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NEOCHAP BULLETIN

AN OFFICIAL PUBLICATION OF IAP NEONATOLOGY CHAPTER

Dr. Rhishikeh Thakre (Editor)

Dr. Naveen Bajaj (Guest Editor)

EDITORIAL

Dear Friends,
Greetings !

I feel privileged to communicate with you all by IAP Neochap Bulletin. Neonatology Chapter is growing leaps and bounds with each passing day. We are actively updating our website www.iapneochap.org regularly now a days so that latest information is available to you all the time. It is particularly very beneficial to our Fellowship students who can now keep up with latest information from secreteral's office. I am very pleased to write that our last bulletins are available on our website in pdf format and you can download these bulletin in your computer and smartphone. We have also launched iap neonatology chapter application for the android smatphone and is available free on Google play store. Application for the iphone is also being developed.

Sepsis in neonatal period is a common cause of morbidity and mortality in our country. In this news bulletin we have incorporated articles on two important aspects of sepsis, one prevention of nosocomial infections in NICU and other Lab diagnosis of sepsis. I hope you will find this bulletin useful and informative.

IAPNEOCON 2014 is going to be organized in Meerut (UP) from 31 st October to 2nd November. The detailed information has been provided in this bulletin. The organizing secretary, Dr Amit Upadhay is working very hard to make this conference a well designed scientific fair with 11 workshops and talks on common neonatal problems. I wish him all success.

I hope to see you all in Meerut !

With warm regards
Dr Naveen Bajaj
Guest Editor

7th National Conference of IAP Neonatology Chapter

"IAP NEOCON 2014"

Meerut

31st Oct. to 2nd Nov. 2014

Organized by :

Indian Academy of Pediatrics, Meerut &
Department of Pediatrics, L. L. R. M. Medical College, Meerut

Venue : Auditorium, L. L. R. M. Medical College, Meerut - 250 004

Workshops [31st Oct (Day 1, 2 to 6 pm), 1st & 2nd Nov(Day 2 & 3, 9 am to 1 pm)]

- Exam preparation for PG/fellows (Day 1, 9 am- 1 pm)
- Neurodevlopmental follow up of NICU graduates (Day 1)
- Procedures & good NICU Practices (Day 1)
- Neonatal Ventilation (Day 1, 2)
- Breast Feeding & KMC Workshop (Day 2)
- SNCU care at District Hospital (Registration Free) (Day 2)
- Programme for Nurses (SNCU Care, Basic Neonatal Resuscitation, Basic Newborn Care & Equipment Care (Registration free) (Day 2)
- Growth, Nutrition & followup of VLBW babies(Day 2)
- case based protocols discussion of common major morbidities in NICU (Day 2)
- Perinatology (Day 3)

Registration Fees

	Up to 30th June 2014	Up to 15th October 2014	16th October onward & spot
Nurse	500/-	500/-	1000/-
PG Student*	2500/-	3000/-	3500/-
IAP Member	3000/-	3500/-	4000/-
Non IAP Member	3500/-	4000/-	4500/-
Accompanying Person	1500/-	2000/-	2000/-
Workshop (ventilation)	2000/-	2000/-	N/A
Workshop (other)	1000/-	1000/-	N/A
Refund on Cancellation	60%	50%	Nil

* HOD Certificate

Mode of Payment
By cash/D.D./ Cheque/ Online* drawn in Favour of **'IAP NEOCON 2014'** payable at Meerut.
Please add Rs. 50/- for outstation Cheques.
*** A/c No. 33719290166**
IFSC Code - SBIN0002419

Conference/ CME will be held on **1st Nov. 2014, 2:00 pm onward & 2nd Nov. 2014**

Registration for Workshop ; "First Come first Serve basis".

Research work invited for Award/ Free Oral Paper & Poster Presentation

Last Date for paper submission is "15th September 2014"

Softcopy of Research paper should be submitted to :
Dr. Rhishikesh Thakre, Secretariat :
IAP Neonatology Chapter, Neo Clinic, 27 Samarth Nagar, Aurangabad - 431 001 | email : iapneochap@gmail.com

Prizes/Medals/Certificates for best Papers in: Oral award/Oral free paper/Poster

Conference Secretariat : Dr. Amit Upadhyay, **Organizing Secretary**
Department of Pediatrics, L. L. R. M. Medical College, Meerut, e-mail : au.llrm@gmail.com

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PREVENTION OF NOSOCOMIAL INFECTIONS IN NICU

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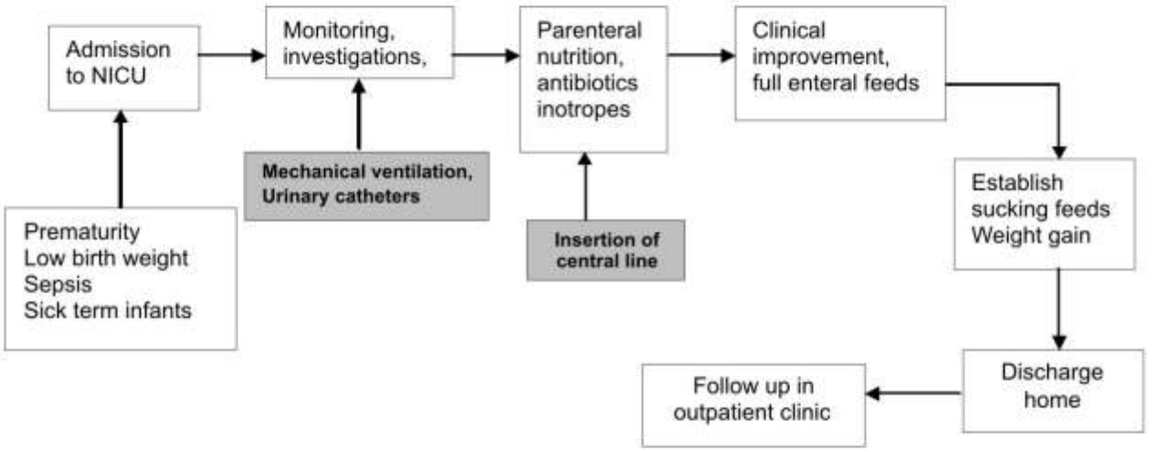
Introduction

Healthcare-associated infections (HAIs) are associated with increased morbidity, mortality, and healthcare costs[1,2]. It is estimated that each year 1 in every 20 patients contracts an HAI while receiving medical care3. The problem is of special significance among newborns. In 2002, an estimated 33,269 HAIs occurred in newborns in high-risk US nurseries[1]. Infants hospitalized in neonatal intensive care units (NICUs) are at particularly high risk for developing HAIs. This is likely secondary to their extensive exposure to central venous catheters, prolonged ventilatory support, and immature immune systems. Premature neonates in particular lack an effective skin barrier, have an immature and often ineffective immune system, and often necessitate prolonged support and hospitalization[4].

The patient journey in the NICU includes



Device associated infections are very common in a Neonatal Intensive Care Unit.

The common device associated infections include:

- Central Line Associated infection
- Ventilator associated pneumonia
- Catheter associated urinary tract infections

CDC definition of device associated infection in infants <12 months

Central Line–Associated Bloodstream Infection(BSI)5

A BSI is considered central line–associated if a central line or umbilical catheter was in place at the time of, or within 48 h before, onset of the event a laboratory confirmed BSI is defined by at least one of the following signs or symptoms: fever (>38°C core), hypothermia (<36°C core), apnea, or bradycardiaand.

