Neo Clips

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Dear Esteemed Members ,

Greetings from NNF Delhi !

It gives me a feeling of immense pride & pleasure to bring to you the Monthly Bulletin **NeoClips** (Neonatal Clinical Practice) of NNF Delhi. This idea has emerged as a unique proposition from the minds of experienced neonatologists teaming up with young budding counterparts. The idea to engage, empower and enrich members with each other's experience and knowledge. My sincere thanks and heartiest congratulations to the team which gave physical shape to the idea, chaired by Dr. T. J. Antony, cochaired by Dr.Avneet Kaur with a very dedicated hard working Editor in Chief Dr Naveen Parkash Gupta for their untiring efforts.

I am also thankful to all the contributors for the successful release of these monthly editions. They have worked with enthusiasm in collecting information from various credible sources. We are very hopeful that this monthly **NeoClips** would assist our members in providing better neonatal care. We would request all the members to give their feedback to help us improve the subsequent issues and also to use this space to share their clinical experiences.

I would like to take this opportunity to extend my sincere thanks to all the esteemed members for reposing their faith in me to lead NNF Delhi as President.

To reduce neonatal mortality to single digit, we need to focus on strengthening the basic care for all newborn and scaling up of low cost & high impact models of care like NRP, KMC, early initiation and promotion of exclusive breast feeding. In this direction, NNF Delhi has started multipronged strategies this year by having various programs like multiple basic and advanced NRP, mentoring and handholding of SNCU, Lactation Workshop, Perinatology Workshop, CPAP/NIV Workshop, Preterm Package Course, Vascular Access Workshop, Basic Nursing Care Workshop, KMC Workshop & QI Workshop etc.

We are also trying to collaborate with Govt of Delhi, WHO and other professional bodies to roll out a govt run program in Delhi for the cause of newborn and take NNF to greater heights.

We are also planning to start a much needed **fresher/crash course** for our NNF/IAP Fellows & DNB paediatrics residents which would help them to prepare for their exit exam.

None of these programs can succeed without active participation of you, the NNF member. Let me end by requesting you to join in various programs and make them a success.

With Best Regard

L Bharti

Dr. Lalan Bharti
President, NNF Delhi

From Secretary's Pen

DR KUMAR ANKUR

Secretary, NNF Delhi

Dear friends,

Warm greetings from National Neonatology Forum, Delhi!

It gives me immense pleasure in announcing that NNF Delhi is releasing monthly E-bulletin with the name '***NeoCliPS' (Neonatal Clinical Practice)***. This bulletin is an amalgamation of various evidence based clinically relevant topics. It includes Case of the month which is the case discussed in the monthly meeting that particular month. It also covers evidence based reivew article in guest lecture column. To make it more interesting we are adding a Journal Scan of the month and Image of the month. Objective Structured Clinical Examination (OSCE) will be the flavour of the day. We plan to include ten OSCE scenarios in each bulletin. This would help the NNF/ IAP fellows and DNB students to sharpen their skills and prepare for their exit exam while helping the others refresh their knowledge.

We are extremely fortunate to have stalwarts who are spearheading this committee (Dr. T J Antony, Dr. Avneet Kaur). However, my special thanks to Dr. Naveen Parkash Gupta who is the chief editor and taking a lot of pain to make it more useful.

We request all the esteemed members to contribute to this E bulletin. All contributors will be given due credit.

We all know that such projects need significant financial resources. To make it sustainable, we encourage all of you to advertise your Hospitals/Clinics/Labs in our NeoClips at a very nominal rate.

We eagerly look forward to your feedback and hope to give you an experience that you will cherish forever!

Dr. Kumar Ankur
Secretary, NNF Delhi

Editor's Desk

DR NAVEEN PARKASH GUPTA

Chief Editor, Neo Clips

Dear Friends,

Greetings from the NeoClips team. I hope you enjoyed previous issues of NeoClips.

In this issue, we have come up with some interesting articles.

Fungal meningitis in an extremely low birth weight baby is covered as a case report.

The review article is on persistent pulmonary hypertension of neonate, which is one of common cause of hypoxemic respiratory failure in newborns.

Many controversies surround use of postnatal steroids in bronchopulmonary dysplasia. Hydrocortisone has been tried in recent trials. Journal scan of this issue covers an interesting trial on use of hydrocortisone in third and fourth week.

Image section covers the interesting case of lung malformation presenting in the neonatal period.

Picture of the month includes a case of neonatal cataract.

Neonatal hemodynamics is covered in OSCE section of this month

We hope that you will enjoy reading this issue. Please share your feedback with us. It will help us improve the journal.

Dr Naveen Parkash Gupta

Fungal meningitis in ELBW Neonate

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Baby boy was born at 23 weeks gestation as one of the twins weighing 520 grams to a primigravida mother by LSCS due to abruptio placenta. Mother had not received antenatal steroids. Baby needed intubation in delivery room and received 2 doses of surfactant. Baby was started on parenteral nutrition, minimal enteral nutrition and antibiotics (Piperacillin Tazobactum). Baby was given a trial of extubation at 72 hrs of life which baby failed. Echo showed no PDA and cranial ultrasound was normal. Baby had an episode of ventilator associated pneumonia(VAP) on day 7 of life for which antibiotics were upgraded to Linezolid and Meropenem. Blood and endotracheal secretions were sterile. VAP resolved but baby continued to be ventilator dependent, dexamethasone was started as per DART regimen on day 13 . Baby was given a trial of extubation on day 16 of life which baby failed. Sepsis workup including CSF was sent. CSF grew Candida tropicalis which was sensitive to both Amphotericin B and fluconazole while blood and urine culture were sterile. CSF cytology and biochemistry were normal. Baby was started on Amphotericin B, dexamethasone was stopped and central lines were removed. End organ screening was normal. Baby was extubated on day 20 of life. Amphotericin B was given for total of 21 days with repeat CSF culture done after 7 days of antifungal therapy being sterile. Baby currently is on heated humidified high flow nasal cannula (HHHFNC), feeds, caffeine and weighs 1400 grams at PMA of 35 weeks. ROP examination showed Zone 3 stage 1 disease in both eyes.

Discussion:

Epidemiology :

Fungal infections are an important health problem with significant morbidity and mortality. Preterms are at high risk due to immature immune system and lack of protective barriers. Candida is the most common fungal infection in neonates. Incidence of invasive candidiasis for babies with BW <750grams is 13% as compared with 6% in babies with BW 751-1000grams. Most common and most pathogenic species is Candida albicans accounting for nearly 60% of cases. Other species causing infections are C. parapsilosis (33%), C.glabrata , C. tropicalis, C. krusei with C. auris being the new emerging species.

Risk factors:

Immaturity of skin, gut and respiratory tract's immune system's primary or physical barriers predisposes to fungal infection. Other risk factors are use of medicines such as cephalosporins, carbapenems, post natal steroids,proton pump inhibitor, prolonged use of central catheter, endotracheal tubes and maternal vaginal candida colonization.

Candida can affect skin, renal tract, central nervous system, gastrointestinal tract, respiratory tract, cardiovascular system and eye.

Central nervous system (CNS) candidiasis occurs as disseminated disease or complication of neurosurgical procedure. It manifests as meningitis or brain abscesses and is most commonly due to C. albicans. It occurs in 1.6% of VLBW infants and in 25 to 30% of infants with systemic candidiasis. It is significantly underdiagnosed as in many cases CSF is not performed due to sickness and CSF biochemistry can be normal in many cases and no pleocytosis in many cases. Nearly 50% of culture positive meningitis have positive blood culture.

Diagnosis:

It is usually made by isolation of fungus from a sterile

body fluid with 90% of fungus showing growth within 72 hours. Growth of Candida species can almost always be identified from the standard BACTEC bottles used for detection of bacterial growth. All cases of candidemia shoud be evaluated with examination of eyes by ophthalmoscopy, renal evaluation with ultrasonography, echocardiography for endocarditis/vegetation and neuroimaging to look for CNS involvement. MRI is the best modality to detect micro abscesses however it may not always be feasible due to sickness and in such cases ultrasound should be used. This evaluation can be done at time of diagnosis or within 5 to7 days of initial diagnosis.

Treatment:

Treatment should be initiated with Amphotericin B at dose of 1 to 1.5 mg/kg/day along with prompt removal of central venous catheter. Fluconazole with loading dose of 25 mg/kg and maintenance dose of 12 mg/kg remains an alternative option specially in patients without exposure to fluconazole for prophylaxis. Liposomal amphotericin B has lower concentration in kidneys with insufficient data regarding CSF penetration. It can be used as alternative antifungal agent in setting of nephro and hepatotoxicity as long as CNS and renal involvement can be ruled out. Echinocandins inhibit 1-3 B D glucan synthesis. There are concerns regarding penetration into CSF, eye and urine and limited data is available for neonatal population. Its use is limited to salvage therapy or resistance/toxicity with Ampho B or Fluconazole. There are no randomized trials to determine ideal treatment of meningitis with most experience being with Amphotericin B and Flucytosine. The combination is being recommended because of in vitro synergism. However the benefit of this combination in neonates is uncertain. Flucytosine can cause bone marrow suppression and gastrointestinal side effects hindering oral feeding. Its current role is only in cases who are not responding to Amphotericin B. Fluconazole can be used as stepdown in susceptible isolates. The optimal length of therapy has not been studied but a minimum of 3 weeks of antifungal therapy after documentation of negative cultures is recommended.

Persistent candidemia is defined as culture positivity even after 5 days of antifungal therapy. The common causes are delayed removal of central venous catheter and slow resolution of microthrombus. The management includes ultrasonography to detect microthrombi at catheter tip, repeating end organ screening and addition of second antifungal agent . Fluconazole prophylaxis should be considered among ELBW infants in NICUs with moderate to high (>5 %) rates of invasive candidiasis at dosage of 6 mg/kg twice weekly. Neurodevelopmental impairment or delay is a common long term complication of invasive candida infection even n the absence of documented fungal meningitis. Mortality is high in premature infants with candiduria as well as candidemia.

Aggressive enteral feeding, removal of central lines when not indicated and judicious use of antibiotics with use of fluconazole prophylaxis are few strategies to prevent fungal infections. In case of fungal infections timely initiation of treatment along optimal duration and removal of central venous catheter are must.

Key Messages:

- Fungal infections are an important cause of morbidity, mortality and long term neurologic problems in ELBW neonates.
- Prevention of fungal infections with timely initiation of antifungal therapy at adequate dose when needed is the key to decrease the risk associated with fungal infections.

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Persistent Pulmonary Hypertension in Neonate

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Definition - Persistent pulmonary hypertension of the newborn (PPHN) is secondary to failure of normal circulatory transition at birth. It is a syndrome characterized by elevated pulmonary vascular resistance (PVR) that causes labile hypoxemia due to decreased pulmonary blood flow and right-to-left shunting of blood.

To understand the pathophysiology of PPHN we need to revise our knowledge of fetal circulation and the changes that happen normally at the time of birth.

