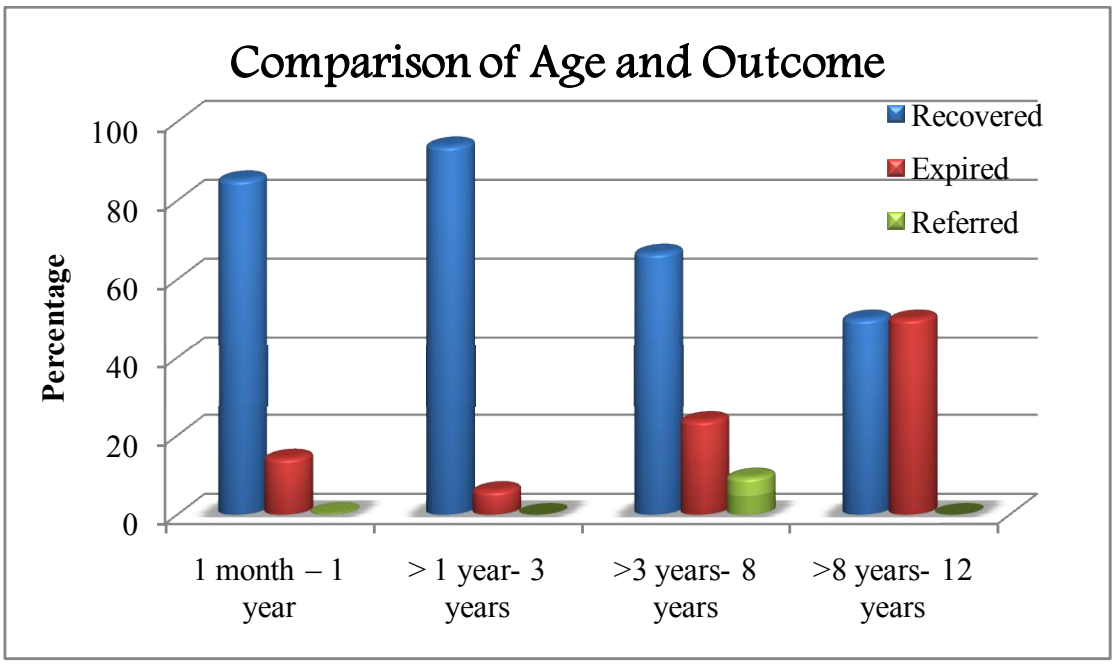


Table 12: Comparison of Weight and Outcome

	Recovered	**Expired**	**Referred**	**Total**
Normal	257 (88%)	32(11%)	3 (1%)	292
Grade 2 malnutrition	17 (51.5%)	16 (**48.5%**)	0	33

P=0.001

Chart 5

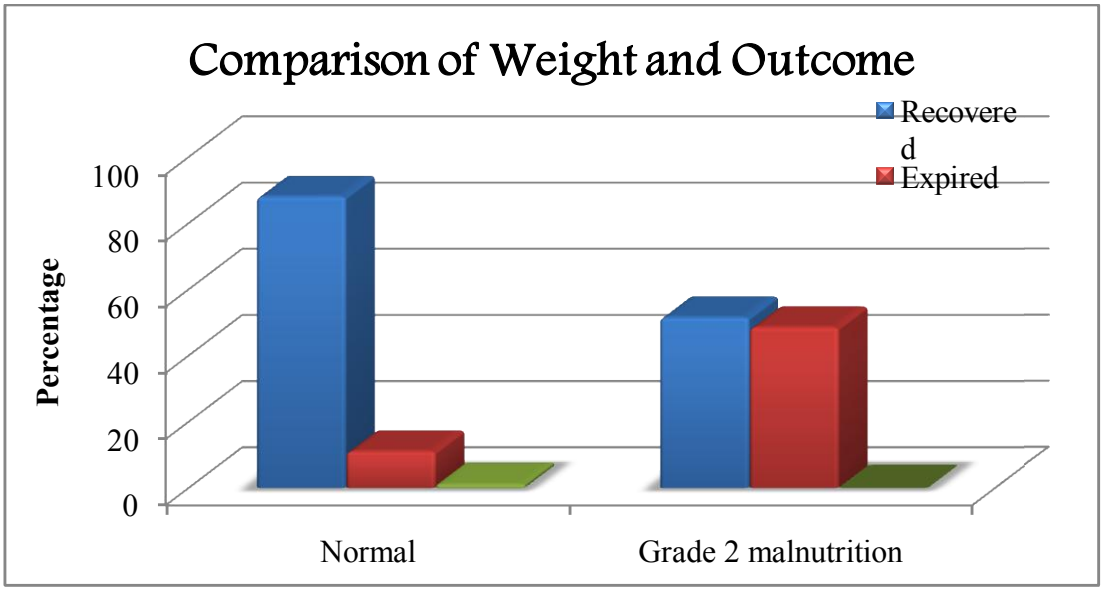
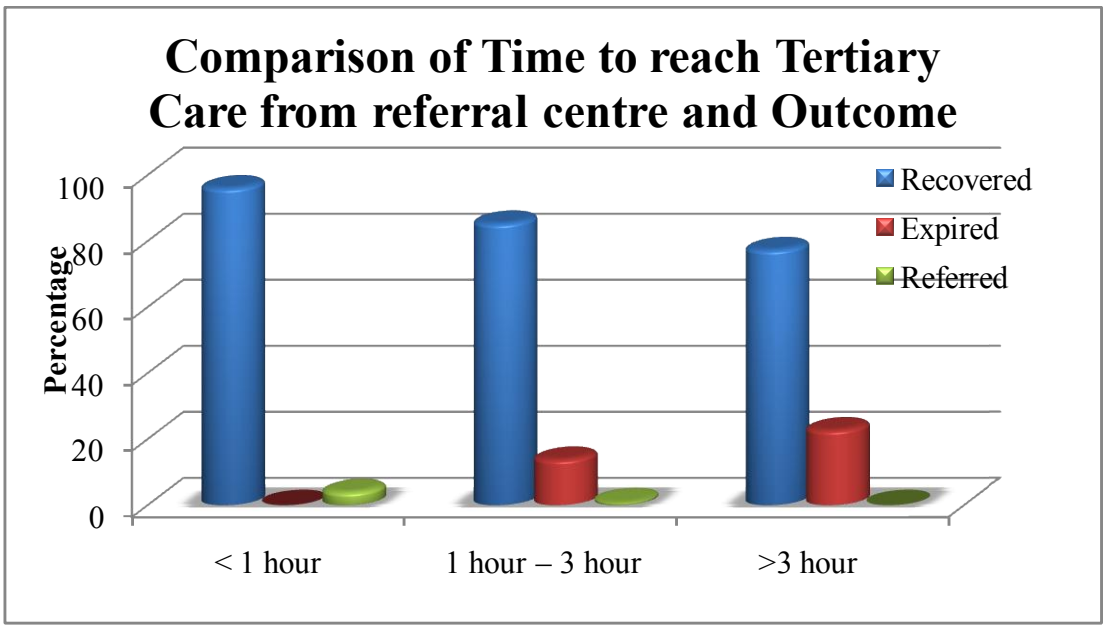


Table 13: Comparison of Time to reach Tertiary Care from referral centre and Outcome

Time to Tertiary Care	Recovered	Expired	Referred	Total
< 1 hour	24 (96.0%)	0	1 (4%)	25
1 hour – 3 hour	192 (85.3%)	31(13.8%)	2 (0.9%)	225
>3 hour	58 (77.3%)	17 (22.7%)	0	75

P=0.025

Chart 6



Clinical variables and its association with epidemiological parameters :

We observed that majority of infants 61.2% and toddlers 65.3% could be successfully managed with CPAP alone [table 9,chart 3]. Infants were the majority of the study population requiring CPAP and mechanical ventilation [table10]. The mortality was more in the older age group being around 23.8% in age group (> 3-8 years), and 50% in children > 8 years which was statistically significant [table 11,chart 4]. Children with grade 2 malnutrition had increased mortality, whereas no deaths occurred among those who reached tertiary care within one hour from referral centre [tables 12,13; charts 5,6]. These associations were found to be statistically significant.

Table 14: Distribution of CPAP cases

Success with CPAP alone	n (192)	**89.7 %**
CPAP failure	n (22)	10.3%
Total	214	

Table 15: CPAP alone: Indications

CPAP Indication	**Total**	**%**
Bronchopneumonia	94	**49.0**
Bronchiolitis	59	30.7
Septic Shock /septicemia	23	12.0
Scorpion sting- myocardial dysfunction	5	2.6
Others	11	5.7
Total	192	

Chart 7

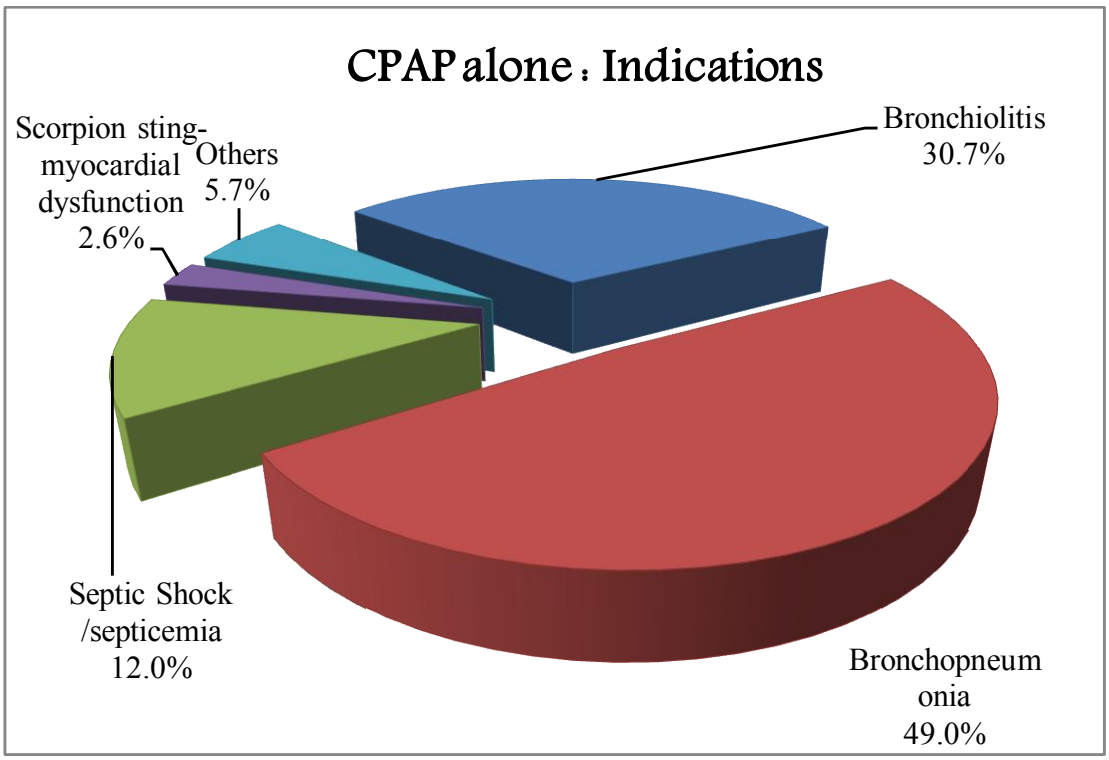


Table 16: CPAP alone: Indication & Duration

	CPAP Duration		
CPAP Indication	**24-48 hrs**	**48-96 hrs**	**>96 hrs**
Bronchiolitis	54 (34.2%)	5 (15.6%)	0
Bronchopneumonia	68 (43.0%)	**24(75.0%)**	**2 (100%)**
Septic Shock /septicemia	22 (13.9%)	1 (3.1%)	0
Scorpion sting-myocardial dysfunction	5(3.2%)	0	0
Others	9 (5.7%)	2 (6.3%)	0
	158	32	2

Table 17: Complications with CPAP alone group

Barotrauma	0
Others: oral/pharyngeal dryness, pressure sores	**15 (7.8%)**
	192

CPAP success:

In our study CPAP was successful in 89.7% of the study population [table14] . The commonest indication for CPAP in our study was bronchopneumonia in 49% followed by bronchiolitis in 30.7% of cases [table 15, chart 7]. Children with pneumonia required prolonged duration of CPAP support as observed in our study. The maximum duration of CPAP in our study was taken as > 96 hours, in which we had 2 cases and both were due to bronchopneumonia [table 16]. The complications among the CPAP group was estimated to be 7.8%. None were due to barotrauma [table 17].

Table 18: Age distribution in CPAP failure cases

Age	n	%
1 month – 1 yr	19	**86.4**
> 1 yr- 3 yrs	2	9.1
>3 yrs- 8 yrs	1	4.5
>8 yrs - 12 yrs	0	0
Total	22	

Table 19: Initial CPAP indication for CPAP failure group

CPAP Indication	n	%
Bronchopneumonia	16	**72.7**
Bronchiolitis	1	4.5
Septic Shock /septicemia	3	13.6
Scorpion sting- myocardial dysfunction	1	4.5
Others	1	4.5
Total	22	

Table 20: Initial CPAP duration in CPAP failure group

Duration	n	%
< 12 hours	16	72.7
12-24 hours	5	22.7
> 24 hours	1	4.5
	22	

Table 21: Comparison of initial CPAP duration and outcome in CPAP failure cases

Initial CPAP duration	Recovered	Expired
< 12 hours	**13 (86.7%)**	3 (42.9%)
12-24 hours	1(6.7%)	4 (57.1%)
>24 hours	1(6.7%)	0
Total	15	7

P=0.029

Table 22: Outcome in CPAP failure cases

Recovered	15	68.2 %
Expired	7	**31.8 %**
Referred	0	0
	22	

Table 23: Overall mortality

Direct invasive ventilation	41	85.4%
CPAP failure	7	**14.5%**
Total	48	

CPAP failure:

In our study CPAP failure was noted in 10.3% of the population. We observed that infants constituted the majority of the group which failed CPAP [table 18]. In majority of the cases, bronchopneumonia was the indication for initiating CPAP contributing to 72.7% [table 19]. Among the 22 children who failed CPAP, majority (72.7%) had a short duration of initial CPAP support of < 12 hours , [table 20] and the same group had a better outcome when compared to those who required a longer CPAP support prior to intubation , which was statistically significant [table 21]. Although the mortality rate in this group was 31.8% [table22], CPAP failure contributed to only 14.5% of the overall mortality of our study population [table23].