Signs and symptoms and positive laboratory results are not related to infection at another site and Patient has a recognized pathogen (eg, Escherichia coli) cultured from 1 or more blood cultures Or

A common skin commensal (eg, coagulase-negative staphylococci [including Staphylococcus epidermidis]) is cultured from 2 or more blood cultures drawn on separate occasions.

Central Line Associated Blood Stream Infection (CLABSI) is estimated to cause up to 70% of all hospital acquired blood stream infections in preterm infants. Studies from adult and pediatric patients implicate intra-vascular catheter placement and secondary invasion, around the catheter as the source of bacteremia. Efforts to reduce infection in the nursery would include optimal infection control practices (hand hygiene), judicial use of invasive devices and appropriate use of antimicrobial agents.

Ventilator-Associated Pneumonia[6]

Pneumonia is considered ventilator associated if

the patient was intubated and ventilated at the time of, or within 48 h before, the onset of the infection.

Pneumonia is defined radiologically in patients with underlying pulmonary (eg, bronchopulmonary-dyspasia) or cardiac disease by >2 (or >1 in patients without underlying disease) serial chest radiographs with at least one of the following: new or progressive and persistent infiltrate, consolidation, cavitation, or pneumatoceles and worsening gas exchange (eg, O2 desaturations, increased oxygen requirements or ventilator demand) and at least 3 of the following:

1. temperature instability with no other recognized cause;
2. leukopenia (<4000WBC/mm3) or leukocytosis (>15,000 WBC/mm3) with left shift (>10% band forms);
3. new onset of purulent sputum (ie, >25 neutrophils and <10 squamous epithelial cells per low power field), change in character of sputum, or increased respiratory secretions/suctioning requirements;
4. apnea, tachypnea (>75 breaths/minute), nasal flaring with retractions or grunting;
5. wheezing, rales, or rhonchi;
6. cough;
7. bradycardia (<100 beats/min) or tachycardia (>170 beats/min)

Catheter-Associated Urinary Tract Infection[7]

A UTI is defined as catheter associated if the patient had an indwelling urinary catheter at the time of, or within 48 h before, onset of the event a symptomatic UTI is defined in a patient <1 year of age with at least one of the following signs or symptoms with no other recognized cause: fever (>38°C core), hypothermia (<36°C core), apnea, bradycardia, dysuria, lethargy, or vomiting & a positive urine culture of >105 CFU/mL with <2 species of microorganisms or at least one of the following findings:

1. positive dipstick for leukocyte esterase and/or nitrite;
2. pyuria (>10WBC/mm3 of unspun urine or >3 WBC/high power field of spun urine);
3. microorganisms on gram's stain of unspun urine In addition to:
   A positive urine culture of between >103 and <105 CFU/mL with <2 species of microorganisms an asymptomatic UTI is defined in a patient <1 year of age without signs or symptoms but with:
   A positive urine culture of >105 CFU/mL with <2 species of uropathogen microorganisms and
   A positive blood culture with >1 matching uropathogen to the urine culture, or >2 matching blood cultures drawn on separate occasions if the matching pathogen is a common skin commensal.

INTERVENTIONS

This intervention to reduce central line infection would include the following steps[8]

1. Identification of the babies who would require central lines. This is done to save the antecubital veins for easy access for central line insertion;
2. maintenance of strict sterile technique;
3. elimination of pulling the tubing through the isolette side holes, thereby accessing the tubing only through open isolette doors;
4. consistent hub care with alcohol, using friction and waiting for drying time;
5. use of a NO TOUCH method to keep the sterility of the tubing;
6. elimination of the Y-connector to maintain continuous flow of fluid through the PICC;
7. single use of microtubing for medication administration;
8. expeditious removal of central catheters

Premature neonates in particular lack an effective skin barrier, have an immature and often ineffective immune system, and often necessitate prolonged support and hospitalization[9]

Hand hygiene

Hand hygiene remains the most effective method for reducing health care–associated infections. World Health Organization Recommendations for Hand Hygiene[10]

- Wash hands with soap and water when visibly dirty or soiled with blood or other body fluids or after using the toilet.
- Use of an alcohol-based hand rub forall routine antisepsis is recommended forall clinical settings if the hands are not soiled. If an alcohol-based hand rub is not obtainable, wash hands with soap & water.
- Perform hand hygiene:
  - Before and after touching the patient.
  - Before handling an invasive device for patient care, regardless of whether gloves are worn.
  - After contact with body fluids or excretions, mucous membranes, nonintact skin, or wound dressings.
  - If moving from a contaminated body site to another body site during care of the same patient.
  - After contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient.

- After removing sterile or non-sterile gloves.

- Selection and handling of hand hygiene agents:
  - Provide products with a low irritancy potential.
  - Determine any known interaction between products used to clean hands, skin care products & the types of gloves used in the institution.
  - Ensure that dispensers are accessible at point of care.
  - When alcohol-based hand rub is available in the health care facility, use of antimicrobial soap is not recommended.
  - Soap and alcohol-based hand rub should not be used concomitantly.
- Use of gloves:
  - The use of gloves does not replace the need for hand hygiene.
  - Wear gloves when it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, or nonintact skin will occur.
  - Remove gloves after caring for a patient. Do not wear the same pair of gloves for more than 1 patient.
  - Change or remove gloves during patient care if moving from a contaminated body site to either another body site (including nonintact skin, mucous membrane, or medical device) within the same patient or the environment.
- Other aspects of hand hygiene:
  - Do not wear artificial fingernails or extenders when having direct contact with the patient.
  - Keep natural nails short.

Prevention of VAP

Efforts aimed at caregiver education, attention to hand hygiene, the use of noninvasive mechanical ventilation, avoidance of abdominal distension, elevating the head of the bed, and proper cleaning and maintenance of respiratory equipment and circuitry have been shown to be particularly effective in reducing VAP[11]

Prevention of UTI

CDC recommend that urine specimens be obtained either via suprapubic aspiration or bladder catheterization.

Cutaneous antisepsis

Skin colonisation and catheter hub colonisation remain important determinantsof CRBSI (Moro 1994), and methods to decrease its occurrence include appropriate skin antisepsis during vascular access and vigilance during catheter maintenance and access. Reducing bacterial colonisation at central line insertion sites remains an important step in decreasing CRBSIs[12]. Cutaneous disinfectants widely used in neonatal nurseries include chlorhexidine, isopropyl alcohol, povidone- iodine, hexachlorophane or cetrimide or a combination of these agents at varying concentrations. CHG has been used in various invasiveprocedureslikecentral/umbilicallineinsertions, central line maintenance and bathing of newborn infants as well13. In their study,Alcohol-based CHG was commonly used in term infants, whereas majority of units (72%) used aqueous CHG in preterm infants.

Other strategies

- The use of human milk feedings has been associated with a lower risk of sepsis and necrotizing enterocolitis in preterm infants. Human milk contains a large number of immune-protective substances, prebiotics and probiotics and has been shown to decrease the incidence of gastrointestinal & respiratory infections in infancy.
- The use and misuse of antibiotics can be associated with alteration in neonates' microflora and the development of antibiotic resistance. Judicious use of antibiotic agents is commonly recommended as appropriate in the NICU, but it is not commonly practiced.

Invasive candidiasis

Invasive candidiasis (IC) is a leading cause of death in preterm infants, and survivors often suffer from multiple morbidities.