Fetal circulation - In the fetus the placenta is the site of oxygenation. Oxygenated blood is carried from the placenta by umbilical vein and it reaches right atrium. Because of presence of foramen ovale it is preferentially shunted towards left side (from Right atrium to left atrium). Rest of blood goes from right atrium to right ventricle. Because of increased pulmonary vascular resistance, blood from the right ventricle is shunted through the ductus arteriosus, into the post ductal aorta to maintain systemic circulation, instead of flowing into the lungs.Most of the blood reaching the right ventricle is blood flowing into the right atrium from the superior vena cava. Blood from the placenta that is preferentially diverted to the left atrium enters the left ventricle and then flows to the ascending aorta supplying the brain and the upper part of the body.

Normal transition – With first breath and clamping of umbilical cord, placenta is no longer site of oxygenation. With first breath the pulmonary vascular resistance starts falling, blood goes to pulmonary artery and then to lungs (which become site of oxygenation). Oxygenated blood returns to the left atrium, which then goes to left ventricle and then to body. Ductus arteriosus also closes on exposure to oxygen (no more shunting from pulmonary artery to aorta).

Failure of this normal transition leads to increased pulmonary vascular resistance, persistence of fetal shunting (through foramen ovale and ductus arteriosus), less blood going to lungs and difficulty in oxygenation. This is called persistent pulmonary hypertension of neonate.

Incidence - 1.9 per 1,000 live births (0.4–6.8 per 1,000 live births) in the United States and 0.43 to 6 per 1,000 live births in the United Kingdom, with mortality rates ranging from 4% to 33% (1,2).

Etiology

Category	Diseases
Secondary to lung parenchymal disease (Abnormally constricted pulmonary vasculature)	Meconium aspiration syndrome Respiratory distress syndrome Pneumonia
Hypoplastic pulmonary vasculature	Congenital diaphragmatic hernia Lung hypoplasia
Normal parenchyma with remodeled pulmonary vasculature	Idiopathic PPHN Congenital Heart disease Hypoxic ischemic encephalopathy Chronic lung disease

Hemodynamic changes in PPHN (Figure 1): The primary physiologic abnormality in PPHN is increased pulmonary vascular resistance (PVR) exposing the right ventricle to high afterload. Significant or prolonged exposure to increased afterload often leads to right ventricular dysfunction. The coexistence of a high PVR and RV dysfunction may result in critically low pulmonary blood flow. Pulmonary hypoperfusion may cause significant ventilation perfusion mismatch and a reduced venous return to the left atrium. In addition patients often develop

hypoxia and acidosis which can further impede myocardial performance. The left ventricle is able to compensate for reduced preload by increasing the contractility and heart rate. But this occurs at rate of increased oxygen consumption. In addition high PVR may also led to RV dilatation causing leftward deviation of interventricular septum, thereby reducing the LV cavity size and compliance. This will further compromise left heart preload, and both systolic and diastolic function. If clinical state remains uncorrected, the LV ultimately decompensate causing critically low cardiac output manifesting as decreased left ventricular output on echocardiography and systemic hypoperfusion.

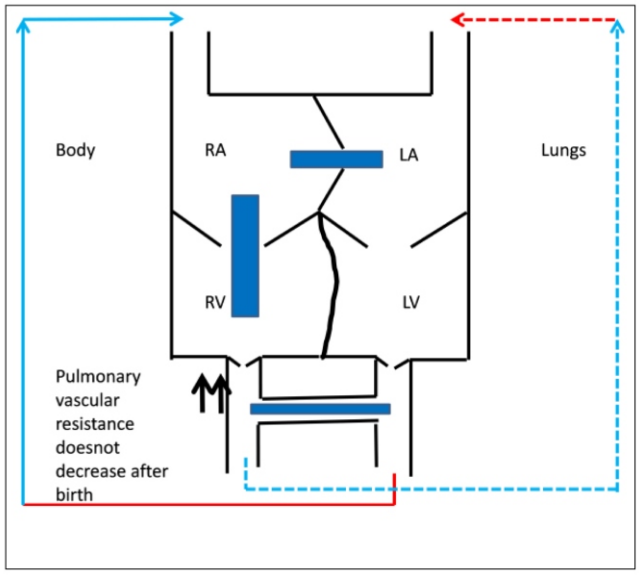

Fig.1. Hemodynamic changes in PPHN. Blue bold lines indicating right to left shunting at level of foramen ovale and ductus arteriosus. At level of tricuspid valve the blue bar denotes tricuspid regurgitation due to blood going back from right ventricle to right atrium.

Diagnosis:

Clinical

1. Settings (Asphyxia, MAS, RDS, Congenital diaphragmatic hernia)
2. Labile oxygenation – SpO2 fluctuates on loud noise, light exposure or handling of neonate.
3. Preductal and post ductal saturation difference (only if shunting is happening at ductus arteriosus, when shunting happens at level of foramen ovale though baby is having PPHN but pre and post ductal saturation difference is not found). Saturation differences of greater than 5% to 10% or PaO2 differences of 10 to 20 mm Hg between right upper limb and lower limbs are considered significant.
4. High ventilation needs – If it is secondary to lung disease/ Congenital diaphragmatic hernia usually present with hypoxemic respiratory failure (high pressure and FIO2 needs). If secondary to asphyxia sometimes present with disproportionate FIO2 needs as compared to pressure needs (since alveoli are not injured)
5. Cardiac examination – prominent precordial pulse, systolic murmur of tricuspid regurgitation,
6. Shock (if LV dysfunction has set in) – may manifest with rising lactate, raised CRT, hypotension, decreased urine output etc.
7. In cyanotic neonate we need to differentiate PPHN from cyanotic congenital heart disease. ECHO is important in that.
8. Hyperoxia testing to differentiate between cyanosis because of lung disease or cyanotic CHD (obtaining an arterial gas measurement after 15 minutes of exposure to 100% oxygen) and hyperoxia-hyperventilation to differentiate between cyanotic CHD and PPHN (hyperoxia and alkalosis to induce pulmonary vasodilation and improve PaO2) are no longer widely practiced because of the known adverse effects of hyperoxia and alkalosis. These tests can be avoided by confirming elevated pulmonary pressures by early echocardiography, when available.

Echocardiography – Echocardiography is gold standard for diagnosis of PPHN. In PPHN the primary pathology is right ventricular dysfunction owing to increased pulmonary pressures leading to right atrial and ventricular dilatation, bowing of interventricular

and interatrial septum towards left, bidirectional (predominant right to left shunting across foramen ovale and ductus arteriosus). Diastolic dysfunction of ventricles is evident by decrease is E/A wave ratio and increase in isovolumetric relaxation time (IVRT). Tricuspid regurgitation is a good reproducible way to estimate right ventricular systolic pressures but sometimes it underestimates the pressure especially if there is right to left shunting occurring across the ductus.

Management:

Supportive Management (figure 2) (3)

1. Maintain normothermia and correct metabolic abnormalities such as hypoglycemia, hypocalcemia, acidosis and polycythemia. Covering eyes and ears and maintaining a low-noise environment (try to do round discussions at distance from baby) should be done.
2. Minimal stimulation, along with judicious use of sedation and analgesia with narcotic analgesics like morphine and fentanyl or benzodiazepines such as midazolam is recommended.
3. Avoid routine paralysis – may be associated with increased mortality
4. Avoid hyperoxia and hypocarbia.
5. Hyperventilation and alkali infusions to maintain an alkaline pH were strategies previously in use but are now considered outdated. There were concerns of impaired cerebral perfusion and

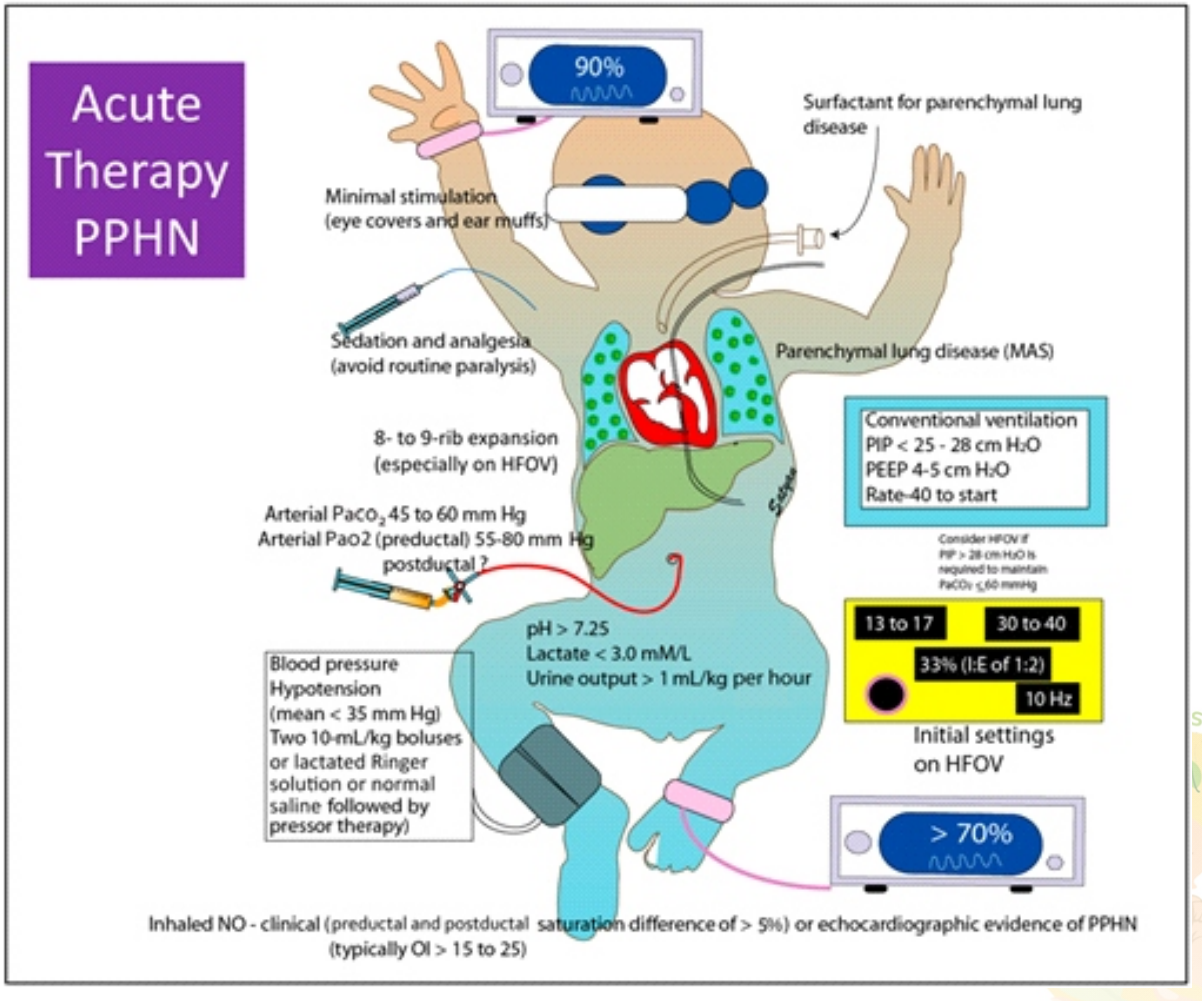

Fig.2. Supportive management in Acute PPHN (3).

sensorineural deafness with respiratory alkalosis. Alkali infusion was associated with increased use of ECMO and need for oxygen at 28 days.