Chart 8: Direct Mechanical ventilation - indication

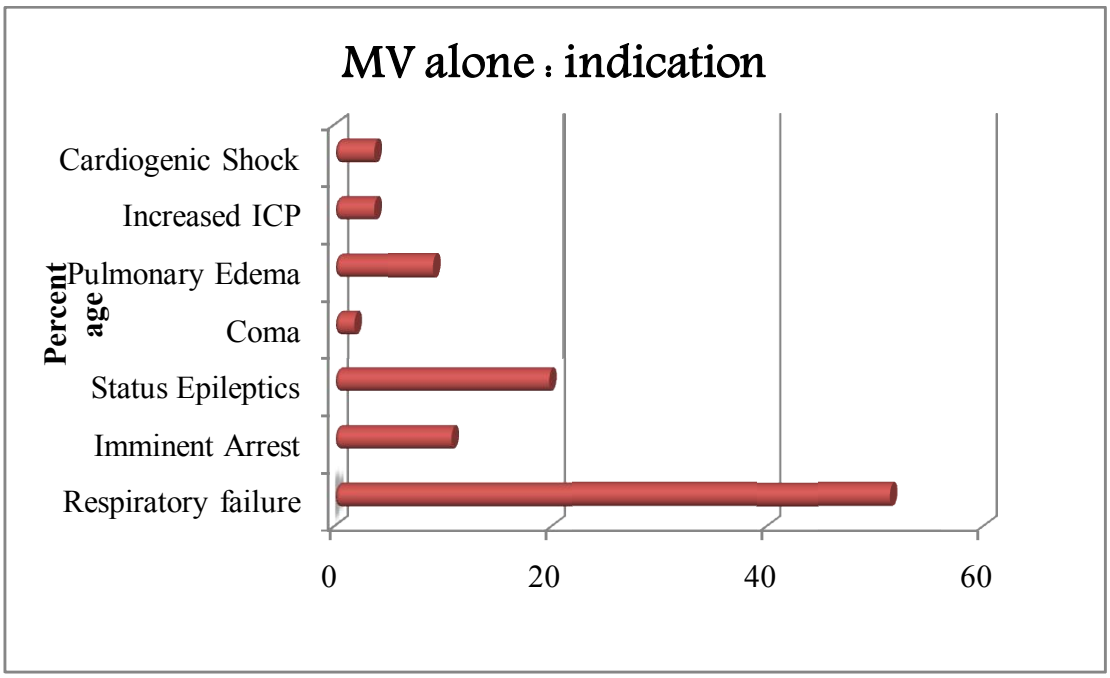


Table 24: Mechanical ventilation Duration & Duration of hospital stay (MV alone)

Mechanical ventilation Duration	Duration of hospital stay			Total
	< 7 days	7-14 days	>14 days	
< 72 hrs	38 (52.1%)	33 (45.2%)	2 (2.7%)	73
>72 hrs	4 (11.4%)	18 **(51.4%)**	13 **(37.1%)**	35
Total				108

P=0.000

Chart 9

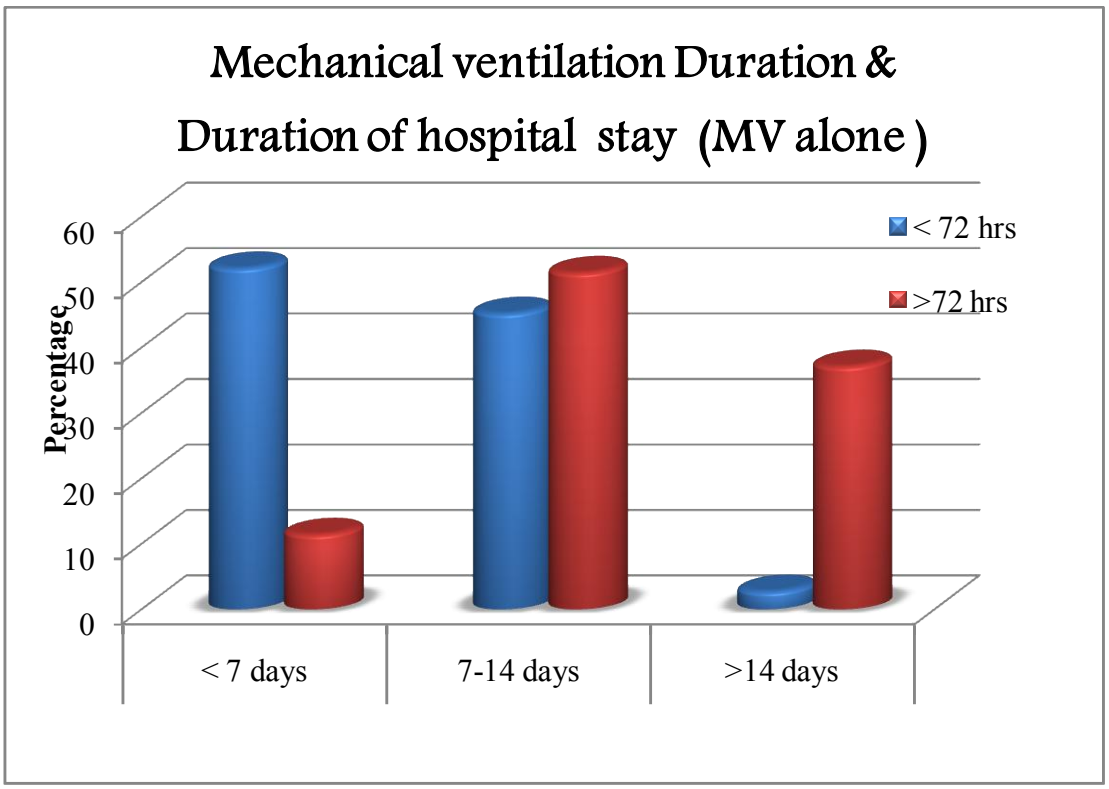


Table 25: Complications with Mechanical ventilation

Complications	n	%
Upper lobe collapse	**9**	**47.4**
VAP	4	**21.1**
Bedsore	0	0
Barotrauma	0	0
Post intubation stridor	3	15.8
Others	3	15.8
Total	19	

Chart 10

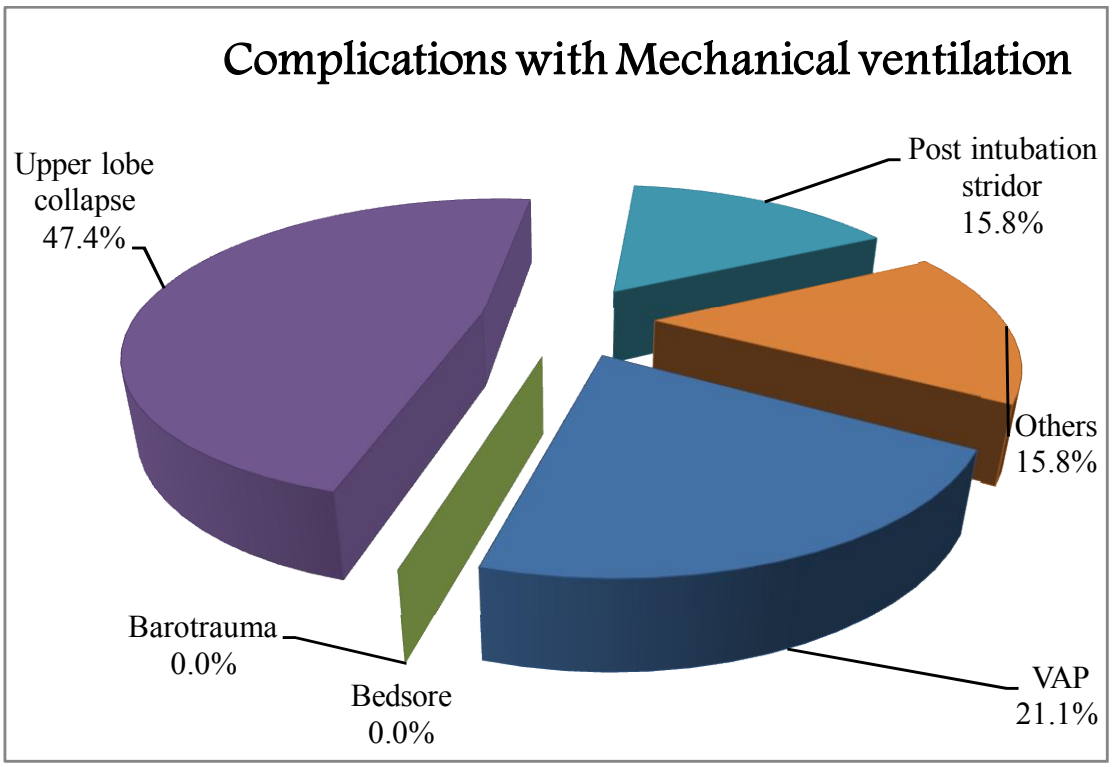


Table 26: Mechanical ventilation: Duration & Complications

Mechanical ventilation Duration	**VAP**	**Upper lobe collapse**	**post intub stridor**	**others**	
< 72 hrs	0	3(50%)	3(50%)	0	6
>72 hrs	4(**30.8%**)	6(46.2%)	0	3(**23%**)	13
	4	9	3	3	19

P=0.021

Table 27: Distribution of Extubation

	n	**%**
Spontaneous	3	**3.6**
Planned	81	96.4
Total	84	

Table 28: Distribution of Reintubation

	n	**%**
Yes	5	**3.8**
No	127	96.2
Total	132	

Mechanical ventilation :

Respiratory failure was the most common indication for invasive ventilation contributing to 51.4% [chart 8]. We also observed that children who required prolonged ventilator support of > 72 hours had a prolonged duration of hospital stay,which reached statistical significance [table 23, chart 9]. Upper lobe atelectasis (47.4%) and ventilator associated pneumonia (21.1%) were the major complications observed in our study [table 24, chart 10]. We had a statistically significant analysis, that children who required prolonged invasive ventilation of > 72 hours had more complications [table 25]. The rate of spontaneous extubation in our study was 3.6% [table 26], and reintubation rate was 3.8% [table 27].

Table 29: Comparison of Shock with respiratory support

	CPAP Alone	MV Alone	CPAP failure	Total
Compensated Shock	30 (27.5%)	63 (57.8%)	16 (14.7%)	109
Decompensate Shock	0	20 (100%)	0	20
Total				129

P=0.001

Chart 11

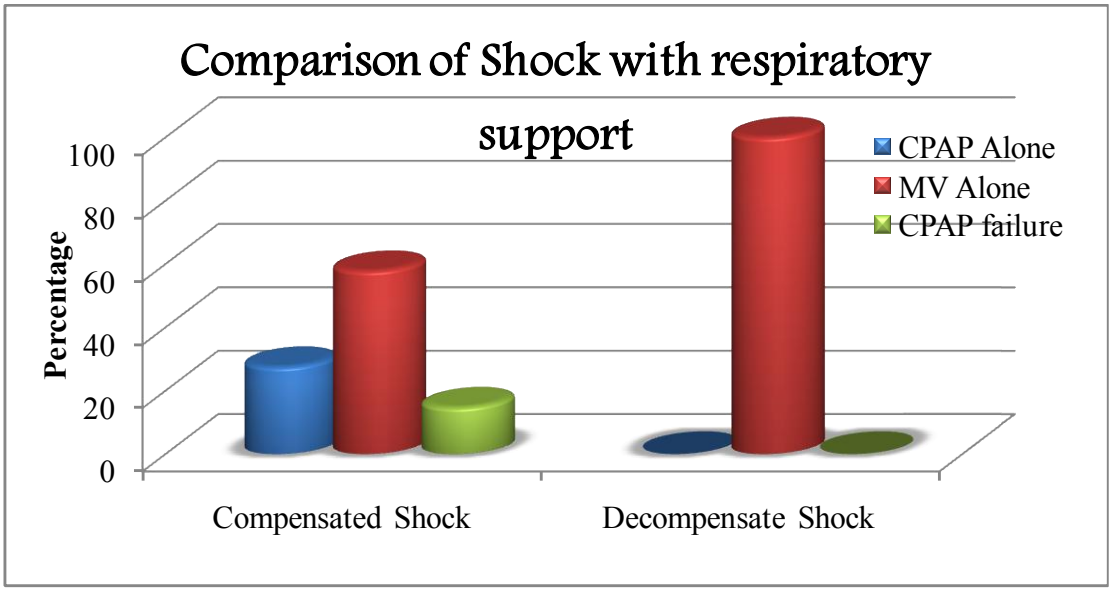
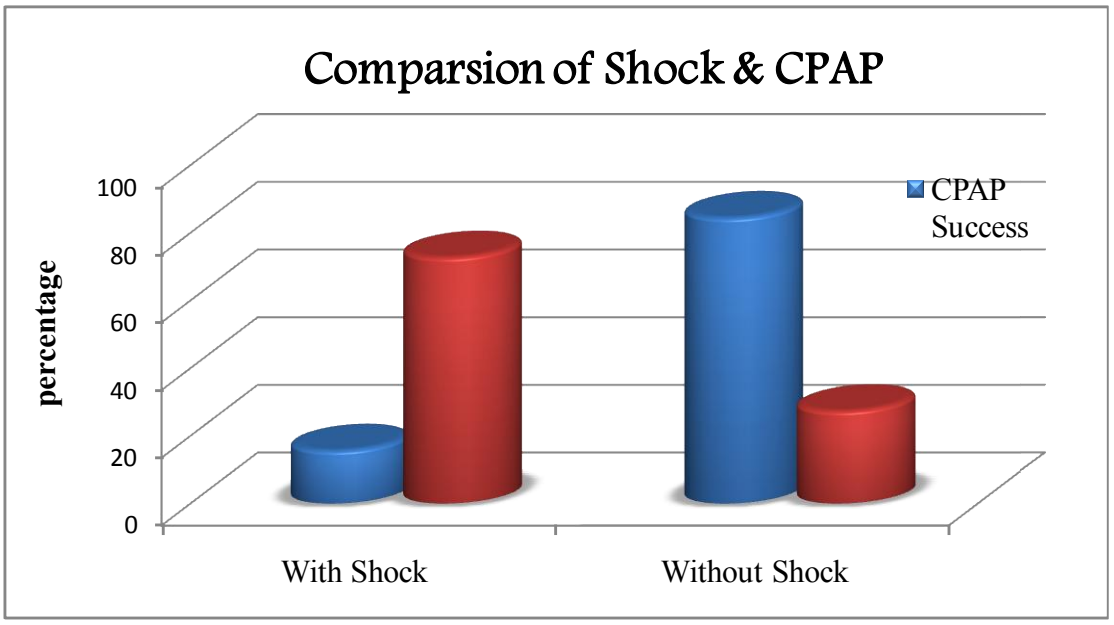


Table 30: Shock and CPAP support

	With shock	Without shock	Total
CPAP success	30 (15.6%)	162 (84.4%)	192
CPAP failure	16 (72.7%)	6 (27.3%)	22

Chart 12



Hemodynamic instability & respiratory support:

No child with decompensated shock was initiated CPAP. Majority of the children with compensated shock (57.8%) needed direct invasive ventilation, whereas 27.5% of them could still be successfully managed with CPAP [table 28, chart 11]. This was statistically significant.

It was observed that out of the 22 children who failed CPAP, 72.7% had compensated shock. In the CPAP success group, 84.4% were hemodynamically stable. Thus associated shock was found to be a detrimental factor for failure of CPAP which was statistically significant.

Chart 13

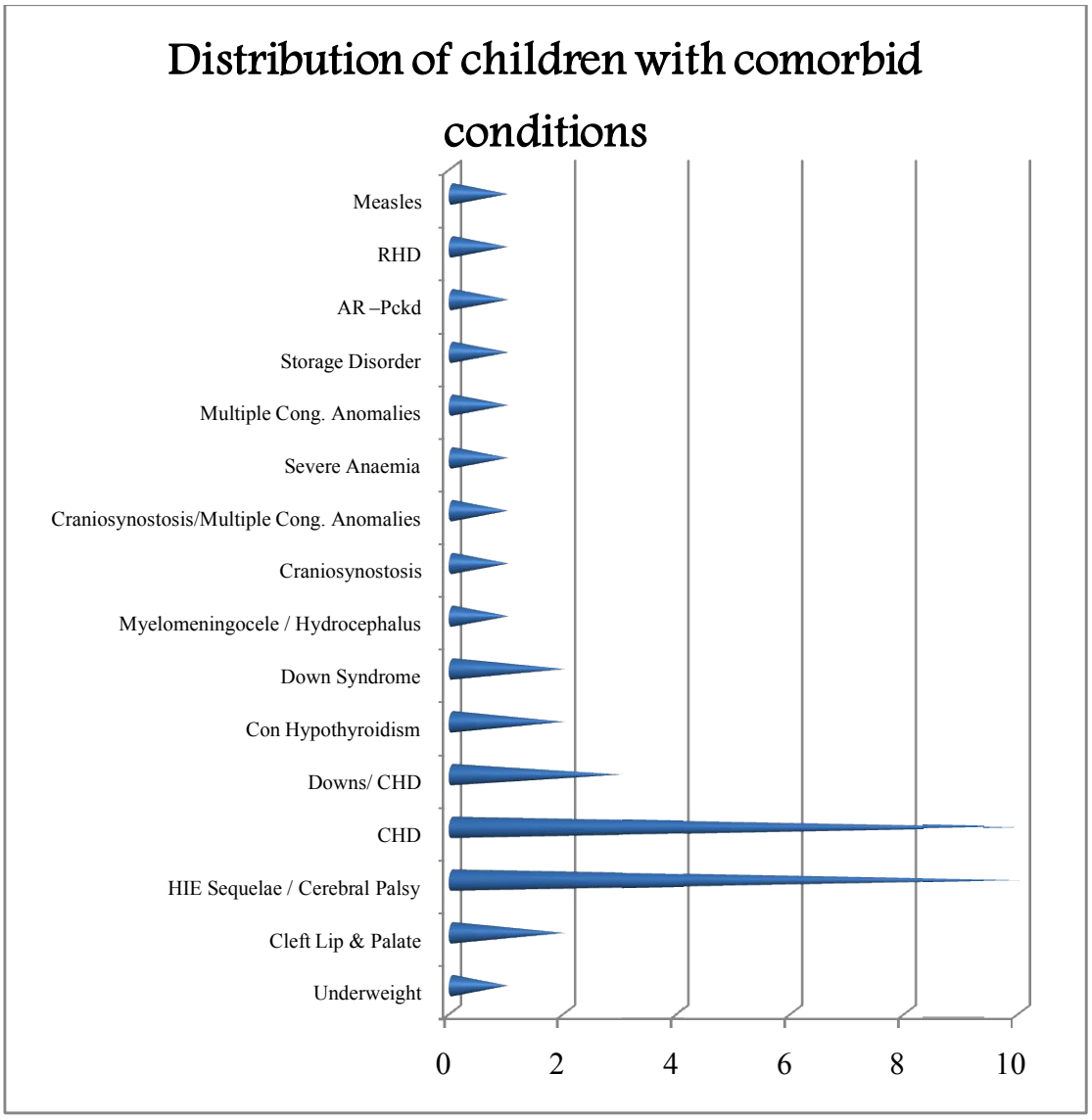


Table 31: Comorbidity & respiratory support

Direct invasive ventilation	27	**69.2 %**
CPAP success	9	23.1 %
CPAP failure	3	7.7 %
Total	39	