There is evidence to suggest that fluconazole prophylaxis is safe and efficacious in preventing IC and colonization in premature infants[14].

Nystatin (Nilstat) has been widely used as antifungal prophylaxis in preterm infants especially in presence of central venous catheters[15].

Strategies that might be helpful in the NICU setting include the following:

1. auditing antimicrobial use of practitioners and providing feedback
2. formulary restriction and pre- authorization requirements for selected antimicrobial agents
3. education of prescribers and nurses concerning the role of antimicrobial use and the development of resistance
4. developmentofclinicalguidelines/pathways for selected conditions
5. anti-microbial order forms
6. specific plans for streamlining (broad- to narrow-spectrum antibiotic agents) or deescalating (elimination of redundant or unnecessary)

antimicrobialagents

7. dose optimization on the basis of individual characteristics (eg, weight, renal status, drug-drug interactions)
8. switching from parenteral to oralantibiotic agents when appropriate and feasible

MRSA colonisation in nurseries[16]

Methicillin-resistant Staphylococcus aureus (MRSA) is a frequent source of infections affecting premature and critically ill infants in neonatal intensive care units. It is critical that medical communities continue to monitor and share reports regarding their local prevalence of MRSA strains, incidence of invasive MRSA infections, and MRSA antibiotic susceptibility patterns in an effort to provide cumulative data that can ultimately contribute to global awareness and treatment guidelines for this pervasive pathogen.

Conclusion

The NICU population is particularly vulnerable to infection, with premature neonates often necessitating support with multiple devices for prolonged periods. Infections in this and other ICU populations come with significant risk of morbidity, mortality, and increased costs to the health care system.

The following aspects needs to be observed

1. Minimize the use of invasive devices, especially invasive mechanical ventilation, endotracheal tubes, urinary catheters and central venous lines
2. Strict hand washing policies in the unit
3. Unit policy on cutaneous antisepsis
4. Judicious use of antibiotics
5. Use of human breast milk
6. Consider using prophylactic antifungal in babies with central lines
7. Routine infection screening (eg MRSA screening) in the NICU.

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LABORATORY DIAGNOSIS OF NEONATAL SEPSIS

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Sepsis is the commonest cause of neonatal mortality; it is responsible for about 30-50% of the total neonatal deaths in developing countries.[1,2] It is estimated that up to 20% of neonates develop sepsis and approximately 1% die of sepsis related causes[1] Early and accurate diagnosis of sepsis is of paramount importance in survival of a septic neonate. Delay in treatment increases morbidity and mortality.

Sepsis Screening Tests

Definitive diagnosis of sepsis rests upon isolation of pathogenic bacteria in cultures of specimens obtained from normally sterile spaces within the body (blood, cerebrospinal fluid, urine, other body fluids (peritoneal, pleural, joint, middle ear), or tissues (bone marrow, liver, spleen).[3] Culture techniques though specific have a low sensitivity (upto 60%) and very long turn-around time. Intrapartum antibiotic prophylaxis may temporarily give falsely negative blood culture. In order to overcome these problems a number of tests have been evaluated to predict presence or absence of infection in the newborn. These tests are screening tests.

1. **Hematological tests –** These tests are commonly used at all ages to screen infection. Their role pertaining to Neonatal Sepsis is discussed.
   a. **Total Leukocyte Count (TLC) -** A total WBC <5,000 /cmm or above 20000/cmm is considered abnormal. Sepsis is one of many causes of abnormal leukocyte count in a newborn (Table 1). TLC has wide sensitivity (range from 17 % to 90%) and Specificity (31% to 100%) in diagnosing Neonatal Sepsis.[4] Thus overall total leukocyte counts alone, have limited value in diagnosis of septicemia in the newborn.
   b. **WBC Morphology on peripheral smear:** Neutrophils may show abnormal morphology with appearance of Dohle bodies (appearance of rough endoplasmic reticulum which stain light blue with Giemsa stain), toxic granulations (eosinophilic granules in cytoplasm of neutrophils) and vacuolization in response to sepsis. These features though commonly seen, are of limited value in establishing a diagnosis; their presence has, at best, a positive predictive value for sepsis of only 33 to 50%[5]
   c. **Absolute Neutrophil count –** (Normal > 1800/ cmm) < 1750/ cmm is significant. ANC is more specific for presence of sepsis. ANC nomograms for normal term and VLBW newborn are available (fig. 1 & 2). ANC is reduced in sepsis. Commonly an ANC < 1750/cmm is considered abnormal and < 1000/cmm is severely abnormal. The neutrophil count, although slightly more sensitive than the total leukocyte count, is too often normal in the face of serious infection to be used as a guide for treatment.

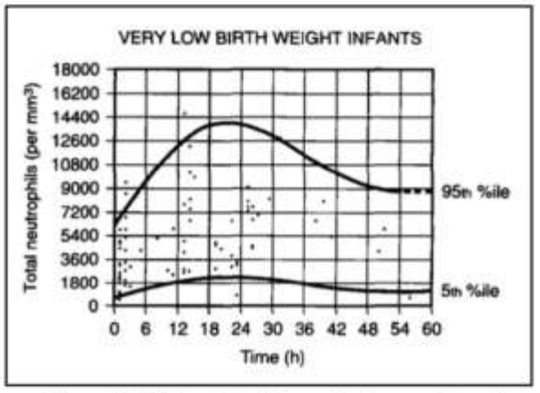

Figure 1: Total neutrophil counts in normal very low birth weight infants (data from Mouzinho A et al Revised reference ranges for circulating neutrophils in very-lowbirth- weight neonates. Pediatrics 94~76-82, 1999.)

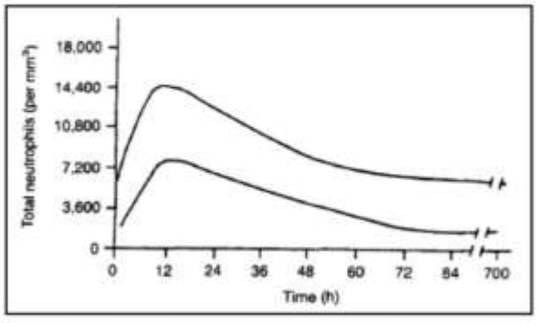

Figure 2: Change in total number of neutrophils in the neonate (data from Manroe BL et.al. The neonatal blood count in health and disease. J Pediatri 95; 89-98,1979)

d. **Neutrophil Ratios –** In response to infection, immature neutrophils are released from the bone marrow into the bloodstream, producing a differential cell count with a "shift to the left" even greater than that normally present in the neonate. A ratio of immature to total leukocytes is drawn. The maximum ratio for the first 24 hours is 0.16 which gradually falls to around 0.12 by 60 hours of age and remains unchanged for the remainder of the first month.[5] In practice I/T ratio up to 0.2 is taken as normal. A large number of clinical studies have evaluated the I:T ratio. Results have been widely disparate, but in most series, they indicate that this ratio is too unreliable to achieve more than limited usefulness by itself. Sensitivities ranges from 38-96% have been reported. Furthermore, elevated ratios caused by a variety of perinatal conditions (see table 1) have been seen in 25% to 50% of uninfected ill infants. Perhaps the ratio's greatest value lies in its good negative predictive value: If the I:T ratio is normal, the likelihood that infection is absent is extremely high (99%)[4,5] In addition, serial determinations of the I:T ratio may lead to increased sensitivity.

e. **Platelet count -** (Normal 1.5 lakhs to 4 lakhs) < 1 lakh is significant. Thrombocytopenia accompanying bacterial infection is thought to be caused by a direct effect of bacteria or bacterial products on platelets and vascular endothelium, leading to increased aggregation and adhesion, or by platelet destruction caused by immune mechanisms. Even though thrombocytopenia is a common finding in sepsis, their overall sensitivity and specificity remains low. Platelets may drop before, during or 1 to 3 days after serious illness becomes clinically apparent. Also duration of thrombocytopenia may remain as long as 2 to 3 weeks after clinical sepsis shows improvement. There are many causes of thrombocytopenia in a neonate other than sepsis (eg. Asphyxia, hypothermia, NEC etc.) Because of all these reasons thrombocytopenia alone is not a good screening test for Neonatal Sepsis.