6. Target blood gas parameters – pH >7.25, paCO2 45- 60 mm Hg, paO2 50 – 80 mm Hg.
7. Target preductal SaO2 – 91 – 95%. Hyperoxia can lead to decrease responsiveness to nitric oxide
8. Optimize ventilation and lung recruitment – Since a majority of PPHN is secondary to lung disease, optimizing ventilation and lung recruitment leads to better oxygenation and PaO2 which leads to decrease pulmonary vascular resistance thereby managing PPHN.
9. Surfactant administration - When PPHN is secondary to lung disease and there are significant ventilation needs, surfactant helps in decreasing PVR by optimizing inflation and alveolar recruitment. Use of surfactant in congenital diaphragmatic hernia is controversial (Needs to determine on case to case basis).
10. Mechanical Ventilation: Optimal lung recruitment (8- to 9-rib expansion on an inspiratory chest radiograph) with the use of positive end-expiratory pressure (PEEP) or mean airway pressure decreases PVR. Since both underinflation or overinflation can lead to increase pulmonary vascular resistance.
11. High frequency ventilation may optimize lung inflation and give better results. High frequency ventilation when used with nitric oxide gives supra additive results

Medical Management (Figure 3):

Pulmonary vasodilator therapy: There are predominantly 3 pathways going on in pulmonary

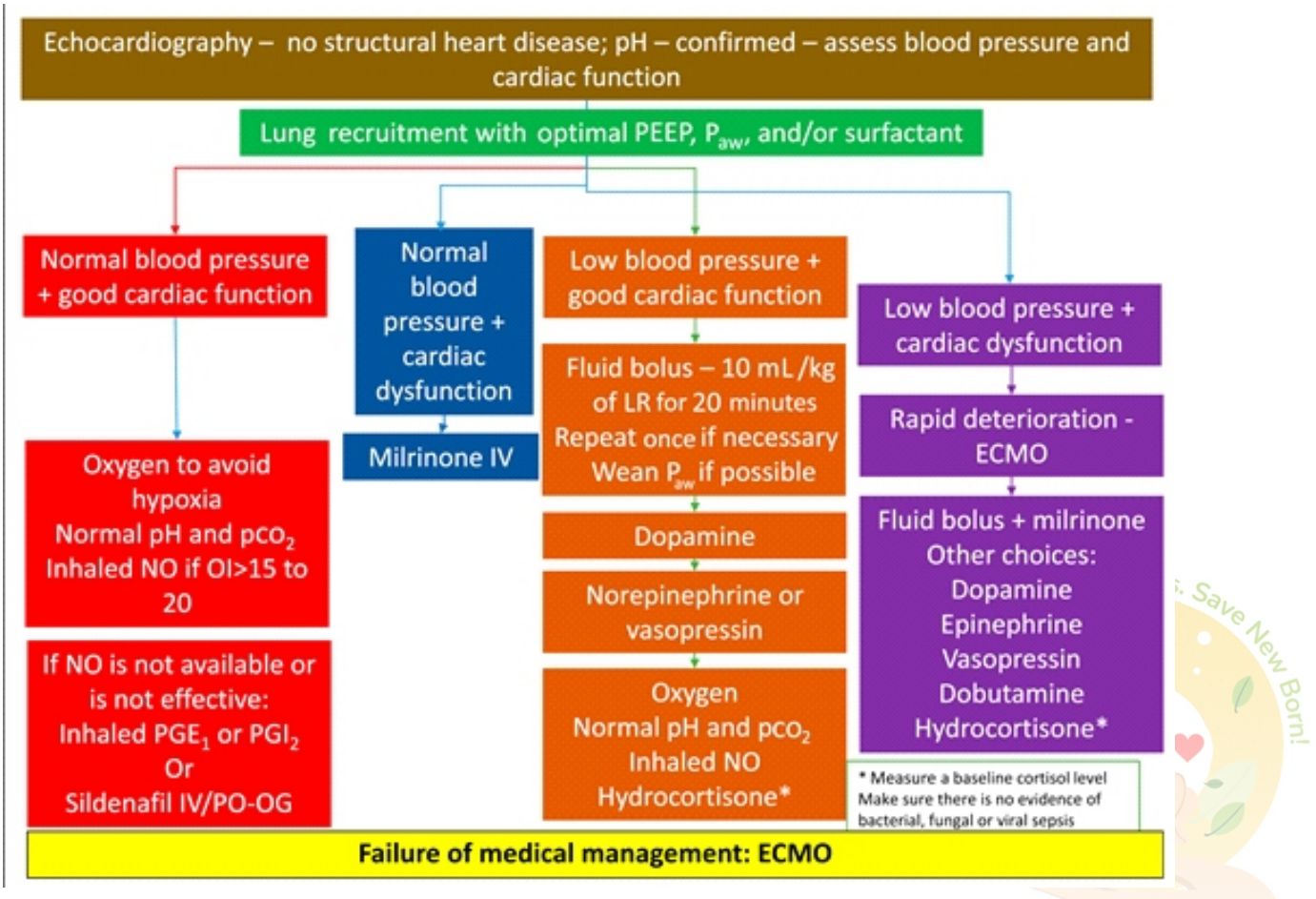

Fig. 3. Practical approach to PPHN (3).

vasculature leading to pulmonary vasodilation or vasoconstriction

1. cGMP pathway – Nitric oxide in presence of soluble guanylate cyclase converts cGTP to cGMP in endothelium which diffuse to muscular layer and leads to vasodilation. cGMP is degraded in presence of phosphodiesterase 3 (PDE3). Nitric oxide acts by increasing cGMP and Sildenafil acts by decreasing cGMP degradation by inhibiting PDE3
2. cAMP pathway – Prostacyclin (PGI2) in presence of adenylate cyclase converts cATP to cAMP which is a potent vasodilator. cAMP gets degraded in presence of phosphodiesterase 5 (PDE5). Prostacyclin acts by increasing cAMP and Milrinone acts by decreasing cAMP degradation by inhibiting PDE5
3. Endothelin acts on ET A receptors causing vasoconstriction. Bosentan is ET A receptor antagonist. A second endothelin receptor ET B on endothelial cell stimulates NO release and vasodilation.

Commonly used pulmonary vasodilators

- Nitric oxide
- Sildenafil
- Milrinone
- PGI2
- Bosentan

Inhaled Nitric Oxide (iNO): iNO is a potent and selective pulmonary vasodilator without a significant decrease in systemic blood pressure (selective effect of iNO). iNO is also preferentially distributed to the ventilated segments of the lung, resulting in increased perfusion of the ventilated segments, optimizing ventilation-perfusion match (microselective effect of iNO). It reduces the need for ECMO in term neonates with hypoxemic respiratory failure (4). It is the only therapy approved by the US Food and Drug Administration for clinical use in term or near-term newborn infants (> 34 weeks' gestation).

When to start (Rule of 20 – 20 -20) (5,6)

1. OI more than 20
2. Dose of 20 ppm
3. Initial response PaO2 / FiO2 of 20 or more

Monitoring

Methemoglobin levels are monitored at 2 hours, 8 hours after initiation of iNO, and then once a day for the duration of iNO therapy. Some centers stop checking methemoglobin levels after the first couple of days if levels are low (<2%) and iNO dose remains less than 20 ppm.

How to wean (Rule of 60 – 60 – 60)

1. FIO2 < 60%
2. PaO2 > 60 mm Hg
3. For at least 60 minutes
4. Wean iNO at rate of 5 ppm every 4 hrs
5. Once dose of 5 ppm is reached wean by 1 ppm every 2-4 hours. It minimizes risk of rebound hypertension.

NO and adjunctive therapies - In clinical studies using inhaled nitric oxide (iNO), the combination of high-frequency ventilation and iNO resulted in the greatest improvement in oxygenation in PPHN associated with diffuse parenchymal lung disease, such as RDS and pneumonia, but had no benefit in idiopathic PPHN or CDH.

Options where NO is not available – Management is mainly based upon systemic blood pressure and ventricular function on echocardiography.

1. IV sildenafil – Loading dose of 0.42 mg/kg for 3 hours (0.14 mg/kg per hour) followed by 1.6 mg/kg per day as a continuous maintenance infusion (0.07 mg/kg per hour). May lead to systemic hypotension although not seen in trials (7).
2. Oral sildenafil (1–3 mg/kg every 6 h) improves OI and reduces mortality in centers limited by non-availability of iNO (8).

3. Milrinone - If blood pressure is normal but there is evidence of ventricular dysfunction, an inodilator such as milrinone might be the preferred therapeutic agent in PPHN. For example, if left ventricular dysfunction is associated with high left atrial pressures and a left-to-right shunt at the level of the foramen ovale in the presence of a right to-left shunt at the ductus arteriosus, iNO is contraindicated because it may precipitate pulmonary edema and respiratory deterioration (9).

   Dose - A loading dose (50 mg/kg for 30–60 minutes) followed by a maintenance dose (0.33 mg/kg per minute and escalated to 0.66 and then to 1 mg/kg per minute based on response) are commonly used. The loading dose is not recommended in the presence of systemic hypotension. Fluid bolus (10 mL/kg of normal saline) before a loading dose may decrease the risk of hypotension.

4. In the presence of systemic hypotension and good cardiac function, 1 or 2 fluid boluses (10 mL/kg of lactated Ringer solution or saline) followed by vasoactive agent (epinephrine or dobutamine) are recommended. Some centers prefer the use of norepinephrine or vasopressin because these agents are thought to be more selective systemic vasoconstrictors.

· If more than 2 inotropes or vasopressors are needed, a cortisol level is measured and hydrocortisone may be started.

5. If in spite of all this condition continues to deteriorate and Oxygenation index keeps on increasing child needs transfer to ECMO center.

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Neonatal Cataract- A Rare Cause

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Dr. Rohan Ravinder Verma
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Clinical presentation – A ten days old male baby born at 39 weeks gestation with birth weight of 3.66 kgs with cataract.

Examination findings

At birth - General examination and systemic examination were unremarkable. B/L red reflex was present. The baby was discharged on breastfeeds.

10 days of life – Abnormal red eye reflex bilaterally.

Suspicion – Bilateral Neonatal cataract.

Course – Baby was evaluated for bilateral cataract. He was on breast feeds and was gaining weight adequately. Blood sugars were normal. TORCH titers were normal in mother.

Newborn screening revealed raised total galactose of 72.6 mg/dl (normal - < 15 mg/dl) with a normal amino acid profile.

Urine for reducing substance (Benedict's test) was positive. Repeat Plasma galactose was highly raised at 7496 uM/L (normal - 0-56). Other relevant investigations were SGOT / SGPT- 81/83 IU/L; ALP/GGT - 1283/169 IU/L.

The ophthalmological evaluation suggested oil drop cataract (Figure 1). The baby was shifted to soya milk formula.