Table 32: Comparison of comorbidity and respiratory support

	CPAP Alone	**MV Alone**	**CPAP Failure**
With comorbidity	9(4.7%)	27(**24.3%)**	3 (13.6%)
Without comorbidity	183 (95.3%)	84 (75.7%)	19 (86.4%)
Total	192	111	22

P=0.000

Chart 14

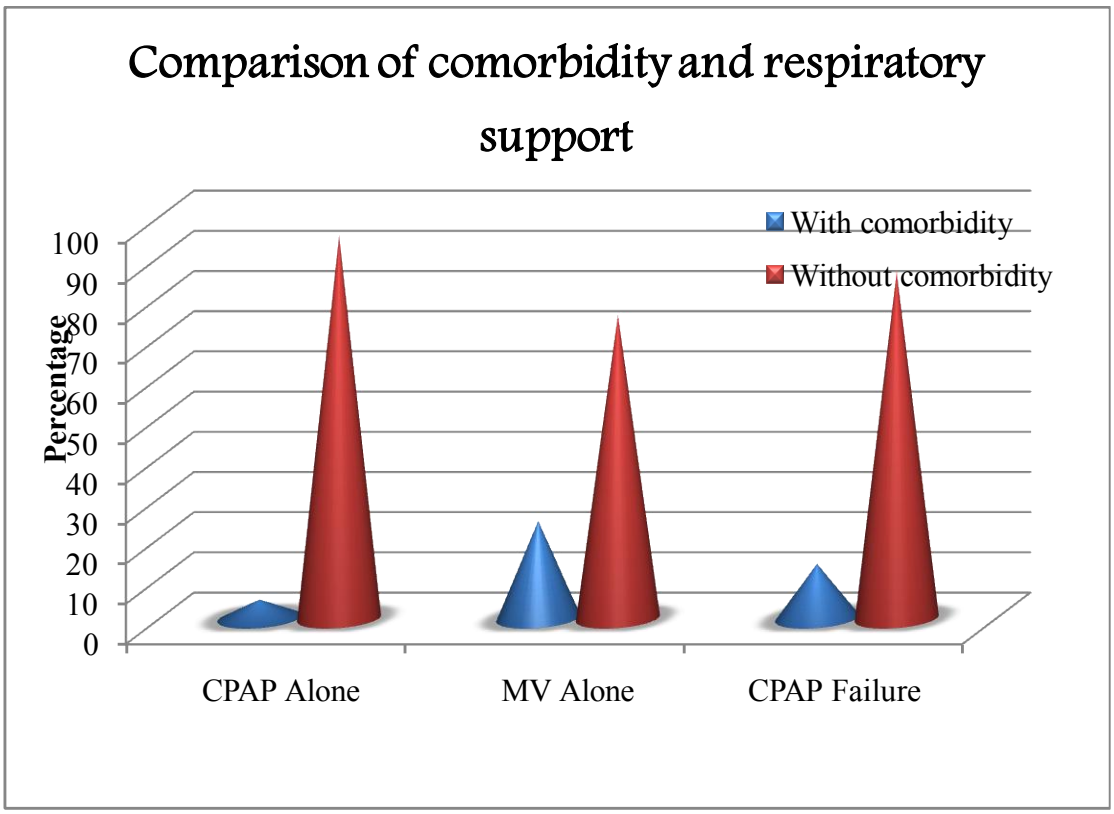
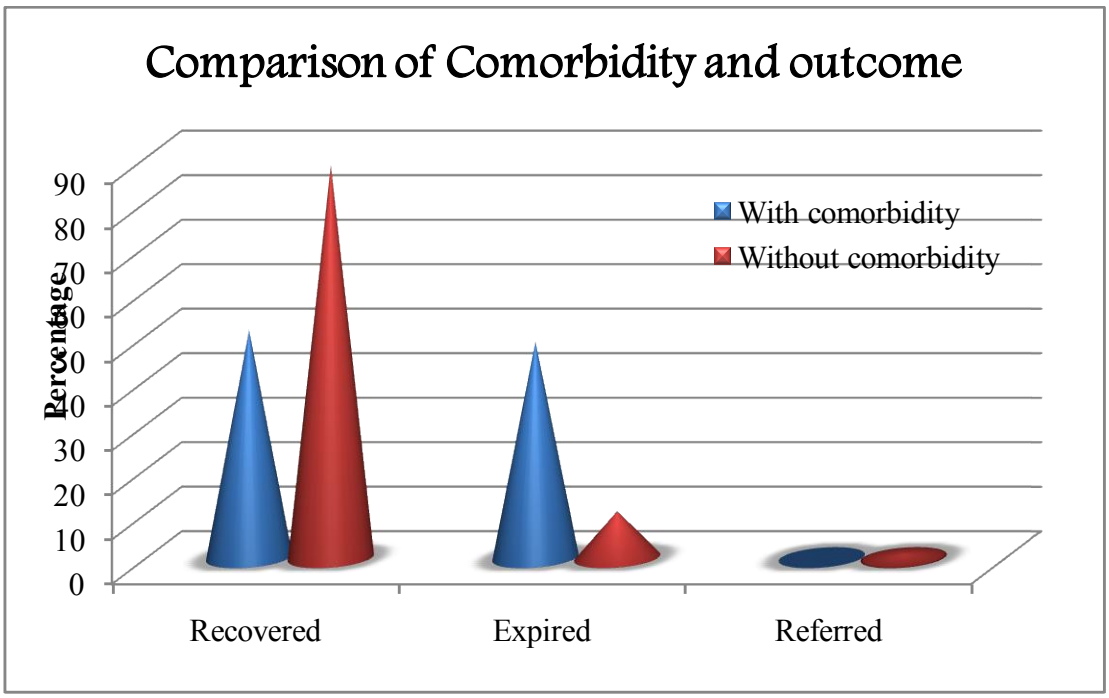


Table 33: Comparison of Comorbidity and outcome

Outcome	**With comorbidity**	**Without comorbidity**
Recovered	20 (51.3%)	245 (88.4%)
Expired	19 (**48.7%**)	29 (10.5%)
Referred	0	3 (1.1%)
	39	277

P=0.000

Chart 15



Comorbidity & respiratory support:

HIE sequelae/ cerebral palsy and congenital heart disease were the major comorbid conditions in our study [chart 12]. We observed that comorbidity predisposed children to direct invasive ventilation which amounted to 69.2% of the comorbid group [table 29,30 chart 13]. This reached statistical significance. Comorbidity had an influence on outcome, as the mortality was 48.7% in the comorbid group [table 31,chart 14],which was statistically significant.

Table 34: Final diagnosis & respiratory support (etiology wise)

Final diagnosis	CPAP Alone	MV Alone	CPAP Failure	Total
Bronchiolitis	59**(93.7%)**	3(4.8%)	1(1.6%)	63
Bronchopneumonia	88**(89.8%)**	6(6.1%)	4(4.1%)	98
Bronchopneumonia & septic Shock	6(12.0%)	32(**64.0%**)	12(**24.0%)**	50
Septicemia	23 (53.5%)	17(39.5%)	3(7.0%)	43
Kerosene ing/ As.pn	9(**81.8%)**	1(9.1%)	1(9.1%)	11
Seizure disorder/ Status Epilepticus	0	20(100%)	0	20
Snake Bite/Res.Failure	0	6(100%)	0	6
CHD/CCF	2(28.6%)	5(71.4%)	0	7
Late HDN/ IC bleed	0	4(100%)	0	4
Drowning / Hypo	0	2(100%)	0	2
Bronchial Asthma	0	1(100%)	0	1
Acute CNS Infection / Encephalopathy	0	5(100%)	0	5
Scorpion Sting / Pulmonary edema	5(41.7%)	6(50.0%)	1(8.3%)	12
Pneumothorax	0	1(100%)	0	1
OPC Poisoning	0	2(100%)	0	2

Bronchiolitis was the most successful condition managed with CPAP alone (93.7%), next was bronchopneumonia alone (89.8%), followed by kerosene aspiration pneumonitis (81.8%) .

Table 35: Final diagnosis & respiratory support

Final diagnosis	**CPAP Alone**	**MV Alone**	**CPAP Failure**
Bronchiolitis	59 (30.7%)	3 (2.7%)	1(4.5%)
Bronchopneumonia	88(**45.8%)**	6(5.4%)	4(18.2%)
Bronchopneumonia & septic Shock	6(3.1%)	32(**28.8%**)	12(**54.5%)**
Septicemia	23(12.0%)	17(15.3%)	3(13.6%)
Kerosene ing/ As.pn	9(4.7%)	1(0.9%)	1(4.5%)
Seizure disorder/ Status Epilepticus	0	20(18%)	0
Snake Bite/Res.Failure	0	6(5.4%)	0
CHD/CCF	2 (1.0%)	5(4.5%)	0
Late HDN/ IC bleed	0	4(3.6%)	0
Drowning / Hypo	0	2(1.8%)	0
Bronchial Asthma	0	1(0.9%)	0
Acute CNS Infection / Encephalopathy	0	5(4.5%)	0
Scorpion Sting / Pulmonary edema	5(2.6%)	6(5.4%)	1(4.5%)
Pneumothorax	0	1(0.9%)	0
OPC Poisoning	0	2(1.8%)	0
Total	192	111	22

The major underlying etiology for CPAP failure and for direct invasive ventilation was bronchopneumonia associated with septic shock in 54.5% and 28.8% each.

Table 36: Final diagnosis & MV duration

	Mechanical Ventilation .duration	
Final diagnosis	**< 72 hours**	**>72 hours**
Bronchiolitis	2 (2.6%)	1 (2.9%)
Bronchopneumonia	5 (6.6%)	1 (2.9%)
Bronchopneumonia & septic Shock	20 (26.3%)	12 (**34.3%**)
Septicemia	11 (14.5%)	6 (**17.1%**)
Kerosene ing/ As.pn	0	1 (2.9%)
Seizure disorder/ Status Epilepticus	15 (19.7%)	5(14.3%)
Snake Bite/Res.Failure	4(5.3%)	2 (5.7%)
CHD/CCF	5(6.6%)	0
Late HDN/ IC bleed	0	4 (11.4%)
Drowning / Hypo	2 (2.6%)	0
Bronchial Asthma	1 (1.3%)	0
Acute CNS Infection / Encephalopathy	4(5.3%)	1 (2.9%)
Scorpion Sting / Pulmonary edema	5(6.6%)	1 (2.9%)
Pneumothorax	0	1 (2.9%)
OPC Poisoning	2 (2.6%)	0
Total	76	35

A prolonged duration of invasive ventilation of > 72 hours was required in bronchopneumonia with associated septic shock, being around 34.3%.

Table 37: Final diagnosis & Outcome

	Outcome		
Final diagnosis	**Recovered**	**Expired**	**Referred**
Bronchiolitis	63(23.0%)	0	0
Bronchopneumonia	98 (35.8%)	0	0
Bronchopneumonia & septic Shock	31(11.3%)	19(**39.6%)**	0
Septicemia	36(13.1%)	7(14.6%)	0
Kerosene ing/ As.pn	11(4.0%)	0	0
Seizure disorder/ Status Epilepticus	9(3.3%)	10(**20.8%)**	1(33.3%)
Snake Bite/Res.Failure	4(1.5%)	1(2.1%)	1(33.3%)
CHD/CCF	3(1.1%)	4(8.3%)	0
Late HDN/ IC bleed	4(1.5%)	0	0
Drowning / Hypo	1(0.4%)	1(2.1%)	0
Bronchial Asthma	0	0	1(33.3%)
Acute CNS Infection / Encephalopathy	1(0.4%)	4(8.3%)	0
Scorpion Sting / Pulmonary edema	12(4.4%)	0	0
Pneumothorax	1(0.4%)	0	0
OPC Poisoning	0	2(4.2%)	0
Total	274	48	3

A high mortality of 39.6% was observed in children with bronchopneumonia and associated septic shock.

DISCUSSION

The study was conducted in the paediatric intensive care unit in Chengalpattu medical college hospital. We analysed children managed with indigenous CPAP through flow inflating device and those with mechanical ventilation. During the study period of one year we studied 325 children managed with CPAP and mechanical ventilation.

Analysis of epidemiological parameters:

- **Age:** A total of 325 children were included in our study. Infants contributed to the majority of the study population ranging to 75.4% . This is because of the difference in respiratory physiology in infants with the following characteristics :
    - a very compliant chest wall
    - with stiff lungs,
    - a low FRC of only 15% of tidal volume,
    - weak muscles, horizontal ribs,
    - small zone of apposition of diaphragm
    - High flow resistance of nose and smaller airways
    - More REM sleep – decreased muscle tone
    - Frequent apneas
    - Increased metabolic rate and O2 demand

- All these features result in rapid progression to respiratory fatigue and failure
- **Sex:** We had 180 male children and 145 female children.
- **Nutritional status:** Majority of the children were of normal nutritional status amounting to 89.8%. The remaining 10.2% had grade 2 malnutrition according to IAP classification. We did not have any child requiring CPAP or mechanical ventilation with grade 3& 4 malnutrition.
- **Socio-economic status:** **T**his was classified according to modified Kuppusamy scale. Upper lower group contributed to 65.2% and lower socioeconomic group to 21.5%. Thus 86.7% of the study population hailed from both upper lower and lower socioeconomic strata of the society.
- **Education:** 68.3% of the parents of the subjects of this study were Illiterate.
- **Place:** Majority of the study population were from rural area contributing to 72.6%. The remaining 27.4% were from urban area.
- **Distance to tertiary care:** The time taken to reach the tertiary level care from the referral centre was considered, to see if delayed

reach to our centre affected outcome. 69.2% of the group reached between 1-3 hours. A delay of more than 3 hours was seen in 23.1%. Very few reached within 1 hour, around 7.7%.

Outcome and hospital stay of study population:

- Out of the 325 children managed with CPAP and mechanical ventilation, 84.3% recovered and 14.8% expired.
- Only 6.8% required a prolonged hospital stay of > 14 days. The remaining were discharged within 14 days.

Analysis of clinical variables and its comparison with epidemiological parameters:

AGE AND RESPIRATORY SUPPORT:

a) Distribution within the determined age group:

Among the infant and toddler population, majority of them could be managed with CPAP support alone. The majority of the study population were infants being around 245 subjects. Around 61.2% of infants and 65.3% of toddlers could be managed with CPAP alone. With regard to older age group, majority were found to require more of direct mechanical ventilation.

b) Age wise distribution within the type of respiratory support used :

Infants were the predominant group in all types of respiratory support in our study. Out of the 192 children who were successfully managed with CPAP alone, 78.1% were infants. CPAP failure was noted in 22 children and infants contributed to 86.4% of the failure cases. We had 111 children who required direct mechanical ventilation and the majority were again infants contributing to 68.5%.

CPAP success was more in infancy and toddler age group as the underlying etiology here was primary respiratory illness, whereas older age group required CPAP for cardiac conditions like myocardial dysfunction due to scorpion envenomation and CCF from structural or acquired heart diseases.

Thus respiratory illness being the predominant group of PICU admissions, require either invasive or non invasive ventilation. CPAP has been observed to be useful in primary respiratory conditions.

In a study done by Lucy et al in Malaysia, infants contributed to 56.5% of the group managed with NIV(31). Young age was observed as a significant risk factor for failure of non invasive ventilation (7) (51) (52) (53) (54).

c) Age and outcome :

In our study we analysed the age wise mortality to be more in the older age group, 50% in the above 8 years group and 23.8% in children in the group above 3 years upto 8 years. This was found to be statistically significant.

d) Age and Duration of Hospital stay:

In our study we observed that only infants and toddlers had a prolonged hospital stay of > 14 days.

e) Nutritional status and outcome :

In our study 292 children had normal nutritional status and the mortality in this age group was 11%. We did not have any children in grade 3&4 malnutrition group. We had a mortality of 48.5% among the 33 children with grade 2 malnutrition. This association was statistically significant.

Children with grade 2 malnutrition had increased mortality in our study. Though more focus is on management and prevention of severe acute malnutrition among children , our study stresses the importance of identifying and correcting grade 2 malnutrition also , which poses a threat to the lives of these children .

Elaine et al in their study on the influence of mechanical ventilation among malnourished children, estimated that the mortality of malnourished children who underwent invasive ventilation was 9%, compared to 7% in the normal group (11). This however did not reach statistical significance.

f) Time to reach Tertiary Care from referral centre and Outcome :

In our study we did not have any deaths among children who reached our centre within one hour. The mortality was found to be high among those who had a delayed admission to us .Seventy five children had a delay of 3 hours to reach our centre and the mortality in this group was 22.7%.