Table.1: Clinical factors affecting Neutrophil counts in Newborn infants

Factor	Neutrophil counts			
	Increase/ decrease (↑/↓[a])	Immature cells	I/T ratio	Approximate duration
Maternal PIH	↓↓↓↓	↑	↑	72
Maternal fever, neonate healthy	↑↑	↑↑↑	↑↑↑↑	24
≥6 hours intrapartum oxytocin administration	↑↑	↑↑	↑↑↑↑	120
Asphyxia (5-minute Apgar score <5	↓/↑↑	↑↑	↑↑↑	24-60
Meconium aspiration syndrome	↑↑↑↑	↑↑↑	↑↑	72
Pneumothorax with uncomplicated HMD	↑↑↑↑	↑↑↑↑	↑↑↑↑	24
Seizures-no hypoglycemia, asphyxia, or IVH	↑↑↑	↑↑↑	↑↑↑↑	24
Prolonged (for 24 minutes) crying	↑↑↑↑	↑↑↑↑	↑↑↑↑	1
Asymptomatic blood sugar ≤30 mgldL	↑↑	↑↑↑	↑↑↑	24
Hemolytic disease	↓↓ /↑↑	↑↑↑	↑↑	7-28
Surgery	↑↑↑↑	↑↑↑↑	↑↑↑	24
High Altitude	↑↑↑↑	↑↑↑↑	-	-

a: ↑/↓, denotes 0 to 25% of neonates affected; ↑↑/↓↓, 25% to 50%; ↑↑↑/↓↓↓, 50% to 75%; ↑↑↑↑/↓↓↓↓, 75% to 100%

f. **Micro ESR:** Micro ESR is done by collecting capillary blood in a standard pre-heparinised microhaematocrit tube and reading the fall of erythrocyte column after one hour. Micro ESR increases slowly during the first weeks of life, perhaps as a result of rising fibrinogen and falling hematocrit levels. (5)Normal micro ESR = age in days +3, after 14 days - > 15 mm/ at the end of 1 hr is abnormal[5,6] However elevation in ESR may be late in the course of sepsis (in 30 to 60% cases) and once elevated it may show a slow recovery. Thus, use of the microerythrocyte sedimentation rate is of little value in either diagnosing or monitoring serious bacterial infection during the newborn period.(5)

Acute Phase Reactants. In the presence of inflammation caused by infection, trauma,or other cellular destruction, the liver, under the influence of the proinflammatory cytokines, interleukin- 1 p (IL- lp), interleukin-6 (IL-6), and tumor necrosis factor-a (TNF-a), rapidly synthesizes large amounts of certain proteins collectively known as acute-phase reactant(5) (Fig. 3)

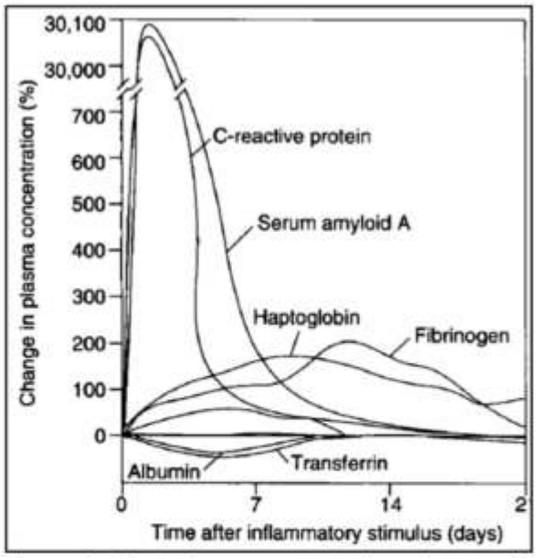

Figure 3: Acute-phase reactants in patients with inflammatory illnesses. (Data from Gabay C, Kushner I. Acute-phase proteins and other systemic responses to inflammation. N Engl J Med 34048-454.1 999.)

a. **C-Reactive Protein (CRP) :** CRP is a protein synthesized in liver in response to elevated the influence of the proinflammatory cytokines. CRP cross-reacts with C-polysaccharide of Streptococcus pneumonia and hence caries this name. Its level in blood starts rising in about 4-6 hours after onset of infection and becomes abnormal by 24 hours. Levels generally peak at two to three days after infection and remain elevated until the infection is controlled and the inflammation begins to resolve[5] Because of this, a very early CRP test may come normal.

Currently, the most widely used method for measuring CRP is rate nephelometry. This method measures light scattering from aggregates of CRP with specific antibodies; it provides accurate and reproducible results within 15 to 30 minutes and is sensitive to within 0.04 mg/liter. Traditional qualitative methods such as latex agglutination can be erroneous due to prozone effect. A value of >1 mg/dl (10 mg/ liter) in neonates is accepted as an elevated level. Qualitative CRP has also been used as a guide to duration of antibiotic therapy.

Increases of CRP levels in neonates, up to 10 times normal, have been associated with noninfectious conditions causing tissue injury or inflammation, such as fetal asphyxia, respiratory distress syndrome, intracerebral hemorrhage, and meconium aspiration pneumonitis

Reported overall sensitivity of CRP ranges between 50% and 90%, and the specificity ranges between 85% and 95%. The positive and negative predictive values, respectively, may be as low as 30% and as high as greater than 95%. Reliance on CRP levels alone as an early indicator of neonatal bacterial infection is not recommended.[5]

CRP, by virtue of a relatively short serum half-life of about 19 hours, it fall promptly and return to normal within 5 to 10 days in most infants who have a favorable outcome. Serial

measurements of CRP levels over 1 to 3 days after onset of possible neonatal bacterial infection may help determine the duration of antibiotic therapy, and identify the occurrence of relapse or complications during or after treatment of known infection. Several studies document that serial determination of CRP levels in this fashion yields diagnostic sensitivity of 75% to 98%, specificity of 90%, and perhaps most notably, a negative predictive value of 99%.

b. **Procalcitonin:** Procalcitonin (PCT), a precursor of calcitonin is a 116 amino acid protein secreted by the C cells of thyroid gland in normal situation but its levels may increase during sepsis. This marker also is produced by macrophage, and monocyte cells of various organs in severe bacterial infection and sepsis. Serum concentrations of PCT begin to rise four hours after exposure to bacterial endotoxin, peak at six to eight hours, and remain raised for at least 24 hours. The half-life is estimated to be about 25– 30 hours, and the serum concentrations do not appear to be affected by the gestational age. Its diagnostic profile has been claimed to be superior to other acute phase proteins, including CRP, with sensitivity and specificity ranging from 87% to 100%. Optimum cut-off values of PCT are 2.5 µg/L for the diagnosis of sepsis at birth. Determination of PCT is of value in excluding bacterial infection in neonates since it has a negative predictive value of 93%.[7-13]