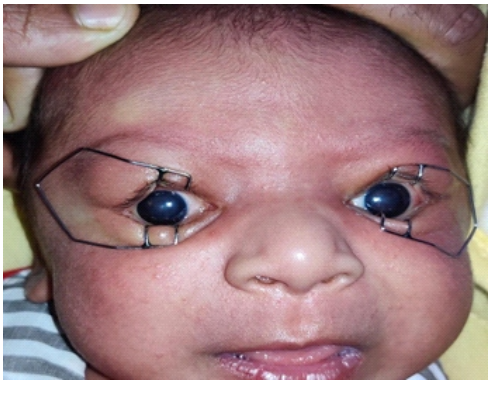

Fig 1. Opacification of lens in right eye

Galactose 1 phosphate uridyl transferase (GALT) assay was normal - 15.61 U/gm Hb (range 11-41). Molecular genetic analysis of GALK1gene suggested a homozygous for c.410_410delG(p.G137Vfs*27) confirming the diagnosis of Galactokinase deficiency.

Presently baby is on soya milk and is thriving well. After 2 weeks of starting soya milk, significant regression in cataract was seen. (Figure 2)

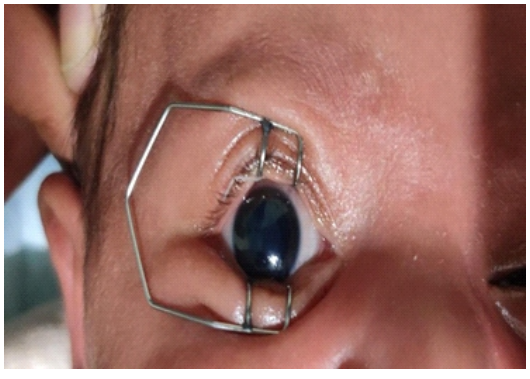

Fig 2. Regressing opacification after 2 weeks of soy-based formula milkz

Condition -

Cataract is an opacification of the lens. Congenital cataracts usually are diagnosed at birth. If a cataract goes undetected in an infant, permanent visual loss may ensue.

Bilateral cataracts are often inherited and associated with other diseases. They require a full metabolic, infectious, systemic, and genetic workup. The common causes are hypoglycemia, trisomy (eg, Down, Edward, and Patau syndromes), myotonic dystrophy, infectious diseases (eg, toxoplasmosis, rubella, cytomegalovirus, and herpes simplex [TORCH]), galactosemia, hypoparathyroidism, and prematurity. Galactosemia is characterized by altered metabolism of galactose due to deficiency of one of three enzymes. Classical galactosemia is the commonest and the most severe form. Type II galactosemia due to galactokinase deficiency (in our case) manifesting as cataract has good prognosis if detected early.

Key messages

New born screening is very important to detect and manage galactosemia at an early stage.

Image Section

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Clinical Presentation

A four day old baby was admitted to our hospital with a history of respiratory distress since birth requiring mechanical ventilation. The initial Chest X-ray was suggestive of pneumothorax and so an Intercostal chest drain (ICD) was inserted. A repeat Chest X-ray (Figure 1) showed persistence of the cystic lesion (after the ICD insertion) in the right middle and lower zones and so the baby was referred to our hospital.

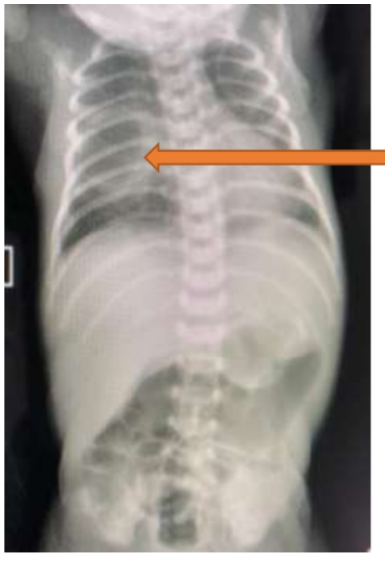

Fig 1. The cystic lesion in right middle and lower lung zones

Suspicion- Congenital lung anomaly, maybe CPAM (congenital pulmonary airway malformation)

Investigations-

1. CECT Chest done showed a large well defined thick walled cystic lesion measuring 28*27 mm in the superior segment of right lower lobe with presence of air fluid level within. The lesion was displacing the left lower lobe bronchus medially. (Figure 2)

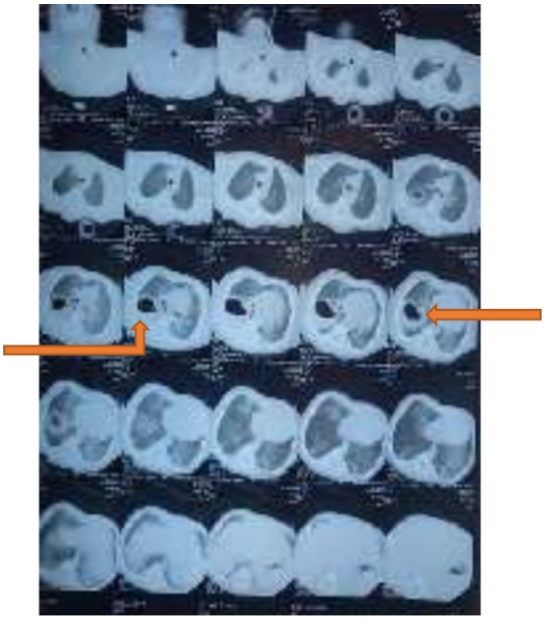

*Fig 2. CECT showing - defined thick walled cystic lesion measuring 28*27 mm in the superior segment of right lower lobe with presence of air fluid level within suggestive of CPAM*

Management- Right Thoracotomy and Right Lower Lobectomy(Figure 3,4,5,6)

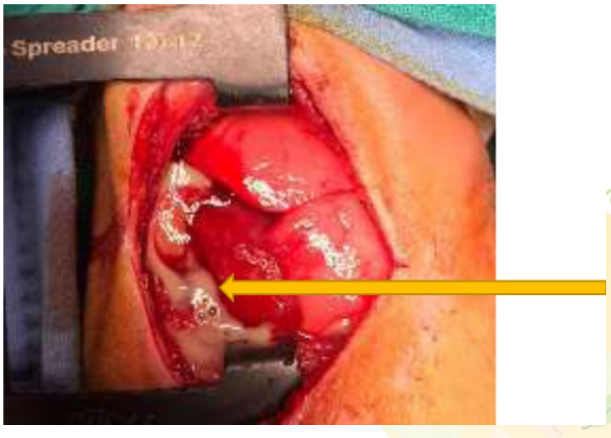

Fig 3. Infected CPAM with pus

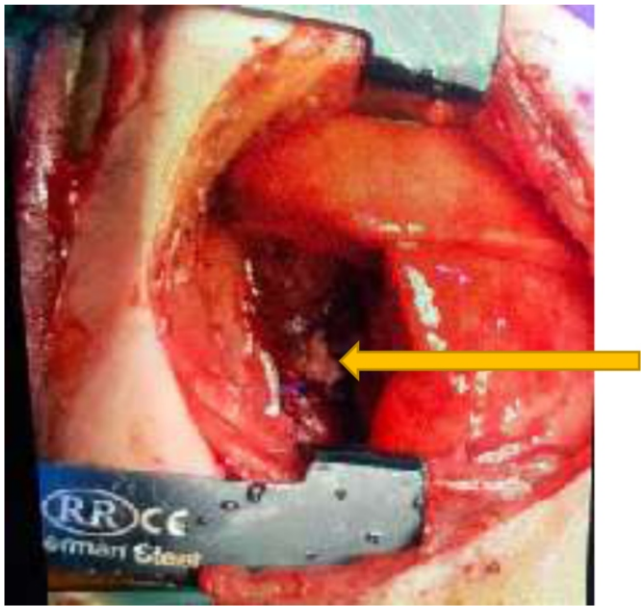

Fig 4: CPAM in the right lower lobe

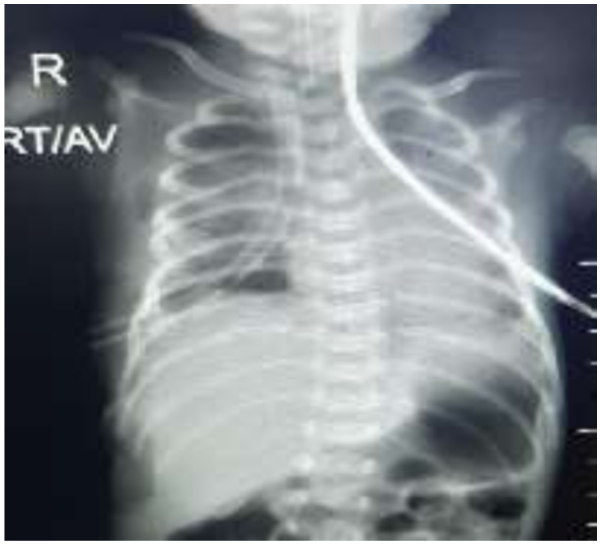

Fig 5: Post operative resolution of the cystic lesion (CPAM) with chest drain inside

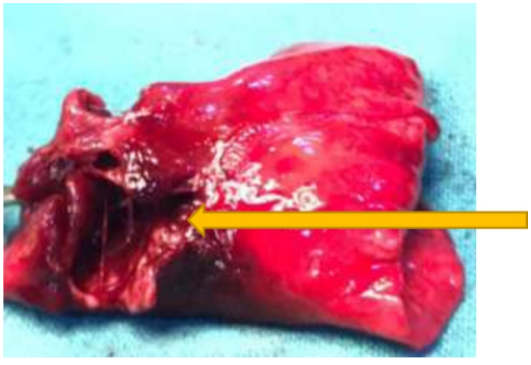

Fig 6: Excised lower lobe with a CPAM

Histopathology report of specimen– Cavitatory lesion located 3 cm from pleural surface of right lung measuring 2*1.5*2cm with whitish fibrotic areas around the cavity.

Microscopy revealed a uniloculated benign cyst internally coated with layer of fibrinous exudate suggestive of cystic pulmonary airway malformation with abscess formation

Key message-

1. Congenital pulmonary airway malformation (CPAM) is a rare congenital abnormality that affects mostly the newborn and presents with progressive respiratory distress.
2. Varying presentation ranging from post natal respiratory failure to an incidental finding on a Chest X-ray
3. It is often misdiagnosed as a persistent and localised pneumothorax without any pathological diagnosis.
4. In patients with CPAM that is causing any respiratory symptoms, surgical resection rather than observation is recommended.

Journal Scan

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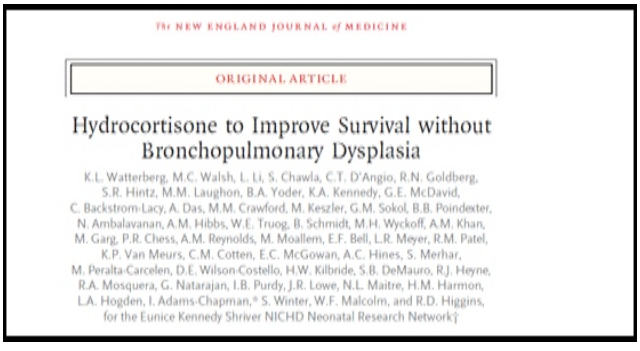

Background: One-half to three fourth of babies born before 29 weeks of gestation develop Bronchopulmonary dysplasia (BPD). It is a disease of multifactorial origin with a potential long term impact on growth, neurodevelopment, and respiratory function. The objective of this trial was to determine both the efficacy of hydrocortisone in increasing survival without BPD and its long-term safety, as assessed by survival without moderate or severe neurodevelopmental impairment at 22 to 26 months of age, adjusted for prematurity.