There was no mortality in the group which reached tertiary care within one hour from the referral centre, which highlights the importance of early tertiary level care for improved outcome.

ANALYSIS OF CHILDREN MANAGED WITH CPAP THROUGH FLOW INFLATING DEVICE :

Two thirds of our study population were managed with CPAP ventilation; that is around 214 cases out of the total 325.

A) CPAP SUCCESS GROUP:

We had a success of 89.7% with CPAP alone being used as a mode of respiratory support. This was similar to the other studies.

Clara Abadesso et al in their study in an intensive care unit in Portugal reported a success of 77.5% among children managed with non invasive ventilation (6). They have also reported that previous studies had a success range of 57-92%. Antonelli et al reported a success of 69-79% (55). Essouri et al in their 5 year observational study estimated the success to be around 77%. (56). A study done by Mayordomo observed a success in non invasive ventilation to be 84% (7). Munoz Bonet et al reported a success of 81% (51).

Age :

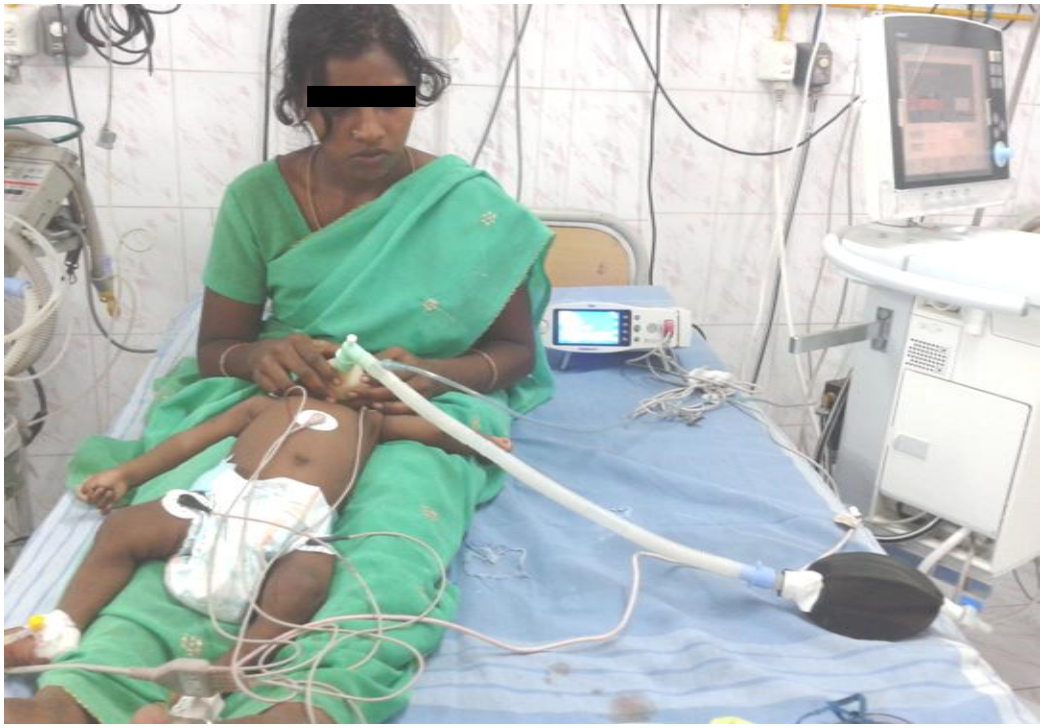
Infants constituted the majority of the group managed successfully with CPAP alone being around 78.1%.

Indications:

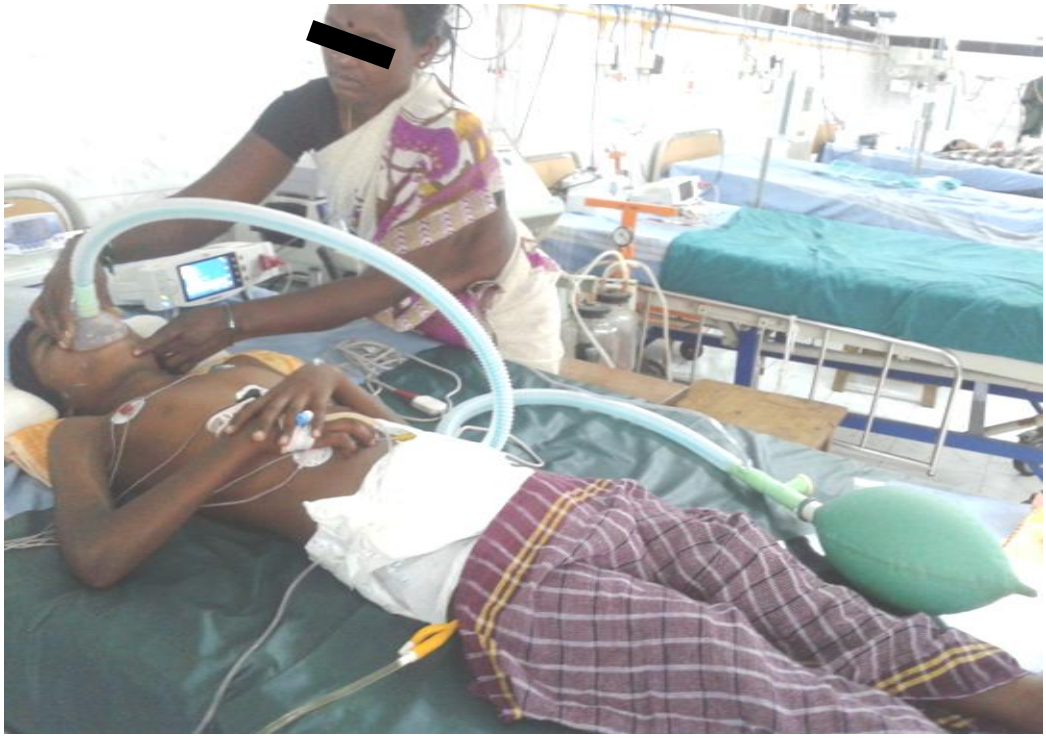
Out of the 192 cases managed successfully with CPAP alone, majority of the indications were children with pneumonia contributing to 49% of the cases. The next was bronchiolitis contributing to 30.7%.

Thus primary respiratory illness contributed to the majority of the cases successfully managed with CPAP alone, which was also observed in the study done by Christopher et al (57).

We had a success of 98.3% with bronchiolitis managed with CPAP alone. This was marginally higher than the other studies. Subodh Suhas et al reported a success of 83.2% in children with bronchiolitis managed with CPAP alone (54). The other studies on non invasive ventilation used successfully in children with bronchiolitis had a success of 81% as in the study by Javouhey (58) , 75.5% as analysed by Larrar et al (59) , and 83% as observed by Campion et al (53).



An infant with bronchiolitis on Jackson –Rees circuit

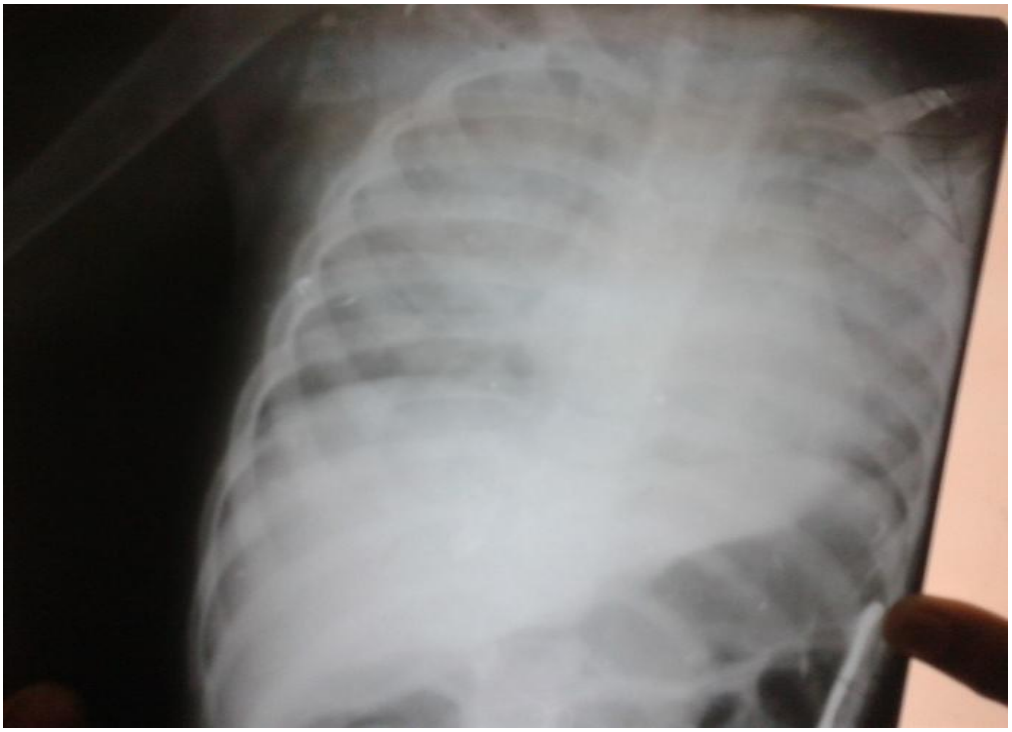


Scorpion myocardial dysfunction-Pulmonary edema- on Bain circuit

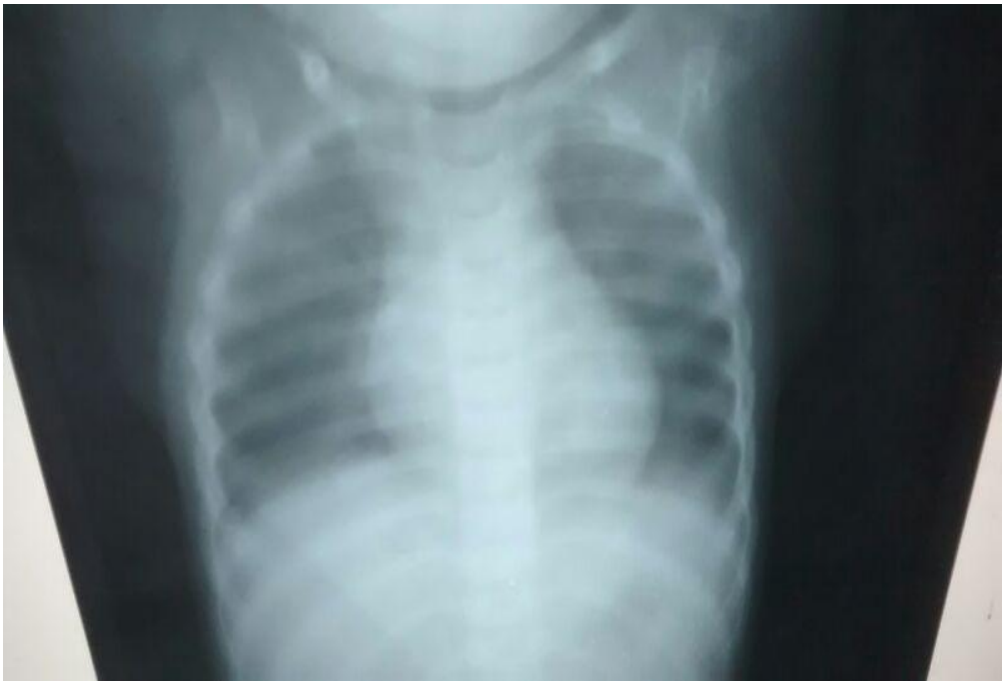
Duration of CPAP support :

Pneumonia, being a parenchymal disease was observed to require a longer duration of CPAP support in our study. The maximum duration of CPAP was taken as > 96 hours in our study, of which we had 2 cases and both were due to pneumonia.

Children who were managed with CPAP alone for myocardial dysfunction due to scorpion envenomation , required a shorter duration of CPAP support of < 48 hours.



Scorpion myocardial dysfunction-Pulmonary edema –initial xray



Improvement in pulmonary edema after 24 hours of cpap through Jackson-Rees.

Complications with CPAP alone :

The complications other than barotrauma in CPAP support alone were categorised together . Some of them were dryness of oral and pharyngeal mucosa, pressure sores due to mask etc. The complication rate in our study was 7.8%. Lucy et al observed that 14% of the complications were due to large size mask , and 5.8% due to pressure sores (31).

B) CPAP FAILURE GROUP :

In our study we initiated CPAP as a primary mode of ventilation for 214 children, out of which 22 children had a failure of CPAP and had to be mechanically ventilated. The failure of CPAP in our study was 10.3%.

Abadesso et al observed a failure of 22.5% with non invasive ventilation (6). The failure rate was 36% in the study by Christopher et al (57) and 19.1% in the study by Munoz Bonet et al (51).

Bernet et al observed failure rates of 8-43% with non invasive ventilation (32)(6) .

Age :

Infants were observed to have a higher rate of CPAP failure contributing to 86.4% of the cases. Many other studies also supported our analysis with younger age being a risk factor for CPAP failure.

Indications:

Children started on CPAP for pneumonia had a higher rate of CPAP failure in our study. This was also supported by Abadesso et al and Munoz –Bonet et al (6)(51).

Duration :

Our study had majority of CPAP failure within 12 hours of initiation of CPAP, amounting to 72.7% and it was also observed that 86.7% of these cases recovered, which was statistically significant. This indicates that most cases of CPAP failure in our study could be due to underlying disease severity and progression as they could tolerate CPAP support for a relatively short period.

Indication for mechanical ventilation in CPAP failure cases :

We analysed that respiratory failure was the indication for mechanical ventilation in 95.5% of the cases which failed CPAP. Lucy et al in their study observed respiratory failure as a cause of non invasive ventilation failure in 66% of cases (31).

Outcome in CPAP failure group:

The mortality profile in our study was 14.8%, of which CPAP failure contributed to 14.5% and the remaining 85.4% were children who were directly put on mechanical ventilation. Thus CPAP failure did not contribute to high mortality rates in our study, which was contradictory to the study done by Lucy et al (31).

C) DIRECT MECHANICAL VENTILATION:

Age:

Infants contributed to 68.5% of the group which needed direct mechanical ventilation.

Indication:

Respiratory failure was the most common indication for direct mechanical ventilation in our study contributing to 51.4%.

This was supported by other studies. Kendirli et al in their study observed respiratory failure as the indication in 64.8% of cases (4), whereas it was 59.18% in a study by Dafne Cardoso in Brazil (35). Farias et al observed acute respiratory failure as the cause for initiation of invasive ventilation in 72% of the cases (60).

Duration:

In our study we analysed that children who required mechanical ventilation for a longer duration of > 72 hours , had a prolonged hospital stay which was statistically significant.

We also found that all cases ventilated for increased ICP , required a prolonged ventilator support whereas children intubated for pulmonary edema and status epilepticus required a shorter duration.

Based on underlying disease etiology, children with bronchopneumonia and associated septic shock required a prolonged respiratory support of > 72 hours followed next by septicaemia. Valerie Payen et al in their study also observed that associated hemodynamic instability prolonged the duration of invasive ventilation (61).

Complications:

In our study among the children who underwent mechanical ventilation, upper lobe collapse was identified as the commonest complication contributing to 47.4% followed next by VAP accounting for 21.1%.

Majority, 68.4% of the complications occurred in the group which required prolonged ventilator support of > 72 hours. The main

complication in this group was again upper lobe collapse and it was also observed that all cases of VAP occurred in the > 72 hour group.

VAP in other studies:

Maria Francesca et al in their study on ventilator associated pneumonia in an Italian intensive care unit, observed 6.6% of VAP (62).

Srinivasan et al observed 32% of VAP in their study (63), whereas 10.7% was observed by Casado et al (64).

VAP was observed in 17.5% of cases in a study by Kendirli et al (4), whereas it was 27.4% in the study done by Tullu et al (38).

Atelectasis in other studies :

This was the commonest complication in the study by Kendirli et al attributing to 26.3% (4) , whereas it was 13.8 % in the study by Wang et al (37).

Extubation & Reintubation :

In our study 3.6% of cases spontaneously extubated. The overall reintubation rate in our study was 3.8%. Among the cases which had reintubation, 40% were due to spontaneous extubation.

Farias et al in his study observed that 4 % of children had spontaneous extubation and the reintubation rate was 10% (60). Studies

have shown that unplanned extubation amounts to 3 -13 % and the reintubation rate following this as 30%.

HEMODYNAMIC INSTABILITY & RESPIRATORY SUPPORT:

In our study, among children with compensated shock 57.8% had to be put on mechanical ventilation directly and 14.7% failed initial CPAP . No child with decompensated shock was initiated CPAP.