Concept of 'Sepsis screen'

An ideal screening test should have near 100% sensitivity and maximal negative predictive value for sepsis. In other words, if infection is present, the result would always be abnormal; if the result is normal, infection would always be absent[5] In practice no single screening test has adequate sensitivity and Negative predictive value. This has led to efforts to devise a panel of screening tests, combining data from several different determinations, as a means of increasing predictive value. The reported negative predictive value (if a result is normal, disease is absent) of such sepsis screen is as high as 100% in some studies. Two negative sepsis screens 12 to 24 hrs apart, virtually rules out sepsis. Positive predictive value of sepsis screen is generally low at 30 to 40%.[8,14]

Besides ruling out sepsis, sepsis screen reduces antimicrobial agent usage in the NICU. Antibiotics can be discontinued earlier with greater confidence. An increasingly important area in which a screening test panel might be useful is in the evaluation of asymptomatic infants whose mothers have been given intrapartum antibiotics. The goal is to identify infants with sepsis, including those whose blood cultures may have been sterilized temporarily by maternal antibiotic prophylaxis.

Commonly in most NICU's sepsis screen would comprise of four or five panel tests, comprising of TLC, ANC, I/T Ratio, micro ESR and CRP. If any 2 or more tests are abnormal the baby is said to have probable sepsis and this baby should receive antibiotics. Blood culture should be drawn in all babies just prior to commencing antibiotics. If first screen is negative, but clinical suspicion of sepsis is high, then a repeat sepsis screen should be performed 12 to 24 hrs after first screen.

Newer Rapid Screening and Diagnostic Tests for Neonatal Sepsis.

1. **Chemokines and Cytokines**

Chemokines and cytokines have been extensively studied in the past decade. The proinflammatory cytokine IL-6, the anti-inflammatory cytokine IL-10, and chemokines IL-8, have been found to be potentially useful for early diagnosis of neonatal sepsis[15] However these tests are not in routine clinical use due to cost constrains and availability.

a. **Interleukin-** 6: IL-6 is synthesized by a number of cells such as monocytes, endothelial cells, and fibroblasts after TNF and IL1 stimulation. IL -6 is a major inducer of hepatic acute phase protein synthesis including CRP and fibrinogen. In most cases of neonatal sepsis, IL-6 increases rapidly, several hours before the increase in the concentration of CRP, and decrease within 24 hours to undetectable levels. The short half life

of IL 6 is caused by binding to plasma proteins such as beta 2 macroglobulin, early clearance in the liver and inhibition by other cytokines. When used as a marker of infection, IL 6 has good sensitivity and good specificity. The fact that IL 6 levels come normal within 24 hours of onset of sepsis, combining IL 6 with CRP test (which peaks at 24 to 48 hours after the onset of infection), the sensitivity of the combination sepsis screen becomes 100%. Concentration of IL 6 is markedly elevated in infants with perinatal asphyxia.[16,17]

2. **Granulocyte Colony Stimulating Factor**

GCSF is produced from bone marrow. It facilitates production and differentiation of Neutrophils. It has been identified as a good marker of early diagnosis of neonatal sepsis. A concentn $\geqslant$ 200 pg/ml has high sensitivity(95%) and negative predictive value (99%) for predicting early onset neonatal bacterial and fungal infectns.

3. **Cell-surface Antigens**

Many cell-surface antigens have been investigated in relation to neonatal sepsis, and the most promising ones are neutrophil CD64 and neutrophil/ monocyte CD11b . Elevated CD64 has sensitivity of 96% and NPV of 97% at 24 hrs for neonatal sepsis. Similarly elevated CD11b has sensitivity and specificity of 96–100% and 81-100%,respectively.[9,15,17,18]

4. **PCR for bacterial antigens**

Techniques such as PCR assays have been used for diagnosis of specific bacterial infections. PCR can potentially make a 100 percent specific and sensitive method for the rapid diagnosis of sepsis. Recently introduced PCR of 16s rRNA gene has been used for diagnosis of bacteremia, in which there is a turnaround time of only 4–6 h compared with 48-72 hrs delay in detecting bacterial growth in conventional blood culture. sensitivity of PCR was 100% and specificity was 95.6%. It was concluded that Polymerase chain reaction is useful and superior to blood culture for early diagnosis of sepsis in neonates.[19]

Diagnostic Tests:

Culture Methods.

Blood culture is considered as "gold standard" for diagnosing sepsis. Blood culture should be collected prior to start of antibiotic therapy.

Traditional Blood Culture technique: In conventional blood cultures the culture broth is incubated for 5-7days. The culture bottles are manually examined for visible growth 2-3 times a day initially and then daily; subcultures are done based on the changes or blindly. Usually the yield in conventional technique is poor and highly variable. Conventional Blood culture system has sensitivity of 50-80%.[14]

Newer blood culture techniques - These are automated culture technique which uses highly enriched media and a continuous monitoring system, such as BACTEC® and BACT-ALERT® systems. The system automatically alarms about the growth and subcultures are required only if a growth is detected. These culture techniques have improved the turnaround time for cultures to about 12 h and are very sensitive, detecting organisms in as low concentrations as 1-2 CFU/ml.[5,6,17]

Neonatal blood culture should be collected with strict aseptic precautions. Cultures from catheters and indwelling lines are likely to be contaminated; hence it is prudent to collect blood cultures only from peripheral venipuncture site. Volume of blood drawn should be at least 0.5 ml. Even 0.5 ml of blood has been found to have a sensitivity of 95% and specificity of 99%.[5]

Conclusions

As we see none of the laboratory investigations are either absolutely sensitive or specific for neonatal sepsis and an ideal sepsis marker continues to elude even today. A sepsis screen comprising of four or five rapid screening tests help us to identify babies who have 'probable sepsis'. Sepsis screen has a very high negative predictive values (>99%) in 'ruling -out' sepsis. Some of screening tests also help in monitoring response to the therapy. When ordering screening test one has to weigh the balance between the costs and the turnaround time. The result of rapid screening tests also depends on the timing of investigation during the course of illness and on presence of other co-morbidities. This still means that we would still have to start antibiotics in suspected infection episodes despite the screen being negative.

With advancing science, newer 'Diagnostic' tests for neonatal sepsis are on the horizon. They have more

accuracy and rapid turn-around time. These tests are likely to change / reduce use of sepsis screen. Blood culture methods remain 'gold standard' for diagnosis of sepsis, however prior use of antibiotics may give falsely negative blood cultures in a septic neonate.

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PATENT DUCTUS ARTERIOSUS (PDA) IN PRETERM – PROBLEM OR NOT?

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PDA is a common problem in preterm infants. Its incidence varies inversely with gestational age and may be as high as 60% in infants less than 28 weeks' gestation.

Physiology

The ductus arteriosus, connecting the pulmonary artery and the aorta, is an essential structure during fetal life. Because fetal pulmonary vascular resistance is high, nearly 90% of the blood ejected by the fetal right ventricle flows through the ductus arteriosus to the descending aorta. The fetal ductus arteriosus is thus an important structure essential for normal fetal development, permitting right ventricular output to be diverted away from the high-resistance pulmonary circulation. Premature constriction or closure may lead to, right heart failure and fetal hydrops and pulmonary hypertension postnatally.