Hypothesis: Earlier extubation would result in a decreased incidence of moderate or severe bronchopulmonary dysplasia or death.

Research Question (PICOT)

Population	Infants less than 30 weeks gestation, who had been intubated for at least 7 days were enrolled at 14 to 28 days
Intervention	Hydrocortisone sodium succinate at 4mg/Kg/d for 2 days, followed by 2mg/Kg/d for 3 days, 1 mg/Kg/d for 3 days and 0.5 mg/Kg/d for 2 days (total 10days)
Control	Saline placebo
Outcome	Primary **efficacy outcome**- survival without moderate or severe BPD at 36 weeks PMA Primary **safety outcome**- survival without moderate or severe neurodevelopmental impairment (NDI) at 22 to 26 months of corrected age using Bayley–III
Time	Infants were enrolled from August 2011 to February 2018. Follow-up visits occurred from August 2013 to March 2020

Methodology

Design: Double-masked, placebo-controlled, stratified block randomisation (1:1), conducted in 19 U.S. academic centres (including 50 NICU).

Subjects: Infants from 14 to 28 postnatal days born at GA<30 weeks**,** or admitted to a registered site at less than 72 hours of postnatal age, who received mechanical ventilation through an endotracheal tube for at least 7 days, and receiving mechanical ventilation through an endotracheal tube at trial entry**.** Those with major congenital anomalies**,** decision to limit life support**,** indomethacin or ibuprofen treatment within 48 hours before trial entry**,** previous systemic glucocorticoid treatment for at least 14 cumulative days or within 7 days before trial entry were excluded.

S**ample size** of 800 infants was chosen for 80% power to detect 10% increase in survival without moderate or severe BPD from a baseline survival of 35% or less.

Mandatory extubation thresholds were specified as Fio2< 0.40 to maintain a saturation of at least 88% & MAP < 8. Successful extubation was defined as remaining extubated for at least 1 week, including at least 3 days after the last dose of hydrocortisone or placebo.

Analysis: Intention-to-treat analysis using SAS software version 14.3. Robust Poisson regression with control for centre and gestational-age strata as fixed effects was used to obtain adjusted relative risk.

Findings: 800 babies with mean (±SD) birth weight of 715±167 g and gestational age of 24.9±1.5 weeks were enrolled and randomised.

No difference was seen in survival without moderate or severe BPD at 36 weeks in two groups [16.6% in hydrocortisone and 13.2% in placebo (ARR 1.27; CI 0.93-1.74)].

Survival without moderate or severe NDI at 22-26 months was similar in two groups (known for 91% of enrolled)- 36.9% in the hydrocortisone vs 37.3% in the placebo (ARR 0.98; CI 0.81- 1.18).

More infants in the hydrocortisone group were successfully extubated, and had fewer days of mechanical ventilation. However, similar numbers were extubated by 36 weeks of PMA, total duration of supplemental oxygen therapy and length of stay were not different between the two groups. Hypertension requiring treatment was more common in hydrocortisone group (ARR 4.27, CI 1.45-12.55).

Conclusion: The study does not support the use of hydrocortisone to improve BPD outcomes in extremely preterm infants owing to its inability to improve efficacy and safety related outcomes.

Strengths: Multicenter design using a well-established clinical trials network, a larger sample size, and certification of all the examiners performing the neurologic examinations and Bayley- III assessments at 2 years

Limitations: Stringent inclusion criteria with only infants surviving to 14 days may limit its generalizability. There was potential confounding by open label dexamethasone use across both the groups. The trial was not powered for subgroup effects.

Reviewer's Comments

The pendulum of steroid use for prevention or treatment of BPD has swung from rampant use of dexamethasone in 1980's to complete cessation of postnatal corticosteroids with the emergence of its adverse effects on long term neurodevelopmental outcomes. Researchers continue to search for the preferred timing (early < 7 days, late > 7 days), safer agent (dexamethasone, hydrocortisone, methylprednisolone, budesonide), preferred mode of administration (intravenous, oral, inhalational) and preferred approach (prophylactic vs therapeutic). Most of the ongoing research was based on the information that dexamethasone and hydrocortisone behave differently in the brain: hydrocortisone being identical to native cortisol, binds to both mineralocorticoid receptors and glucocorticoid receptors; whereas dexamethasone binds only to glucocorticoid receptors and suppresses native cortisol production, which promotes apoptosis and results in adverse outcomes in animal models.

We have summarized the landmark studies and relevant meta analysis on the subject in the table below to understand the evolution of the scientific evidence over the last two decades:

Conclusion & Further research: Larger scale international studies are needed to determine the

Study, Year	Population	Intervention	Outcomes
DART 2006 (Dexamethasone: A Randomised Trial)	70 very preterm (GA<28weeks)/ ELBW who were ventilator dependent after the first 1 week of life from 11 centres	Assigned randomly to receive dexamethasone (0.89 mg/kg over 10 days) or saline placebo	Median age at enrolment 23 days. More infants were extubated by 10 days of treatment in the dexamethasone group (OR 11.2, CI 3.2-39.0)
NEurOSIS study 2015 (Neonatal European Study of Inhaled Steroids)	863 extremely preterm infants (GA< 28weeks)	Randomly assigned to receive early (within 24 hours after birth) inhaled budesonide or placebo	Incidence of BPD was lower in early inhaled budesonide group (CI0.60-0.91; P=0.004), but at the expense of increased mortality (CI 0.91-1.69; P=0.17)
PREMILOC Trial 2016	Extreme preterms done at 21 French NICU's	Double-blind, placebo-controlled RCT to assess whether low-dose hydrocortisone improved survival without BPD	Rate of survival without BPD at 36 weeks PMA was significantly increased by prophylactic low-dose hydrocortisone (Adjusted OR 1·48, CI 1·02–2·16, p=0·04)
SToP-BPD trial 2018 (Systemic Hydrocortisone To Prevent BPD in preterm infants)	372 infants (mean GA 26 weeks) from Netherlands, multicentric	Randomly assigned to receive a 22-day course of systemic hydrocortisone (cumulative dose, 72.5 mg/kg) or placebo	No significant difference in the composite outcome of death or BPD at 36 weeks' PMA between the groups (AOR 0.87, CI 0.54-1.38; *P* = .54)
Cochrane meta-analysis 2017	32 RCTs enrolling 4395 participants 21 RCTs enrolling 1424 participants	Role of early (< 8 days) systemic postnatal corticosteroids Role of late (> 7 days) systemic postnatal corticosteroids	Both resulted in a reduction of BPD and BPD or death and prevented extubation failure, but benefits may not outweigh actual or potential adverse effects
Zeng et al Network Meta analysis 2018	47 RCTs with 6747 participants	Any steroid regimen for prevention of BPD in preterm infants	High-dose dexamethasone (>3.0 mg/kg) initiated early (<7days) was more effective, but advised caution in view of NDI
Ramaswamy et al Network Meta-analysis 2021	62 studies involving 5559 neonates with mean GA 26 weeks	Any corticosteroid regimen initiated within 4 weeks of postnatal age	Moderately early-initiated (8-14days), medium cumulative dose (2-4 mg/kg) of systemic dexamethasone (MoMdDX) was found to be the most appropriate for preventing BPD or mortality at a PMA of 36 weeks (RR, 0.61; CI 0.45-0.79)

optimal corticosteroid drug, timing, dose, mode, and duration to prevent and treat BPD in extreme preterm infants. Variables of interest could be markers of fetal/ neonatal inflammatory response syndrome (FIRS/SIRS), lung inflammation and adrenal functions (cortisol level) so that we move a step closer to finding the benefit-risk adjusted treatment strategy. Until such scientific evidence evolves, medium dose dexamethasone may be used in the second week of life in extreme preterm infants with evolving signs of BPD. Children from Watterberg's cohort are currently being evaluated at school age for pulmonary and developmental outcomes.

References for further reading

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Question 1.

A neonate is admitted with complaints of poor feeding, lethargy, and fast breathing on day 21 of life. On examination, baby has tachycardia, tachypnea, CFT 2 seconds and normal BP. The ECG of this baby is as shown in Fig. 1.

a. What is the diagnosis?

b. What is the drug of choice? What is its serum half-life?

c. Write the dose and technique by which this drug is administered.

d. The baby did not respond to this drug and developed cold peripheries and hypotension. How will you manage this baby now?

e. What are the indications for long term medical treatment of this condition? Which drugs are used for chronic medical treatment?

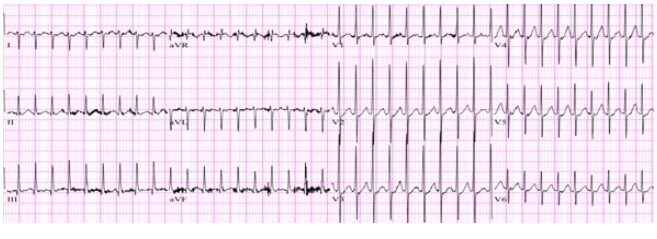

Fig 1

Question 2.

A 10-day old neonate is admitted in ER with fine rash over periorbital area. On systemic examination, baby is noted to have irregular heart rhythm. ECG of this baby is as shown in Fig. 2. Lab evaluation shows raised transaminases.

a. Interpret the ECG.

b. What is the probable diagnosis? What investigation would you do to confirm the diagnosis?

c. What is the underlying pathogenesis of the disease?

d. What are the indications for permanent pacemaker implantation in neonates?

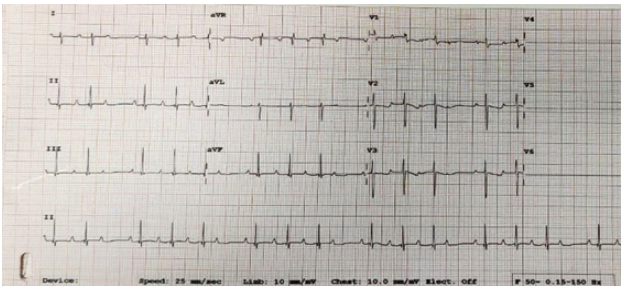

Fig 2

Question 3.

A 27 week 980 g preterm baby on Assist control (A/C) ventilation has worsening clinical condition on day 3 of life. Baby has increasing Fio2, and pressure requirements and pinkish secretions are noted in ET tube. Heart rate is 170/min. Baby has low diastolic pressure and dorsalis pedis is well felt. Sepsis screen is negative.

a. What is your probable clinical diagnosis?

b. 2D ECHO is planned and images are as shown below. Identify the view in Fig.3. What are the ECHO findings suggestive of?

c. Identify the view and structures labelled in Fig. 4. Which important parameter related to above clinical condition is measured in this view and how is it measured? What is the clinical utility of this parameter?

d. What neonatal complications may be associated

with this condition?

e. What drugs are used for medical management of this condition? What are the side effects

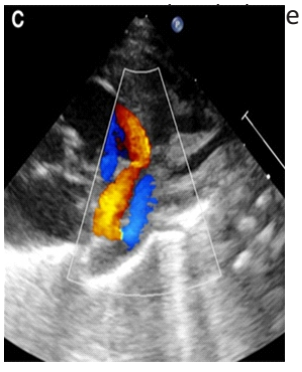

Fig 3

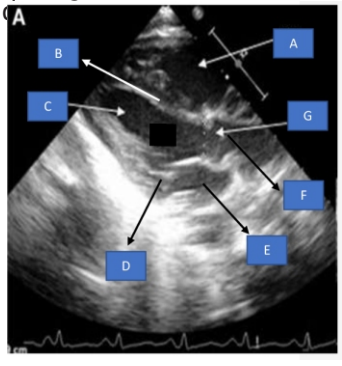

Fig 4

Question 4.