Shock correction with fluids and inotropes were required more in infancy. We also observed that shock correction did not affect the duration of hospital stay.

COMORBIDITY AND TYPE OF RESPIRATORY SUPPORT :

Comorbidity among our study population was 12 %. Among the comorbid conditions in our study, majority were HIE sequelae and CHD. In our study 69.2% of children with comorbidity needed direct mechanical ventilation. This was statistically significant that children who required direct invasive ventilation had associated comorbid conditions. CPAP was initiated in the remaining 30.8% of children. We observed that 75% of children with comorbid conditions could be successfully managed with CPAP. We also observed a high mortality in the comorbid group but comorbidity did not influence the duration of

hospital stay. The outcome was good in young children ventilated for primary respiratory pathology without associated comorbidity.

This concludes that although comorbidity predisposes to invasive ventilation in majority of the cases, in children with global developmental delay/ cerebral palsy where mechanical ventilation is preferably avoided, CPAP could still be used as it was found to be effective in 75% of children with comorbidity in our study.

Valerie Payen et al in their study had Congenital heart disease as the major comorbidity (61). Volakli et al observed a comorbidity of 41.3% in their study (65).

CPAP AND MECHANICAL VENTILATION IN VARIOUS CLINICAL CONDITIONS:

Majority of the bronchiolitis cases 93.7% could be managed with CPAP alone , only one case failed CPAP and three children required direct mechanical ventilation. This success with CPAP is because of the auto-PEEP pathophysiology in this condition, where the inflamed airways close prematurely, along with an increase in expiratory time constant. CPAP helps to tide over this auto-PEEP.

We also observed that children with bronchopneumonia alone could be managed with CPAP support effectively which constituted the majority of the cases in CPAP success group.

Kerosene ingestion with aspiration pneumonitis could be effectively managed with CPAP alone, with only one case each, requiring direct invasive ventilation and failure of CPAP.

Bronchopneumonia when associated with septic shock, required direct invasive ventilation in majority of cases and maximum CPAP failure was also noted in the same group being around 54.5%.

Mortality profile in our study:

Mortality in our study was 14.8%. Cases put on direct mechanical ventilation contributed to 85.4% and 14.5% were due to CPAP failure.

We observed that mortality was high in pneumonia with associated septic shock contributing to 39.6%. Comorbidity also influenced outcome as children with comorbid conditions also had high mortality.

Mortality profile in other studies:

A similar mortality of 14% was observed in a study done in Pakisthan (66). Singhal et al and Jeena et al observed a mortality of 18-35% in their studies (67) (68) . A high mortality of 58.3% was observed among mechanically ventilated children in a study by Kendirli et al (4).

Mortality rates as low as 4.5% was observed by Tan et al (69), whereas Camila et al had a mortality of only 1.85% in a study done in Brazil (70).

Studies in United Kingdom have revealed that septicemia and septic shock had a mortality of 17% (48), whereas developing countries have a sepsis related mortality higher than 50% as reported by Branco et al and Sarthi et al in their studies (71) (72) . Children with septic shock had a mortality of 32.6% in a study done in an intensive care unit in Pakisthan by Muhammad Rehan et al (42).

LIMITATIONS

- Cases which were managed with CPAP post extubation were not included.
- Being a public sector, with limited resources, blood gas analysis was not done for our patients. We resorted only to non-invasive monitoring of vital signs – pulse oximetry, cardiac monitor etc along with bedside clinical assessment to monitor our patients.

CONCLUSION

- The success rate in children managed with CPAP alone (Jackson-Rees / Bain circuit) in our study was 89.7%.
- CPAP was more successful in infants compared to older children in our study.
- CPAP alone as a respiratory support, was effective in majority (93.7%) of cases with bronchiolitis .This highlights the good success rate of CPAP in children with bronchiolitis.
- A prolonged duration of CPAP support was required in parenchymal illness such as pneumonia.
- CPAP failure was observed in 10.3% of cases .
- There was no increase in mortality in the CPAP failure group.
- Pneumonia with associated septic shock was observed as a risk factor for CPAP failure.
- In our study, 40.9% of the study group required invasive ventilation, with 34.1% managed with direct mechanical ventilation and the remaining 6.8% intubated following CPAP failure.

- The most common indication for invasive ventilation in our study was respiratory failure (51.4%).
- Prolonged invasive ventilation of > 72 hours was associated with prolonged hospital stay of 2 weeks and above and more complications .
- The most common complication of invasive ventilation in our study was upper lobe atelectasis (47.4%), followed by ventilator associated pneumonia (21.1%).
- The mortality in our study population was 14.8%.
- Bronchopneumonia with associated septic shock had increased mortality than bronchopneumonia alone.
- Our demographic profile had a marginal increase of male children, with our study population being from a rural set up, with majority of parents being illiterate and from upper lower socioeconomic background.
- Although we did not have children with grade 3 & 4 malnutrition in our study, we observed that children with grade 2 malnutrition had increased mortality. This stresses the need for more focus in improving the nutritional status of children with grade 2 malnutrition.

- Early admission to tertiary care, of within one hour from referral centre was associated with improved outcome.
- Underlying comorbid conditions such as HIE sequelae, CHD etc, predisposed to direct invasive ventilation and mortality was also high in this group.

Thus, our study reveals that flow inflating devices – Jackson-Rees/ Bain circuit are effective in providing CPAP in an indigenous way which is extremely beneficial in settings with limited resources, where there is no access to NIV machines.

CPAP through flow inflating device when applied to the properly selected group, helps to avoid invasive ventilation. It should also be remembered that **CPAP is not a substitute for invasive ventilation**, for when the need for intubation arises- timely intervention is needed for an improved outcome.

What is already known?

Conventional CPAP through NIV machines helps to relieve respiratory distress in bronchiolitis, pneumonia, cardiogenic pulmonary edema.

What this study adds?

Indigenous CPAP through flow inflating device – Jackson-Rees/ Bain circuit can also relieve respiratory distress in an effective manner in resource poor settings.

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EPIDEMIOLOGY AND CLINICAL PROFILE OF CHILDREN MANAGED WITH CPAP AND MECHANICAL VENTILATION IN A TERTIARY CARE HOSPITAL

PROFORMA

Name: **Date of admission:**

Sex: **Date of discharge/referral/death:**

A) **Age:** 1) 1 month-1yr 2) >1-3yrs 3) >3-8yrs 4) >8-12yrs

B) **Weight:**

1) normal 2) Grade 2 malnutrition 3) Grade 3&4 malnutrition

C) **Socio-economic status:**

1) upper 2) upper middle 3) lower middle 4) upper lower

5) lower

D) **Parental education**: 1) literate 2) illiterate

E) **Place:** 1) urban 2)rural

F) **Distance to tertiary care :** 1) <1hr 2) 1-3hrs 3) >3hrs

G) **Referral diagnosis:**

H)

SYMPTOMS	**+/-**
1.Fever	
2.Cough and cold	
3.Breathlessness	
4.Convulsions	
5.Posturing	
6.Loss of consciousness	
7.Altered sensorium	
8.Refusal of feed/not looking at mother	
9.Poisoning / envenomation	

I) HEAD TO FOOT EXAMINATION:

1. Fever : Yes/No Temperature
2. Shock:
   - CRT : prolonged/flash
   - Cold extremeties: yes/no
   - Colour: pink/pale/dusky/cyanosed
   - Pulse: weak/bounding
   - BP: HR: RR: SpO2:

     a) Compensated b) decompensated shock
3. CVS: Murmur : yes/no
4. RS:

   a) Respiratory distress : Yes/no (SCR/ICR/Ala nasi flaring)

   b) Shallow breathing : yes/no

   c) Grunt: Yes/no

   Lung signs: Crepts/ wheeze
5. CNS:
   - Sensorium: A/V/P/U
   - Seizures Yes/no
   - Posturing : Yes/no
   - IC Bleed Yes/no
6. Abdomen: Hepatomegaly/splenomegaly
7. Comorbidities:

   IMPRESSION:

J) ANTIBIOTICS:

Empirical 1st line DRUG: DURATION:

If changed,Reason:

1.Empirical 2nd line DRUG: DURATION:

2.Culture based:

K) SHOCK CORRECTION:

a) Fluid bolus: Yes / no

b) Inotrope support: Yes / no

L) INVESTIGATIONS:

1.CBC		7.CXR	
2.S/RFT/Electrolytes		8.ECG/Echo	
3.NEC		9.USG cranium/ abdomen/chest	
4.CRP		10.CT brain/chest	
5.Urine c/s		11.Tracheal aspirate	
6.CSF		12.others	

VENTILATORY SUPPORT:

M) INDICATIONS:

1) CPAP	
a. Bronchiolitis	
b. Bronchopneumonia	
c. Septic shock	
d. Scorpion-myoc.dysfn	
e. Others	
2) Mechanical ventilation	
a. Respiratory failure	
b. Imminent arrest	
c.Refractory/hypotensive shock	
d. Status epilepticus	
e. Anaphylaxis	
f. Coma	
g. Pulmonary edema	
h. Increased ICP	
i. Cardiogenic shock	

N) DURATION:

1) CPAP: a) 24-48hrs b) 48-96hrs c) >96hrs

2) Mechanical ventilation: a) <72hrs b) >72hrs

3) CPAP ⟹ Mechanical ventilation:

A) Initial CPAP: a) <12hrs b) 12-24hrs c) >24hrs

B) Total duration: a) <4d b) >4d

O) EXTUBATION: a) Spontaneous b) planned

P) REINTUBATION:

a) after spontaneous extubation- cause :

b) after weaning(weaning failure)- cause:

1) Unresolved lung disease
2) Secondary pneumonia (VAP)
3) Upper airway obstruction
4) Thick secretions
5) Malnutrition
6) Severe electrolyte imbalance
7) NM disorder
8) Others

Q) COMPLICATIONS:

a) CPAP: 1) Barotrauma 2) others

b) Mech.ventiltion:

1) VAP 2) Bedsore 3) Barotrauma

4) Upper Lobe Collapse 5) Post intubation stridor 6) others

R) FINAL DIAGNOSIS:

S) OUTCOME OF VENTILATORY SUPPORT:

a) 1) Recovered 2) Expired

b) Duration of hospital stay: 1) <7d 2)7d-14d 3) >14d

KEY TO MASTER CHART

Age:

1) 1 month – 1 year
2) > 1-3 years
3) > 3-8 years
4) > 8-12 years

Sex:

1) Male
2) Female

Weight:

1) Normal
2) Underweight
3) SAM

Socio-economic status:

1) Upper
2) Upper middle
3) Lower middle
4) Upper lower
5) Lower

Parent education:

1) Literate
2) Illiterate

Place:

1) Urban
2) Rural

Time to tertiary care:

1) < 1 hour
2) 1-3 hours
3) > 3 hours

Referral diagnosis:

1) Bronchopneumonia/ Pneumonia/Bronchiolitis
2) Late onset sepsis/ septicaemia
3) Congenital heart disease
4) Acute CNS infection
5) Unknown bite
6) Scorpion sting with/without pulmonary edema
7) Kerosene ingestion
8) Status epilepticus
9) AGE with dehydration

Symptoms:

1) Fever
2) Cough and cold
3) Breathlessness
4) Convulsions
5) Posturing
6) Loss of consciousness
7) Altered sensorium
8) Refusal of feeds/ not looking at mother
9) Poisoning/ Envenomation

Fever:

1) Present
2) Absent

Shock:

1) Compensated shock
2) Decompensated shock

CVS:

1) Murmur present
2) Murmur absent

Respiratory system:

1) Respiratory distress
2) Shallow breathing
3) Grunt

CNS:

1) Sensorium
    1a) alert
    1b) verbal
    1c) Pain responsive
    1d) Unresponsive
2) Seizures
3) Posturing
4) IC bleed

Abdomen:

1) Hepatomegaly
2) Splenomegaly
3) Hepatosplenomegaly

Comorbidities:

1) Underweight
2) Cleft lip and palate
3) HIE sequelae / cerebral palsy
4) CHD

5) Congenital hypothyroidism
6) Down syndrome
7) Meningomyelocele / hydrocephalus
8) Craniosynostosis
9) Severe anaemia
10) Multiple congenital anomalies
11) Storage disorder
12) AR PCKD
13) RHD
14) Measles

Antibiotics:

1) Empirical 1st line
2) Empirical 2nd line
3) Culture based

Shock correction:

1) Fluid bolus
2) Inotrope support

Investigations:

1) CBC
2) Blood glucose, RFT, electrolytes
3) NEC
4) CRP
5) Urine c/s
6) CSF
7) CXR
8) ECG/ ECHO
9) USG Cranium/ abdomen/ chest
10) CT Brain/ chest

11) Tracheal aspirate

12) others

CPAP:

1) Yes
2) No

CPAP Indication:

1) Bronchiolitis
2) Bronchopneumonia / pneumonia
3) Septic shock / septicaemia
4) Scorpion sting- myocardial dysfunction
5) Others

CPAP Duration:

1) 24-48 hours
2) 48-96 hours
3) > 96 hours

Mechanical Ventilation:

1) **Yes**
2) **No**

Mechanical Ventilation indication:

1) Respiratory failure
2) Imminent arrest
3) Refractory / hypotensive shock
4) Status epilepticus
5) Anaphylaxis
6) Coma
7) Pulmonary edema
8) Increased ICP
9) Cardiogenic shock

Mechanical Ventilation duration:

1) < 72 hours
2) > 72 hours

CPAP- Mechanical Ventilation duration:

1a) initial CPAP < 12 hours

1b) initial CPAP 12 -24 hours

1c) initial CPAP > 24 hours

2a) Total duration < 4 days

2b) Total duration > 4 days

Extubation:

1) Spontaneous
2) Planned

Reintubation:

1) Yes
2) No

Reintubation cause :

1) Spontaneous extubation
2) Weaning failure:

2a) unresolved lung disease

2b) ventilator associated pneumonia

2c) upper airway obstruction

2d) malnutrition

2e) severe electrolyte imbalance

2f) NM disorder

2g) others

Complications:

1) Due to CPAP
   1a) barotrauma
   1b) others
2) Due to mechanical ventilation:
   2a) VAP
   2b) bedsore
   2c) barotraumas
   2d) upper lobe collapse
   2e) post intubation stridor
   2f) others

Final diagnosis:

1) Bronchiolitis
2) Bronchopneumonia / pneumonia
3) Bronchopneumonia / pneumonia and associated septic shock
4) Septicaemia / septic shock
5) Kerosene ingestion/ Aspiration Pneumonia
6) Seizure disorder/ status epilepticus
7) Snake bite / respiratory failure
8) CHD/ CCF
9) Late HDN / IC bleed
10) Drowning / hypoxic encephalopathy
11) Bronchial asthma
12) Acute CNS infection/ encephalopathy
13) scorpion sting / pulmonary edema
14) Pneumothorax
15) OPC poisoning

Outcome:

1) Recovered
2) Expired
3) Referred

Duration of hospital stay:

1) < 7 days
2) 7- 14 days
3) > 14 days

IP no	Name	Age	Sex	Weight	SE status	Parent education	Place	Time to ter.care	Referral diagnosis	Symptoms	Fever	Shock	CVS	RS	CNS	Abdomen	Comorb idities	Antibiot ics	Shock correction	Investigations	Positive reports	CPAP	CPAP Indication	CPAP Duration	Mechanical ventilation	Mec.ve n.Ind	Mec.ven. duration	CPAP to MV Duration	Extubation	Reintubati on	Reintubati on Cause	Complicati ons	Final diagnosis	Outcome	Duration of hospital stay
48887	Agasthiya	1	2	2	4	2	2	2	1,3	1,2,3,5,8	2	2	1	1,3	1c,3	1	4	1	1,2	1,2,7,8	7,8	2			1	2	1			2			3	2	1
5810	keerthi	1	2	1	4	2	2	2		1,2,3,8	1		2	1,3	1c,3			1		1,2,3,4,5,7,11	4,7	2			1	1	1		2	2			2	1	2
47652	B/O Anandi	1	1	1	4	2	2	2	4	5,6,8	2		2	2	1c,2,3,4			1		1,2,3,4,5,7,10	10	2			1	8	2		2	2		2d	9	1	2
48432	B/O Sumathi	1	2	1	5	2	2	2		1,4,7,8	2	2	2	2	1c,3			1	1,2	1,2,7		2			1	2	1			2			4	2	1
47321	Dharshan	1	1	1	4	2	2	2		2,3,5,8	2		2	1,3	1c			1		1,2,3,4,5,7,9	7	2			1	1	1			2			1	1	2
11508	B/O Nadhiya	1	1	1	4	1	1	2		4,5,6,8	2	1	2	2	1c,2,3,4			1	1,2	1,2,3,4,5,7,9,10	9,10	2			1	8	2		2	2		2d	9	1	3
68	B/O Nadhiya	1	1	1	4	2	2	2		2,3	2	1	2	1,3	1c	1	4	1	1,2	1,2,3,4,5,7,8	7,8	2			1	9	1		2	2			8	1	2
49469	Bhoomika	4	2	1	4	2	2	2		3,7,9		2	2	1	1c			1	1,2	1,2,3,4,5,7	7	2			1	7	1			2			7	2	1
33556	Nithish	2	1	1	4	2	2	2		1,4,6,8	2		2	1,3	1c,2			1		1,2,3,4,5,7,10		2			1	4	1		2	2			6	1	2
9310	Santhosh	1	1	1	4	2	2	3		1,2,3	1	1	2	1,3	1b			1	1,2	1,2,3,4,7	4,7	2			1	1	2		2	2			3	1	2
545	Yashini	1	2	1	3	1	1	2		1,2,3,8	1	1	2	1,3	1c			1,2	1,2	1,2,3,4,5,7,9	7	2			1	1	1		2	2			3	1	2
39977	Venkatraman	3	1	2	5	2	2	3		4,6	2		2	2	1c,2		3	1		1,2,4,7		2			1	4	1			2			6	2	1
52858	Tamilmathi	2	2	1	3	2	2	2		1,4,6	1	1	2	1	1c,2,3			1	1	1,2,3,4,5,6,7,10,11	4	2			1	4	1		2	2		2d	6	1	2
8750	Sanjay	1	1	1	4	2	2	2		2,3,5,8	2		2	1,3	1c,3			1		1,2,3,4,5,7,9	4,7	2			1	1	1		2	2			1	1	2
6560	Jeganathan	1	1	1	5	2	2	3		1,2,3,5	1	1	2	1,3	1c,3	1		1,2	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2			3	1	2
10624	Tajkhan	1	1	1	4	2	2	3		4,5,6,8	1		2	1	1c,2,3	1	3	1		1,2,3,4,5,7,9,10	4,9,10	2			1	4	2		2	2			6	1	2
26586	B/O Paanjaalai	1	1	1	4	1	2	2	4	3,4,5,6,8	2		2	2,3	1c,2,3			1		1,2,3,4,5,7,10	4	2			1	4	2			2			6	2	1
753	Sakthivel	1	1	1	4	2	2	2		1,3,4,5,7	1	1	2	1	1c,2,3			1	1,2	1,2,3,4,7		2			1	4	1			2			6	2	1
52656	Murugan	3	1	1	4	1	2	2		3,6,	2	1	2	1,3	1c			1	1,2	1,2,7	2	2			1	7	1			2			7	3	
30174	Jeevitha	3	2	1	4	2	2	2		3,6,9	2	1	2	2	1c			1	1,2	1,2,3,4,5,7	4	2			1	1	1		2	2			7	1	2
2905	Kishore	1	1	1	4	2	2	2		1,2,3,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	2			1	1	1		2	2			3	1	2
37144	Meera	2	2	1	5	2	2	2		3,5,7	2	1	2	1,3	1c,3			1	1,2	1,2,3,4,5,7	7	2			1	1	1			2			10	2	1
14876	Indrakumar	2	1	2	5	2	2	3		1,4,7	1		2	2	1c,2,3			1		1,2,3,4,5,7		2			1	4	1		2	2			6	1	1
11060	Tamilendi	3	2	1	4	2	2	1		1,4,6	1		2	2	1c,2			1		1,2,3,4,5,7	4	2			1	4	1		2	2			6	1	2
165	B/O Nishanthi	1	1	1	4	2	2	3		1,2,3,4,8	1	1	2	2	1c,2,3	1		1	1,2	1,2,3,4,5,6,7,9	4,7	2			1	1	2		2	2		2d	4	1	2
33886	Sarathy	1	1	1	4	1	1	2	2	1,2,3,5,8	2	1	2	1,3	1b,3			1	1,2	1,2,3,4,5,7,9	4,7	2			1	1	1		2	1	2c	2e	3	1	2
50096	Sanjay	1	1	1	4	2	2	3		1,2,3,5,8	1	1	2	1,3	1c		5	1	1,2	1,2,3,4,5,7,11	4,7	2			1	1	1		2	2			3	1	2
106231	B/O Kamalan	1	1	1	4	2	2	3		1,2,3,5,8	1		2	1,3	1c			1		1,2,3,4,5,7	4,7	2			1	1	1		2	2			2	1	2
5869	Ajmeer	1	1	2	5	2	2	2		1,2,3,5,7,8	2	2	2	2	1c,3	1		1	1,2	1,2,7	7	2			1	2	1			2			3	2	1
107589	Ragavi	1	2	1	4	2	2	2		1,2,3,5,8	1	1	2	1,3	1c			1	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2			3	1	2
5762	Ajay	1	1	2	4	2	2	2		1,2,3,5,8	2	1	2	1,3	1c			1	1,2	1,2,3,4,5,7	4,7	2			1	1	1			2			3	2	1
6733	Vennila	1	2	1	4	2	2	3		4,5,7,8	2		2	1,3	1c,2,3			1		1,2,3,4,5,7,9,10	4	2			1	4	1		2	2			6	1	2
4109	Rathnam	2	1	1	5	2	2	3		3,9	2	1	2	1,3	1c			1,2	1,2	1,2,3,4,5,7,11	4,7	2			1	1	2		2	2		2d	5	1	3
31869	Ganapathy	1	1	1	4	2	2	2		1,3,5,8	2	1	2	1,3	1c	1		1	1,2	1,2,3,4,5,7	4,5	2			1	1	2		2	2			4	1	2
494	Venkatakrishnan	1	1	1	4	2	2	3		1,2,3,5,8	1	1	2	1,3	1c,3			1	1,2	1,2,3,4,5,7	4,5,7	2			1	1	1		2	2			3	1	2
256	B/O Muthulaksh	1	2	1	4	1	1	1	2	4,5,7,8	2		2	2	1c,2,3,4			1		1,2,3,4,7,10	10	2			1	8	2		2	2			9	1	3

4899	Divagar	3	1	1	4	1	1	2		3	2		2	1,3	1b			1		1,2,7	7	2			1	1	1			2			11	3	
12689	Manikandan	1	1	1	4	2	2	2		1,2,3,5,8	1		2	1,3	1c,		3	1		1,2,3,4,5,7	4,7	2			1	1	1		2	2			2	1	2
47846	B/O Deepa	1	1	2	4	1	2	2		4,6,7,8	2		2	1	1c,2,3		3	1		1,2,3,4,5,7,10	4,10	2			1	4	1		2	2			6	1	2
24819	Guruprasath	1	1	1	4	1	1	2		1,4,5,7	1		2	2	1c,2,3			1		1,2,3,4,5,6,7,10,11	4,6,10	2			1	4	2		2	2			12	1	3
12260	Dharaneshwaran	4	1	1	4	1	2	2	6	3,7,9	2	2	2	1,3	1c			1	1,2	1,2,3,4,5,7,8	4,7,8	2			1	7	2		2	2		2f	13	1	2
18327	Priyadarshini	1	2	1	4	2	2	2	1	1,2,3,8	2	1	1	1,3	1c	1	4,6	1	1,2	1,2,7,8	7,8	2			1	1	1			2			3	2	1
5537	Rajapriyan	3	1	2	5	2	2	3		4,5,6,8	2		2	2	1c,2		3			1,2		2			1	4	1			2			6	2	1
4683	Deepak	1	1	2	5	2	2	2		3,6,8	2	1	1	1	1b	1	4	1	1,2	1,2,4,7,8	4,7,8	2			1	9	1			2			8	2	1
6195	Mahalakshmi	1	2	1	5	2	2	3		1,2,3,5,8	2	2	2	1,3	1c,3			1	1,2	1,2,3,4,5,7	4,7	2			1	1	1			2			3	2	1
34906	Danniyashika	4	2	1	4	2	2	2		1,4,7	1	1	2	2	1c,2			1	1,2	1,2,4,7	4,12	2			1	6	1			2			12	2	1
9603	Vishnupriya	1	2	2	4	2	2	2		1,4,5,7,8	2	2	2	2	1c,3		7	1	1,2	1,2		2			1	2	1			2			12	2	1
14613	Dillibabu	1	1	2	5	2	2	3	1	1,2,3,5,8	2	1	1	1,3	1c,3	1	4,6	1	1,2	1,2,3,4,5,7,8	4,7,8	2			1	1	2		1	1	1		3	2	1
20946	Archana	4	2	1	4	2	2	3		1,4,6	2	1	2	2	1d			1	1,2	1,2,4,7	4	2			1	6	1			2			12	2	1
4444	Jaison	1	1	2	4	2	2	2		4,5,6,8	2		2	2	1c,2,3		8	1		1,2,7		2			1	4	1			2			6	2	1
5061	B/O Geetha	1	2	1	4	2	2	2		4,5,7,8	2		2	2	1c,2,3,4		5	1,2		1,2,3,4,5,7,10,11	7,10	2			1	8	2		2	2		2a	9	1	3
4889	Vijay	2	1	1	5	2	2	3		1,2,3	1		1	1,3	1c		4	1		1,2,3,4,5,7,8	4,7,8	2			1	1	2		2	2			2	1	2
4683	Deepak	2	1	1	4	2	2	2		1,2,3	1		2	1,3	1c			1		1,2,3,4,5,7	4,7	2			1	1	1		2	2		2d	2	1	2
2506	Ilakkiyashree	1	2	1	3	1	1	2		4,5,7,8	2		2	2	1c,2,3			1		1,2,3,4,5,7,9,10		2			1	4	2		2	2			6	1	2
1229	Thanushree	1	2	1	4	2	2	2		1,2,3,5,8	1	1	2	1,3	1c,3			1	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2			3	1	2
9429	Yuvanesh	1	1	1	4	2	2	2	5	3,6,9	2	2	2	1,3	1b			1	1,2	1,2,7,8	7,8	2			1	7	1		2	2			13	1	2
5578	Rakshana	1	2	1	4	2	2	2		1,2,3,8	1		2	1,3	1c			1		1,2,3,4,5,7	4,7	2			1	1	1		2	2			2	1	2
35892	Rohini	1	2	1	4	2	2	2		1,3,5,8	2	1	2	1,3	1c,3	1		1,3	1,2	1,2,3,4,5,6,7,9,11	3,4	2			1	1	2		2	2			4	1	3
6198	Radha	1	2	1	5	2	2	3	1	1,3,5,6,8	2	1	2	1,3	1c,3	3	9	1	1,2	1,2,3,4,5,7,9	1,4,5	2			1	1	1		2	2		2d	4	1	2
13221	Roshitha	2	2	1	4	2	2	2		1,2,3,5,8	1	1	2	1,3	1c			1	1,2	1,2,3,4,5,7	4,7	2			1	1	1		2	2			3	1	2
40832	B/O Suguna	1	1	1	5	2	2	3	1	1,2,3,8	1	1	2	1	1c,2,3	1		1	1,2	1,2,4,7,9	4,7	2			1	4	1			2			4	2	1
33909	Kanishka	1	2	1	5	2	2	3		1,3,4,8	2	1	2	1,3	1c,3	3		1,3	1,2	1,2,3,4,5,6,7,9,11	3,4	2			1	1	2		2	2			4	1	3
28133	Shalini	1	2	1	5	2	2	3	9	1,3,5,8	1	1	2	1,3	1b,3			1,2,3	1,2	1,2,3,4,5,6,7,9,11	3,4,7	2			1	1	2		2	2		2a	4	1	3
43309	Dharshini	1	2	2	5	2	2	3		1,2,3,8	2	1	2	1,3	1c		6	1	1,2	1,2,3,4,5,7,8,9	4,7	2			1	1	1		1	2			3	1	2
21906	Kamesh	2	1	1	4	1	1	2	2	1,3,8	1	1	2	1,3	1c			1,2	1,2	1,2,3,4,5,7,9,10,11	4,5,7,9,10	2			1	1	2		2	1	2a	2f	14	1	3
38665	Ilamaaran	1	1	1	4	2	2	2		1,2,3,5,8	1	1	2	1,3	1c,3	1		1,2	1,2	1,2,3,4,5,7,9,11	4,7	2			1	1	2		2	2			3	1	3
42040	Ilakkiya	1	2	1	5	2	2	3	1	1,2,3,4,8	2	1	2	2	1c,2,3			1,2	1,2	1,2,3,4,5,6,7,9	2,4,7	2			1	1	2		2	2		2a	4	1	3
34610	Preethi	4	2	1	5	2	2	3		1,6	1	2	2	2	1d	1		1	1,2	1,2,4,7,10		2			1	2	1			2			12	2	1
5815	Shaktivel	1	1	1	4	2	2	2		1,2,3,8	1		2	3	1b			1		1,2,3,4,5,7	4,7	1	2		1	1		1a,2a	2	2			2	1	2
48989	Sheela	1	2	1	5	2	2	3		1,2,3,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	1	2		1	1		1a,2b	2	2			3	1	2
40111	Sivasaran	1	1	1	5	2	2	2		1,2,3,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	1	2		1	1		1b,2a		2			3	2	1
38484	Sadhana	1	2	1	4	1	1	2	1	1,2,3,8	1	1	2	1	1b			1	1,2	1,2,3,4,7	4,7	1	2		1	1		1a,2a		2			3	2	1
46428	B/O Loganayagi	1	1	1	4	1	1	2		1,2,3	1	1	2	1	1b		3	1	1,2	1,2,3,4,7	4,7	1	2		1	1		1a,2a		2			3	2	1