Fetal patency of the ductus arteriosus is controlled by many factors, the most important of which are relatively low fetal oxygen tension and prostaglandin [PGE2] and prostacyclin [PGI2]). High levels of PGE2 and PGI2 levels in the fetus because of production by the placenta and decreased metabolism in the fetal lungs causes vasodilation of the ductus arteriosus. After birth, the abrupt increase in oxygen tension inhibits ductal smooth muscle voltage-dependent potassium channels, which results in an influx of calcium and ductal constriction. PGE2 and PGI2 levels fall because of metabolism in the now functioning lungs and elimination of the placental source. The medial smooth muscle fibers in the ductus contract, which results in wall thickening, lumen obliteration, and shortening of the ductus arteriosus. Functional complete closure usually occurs within 24 to 48 hours of birth in term neonates. Within the next 2 to 3 weeks, infolding of the endothelium along with subintimal disruption and proliferation result in fibrosis and a permanent seal. The resulting fibrous band with no lumen persists as the ligamentum arteriosum. Echocardiographic assessment of full term infant indicate that functional closure of ductus occurred in almost 50% by 24 hrs, in 90% by 48 hrs and in all by 72 hrs. Preterm infants have an immature closure mechanism, decreased sensitivity to normal constrictors, such as oxygen tension, and increased sensitivity to prostaglandin E2, all of which promote patency. Other factors that have been associated with a PDA include severe lung disease, exogenous surfactant therapy, phototherapy, high fluid administration, early use of furosemide, and lack of antenatal glucocorticoid exposure. Its relationship to lung disease and mechanical ventilation is well established. Almost, 30% of infants who weighed less than 1.5 kg at birth have a patent ductus arteriosus, possibly as a result of hypoxia and immaturity of the ductal closure mechanisms. Spontaneous PDA closure occurs by 4 postnatal days in approximately one third of infants < 1000 g birth weight.

Hemodynamic effects

The pathophysiologic effects of a PDA in the postnatal period is determined by the direction of shunting. When pulmonary vascular resistance is high, such as with early RDS or meconium aspiration syndrome, shunting is in a right-to-left direction, resulting in mixing of deoxygenated and oxygenated blood and resultant hypoxemia. When pulmonary vascular resistance is less than systemic vascular resistance, shunting is left-to-right. Overperfusion of the lungs can alter pulmonary mechanics, causing a need for higher levels of supplemental oxygen and ventilatory support and an increase in the cardiac work load. A diastolic steal may also occur, reducing blood flow to organs and increasing the risk of ischemic complications like NEC. Persistent PDA is also associated with increased risks for apnea, BPD, congestive heart failure, and impaired weight gain.

Risk factors for delayed closure of ductus arteriosus

- Prematurity
- Respiratory distress syndrome
- Liberal fluid intake
- Sepsis
- IUGR
- Lack of antenatal steroids

Clinical features

Clinical signs of PDA usually appear later than echocardiographic signs but have higher correlation

with the development of PDA associated neonatal morbidities.

- Hyperdynamic precordium is most sensitive clinical sign.
- Widened Pulse pressure (>25 mm of Hg or more than half of systolic blood pressure)
- Bounding pulses
- Systolic murmur in left parasternal area, occasionally pansystolic murmur
- Apneas
- Clinical signs in ventilated neonate
    - o Deteriorating respiratory status or increasing ventilatory requirements on day 3-4 after a period of relative stability.
    - o Metabolic acidosis not attributable to other cause
    - o Unexplained CO2 retention
    - o Fluctuating FiO2 requirements
    - o Recurrent apneas
    - o Difficult in weaning from ventilator
    - o Pulmonary hemorrhage

X ray chest

Initially, x ray is usually normal. Later, pulmonary plethora, increased interstitial fluid may be noted with subsequent worsening lung shadows and pulmonary edema. Cardiomegaly is usually a late sign.

Echocardiography

Echocardiography is more sensitive and specific than clinical signs. Echocardiography is the method of choice to diagnose the PDA, to judge its hemodynamic severity, to exclude cardiac malformations with ductus-dependent systemic or pulmonary perfusion, and to indicate and monitor treatment. Echocardiographic criteria of a significant left to right shunt usually precede clinical symptoms by an interval of 2-3 days. Before a PDA intervention is planned, congenital heart defects, especially those with PDA dependent pulmonary or systemic circulation must be excluded by echocardiography.

Echocardiographic markers of PDA are:

1. Direct visualization of ductus – size, diameter, direction and size of the shunt flow within the ductus and both great arteries.
   Mild- <1.5, Moderate – 1.5-3.0, Large - >3.0
2. Determination of the LA/Ao ratio >1.5
3. Pulsatile transductal flow (V max) < 1.8m/sec
4. Reverse end-diastolic flow in descending aorta / mesenteric artery

Biochemical markers

B type B-type natriuretic peptide (BNP) is produced in response to increased myocyte stretch and may be a useful bedside screening tool for the presence of a PDA or response to therapy in premature infants.

Management strategies

Four broad strategies of pharmacological therapy for PDA can be considered:

- Treatment of all at risk infants within the first 24 hours after birth -Prophylactic treatment.
- Treatment following diagnosis of a PDA (usually by screening echocardiography in first 24 hours after birth) but prior to the development of "left to right" shunting of blood-Targeted treatment
- Treatment of those who were known to have a PDA (identified clinically or by echocardiogram) without any clinical or radiologic evidence of heart failure-Asymptomatic PDA treatment.
- Treatment only when the PDA is judged to be haemodynamically-important based on clinical or echocardiographic assessments - Symptomatic PDA treatment.

Medical Management:

General supportive measures

Restrictive fluid strategy lowers the risk of PDA. First line treatment of PDA involve fluid restriction, use of diuretics in fluid overload, avoid hypoxia and acidosis, high PEEP and lower inspiratory time (Ti) in ventilated babies, and optimizing oxygen delivery by maintaining hematocrit >40%.

Pharmological Therapy

The pharmacological basis for medical therapy is the use of non selective cyclo-oxygenase (COX) inhibitors, which inhibits prostaglandin synthesis and causes ductal constriction. The two most widely studied and used non selective COX inhibitors are indomethacin and ibuprofen.

Indomethacin

Indomethacin is most commonly used drug and has overall efficacy of 70- 80%. Prophylactic administration of indomethacin has short term benefits including a reduction in the incidence of symptomatic PDA, the need for surgical PDA closure, and the incidence of severe IVH but does not have a substantial

effect on mortality or neurodevelopmental outcomes. Indomethacin therapy initiated after 24 hours of life in preterm babies, with asymptomatic PDA diagnosed with echocardiogram, has shown significant reduction in incidence of symptomatic PDA as well as reduction in duration of supplemental oxygen. However, meta-analysis failed to show significant difference in mortality, chronic lung disease, intraventricular hemorrhage (IVH), and retinopathy of prematurity (ROP) or duration of ventilation. Long term outcomes were also not reported.

The commonly used dosing schedules for indomethacin are the short course (3 intravenous doses at 12 hourly intervals with starting dose of 0.2 mg/kg followed by 0.1 mg/kg for babies less than 2days of age, 0.2 mg/kg for 2-7 days and 0.25 mg/kg for >7 days old infants) and the long course (0.1mg/kg per day for 6 doses) therapy. Prolonged course of indomethacin has shown to be associated with an increased risk for NEC as compared to short course, without having any beneficial effect on PDA closure, re-treatment, re-opening, or ligation rates, hence short course is preferred routinely. Second course of indomethacin can be used if ductus fails to close after first course or there is reopening of ductus. Routine administration of furosemide or dopamine to premature infants treated with indomethacin for symptomatic patent ductus arteriosus is not useful.