A term born baby boy had respiratory distress soon after birth. Baby was initially put on CPAP support but in view of increasing FiO2 need, baby was intubated and ventilated. Baby is currently on SIMV with settings PIP 25 cm H20, PEEP 6 cm H20, MAP 12 cm H20, Fio2 100%, Rate 60 bpm. SpO2 is between 80-85%, pulses are well felt, CFT < 3 seconds and mean BP 55 mmHg. C-Xray showed appropriately placed endotracheal tube with both lungs expanded to 8 posterior intercostal spaces and no collapse or pneumothorax. Blood gas revealed pH 7.3, paO2 50 mmHg, pCO2 45 mmHg, and HCO3 17 mmol/L. A 2D ECHO is planned. Based on the echocardiographic assessment of ductal and atrial shunts, what would be your differential diagnoses and treatment considerations in scenarios a, b and c mentioned below?

a. Right to Left Shunt at the ductal and atrial level

b. Right-to-left shunt at the ductal level but a left-to-right shunt at the atrial level

c. Left to right shunt at ductal level but a right to left shunt at the atrial level

Question 5.

The above-mentioned baby had labile hypoxemia and right to left shunt at both ductal and atrial level. 2D ECHO is as shown in Fig 5.

a. Identify the view and abnormality. What is your diagnosis?

b. TR jet velocity is 3.99 m/s. Calculate the pulmonary artery systolic pressure in this baby.

c. Calculate OI in this baby based on above parameters.

d. What would be your line of management in this baby based on OI?

e. What parameter for assessment of RV systolic function is being measured in view shown in Fig. 6? What value is considered normal in term neonates and what value indicates severe pulmonary hypertension?

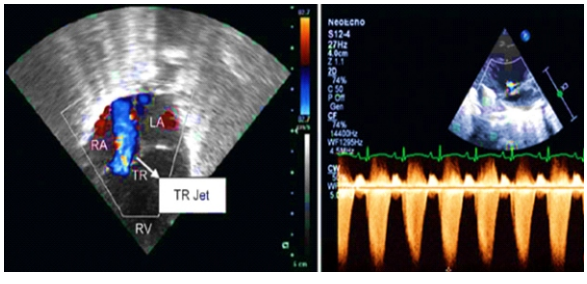

Fig 5

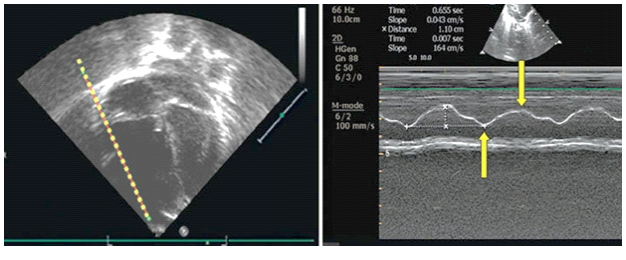

Fig 6

Question 6.

A 3 kg baby boy, term born, developed cyanosis within first few hours of life. Spo2 is 70% and hypoxia is unresponsive to oxygen. Auscultation revealed loud single S2. Chest Xray revealed narrow mediastinum with slight predominance of right ventricle. 2D ECHO is done and PLAX view is as shown in Fig. 7. The vessel arising from LV is traced and Fig.8 demonstrates its bifurcation.

a. What is the diagnosis? What percentage of these babies may have extracardiac malformations?

b. What will be the initial management in this baby?

c. Write the dose and adverse effects of drug used for initial stabilization in this baby.

d. What are the indications of balloon atrial septostomy?

e. What is the definitive treatment?

f. What is the ideal timing of surgery in lesions with intact ventricular septum?

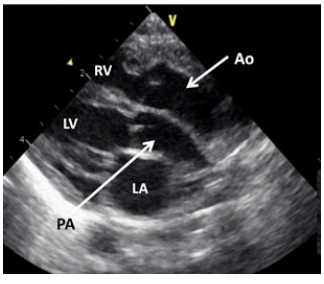

Fig 7

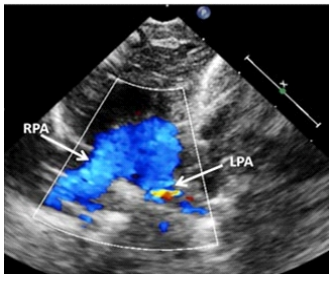

Fig 8

Question 7.

You are managing a critically sick ventilated baby with perinatal asphyxia. The baby has borderline perfusion. You want to assess the intravascular fluid status for deciding total fluid intake in this baby and decide to perform point of care ultrasound and ECHO.

a. How would you measure the IVC (Inferior Vena Cava) diameter?

b. What is Distensibility Index of IVC?

c. The diameter of IVC in this baby is 7 mm with more than 50% collapsibility. How would you interpret this and what would be your line of management?

d. What are the key findings in favor of hypovolemia on 2D ECHO imaging?

Question 8.

Given below are few drugs used for managing cardiopulmonary conditions in neonates. What is their *mechanism of action*/ name of the receptor they act upon. Also mention important *side effect* of each drug:

a. Sildenafil

b. Levosimendan

c. Bosentan

d. Digoxin

Question 9.

A sick neonate is being ventilated post op after cardiac surgery. The baby has signs of poor perfusion and is receiving Dopamine and Dobutamine 10 mcg/kg/min, but there is no significant improvement. Baby still has cold peripheries, CFT 4 seconds but mean BP is 60 mmHg. Bedside ECHO is suggestive of LV dysfunction and a low cardiac output state. You decide to start Milrinone based on clinical and ECHO findings.

a. What is the mechanism of action of Milrinone?

b. What is the half-life of this drug?

c. What is the immediate and most common side effect of Milrinone?

d. What are the indications for using Milrinone in neonates?

e. What is the primary route of excretion of this drug?

Question 10.

A 2 hrs. old term neonate with Meconium Aspiration Syndrome is being ventilated. Currently baby is on SIMV with PIP 22 cm H20, PEEP 6 cm H20 Rate 50 bpm and FiO2 100%. Baby has labile oxygen saturations, ranging from 80 to 90%. Xray chest shows bilateral diffuse patchy opacities, 6 posterior intercostal spaces and low lung volume. Currently, baby's perfusion is good.

a. What is the first step you will take to manage hypoxia in this baby?

b. Baby stabilizes after your intervention but after 6 hours, baby again has very labile oxygen saturations. 2D echo is suggestive of RVSP of 48 mmHg and good cardiac function. Clinically, baby also has signs of poor perfusion and low blood pressure (mean BP 34 mm Hg). Xray chest shows adequate lung expansion. What will be your line of management now?

c. What are the indications of ECMO in a neonate with persistent hypoxemia?

Question 11.

A 3-week-old baby girl was admitted in NICU with respiratory distress of 4 days duration. She was born at term and birth weight was 3.2 kg. She had passed her CCHD pulse oximetry screen and metabolic screen and was discharged on day 3 of life. Her current weight is 2.8 kg. There is no history of fever, cough, cold, vomiting, diarrhea. Mother reveals that baby has severe forehead sweating during feeding and there is history of suck-rest-suck cycle. On examination, she looks pale she looks pale but alert. Her heart rate is 176 beats/min, oxygen saturation 88% on room air and 96% with 25% Fio2. RR 80 breaths/min, with subcostal and intercostal retractions, pulse volume is good, and blood pressure—72/45 (52) mm Hg. There is a loud pansystolic murmur in the tricuspid region with loud S2, and ejection systolic murmur in pulmonary area. There is hepatomegaly of 4 cm below the right costal margin.

a. What is your clinical diagnosis?

b. What would be your immediate line of management in this baby?

c. 2D ECHO revealed a 4 mm VSD and 3 mm ostium secundum ASD. How would you follow up this baby?

d. What are the indications for ASD closure? What are the techniques available for ASD closure?

e. What are the indications for VSD closure and what is the preferred modality?

Question 12.

A 14-day-old neonate is brought to the ER with irritability for last 3 hours. On evaluation temperature is normal, there is marked tachycardia, CFT 3 seconds and pulses are well palpable. spo2 is 95% on room air. The infant is on exclusive breastfeeds. ECG is as shown in Fig 9.

a. Interpret the ECG. What is your diagnosis?

b. What medical conditions can precipitate this in neonates?

c. What are the differential diagnoses of wide QRS complex tachycardia in neonates?

d. What drugs are used for managing this condition?

e. This baby did not respond to medical therapy and developed hypotension after 4 hours. What would be the treatment of choice now?

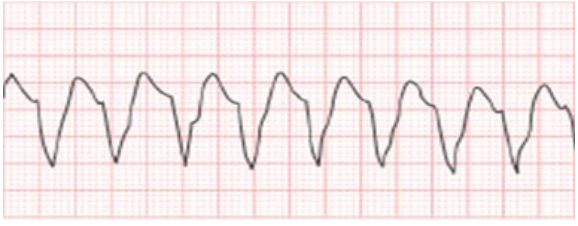

Fig 9

Question 13.

A term neonate, AGA, presented with tachypnea and cyanosis 6 hours after birth. Baby had cried soon after birth, no history of meconium aspiration and no antenatal risk factors for sepsis. Spo2 was 85% on room air, HR 168/min, RR 68/min, mean BP 50 mmHg, and there is hepatomegaly 3 cm below RCM. Chest Xray was suggestive of massive cardiomegaly as shown in Fig 10. 2D ECHO is done and apical 4 chamber view is as shown in Fig 11.

a. What are the ECHO findings in Fig 11 and what is the most probable diagnosis?

b. What is GOSE score and what is its clinical utility?

c. What drugs are used for medical management of these babies?

d. This baby had worsening clinical condition after starting prostaglandin infusion. What could be the possible reason?

e. What are the indications for surgical intervention in neonates?

f. What other cardiac problems would you monitor these babies for?

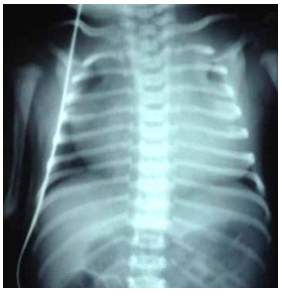

Fig 10

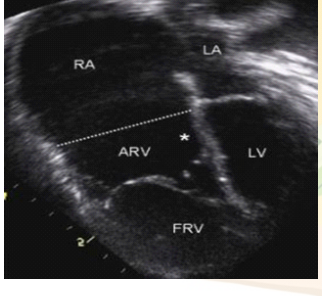

Fig 11

Question 14.