45892	Ezhilarasan	1	1	1	5	2	2	2		2,3	2	1	2	1,3	1b			1,2	1,2	1,2,3,4,5,6,7,8,9	3,4	1	3		1	1		1a,2a	2	2			4	1	3
23917	Gopi	1	1	1	5	2	2	3	1	1,3,5,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,6,7,9	4,7	1	3		1	1		1a,2a	2	2			4	1	2
39818	Dinesh bala	1	1	1	4	1	1	2	1	1,2,3,8	1	1	2	1,3	1b			1,2	1	1,2,3,4,5,7,9	4,7	1	2		1	1		1c,2b	2	2			3	1	2
49239	Ramya	3	2	1	5	2	2	3		3,7,9	2	2	2	2	1c				1,2	1,2,3,4,5,7,8	7,8	2			1	7	1		2	2			13	1	2
49837	Yuvaneshwaran	3	1	1	4	2	2	2		3,7,9	2	1	2	1,3	1b			1	1,2	1,2,4,7,8	4,7,8	2			1	7	1		2	2			13	1	1
49826	Aakash	1	1	1	5	2	2	3		1,2,3,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	2			1	1	1		2	2		2e	3	1	2
45801	Deepika	2	2	2	5	2	2	3		1,2,3	1	1	2	1,3	1c			1,2	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2		2d	3	1	3
42156	Keerthivasan	1	1	1	4	2	2	2		1,3,5,7,8	2	1	2	1,3	1c		8,10	1	1,2	1,2,4,7,9	4,9	2			1	1	1			2			4	2	1
46854	Aishwarya	2	2	1	5	2	2	3		3,5,6	2	1	2	2,3	1c,3			1	1,2	1,2,3,4,5,7		2			1	1	1		2	2			10	1	2
47039	Monisha	1	2	1	5	2	2	3		1,2,3,5,6,8	2	2	2	1,3	1c,3	1		1	1,2	1,2,3,4,7	7	2			1	2	1			2			3	2	1
34480	Divyaprakash	1	1	1	4	2	2	2		4,5,7,8	2		2	2	1c,2		6	1		1,2,7		2			1	4	1			2			6	2	1
17449	Varshini	1	2	1	4	1	1	2	1	1,2,3,8	2	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,7,11	7	1	2		1	1		1a,2a	2	2			3	1	2
7895	Jeevitha	2	2	1	4	2	2	2		3,9	2	1	2	1,3	1c				1,2	1,2,4,7,8	4,7,8	2			1	7	1		2	2			13	1	2
47114	Dhatchayini	1	2	2	4	2	2	2	1	2,3,4,7	2	2	2	2	1c,2		3	1	1,2	1,2,4,7		2			1	2	1			2			3	2	1
46144	Priya	2	2	1	5	2	2	3		1,4,6	2	2	2	2	1c,3			1	1,2	1,2,4,7		2			1	2	1			2			6	2	1
47165	Arivalagan	1	1	2	4	2	2	2		1,4,6,7	1	1	2	2	1c,2			1	1,2	1,2,3,4,7,10	4	2			1	4	2			2			6	2	1
41894	Shaktivel	1	1	2	5	2	2	3		1,2,3,5	1	1	2	1,3	1c,3			1,2	1,2	1,2,3,4,5,7	4,7	2			1	1	1			2			3	2	1
34619	Preeti nandini	4	2	1	4	2	2	3		3,4,6,7	2	2	2	2	1c,2			1	1,2	1,2,4,7,10		2			1	4	1			2			6	2	1
9234	Prathiyusha	1	2	2	4	2	2	3		2,3,5,6,8	2	2	1	1,3	1c,3	1	4	1	1,2	1,2,7,8	7,8	2			1	2	1			2			8	2	1
15339	Gopika	2	2	1	4	2	2	3		3,6,9	2	1	2	1,3	1c			1	1,2	1,2,3,4,5,7,11	7,11	2			1	1	1		2	2			7	1	2
15339	Hariprasanth	1	1	1	5	2	2	3		1,2,3,5,8	1	1	2	1,3	1c,3	1		1	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2			3	2	2
18529	Selvi	1	2	1	4	2	2	2	1	1,2,3,5,8	1	1	2	1,3	1c,3			1,2	1,2	1,2,3,4,5,7	4,7	2			1	1	2		2	2		2d	3	1	2
16220	Prabu	1	1	1	3	1	1	2		1,2,3,5,8	1	1	2	1,3	1c,3	1		1	1,2	1,2,3,4,5,7,11	4,7	2			1	1	1		2	2			3	1	2
14854	Rithish kumar	3	1	1	4	2	2	3		2,3	2	1	1	1,3	1b	1	4	1	1,2	1,2,7,8	7,8	2			1	9	1			2			8	2	1
13336	Bhuvanesh	1	1	1	4	2	2	2		3,5,6,8	2	2	1	1,3	1c,3	1	4	1	1,2	1,2,7,8	7,8	2			1	9	1			2			8	2	1
47749	Yuvaraj	1	1	1	4	2	2	2		1,3,5,8	2	1	2	1,3	1c,3			1	1,2	1,2,3,4,5,7,9	4	2			1	1	1		2	2			4	1	2
18941	Gokul	1	1	1	5	2	2	2		1,3,4,5,8	1	1	2	1,3	1c,3	1		1	1,2	1,2,3,4,5,6,7,9	4	2			1	1	1		2	2			4	1	2
37347	Sunil	1	1	1	4	1	1	2		1,2,3,5,8	1	1	2	1,3	1c	1		1	1,2	1,2,3,4,5,7,9,11	4,5,7	2			1	1	2		2	2			3	1	2
34502	Rasika	4	2	1	5	2	2	3		3,6,9	2	1	2	1,3	1c			1	1,2	1,2,3,4,5,7,11	4,7	2			1	7	2		2	2			7	1	2
46025	B/O Nithya	1	2	1	4	2	2	2		1,2,3,5,8	2	1	2	1,3	1c	1		1	1,2	1,2,3,4,5,7	3,4,7	2			1	1	1			2			3	2	1
40080	Lokeshwari	1	2	2	4	2	2	2		1,2,3,5,8	2	1	2	1,3	1c,3	1		1,2	1,2	1,2,3,4,5,7	4,7	2			1	1	2			2			3	2	1
35277	Hemavarshini	1	2	1	5	2	2	3		1,3,5,7,8	2	2	2	1,3	1c,3	1		1	1,2	1,2,3,4,7	4,7	2			1	2	1			2			4	2	1
41272	Meganathan	1	1	2	5	2	2	3	9	3,5,6,8	2	2	2	2	1c,3	1		1	1,2	1,2,7		2			1	2	1			2			4	2	1
46671	Divya	1	2	1	4	2	2	2		1,3,5,7,8	2	2	2	2	1c,3	1		1	1,2	1,2,7		2			1	2	1			2			4	2	1
32121	Sadhana	1	2	1	4	2	2	2		1,2,3,5,8	1	1	2	1,3	1c,3	1		1,2	1,2	1,2,3,4,5,7,9	4,7	2			1	1	2		2	1	2a		3	1	2
25705	Pushpalatha	4	2	1	4	1	1	2	5	3,6	2	2	2	2	1c			1,2	1,2	1,2,3,4,5,7,8,11	4,7	2			1	7	2		2			2f	7	1	2
40416	Seethalakshmi	1	2	1	5	1	1	2	4	1,4,5,6,8	2	1	2	2	1c,2,3			1,3	1,2	1,2,3,4,5,6,7,9,10	3,4	2			1	4	1		2	2			4	1	3

50580	Raghavan	1	1	1	5	2	2	3		2,3	2		2	1,3	1c,3		10	1		1,2,3,4,5,7,9	4,7	2			1	1	2		2	2			1	1	2
40830	Thaniga	3	2	1	4	2	2	2		4,6	2		2	2	1c,2		3	1		1,2,4,7	4	2			1	4	1			2			6	2	1
41432	Kirubakaran	3	1	1	5	2	2	2		7,9	2	1	2	2	1c			1	1,2	1,2,7		2			1	1	1			2			15	2	1
41433	Anbuselvan	2	1	1	5	2	2	2		7,9	2	1	2	2	1c			1	1,2	1,2,4,7	4	2			1	1	1			2			15	2	1
43369	Pavishka	1	2	1	2	1	1	1		4,5,6,8	1	1	2	1	1c,2,3			1	1,2	1,2		2			1	4	1			2			6	3	
36768	Saravanan	3	1	1	4	2	2	2		3,7,9	2	1	2	1,3	1c			1	1,2	1,2,3,4,5,7,8	4,7,8	2			1	7	1		2	2			13	1	2
34071	Gangammal	1	2	2	4	2	2	2		1,2,3,5,8	1	1	1	1,3	1c	1	4	1	1,2	1,2,7,8	7,8	2			1	1	1			2			3	2	1
29161	Rithika	1	2	1	4	2	2	2		1,2,3,8	1	1	2	1,3	1c			1	1,2	1,2,3,4,5,7,11	4,5,7	2			1	1	1		2	2			3	1	2
24145	Charulatha	1	2	1	4	1	2	2		1,3	1	1	2	1	1b			1	1	1,3,4,7	4,7	1	2	1	2								3	1	1
43889	Avinash	1	1	1	4	1	1	2		1,2,3,8	2	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,7,9	4	1	3	2	2								4	1	2
38356	Yasar	1	1	1	4	1	1	2	1	1,2,3	2		2	1,3	1b			1		1,2,3,4,7,9	4,7	1	2	2	2								2	1	2
42346	B/O Sumathi	1	1	1	4	1	1	2		1,3,5,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,6,7,9	4	1	3	1	2								4	1	2
39456	B/O Sangeetha	1	1	1	4	1	2	2		1,2,3,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7,9	4,7	1	2	2	2								3	1	2
25813	B/O Vasanthi	1	1	1	3	1	1	1		1,2,3,8	2	1	2	1	1b	1		1,3	1,2	1,2,3,4,5,6,7,9	3,4,7	1	3	1	2								4	1	3
26287	Jesse Jennifer	1	2	1	3	1	1	1		1,2,3	2		2	1,3	1b					1,2,4,7	7	1	1	1	2								1	1	1
31738	B/O Abi	1	2	1	3	2	2	2		2,3,8	2	1	2	1	1b	1		1	1,2	1,2,3,4,5,7,9	4,5	1	3	1	2								4	1	2
43477	Nithyashree	1	2	1	4	2	2	2		1,2,3,8	2		2	1,3	1b			1		1,2,3,4,7,9	4,7	1	2	1	2								2	1	1
48853	Aashish	1	1	1	4	1	1	2		1,2,3	2		2	1,3	1b					1,2,4,7	4,7	1	1	1	2								1	1	1
23343	Poornima	1	2	1	4	2	2	2		1,2,3,8	2	1	2	1	1b	1		1	1,2	1,2,3,4,5,7,9	4	1	3	1	2								4	1	2
37790	Logapriya	3	2	1	5	2	2	3	6	3,9	2		2	1	1b					1,2,7,8	7,8	1	4	1	2								13	1	1
38361	Aakash	1	1	1	4	2	2	3	1	1,2,3	1		2	1,3	1b			1		1,2,3,4,7	4,7	1	2	2	2							1b	2	1	1
48020	Mahesh	2	1	1	4	1	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,7	7	1	2	1	2								2	1	2
43816	Deepak	1	1	1	4	2	2	2	1	1,2,3	2		2	1,3	1b					1,2,7	7	1	1	1	2								1	1	1
44784	Nithya ranjani	1	2	1	4	1	1	2		1,2,3	1		2	1	1b			1		1,2,3,4,7	4,7	1	2	2	2								2	1	2
49788	Monisha	2	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
24472	Deepika	1	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,4,7	4,7	1	2	1	2								2	1	1
14199	Mohanraj	4	1	1	4	1	1	2	6	3,9	2		2	1	1b					2,7,8	8	1	4	1	2								13	1	1
33938	Thavanesh	2	1	1	4	2	1	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
38216	Nithish	1	1	1	4	1	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
40061	Logesh	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	2	2								2	1	2
37860	Niranjana	1	2	1	3	1	1	2		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	1
49247	Shalini	1	2	1	4	1	2	2	1	1,2,3	1		2	1,3	1b			1		1,2,3,4,7	4,7	1	2	1	2								2	1	1
48130	Aparna	1	2	1	4	2	1	2		1,3,8	1	1	2	1	1b			1	1,2	1,2,3,4,7,9	4,7	1	3	1	2								4	1	2
49340	Chinnayan	1	1	2	5	2	2	3		1,2,3,8	1	1	2	1,3	1b	1		1	1	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
49776	Yogesh	1	1	1	4	1	2	2		1,3,8	2		2	1,3	1b			1		1,4,7	7	1	1	1	2								1	1	1
49526	Hariharan	2	1	1	4	2	2	3		1,2,3	1		2	1,3	1b			1,2		1,2,3,4,5,7	4,7	1	2	2	2								2	1	2
43681	Sandhya	1	2	1	4	1	1	2		1,2,3,8	1	1	2	1	1b	1		1	1,2	1,2,3,4,5,7,9	4,7	1	2	1	2								3	1	2

39858	Sanjay	1	1	1	4	1	1	2		1,2,3,8	1		2	1,3	1b			1,2		1,2,3,4,5,7	4,7	1	2	3	2								2	1	2
49571	Vishruthi	2	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	1
50386	Deepak	1	1	1	4	2	2	2		1,2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
50416	Anushree	1	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	1
49443	Suchitra Devi	1	2	1	4	2	2	2		2,3	2		2	1,3	1b			1		1,4,7	4,7	1	1	1	2								1	1	1
50391	B/O Nirosha	1	2	1	4	2	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7	7	1	2	1	2							1b	2	1	2
50257	Yashini	1	2	1	5	2	2	2		1,2,3,8	1		2	1,3	1b		14	1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
49416	B/O Umamahesh	1	2	1	4	2	2	2		1,3,5	2	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
21906	Kameshwaran	2	1	1	4	1	1	2		1,2,3	1		2	1	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
50309	Sabith	2	1	1	5	2	2	3		3,9	2	1	2	1	1b				1,2	2,7,8	8	1	4	1	2								13	1	1
32058	Shalini	1	2	1	4	1	1	2		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
36210	Jagadeesh	1	1	1	4	2	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
38136	Koushika	1	2	1	4	1	1	2		2,3	1		2	1,3	1b					1,2,4,7	4,7	1	1	1	2								1	1	1
40693	Veera raghavan	1	1	1	4	2	1	2		1,2,3	1		2	1	1b			1,2		1,2,3,4,5,7	4,7	1	2	2	2								2	1	2
40808	Vidhyashree	3	2	2	4	2	2	3		1,2,3	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	2	2								2	1	2
40726	Kaviya	1	2	1	5	2	2	3		2,3,8	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
40923	Rohith	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,7	4,7	1	2	1	2								2	1	1
43049	Shiny	1	2	1	5	2	2	3		1,2,3	1		2	1,3	1b			1		1,3,4,7	4,7	1	2	1	2								2	1	1
40870	Jeevashree	1	2	1	5	2	2	3		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
43646	Rajesh	1	1	1	4	2	2	2		2,3,8	2		2	1,3	1b					1,4,7	4,7	1	1	1	2								1	1	1
49792	Joseph	1	1	1	4	1	1	2		1,2,3	2		2	1	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	1
49400	Sidhu	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	1
44932	Nesa rathinam	1	1	1	4	1	1	1		2,3	2		2	1	1b					1,2,4,7	7	1	1	1	2								1	1	1
43753	B/O Nagavalli	1	2	1	5	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,7	4,7	1	2	1	2								2	1	2
45493	B/O Hemalatha	1	1	1	4	2	2	2		2,3,8	2		2	1,3	1b			1		1,4,7	4,7	1	1	1	2								1	1	1
51152	B/O Prema	1	1	1	3	1	2	2		1,3,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7,9	4	1	3	1	2								4	1	2
45416	Rithish	1	1	1	5	2	2	3		3,9	2		2	1,3	1b			1		1,2,4,7	4,7	1	5	1	2								5	1	2
45299	Goshanth	1	1	1	5	2	2	3		2,3,8	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
37303	Aishwarya	1	2	1	4	2	2	2		1,2,3,8	1		2	1	1b			1		1,3,4,7	4,7	1	2	1	2								2	1	1
38385	Aarthi	1	2	1	4	2	1	2		1,2,3	2		2	1,3	1b					1,3,4,7	7	1	1	1	2								1	1	1
50817	Sanjana	1	2	1	3	1	1	1		1,2,3	2		2	1,3	1b					1,2,3,4,5,7	7	1	1	1	2								1	1	1
51361	Siva raman	2	1	1	4	1	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	7	1	2	1	2								2	1	1
51772	Yugesh	1	1	1	3	1	2	2		1,2,3,8	2	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
51549	B/O Revathi	1	1	1	3	1	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7,9	4,7	1	2	2	2								2	1	2
51249	Yazhini	1	2	1	4	2	2	2		2,3,8	2		2	1,3	1b			1		1,3,4,5,7	7	1	1	1	2								1	1	1
51124	Sarofina	2	2	1	3	1	1	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
51262	Suganthi	1	2	1	4	2	2	2		1,2,3	2		2	1,3	1b					1,3,4,7	4,7	1	1	1	2								1	1	1

51316	Sanjay	1	1	1	3	1	1	2		1,2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
51815	Vedesh	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
43500	Pushpa	1	2	1	5	2	2	3		1,2,3,8	2		2	1,3	1b			1		1,3,4,7	4,7	1	1	2	2								1	1	2
51709	B/O Vijayalakshr	1	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1,2		1,3,4,5,7,9	4,7	1	2	2	2							1b	2	1	2
51594	Vinayagamoorth	2	1	1	3	1	1	1		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
43621	Diya	1	2	1	4	2	2	2		2,3	2		2	1	1b					1,3,4,7	7	1	1	1	2								1	1	1
17082	Sabari	2	1	1	4	2	2	2		2,3,9	2		2	1,3	1b			1		1,2,3,4,5,7	7	1	5	1	2								5	1	2
17098	Hemesh	2	1	1	4	2	2	2		3,9	2		2	1	1b					1,2,7,8	7,8	1	4	1	2								13	1	1
51190	Saran	4	1	1	5	2	2	3		1,3	1		1	1	1b	1	13	1		1,2,3,4,5,7,8	4,7,8	1	5	1	2								8	1	2
50612	Jagath	1	1	1	4	2	2	2		1,2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
51394	Divyashree	1	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7,9	4,7	1	2	1	2								2	1	2
17246	Siva	2	1	1	4	2	2	2		2,3,9	2		2	1,3	1b			1		1,2,3,4,5,7	7	1	5	1	2								5	1	2
19969	Praganathan	1	1	1	5	2	2	3		1,2,3,8	2		2	1,3	1b		3	1,2		1,2,3,4,5,7	4,7	1	2	2	2								2	1	2
17178	Sujipriya	1	2	1	3	1	1	2		1,2,3	2		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
51020	Dharshan	1	1	1	3	1	1	1		2,3	2		2	1,3	1b					1,2,4,7	7	1	1	1	2								1	1	1
51101	Yashik raj	3	1	1	4	2	2	1		2,3,9	2		2	1,3	1b			1		1,2,4,7	4,7	1	5	1	2								5	1	2
11472	Shafiq	1	1	2	4	2	2	2		2,3	2		2	1,3	1b	1	2	1		1,2,3,4,5,7,9	1,4,7	1	1	2	2								1	1	1
2324	Bhoominathan	1	1	1	3	1	1	1		1,2,3	1		2	1	1b			1		1,3,4,7	4,7	1	2	2	2								2	1	1
2457	Shri Ram	1	1	1	4	1	2	2		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
2351	Keerthana	2	2	1	4	2	2	3		1,2,3	1		2	1	1b			1		1,2,3,4,7	4,7	1	2	1	2								2	1	1
1325	Santhosh	1	1	1	3	1	1	2		2,3	2		2	1,3	1b		4	1		1,2,4,7,8	7,8	1	1	1	2								1	1	1
1304	Parthasarathy	1	1	1	3	1	1	1		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
563	Pradeep	3	1	1	4	2	2	3		3,9	2	1	2	1	1b				1,2	1,2,7,8	8	1	4	1	2								13	1	1
150	Kayalvizhi	1	2	1	3	1	1	2		1,2,3,4	1		2	1	1b			1		1,2,3,4,5,7,10	4,7	1	2	1	2								2	1	2
143	Nithish	2	1	1	3	1	1	2		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
1378	Samuel	1	1	1	3	1	1	2		1,2,3,8	1		2	1,3	1b		12	1		1,2,3,4,5,7,9	4,7,9	1	2	1	2								2	1	2
52637	Ilanchelian	1	1	1	4	2	2	2		2,3	2		2	1	1b	1		1		1,2,4,7	7	1	1	1	2								1	1	1
52066	Jaiganesh	1	1	1	3	1	2	2		1,2,3	2		2	1	1b			1		1,3,4,7	7	1	1	1	2								1	1	1
51649	Noorjahan	3	2	2	4	1	2	3		1,2,3	1		2	1	1b			1,2		1,2,3,4,5,7,12	4,7	1	2	1	2								2	1	2
52015	Dharshan	1	1	1	4	2	2	2		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
51977	Monishree	1	2	1	4	1	2	2		1,2,3	1		2	1	1b			1		1,2,3,4,5,7,9	4,7	1	2	1	2								2	1	2
52613	B/O Manju	1	2	1	4	2	2	3		2,3	2		1	1	1b	1	4			1,2,4,7,8,9	7,8	1	5	1	2								8	1	1
52933	Lakshmi	1	2	2	3	1	2	3		1,2,3	1		2	1	1b			1		1,2,3,4,5,7,9	4,7	1	2	1	2								2	1	2
52769	Sarala devi	3	2	2	3	1	2	3		1,2,3	1		2	1	1b			1		1,2,3,4,5,7	7	1	2	2	2								2	1	2
48934	Hemapriya	1	2	1	5	2	2	3		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
52702	Vinay keerthan	1	1	1	3	1	2	2		1,2,3	1	1	2	1,3	1b	3	11	1,2	1,2	1,2,3,4,5,7,9	4,7,9	1	2		1	1		1a,2b		2			3	2	2
1323	Praveena	1	2	1	4	2	2	3		1,2,3	1	1	2	1,3	1b			1,2	1,2	1,2,3,4,5,7	3,4,7	1	2		1	1		1a,2a	2	2			3	1	2