Ibuprofen

Ibuprofen (10 mg/kg as the initial dose followed by 5 mg/kg 24 and 48 hours later) is as effective as indomethacin in the treatment of PDA with fewer renal and gastrointestinal side effects. Oral ibuprofen is safe and cheap alternative for the PDA treatment.

Prophylactic ibuprofen is effective in reducing the incidence of PDA, the need for rescue treatment with cyclo-oxygenase inhibitors and the need for surgical ligation, but has side effects of kidney dysfunction, gastrointestinal bleeding and occasionally pulmonary hypertension, hence not be recommended for prophylactic use.

Paracetamol

Paracetamol 15 mg/kg every 6 hrs for 3 days has been found to be an effective alternative treatment for closing ductus. However, pharmacokinetics and pharmacodynamics of this drug given at above dosage which is twice the recommended routine dosage is not well studied. Hence, because of safety concerns paracetamol should not be used as routine drug and should only be considered only if indomethacin or ibuprofen is contraindicated. Further studies aiming at lower dosage schedule are warranted.

Surgical treatment:

Surgical closure of PDA is indicated if there is reopening or failure of ductal closure after two courses of pharmacological therapy or contraindication to drugs exists. The data regarding net benefit/harm are insufficient to make a conclusion as to whether surgical ligation or medical treatment with indomethacin is preferred as initial treatment for symptomatic PDA in preterm infants.

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LATE PRETERM NEONATES: DO THEY PERFORM SAME AS THEIR PEERS WHO ARE BORN AT FULL TERM

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Babies who are born before 37+0 weeks of gestation are called preterm. Thirty years ago less than 25% of the tiniest preemies were surviving, now almost 90% survive. With the advancement of initial critical care, the global burden of preterm is rising. Globally preterm birth accounts for over 9.5% of all births. This means that over 15 million babies are born too soon every year. Over 60% of preterm births occur in Africa and south Asia, but preterm birth is truly a global problem; countries with the highest numbers include Brazil, India, Nigeria and the United States of America. In India 21% babies are born preterm and this country tops the list of the countries with greatest number of preterm births (3 519 100).

Who are late preterm:

Currently the greatest chunk of preterm is consisting of these late preterm (71% of all preterm in USA). The expert group invited by the National Institute of Child Health and Human Development of the National Institutes of Health suggested that infants born between the gestational ages of 34 weeks and 0/7 days through 36 weeks and 6/7 days (239th–259th day) be classified as "late preterm" and discontinued the use of the phrase "near term" that was used to be a common term previously. The group was of the opinion that "near term" can be misleading, conveying an impression that these infants are "almost term," resulting in underestimation of risk and less-diligent evaluation, monitoring, and follow-up. Several factors were considered in recommending the gestational age range of 34 0/6 to 36 6/7 weeks to define late preterm. In obstetric practice, 34 completed weeks is considered a maturational milestone for the foetus. Yet, compared with term infants, those born between the 34th and 37th week of gestation suffer from higher rates of morbidity and mortality.

Aetiology of late preterm birth:

The aetiologies of general preterm birth are categorized into two large groups: (1) indicated or iatrogenic births occurring due to an adverse maternal or fetal condition, and (2) spontaneous, which include cases of unexplained preterm labor and PPROM. Approximately 25% of all preterm births are medically indicated and the remaining 75% are spontaneous in nature. Late preterm births are more likely to be the result of spontaneous idiopathic preterm labor or PPROM than medical or pregnancy indications. For late preterm births, the relative distribution of etiologies is 20% medically indicated, 25% PPROM, and 55% preterm labor. The causes of medically indicated late preterm births are similar to that for all preterm births, including preeclampsia (46%), fetal indications (18%), placental abruption (14%), and other indications (20%).

Problem faced by late preterm babies:

Late preterm infants -- babies born between 34 and 37 weeks gestation -- look like smaller versions of full term babies. For a long time, late preterm babies were treated like full term babies. However, research has increasingly shown that these babies are not the same as full term infants, and that they have a unique set of needs and challenges. Babies born close to term are, in fact, preemies.

Even after 37 weeks gestation, full term infants may have some of the same problems as late preterm babies. The risk of health problems due to prematurity starts to decline around 37 weeks, but doesn't level off completely until 39 weeks gestation.

These babies face different type of problems compared to their counter parts that are full term. They have more chances of facing respiratory distress syndrome (RDS), necrotizing enterocolitis (NEC), intracranial haemorrhage (ICH), patent ductus arteriosus (PDA), which leads more incidences of hospital admission and longer stay. The incidence gradually falls from 34 weeks to 37 weeks. At 34 weeks of gestation, relatively high rates of neonatal intensive care unit (NICU) admission were noted (16.3%), whereas the admission rate decreased to 4.8% by 36 weeks of gestation.

The problems can be divided in the following main subgroups:

- Immediate health concerns
- Concerns in the first week
- Long-term health concerns

Immediate health concerns:

Respiratory problems: Respiratory problems occur in 4.2% of late preterm births, but only 0.1% of full term births. Respiratory problems may be mild or severe, and may include RDS, transient tachypnea of the new-born (TTN), pulmonary hypertension (PPHN), and the need for respiratory support. Incidence of RDS is 12% at 33–34 week, 2% at 35–36 week, and 0.11% at term; incidence of TTN is 11.6% at 33–34 week, 5% at 35–36 week, and 0.7% at term; Incidence of recurrent apnoea of prematurity is 4%–5% at 34–36 week vs. 0% at term. Incidence of unspecified respiratory failure is 3% at 33–34 week, 2.48% at 35–36 week, and 0.24% at term. Lack of clearance of lung fluid and/or relative

deficiency of pulmonary surfactant, respectively, remain central to the pathophysiology of these disorders, and birth in the absence of labour and related hormonal changes also contribute to pulmonary dysfunction. Sometimes they require surfactants also which increases the burden of cost too.

Temperature instability: Late-preterm infants are at risk for hypothermia because they don't have as much stored fat as term babies have, and they get cold easily. Cold babies burn more calories to try to stay warm, and this leads to decelerated weight gain. Incidence of temperature instability is 10% at 35–36 week vs. 0% at term.

Hypoglycaemia: While only 4% of term babies suffer from low blood sugar in the hours after birth, 18% of late preterm babies (at 35-36 weeks) are hypoglycaemic after delivery. Babies who are born early have not stored as much sugar as full term babies, and become hypoglycaemic easily when they are cold or stressed.

Hypothermia and hypoglycaemia can potentially worsen their pre-existent respiratory distress.

Concerns in first week:

Though some of the late pre term babies can adjust well with their environment during the initial hours and get discharged after 48 hours, they may need to get readmitted for other problems.

Jaundice: Although only 2.5% of full term babies have jaundice serious enough to need phototherapy, 18% of late preterm babies have serious jaundice and that requires to be treated. Jaundice acts as the cause for discharge delay in 16.3% at 35–36 week vs. 0.03% at term. Hyperbilirubinaemia is more prolonged among late preterm infants than term infants because of delayed maturation and a lower concentration of uridine diphospho- glucuronate glucuronosyltransferase and immature gastrointestinal function. Decreased maternal breast stimulation and decreased breast emptying and lead to suboptimal milk transfer to the baby as well as decreased maternal milk production. This leads to excessive weight loss and decreased bilirubin excretion leading to dehydration, slow postnatal weight gain and new-born jaundice. Feeding difficulties that predispose them to an increase in enter hepatic circulation of bilirubin, decreased stool frequency, dehydration, and hypernatremia-these all add to the overall bilirubin load and risk of toxicity. Bilirubin induced brain injuries (kernicterus) is also more eminent in late preterm neonates.