A preterm neonate, 29 weeks, 1.1 kg, was being cared for in NICU. She had severe RDS requiring 2 doses of surfactant and mechanical ventilation for 2 days, followed by CPAP support. She was started on minimal enteral nutrition and was receiving parenteral nutrition through a PICC line inserted via right antecubital fossa. As she had feed intolerance in initial days, progression of feeds was slow. A week later whilst the baby was still on CPAP support and parenteral nutrition, she was noted to have sudden desaturation and bradycardia. It was preceded by a few brief episodes of apnoea with fluctuating oxygen saturation. Cardiac auscultation revealed muffled heart sounds. Baby was intubated and ventilated, and active resuscitation was commenced. An urgent bedside echocardiogram was done, and image is as shown in Fig 12.

a. What is the diagnosis?

b. What could be the possible reason for this condition in this baby?

c. What would be the emergency management in this baby?

d. What are few complications associated with PICC lines?

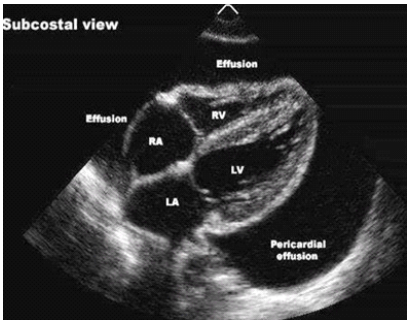

Fig 12

Question 15.

A 1-month-old neonate was admitted with feeding difficulties and respiratory distress. Hypotonia and generalized areflexia were observed during examination. Lab evaluation showed elevated creatine kinase levels. Chest x-ray, ECG and 2D ECHO are as shown in Fig 13, 14 and 15 respectively.

a. What are the findings in CXray, ECG and ECHO?

b. What is the probable diagnosis?

c. How would you confirm the diagnosis?

d. What is the definitive treatment for this condition?

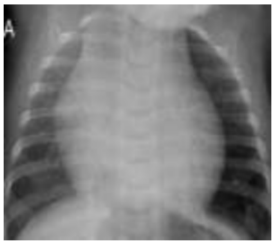

Fig 13

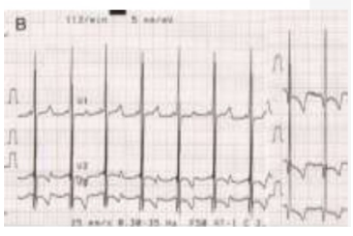

Fig 14

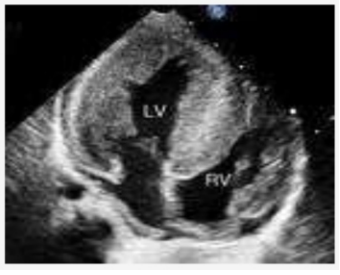

Fig 15

Question 16.

You are called by nursing staff to review a term born, 36 hours old well baby. Baby is feeding well and has passed urine and meconium. The nursing staff performed pulse oximetry screening and reported spo2 of 97% in right upper limb and 92% in lower limb. You examined the baby and performed the test again. The findings are same. Baby's vitals are otherwise stable.

a. How would you interpret this pulse oximetry screening result? What would be your next step?

b. Name 5 congenital heart defects which can be diagnosed or strongly suspected on basis of pulse oximetry screening results.

c. What law is pulse oximetry based upon?

d. What are the advantages of signal extraction technology in pulse oximetry?

e. At what spo2 range is pulse oximetry most reliable?

f. Name 2 conditions with reversal of differential

cyanosis (preductal spo2 less than post ductal spo2)

Question 17.

Below is the drug prescribed to a 20-day old neonate. (Fig 16)

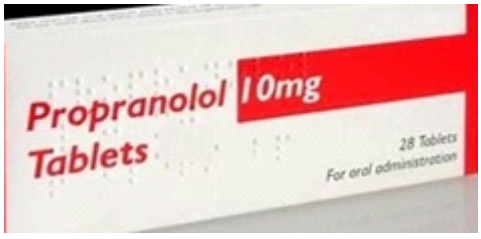

Fig 16

a. What is the mechanism of action of this drug?
b. Which class of antiarrhythmic is Propranolol, according to Vaughan William classification?
c. What are the indications for use of propranolol in neonates?
d. What is the dose of Propranolol in neonates?
e. What would you monitor after starting Propranolol therapy in a neonate?

Question 18.

A 27-day-old neonate presented with tachypnea, poor feeding, cold peripheries, and lethargy. On evaluation, baby was critically sick. RR 80/min, HR 176/min, spo2 75% on room air, CFT 3 seconds, peripheries cold, pulses feeble, mean BP 40 mmHg. Baby had hepatomegaly 4 cm below RCM. Baby was intubated and mechanically ventilated and initiated on anti-heart failure treatment. Cxray revealed cardiomegaly. 2D ECHO ruled out structural heart defect and was suggestive of marked left ventricular (LV) dilatation with global hypokinesia. LV fractional shortening was 15% and LV ejection fraction (LVEF) 25%. LA dilated, and the mitral valve leaflets showed sluggish movement. The baby was discharged after 25 days with furosemide and ACE inhibitors. During the follow-up period, the baby had two episodes of decompensated heart failure again and had failure to thrive.

a. What is the diagnosis?
b. What are the probable causes of this condition in neonates?
c. How would you evaluate such babies?
d. What is the long-term prognosis in these babies?
e. What are the indications for cardiac transplantation in these infants?

Question 19.

A term 3.2-kg boy baby was brought to the ER on day 10 of life with a history of poor feeding and lethargy. On examination, he was mottled with poor peripheral pulses. An ejection systolic murmur was appreciated. Bilateral femoral pulses were not palpable, and he was hypotensive. 2D ECHO was done after primary stabilization and arch view is as shown in Fig. 17.

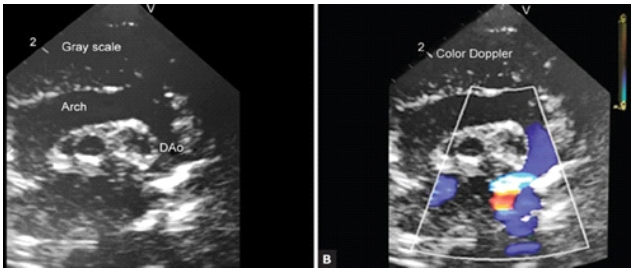

Fig 17

a. Describe the ECHO finding.
b. What is the diagnosis?
c. What drug will you immediately start to improve the systemic circulation in this baby?
d. What would be the definitive treatment of choice in this condition?
e. What are the risks associated with balloon angioplasty of native coarctation in early infancy?
f. What percentage of babies will have recurrence of this condition? How is it managed later?

Question 20.

What are the most common cardiac defects found in chromosomal anomalies and syndromes mentioned below?

a. Trisomy 18
b. Trisomy 21
c. Turner's syndrome
d. Noonan's syndrome
e. DiGeorge's syndrome (deletion 22q11)
f. CHARGE syndrome

Answer 1.

a. Narrow complex Supraventricular Tachycardia

b. Adenosine is the drug of choice. Serum half-life is 10-15 seconds

c. Dose: 0.05 to 0.2 mg/kg

Technique: Two syringe technique. Rapid IV bolus followed by a saline flush.

Two syringes are attached to a three-way which is open to the patient. Syringe carrying adenosine is attached to one end of three way, syringe carrying normal saline is attached to side end of three way. We have to push adenosine fast followed by normal saline flush. Care should be taken to prevent backflow of adenosine.

d. Synchronized DC cardioversion: 0.5–1 J/kg first dose. Repeat dose 2–4 J/kg.

e. Chronic medical treatment is appropriate for neonates who have hemodynamically significant SVT, frequent SVT requiring medical management, pre-excitation on ECG, or congenital cardiac defect. Propranolol, Flecainide, Amiodarone may be used for chronic medical treatment, depending upon clinical response.

Answer 2.

a. Second Degree AV block Mobitz type 1

b. Neonatal lupus is the most probable diagnosis.

Presence of Anti-Ro and Anti-La antibodies shall confirm the diagnosis.

c. Fetal exposure to maternal autoantibodies (anti-Ro and anti-La) results in Inflammation fibrosis and scarring of the AV nodal structures, leading to the loss of transmission of impulses through the conducting system.

d. Indications for permanent pacemaker implantation:

- Congenital third-degree AV block with ventricular rate (VR) 55 bpm or with Congential heart disease and VR less than 70 bpm
- Congenital third-degree AV block with wide QRS escape rhythm, complex ventricular ectopy, or ventricular dysfunction
- Congenital third-degree AV block beyond the first year of life with an average rate less than 50 bpm, abrupt pauses in VR that are 2 to 3 times the basic cycle length or are associated with symptoms due to chronotropic incompetence.

Answer 3.

a. Hemodynamically significant Patent Ductus Arteriosus (hsPDA)

b. Suprasternal view. ECHO findings are suggestive of PDA.

c. PLAX (Parasternal Long Axis View)

Structures:

A: Right ventricle cavity

B: Interventricular septum

C: LV cavity

D: Mitral valve

E: Left Atrium

F: Aorta

G: Aortic valve

Left atrium to aortic root (LA:Ao) ratio is measured in parasternal long axis (PLAX) view using M-Mode. A section is taken of the left atrium at the level of the aortic valve, with the transducer placed perpendicular to it. The aortic valve is measured just before it opens at the end of the diastole, whereas the left atrium is measured at its maximal volume during the systole.

Clinical utility: LA/Ao ratio will increase as the left to right shunting across ductus increases. LA: Ao ratio > 1.5 is considered one of the markers for hemodynamically significant PDA.

d. Congestive cardiac failure, Acute kidney injury,

Bronchopulmonary dysplasia, Necrotising Enterocolitis and Intraventricular hemorrhage.

e. Drugs and their side effects:

Indomethacin: Renal impairment, GI toxicity (NEC, GI hemorrhage, perforation), altered platelet function

Ibuprofen: Renal toxicity, GI toxicity, altered platelet function.

Paracetamol: Lower anti platelet activity. Long term follow-up studies lacking.

Answer 4.

a. Right to left shunt at both levels: PPHN.

Treatment considerations: Lung recruitment, inhaled pulmonary vasodilators like iNO, Sildenafil

b. Right-to-left shunt at the ductal level but a left-to-right shunt at the atrial level:

Left ventricular dysfunction, pulmonary venous hypertension, and ductal-dependent systemic circulation

Treatment considerations: Milrinone, PGE1. iNO is contraindicated and may worsen pulmonary venous hypertension and reduce systemic blood flow.

c. Left to right shunt at ductal level but a right to left shunt at the atrial level:

Duct dependent pulmonary circulation: Tricuspid atresia, pulmonary atresia, critical PS

Treatment considerations: PGE1

Answer 5.

a. Apical 4 chamber view showing TR jet.

Diagnosis: PPHN

b. TR jet velocity (v) is 3.99 m/s.

Pressure gradient= 4 v^2 = 4 x 3.99 x 3.99 = 63.68 mmHg

Hence, RVSP (Right ventricular systolic pressure) = 63.68+5=68.68 mmHg

Hence, PA systolic pressure = 69 mmHg

c. OI = MAP x Fio2 x 100 / paO2

OI in this baby is 24

d. As lung recruitment has already been optimized, pulmonary vasodilator like iNO would be the treatment of choice.

e. TAPSE: Tricuspid annular plane systolic excursion (TAPSE) is a measure of the RV systolic excursion or displacement of the lateral (or medial) tricuspid annulus toward apex along the longitudinal axis. This parameter is particularly useful in cases of PPHN to determine the RV systolic function. Greater the excursion of the annulus, better is the systolic function.