20674	Praveen kumar	1	1	1	4	2	2	2		1,2,3,8	2		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	1		1	1		1a,2a	2	2			1	1	2
17187	Navadharini	2	2	1	4	2	2	2		3,9	2		2	1,3	1b			1,2		1,2,3,4,5,7,11	4,7	1	5		1	1		1a,2b	2	2			5	1	2
7401	Janeeswar	1	1	1	4	1	2	2		1,2,3	1		2	1,3	1b			1,2		1,2,3,4,5,7,11	4,7	1	2		1	1		1a,2a	2	2			2	1	2
3866	Saran	2	1	1	4	2	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7,11	4,7	1	2		1	1		1a,2a	2	2			2	1	2
23159	Vijayan	1	1	1	5	2	2	2		1,2,3,8	2	1	2	1	1b			1,2	1,2	1,2,3,4,5,7,11	4,7	1	2		1	1		1b,2b	1	1	1		3	2	3
6547	Nivedha	1	2	1	4	2	2	2		1,2,3,8	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2		1	1		1a,2a	2	2			2	1	2
19951	Hansika	1	2	1	5	2	2	3		1,3,8	2	1	2	1	1b			1	1,2	1,2,3,4,5,7	4,7	1	3		1	1		1b,2b		2			4	2	1
20486	Ashwin	1	1	1	4	2	2	2		1,2,3,8	2	1	1	1	1b		4,6	1,2	1,2	1,2,3,4,5,7,8,11	4,5,7,8	1	2		1	1		1b,2b		2			3	2	2
6577	Deepak	3	1	1	4	2	2	3	5	3,9	2	1	2	1	1b			1	1,2	1,2,7,8	7,8	1	4		1	7		1a,2a	2	2			13	1	2
1266	Santhosh	1	1	1	4	2	2	2		1,2,3,8	1	1	2	1,3	1b			1,3	1,2	1,2,3,4,5,7	4,5,7	1	2		1	1		1a,2a	2	2			3	1	2
1319	Divyadarshini	1	2	1	3	1	1	2		1,2,3,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	1	2		1	1		1b,2a	2	2			3	1	2
13741	Gopika	1	2	2	5	2	2	3		1,2,3,5,8	1	1	2	1,3	1c,3	3		1,2	1,2	1,2,3,4,5,7,9,11	1,4,7	2			1	1	1		2	2		2e	4	1	3
13363	B/O Uma devi	1	1	1	4	2	2	2		4,5,8	2		2	1	1c,2,3		3	1,2		1,2,3,4,5,7,9,11	7	2			1	4	2		2	2		2a	6	1	3
48965	Harish	1	1	1	4	1	1	2		1,2,3	1		2	1,3	1c			1		1,3,4,7	4,7	1	2	2	2								2	1	2
50515	Vishnupriya	1	2	1	3	1	1	2		1,2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
47989	Tamilan	1	1	1	4	2	1	2		1,2,3	1		2	1	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	2
49183	Dinesh	1	1	1	4	1	1	1		2,3	2		2	1,3	1b					1,2,3,4,7	4,7	1	1	2	2								1	1	1
47997	Kothandaram	1	1	1	4	2	1	2		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	2
48087	B/O Amudha	1	2	1	5	2	2	3		1,2,3,8	1		2	1	1b			1		1,2,3,4,7,9	4,7	1	2	1	2								2	1	2
48348	Yuvana	2	2	2	5	2	2	3		1,2,3	1		2	1,3	1b			1		1,3,4,7	4,7	1	2	2	2							1b	2	1	2
48210	B/O Revathi	1	2	1	5	2	2	3		1,3,8	1	1	2	1	1b			1	1,2	1,2,3,4,7	4,7	1	3	1	2								4	1	2
20021	Prem vishwa	1	1	1	2	1	1	1	1	1,2,3,8	2	1	2	1	1b			1	1	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
20468	B/O Sonia	1	1	1	4	2	2	3		1,2,3,5,8	1	1	2	1	1b	1		1,3	1,2	1,2,3,4,5,7,9	3,4	1	3	1	2								4	1	2
50466	B/O Varalakshmi	1	2	1	4	2	2	2		1,3,8	2	1	2	1,3	1b			1,3	1,2	1,2,3,4,5,6,7,9	3,4	1	3	1	2								4	1	3
50849	B/O Sudha	1	1	1	3	1	1	2		1,3,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7,9	4	1	3	1	2								4	1	2
51868	B/O Girija	1	2	1	4	2	2	2		1,3,4,5,8	1	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,6,7,9	4	1	3	1	2								4	1	3
52640	Praveen kumar	1	1	1	3	1	1	2		1,3,8	2	1	2	1,3	1b	1		1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
37573	Karthiga	1	2	1	3	1	1	2		1,2,3,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	1	2	1	2								3	1	2
50804	Sudhan	1	1	1	4	1	2	2		1,2,3	2		2	1,3	1b					1,2,3,4,5,7	7	1	1	1	2								1	1	1
30749	Jeshwanth	2	1	1	4	2	2	2		2,3,9	2		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	5	1	2								5	1	2
30709	Rithi kishore	2	1	1	3	1	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
50717	Malarvizhi	1	2	1	3	1	1	2		1,2,3	2		2	1,3	1b					1,2,3,4,5,7	7	1	1	1	2								1	1	1
50751	Jeyasurya	2	1	2	5	2	2	2		1,2,3	1		2	1,3	1b			1,2		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
51691	Dharun dharshan	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	7	1	2	1	2								2	1	1
58041	Leo	1	1	2	4	2	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	2	2							1b	2	1	2
51774	Banushree	1	2	1	3	1	1	2		1,2,3	2		2	1,3	1b					1,2,4,7	7	1	1	1	2								1	1	1
51862	Gokulakannan	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1

51840	Yuvashree	1	2	1	4	2	2	2		1,2,3	2		2	1,3	1b					1,2,4,7	7	1	1	1	2								1	1	1
50453	Prasad	1	1	1	4	2	2	2		2,3	2		2	1,3	1b			1		1,2,4,7	7	1	1	1	2								1	1	1
50964	Sudarshan	1	1	1	4	2	2	2		1,2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
51364	Dhanush kumar	1	1	1	3	1	1	2		1,2,3,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7	4,7	1	2	1	2								3	1	2
51700	Mercy	1	2	1	3	1	1	1		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
50713	Tamilarasan	2	1	1	4	2	2	2		2,3,9	2		2	1,3	1b			1,2		1,2,3,4,5,7	4,7	1	5	2	2								5	1	2
50667	Nithya roja	2	2	1	4	2	1	1		1,2,3	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	1
47749	Yuvaraj	1	1	1	5	2	2	3		1,3,5,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
46291	Kumaran	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,7	7	1	2	1	2							1b	2	1	1
46260	Amala	1	2	1	4	2	2	2		2,3	2		2	1	1b			1		1,4,7	7	1	1	1	2								1	1	1
21054	Divyashree	2	2	1	5	2	2	3		3,9	2		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	5	1	2								5	1	2
19958	Haritha	1	2	1	4	1	1	2		1,2,3	2		2	1	1b			1		1,3,4,7	7	1	1	1	2								1	1	1
22072	Keshika	2	2	1	4	1	1	2		1,2,3	1		2	1,3	1b			1,2		1,2,3,4,5,7,10	4,7,10	1	2	1	2								2	1	3
46969	Yuvash	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,7	7	1	2	1	2								2	1	1
22568	Kalaivani	1	2	1	4	2	1	1		1,2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
48355	Nivethra	2	2	1	4	1	1	2		2,3	2		2	1	1b					1,4,7	4,7	1	1	1	2								1	1	1
46756	Jeevarathinam	1	1	1	4	2	2	2		1,3,5,8	1	1	2	1,3	1b			1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
22022	B/O Ranjitha	1	1	1	4	2	2	2		1,3,5,8	2	1	2	1	1b			1	1,2	1,2,3,4,5,7,9	4,7	1	3	1	2								4	1	2
22313	Suman	2	1	1	4	2	2	2		1,2,3	1		2	1	1b			1		1,2,3,4,7	7	1	2	1	2								2	1	1
47780	Jeeva	1	1	1	4	2	1	2	1	1,2,3,8	2		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
47666	Vijay Saravanan	1	1	1	4	2	2	2	1	1,3,5,8	2		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
47346	Subashree	1	2	1	4	1	1	1		1,3,8	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	3	1	2								4	1	2
47888	B/O Nandhini	1	2	1	5	2	2	2		1,2,3	2		2	1	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
47148	Sheik kabir	1	1	1	4	1	1	1	1	1,2,3	2		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	1	2	2								1	1	2
46906	Karthik	2	1	1	4	1	1	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
46552	Sivaranjani	2	2	1	4	1	1	2		1,2,3	1		2	1	1b			1,2		1,3,4,5,7	7	1	2	2	2								2	1	2
46685	Abitha	1	2	1	4	1	1	2		1,2,3,8	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	3	2							1b	2	1	2
46556	Sanjay	1	1	1	4	2	2	2		1,2,3	2		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	2	2							1b	2	1	2
47181	Thavanesh	1	1	1	3	1	1	1		2,3	2		2	1,3	1b			1		1,3,4,7	7	1	1	2	2								1	1	1
47989	Tamilan	1	1	2	4	2	2	3		1,2,3	2		2	1	1b		2	1		1,2,3,4,5,7	4,7	1	2	2	2							1b	2	1	2
48043	Sowbarnika	1	2	1	4	1	1	1		1,2,3	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	2	2								2	1	1
28339	Logeshwaran	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	7	1	2	1	2								2	1	1
32047	Deepak	1	1	1	4	2	2	2		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
50291	Mohanapriya	3	2	1	5	2	2	2		3,9	2		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	5	1	2								5	1	2
22723	Illanthendral	3	2	1	5	2	2	2		3,9	2		2	1,3	1b			1,2		1,2,3,4,5,7	4,7	1	5	2	2							1b	5	1	2
46809	Ananthitha	1	2	1	4	2	2	2		1,2,3,8	1		2	1,3	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
46378	B/O Divya	1	2	1	3	1	1	1		2,3,4,8	2	1	2	1,3	1b			1	1,2	1,2,3,4,5,6,7,9	4,7	1	3	1	2								4	1	2

46471	Prasanna	1	1	1	4	2	2	2		2,3,8	2		2	1,3	1b					1,3,4,7	7	1	1	1	2								1	1	1
46941	Abisha	1	2	1	4	1	1	1		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
31948	Inbarasan	2	1	1	5	2	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
31882	Hansika	2	2	1	5	2	2	3		1,2,3	1		2	1	1b			1		1,3,4,5,7	7	1	2	1	2								2	1	1
47027	Seshadri	1	1	1	4	2	2	2		1,2,3,8	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	1	2								2	1	2
48797	Vinothini	1	2	1	4	2	1	2		1,2,3	1		2	1,3	1b			1		1,4,7	7	1	2	1	2								2	1	1
48162	B/O Sathya	1	1	1	4	1	2	2		1,3,5,8	1	1	2	1	1b			1	1,2	1,2,3,4,5,6,7,9	3,4,7	1	3	1	2								4	1	2
49007	Sudarshan	1	1	1	4	2	1	2		1,2,3	2		2	1	1b					1,3,4,7	4,7	1	1	1	2								1	1	1
40946	Yazhini	1	2	1	4	2	1	2		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
48074	Dharisha	2	2	1	4	1	1	2		1,2,3	1		2	1	1b			1		1,2,4,7	4,7	1	2	1	2								2	1	2
48218	Yasar	1	1	1	4	1	1	2		2,3	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
48741	Logesh	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,2,3,4,7	4,7	1	2	2	2							1b	2	1	2
48821	Rajesh kumar	2	1	1	4	2	2	2		1,2,3	1		2	1	1b			1		1,2,4,7	4,7	1	2	2	2							1b	2	1	2
45821	B/O Rekha	1	1	1	5	2	2	2		2,3,8	2		2	1	1b					1,4,7	4,7	1	1	1	2								1	1	1
45837	Priyadarshini	1	2	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,4,7	4,7	1	2	1	2								2	1	1
46072	Divya darshini	1	2	1	4	2	2	2		2,3	1		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
46251	Anushka	1	2	1	5	2	2	2		2,3	2		2	1	1b					1,4,7	7	1	1	1	2								1	1	1
46257	Chelian	1	1	1	4	2	2	2		2,3,8	2		2	1,3	1b					1,4,7	7	1	1	1	2								1	1	1
21992	Jeeva christina	1	2	2	4	1	1	1		1,2,3	1		2	1,3	1b			1		1,2,4,7	4,7	1	1	1	2								1	1	1
43217	Perinban	1	1	1	4	1	2	2		1,2,3	1		2	1,3	1b					1,4,7	4,7	1	1	1	2								1	1	1
38950	Pragadheesh	1	1	1	3	1	1	1	1	1,2,3	1		2	1	1b			1		1,2,3,4,5,7	4,7	1	2	2	2							1b	2	1	2
44239	Pooja	1	2	1	4	1	1	2	1	1,2,3	2		2	1	1b			1		1,2,3,4,7	4,7	1	2	1	2								2	1	1
49708	Joshlin	1	2	1	4	2	1	2		1,2,3	2		2	1,3	1b			1		1,3,4,7	4,7	1	2	1	2								2	1	1
33848	Kirubakaran	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b					1,4,7	4,7	1	1	1	2								1	1	1
49486	Giridaran	1	1	1	4	2	2	2		1,2,3	1		2	1,3	1b			1		1,4,7	4,7	1	2	1	2								2	1	1
43424	Vishnu	1	1	1	3	1	1	2		1,2,3,8	2		2	1,3	1b			1		1,2,3,4,5,7,9	7	1	2	1	2								2	1	1
40387	Jeevitha	1	2	1	4	2	2	2		1,2,3,8	2		2	1,3	1b			1		1,2,3,4,5,7,9	4,7	1	2	1	2							1b	2	1	1
40388	Rahul	1	1	1	4	1	1	2	1	1,2,3	1		2	1	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
39347	Harish	1	1	1	4	1	2	2		1,2,3	1		2	1,3	1b			1		1,3,4,5,7	4,7	1	2	1	2								2	1	1
21710	Simbu	2	1	2	5	2	2	3	4	1,2,3	1	1	2	1,3	1b	3	1	1,2,3	1,2	1,2,3,4,5,6,7,9,10	1,3,4,7,9,10	1	2	2	2							1b	3	1	3