Feeding problems: Late preterm babies get tired easily and may not be strong enough to drink breast milk or formula adequately to gain weight. This can cause dehydration or failure to thrive. The gastrointestinal tract continues to develop throughout gestation, but late-preterm infants adapt quickly to enteral feedings, including the digestion and absorption of lactose, proteins, and lipids. However, deglutition and peristaltic functions and the sphincter controls in the oesophagus, stomach, and intestines are likely be less mature in late-preterm infants compared with term infants, which may lead to difficulty in coordinating suck and swallowing, a delay in successful breastfeeding, poor weight gain, and dehydration during early postnatal weeks.

Sepsis: The immune system of late preterm is not fully matured as the term babies. So they are at greater risk of getting infected. However Changes in the ecology of gastrointestinal bacteria in the relatively immature gut of the late-preterm infant, and their potential impact on growth and later health (allergy, diabetes), remain to be studied. More studies are also needed to understand the temporal trends in maturation of T-cell and granulocyte functions, other immune mediators, and their role in host-defense mechanisms in late-preterm gestations. But as their liver enzyme functions are not mature enough, drug metabolism is also much delayed in them. So the use of antibiotics (which is used more frequently for their increased rate of sepsis) should be more cautious for them.

Readmission after initial discharge: Late-preterm infants are at higher risk than term infants of developing medical complications that result in higher rates of mortality and morbidity. The readmission rates are much higher for the late preterm after their early discharge. Jaundice, proven or suspected infections, feeding difficulties, and failure to thrive are the most common diagnoses at readmission.

Long-term health concerns:

Although late preterm infants were previously considered similar to term infants, emerging evidence suggests that significant adverse developmental outcomes among late preterm infants, which further indicates that longer-term outcomes of prematurity, remain a concern even for those infants born at the more optimistic late-preterm stages of pregnancy. Few studies have evaluated the long-term neurodevelopmental status of late-preterm infants. The prevalence rates for subtle neurologic abnormalities, learning difficulties, poor scholastic achievements, and behavioural problems in infants born at late-preterm gestational ages are definitely higher. In a study of 869 infants, Gray et al found that 19% to 20% of the cohort born at 34 to 37 weeks of gestation had clinically significant behaviour problems at 8 years of age, a rate higher than those in the term cohorts from the same population.

In an analysis of 10 studies, researchers found out

that Babies born between 34 and 36 weeks gestation were at greater risk for developmental delays (both prominent and subtle), and scored lower on standardized tests of academic achievement, compared to infants born at term. Late preterm infants were also more likely to require early intervention to help them catch up, and were more likely to be underweight and shorter than infants born at term.

Maturation factors that impact postnatal adaptation for the new-borns include brain and autonomic nervous system growth. In case of late preterm new born, brain volume is about 60% at 36 weeks compared to a full term. Even the no. sulci and gyri are less in them. Anatomic immaturity is also defined by their decreased white matter, myelination and cortical migration of neuronal cells. Late-preterm infants are also more susceptible to grey matter injury induced by hypoxia- ischemia than the term infant.

It is also found out that these babies are more at a risk of developing attention deficit hyperactivity disorder (ADHD), hyperactivity.

A direct correlation of sudden infant death syndrome (SIDS) and late preterm is also established in UK studies.

Increased incidence of diabetes, hypertension at later life is also related with late preterm birth.

Finally it can be said that the late preterm neonates are not as safe as their full term peers. They need extra vigilance and care. The main burden of preterm is created by this group of new born as they contribute the greatest percentage among the preterm. Not only during the neonatal period or infancy, they require more thorough evaluation and care throughout childhood. And every time care should be taken so that their birth would be tried to be delayed by few more weeks. This will prevent the development of entire cluster of problems.

References on request

IAP Neonatology Chapter Life Membership Application Form

Name: _____

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Address: _____

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Telephone Nos: _____ Cell No: _____

E-mail Id _____

Central IAP Membership No: _____

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Membership Fee Paid By Cash / Cheque No _____ Dated _____

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[Check for Rs. 500/- to be drawn in favor of 'IAP Neonatology Chapter' payable at Saraswat Bank, Aurangabad (MS)

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'Dr Rhishikesh Thakre, Neo Clinic, 27, Samarth Nagar, Aurangabad. 431001. MS

CME IN NEONATAL NEUROLOGY

ORGANISED BY
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BELGAUM INSTITUTE OF MEDICAL SCIENCE
IN ASSOCIATION WITH
I.A.P. NEONATOLOGY CHAPTER
I.A.P. BELGAUM DISTRICT BRANCH, BELGAUM

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BELGAUM INSTITUTE OF MEDICAL SCIENCE
DR. B. R. AMBEDKAR ROAD, BELGAUM
DATE
13TH & 14TH JUNE 2014

ZONAL CME ON NEONATAL NEUROLOGY

This was organized by organized by Dr Arun Desai, South zonal representative of IAP Neonatal Chapter. He and his Dept of Pediatrics, Belgaum Institute of Medical Sciences, along with NNF Karnataka and IAP Belgaum district branch put up a very good CME on the 13th and 14th of June at Belgaum, Karnataka. More than 150 delegates attended the CME which had lectures on various aspects of neonatal neurology like HIE, Cooling therapy, EEG, neuro imaging and developmental assessment . Faculty from Bangalore, Hyderabad, Pune and Mumbai participated in this CME. The hands on training in developmental assessment and neurological examination of a newborn were the highlights.

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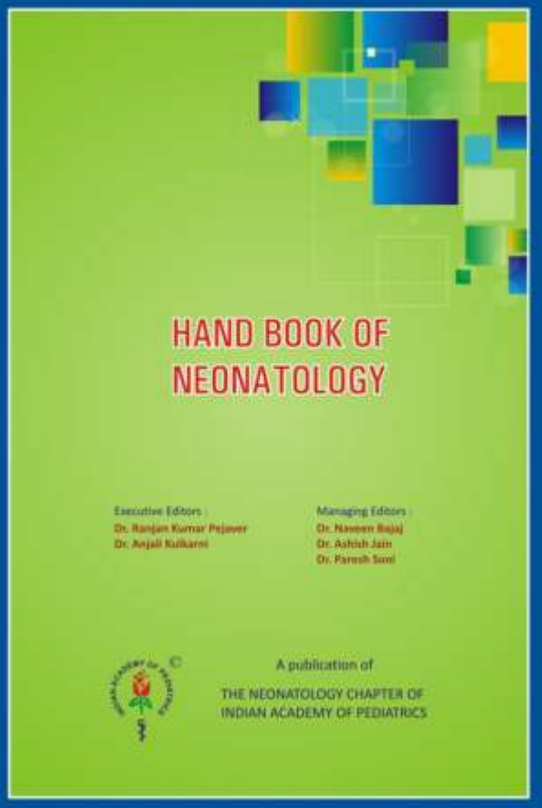

HANDBOOK OF NEONATOLOGY

FIRST OFFICIAL PUBLICATION OF
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