In term neonates, an excursion of >8 mm (Range: 8–11 mm) is considered as normal.

TAPSE measurement <4 mm indicates severe pulmonary hypertension.

Answer 6.

a. Transposition of Great Arteries. 10% of these babies may have extracardiac malformations.

b. Start intravenous infusion of Prostaglandin E1 (PGE1), soon after delivery, if oxygen saturation is lower than 75% and/or lactic acidosis is present.

c. Prostaglandin infusion (PGE1) 0.03 to 0.1 mcg/kg/min.

Adverse effects: Apnea, fever, flushing, tachycardia, hypotension

d. Indications of BAS include:

(a) Low saturations despite PGE1 infusion and ASD is restrictive.

(b) Those presenting with low saturation and a restrictive ASD beyond 3-4 weeks with a closed PDA where PGE1 is likely to be ineffective.

(c) Patient with restrictive ASD, not fit for immediate surgery (e.g. having sepsis or respiratory infection)

(d) Restrictive ASD in TGA patients with large VSD or PDA: to decrease left atrial pressure and pulmonary venous hypertension.

e. Definitive treatment: Arterial Switch Operation (ASO)

f. As early as possible. 7 days to 3 weeks, earlier if baby is unstable or has associated persistent pulmonary hypertension of the new-born. Best done before 4 weeks.

Answer 7.

a. IVC diameter is measured within 1-2 cm of RA-IVC junction in subcostal longitudinal view.

b. Distensibility Index of IVC = Dmax (expiration) – Dmin (inspiration) / Dmean

c. Central venous pressure (CVP) is low, and poor perfusion is likely to be fluid responsive. We would give a fluid bolus and increase the total fluid intake.

d. Key findings in favor of hypovolemia on 2D ECHO imaging:

- LV and RV of small dimensions and hyperkinetic
- Small LV- end- systolic and end- diastolic areas
- Increased LV ejection fraction shortening (>70%)
- Small IVC diameter with wide respiratory variation

Answer 8.

a. *Sildenafil:*

Phosphodiesterase-5 inhibitor

Adverse effect: Systemic hypotension

b. *Levosimendan:*

Calcium sensitizer

Adverse effect: Hypotension

c. *Bosentan:*

Competitive antagonist of endothelin 1 receptors (ET A and B)

Adverse effect: Hepatotoxicity, hypotension, decreased hematocrit, flushing

d. *Digoxin:*

Sodium-potassium ATPase inhibitor

Adverse effect: Arrythmia, Hyperkalemia

Answer 9.

a. Phosphodiesterase -3 (PDE-3) inhibitor

b. Around 4 hours

c. Hypotension

d. Indications: PPHN with LV/ RV dysfunction; Low cardiac output states especially after cardiac surgery; Ebstein anomaly- to increase the antegrade pulmonary blood flow

e. Renal

Answer 10.

a. Lung recruitment- by increasing MAP/ HFOV/ surfactant.

b. Here, priority would be management of shock. In the presence of systemic hypotension and good cardiac function, 1 or 2 fluid boluses (10 mL/kg of NS) followed by dopamine are recommended. Some centres prefer the use of norepinephrine or vasopressin because these agents are thought to be more selective systemic vasoconstrictors. If high doses of vasopressors and multiple vasopressors are needed, hydrocortisone should be considered.

c. ECMO indication: Persistent hypoxemia (OI of >40 or alveolar-arterial gradient >600 despite aggressive medical management of PPHN with mechanical ventilation and iNO) and the presence of hemodynamic instability

Answer 11.

a. Acyanotic congenital heart disease with congestive cardiac failure

b. Stabilise airway, breathing, circulation.

Respiratory support to provide adequate PEEP

Fluid restriction

Diuretics (Furosemide 1-2 mg/kg/dose Q12 hrs). Digoxin/ ACE inhibitors if not controlled on diuretic alone.

Treatment of concomitant infection and anaemia

Optimising nutrition

c. A follow-up of growth and development every month for first 3 months and every 3 monthly thereafter. Follow up ECHO at 1 month, followed by ECHO every 3- 6 month.

d. Indication for ASD closure: ASD with left-to-right shunt associated with evidence of right ventricular volume overload without evidence of irreversible pulmonary vascular disease.

Techniques:

- Transcatheter nonsurgical closure (Amplatzer device)
- Surgical closure

e. Indications for VSD closure: Growth failure refractory to medical management; Pulmonary artery pressure >50% of systemic pressure; Qp/Qs > 2:1.

Modality: Direct surgical closure of the defect.

Answer 12.

a. Wide QRS complex tachycardia.

Diagnosis: Ventricular tachycardia

b. Severe medical illness like shock, hypoxia, electrolyte disturbances, SVT with aberrancy

c. Ventricular tachycardia (VT), Ventricular fibrillation (VF), Torsades de pointes, Supraventricular tachycardia (SVT) with aberrancy.

d. Lidocaine, Amiodarone, Procainamide

e. Synchronized cardioversion

Answer 13.

a. ECHO findings: Caudal displacement of the tricuspid valve with low implantation of posterior leaflet, moderate dilatation of the right ventricle and significant dilatation of the right atrium.

Diagnosis: Ebstein anomaly

b. GOSE (Great Ormond Street score) or Celermajer score is defined as ratio of area of right atrium and arterialized right ventricle to the combined area of the functional RV, LA and LV.

GOSE score of 3 or more with mild cyanosis in a neonate is an indication for surgery in neonatal period.

Also, GOSE score is helpful in grading Ebstein anomaly predicting mortality as follows:

Grade	GOSE SCORE/ Ratio	Mortality
1	< 0.5	8%
2	0.5-0.99	9%
3 (acyanotic)	1-1.49	10% (neonatal) 45% (later)
3 (cyanotic)	1-1.49	100%
4	>1.5	100%

c. Drugs used for medical management of these babies: PGE1, iNO, Milrinone

d. Pulmonary valve regurgitation. In this case, initiation of PGE1 may lead to creation of circular shunt resulting in low systemic output.

e. Indications for surgical intervention in neonates:

- Severe persistent cyanosis
- GOSE score 3 or more with mild cyanosis
- Cardiothoracic ratio> 80%
- Severe TR with persistent right heart failure

f. These babies should be monitored for arrhythmias.

Answer 14.

a. Massive pericardial effusion with cardiac tamponade

b. PICC line migration and malposition of PICC tip in pericardial cavity

c. Emergency Pericardiocentesis by substernal approach

d. PICC line complications: Catheter migration, malposition, catheter rupture, bloodstream infections, occlusions, thrombophlebitis, pericardial or pleural effusion.

Answer 15.

a. Chest Xray: Cardiomegaly

ECG: Signs of left ventricular hypertrophy (Large amplitude QRS complexes) and a short PR interval in precordial leads

2D ECHO: Severe generalized left ventricular hypertrophy, thick IVS, right ventricle hypertrophy. Findings suggestive of hypertrophic cardiomyopathy.

b. Pompe disease

c. Diagnosis: Absent or markedly reduced acid alpha glucosidase (GAA) enzyme activity in dried blood spots or cultured skin fibroblasts. Genetic testing by exome sequencing to demonstrate homozygous mutation in GAA coding gene.

d. Enzyme replacement therapy: Recombinant human acid alpha-glucosidase (GAA)

Answer 16.

a. Congenital cyanotic heart disease screen is positive. We would request cardiac evaluation and

Echocardiography.

b. Transposition of great arteries

Truncus arteriosus

Pulmonary atresia

Hypoplastic left heart syndrome

Obstructed TAPVC

Tetralogy of Fallot

c. Beer Lambert Law

d. Decreases low perfusion artefact and motion artifact

e. 80-95%

f. TGA with coarctation of aorta; TGA with severe PPHN

Answer 17.

a. Nonselective beta blocker

b. First generation class II

c. Indications for use of propranolol in neonates:

SVT and other tachyarrhythmias

Hypertension

Large Hemangioma

For management of cyanotic spells in TOF

Thyrotoxicosis

d. Dose:

Oral: 0.5 to 1 mg/kg/dose BD

IV: 0.01 to 0.02 mg/kg/dose BD

e. Monitor for hypotension (BP) and hypoglycemia (RBS)

Answer 18.

a. Dilated Cardiomyopathy

b. Probable causes of neonatal cardiomyopathy:

Prenatal infections (CMV, HIV, Parvovirus)

Familial or genetic causes

Maternal autoimmune disease with anti- Ro and anti-La antibodies

Prenatal drug exposure

Arrythmia induced cardiomyopathy

Twin-twin transfusion

Storage and metabolic disorders

c. Evaluation should include detailed sequential assessment to rule out disorders mentioned above.

d. Approximately one third of patients with DCM die, one third have chronic heart failure, and one third experience improvement in their condition.

e. Indications for heart transplantation include failure of medical therapy, severe failure to thrive, intractable arrhythmias and severe limitations to activity.

Answer 19.

a. ECHO: Grayscale and colour doppler demonstrating the narrowing of the isthmus and obstructed antegrade flow through the descending aorta (DAo).

b. Coarctation of aorta

c. PGE1

d. Surgical: Resection of coarctation segment and end-to-end anastomosis

e. Risks associated with balloon angioplasty of native coarct: Aneurysm, recoarctation, vascular injury at the site of access.

f. 10-15% of babies will have recoarctation. It is managed with balloon angioplasty.

Answer 20.

a. Trisomy 18: VSD

b. Trisomy 21: Complete AV canal defect and VSD

c. Turner's syndrome: Coarctation and bicuspid aortic valve

d. Noonan's syndrome: Pulmonary valve stenosis

e. DiGeorge's syndrome (deletion 22q11): Interrupted aortic arch and conotruncal malformations

f. CHARGE syndrome: Conotruncal anomalies

Instructions for Authors

Review Article	**The article should be approximately 2-3 pages long with a word count of 2000-2500 words. Author should summarize key practice points at the end. Please include 5-6 references as suggested reading.**
Case Report	**This would be a summary of the case discussed in that months clinical meeting. Interesting cases even if not presented may also be submitted. It should include the clinical presentation and a brief discussion about the condition. Word count should be 1000-1500. Please include 2-3 references at the end.**
Journal Scan	**Some recent research paper of interest to pediatricians and neonatologists. The structure should include Introduction, Research question, Hypothesis, Methods, Results, Limitations and strengths of study, Reviewers comments. Word count should be approximately 1000 words. Please include 2-3 references if needed at the end.**
Picture of Month	**An interesting case related to neonatal practice. It should have a brief case history and a commentary, all fitting on one page along with the pictures.**
Image section	**Any interesting Xray, Ultrasound, CT or MRI of clinical interest. Brief clinical presentation and about the condition should be summarized on one page along with image.**
OSCE	**About 10-12 questions would be included in this section along with answers.**

Contact Us

On behalf of committee, I request all members of NNF, Delhi to actively contribute to various sections of the newsletter.

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