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### **Study Guide**

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## About the Neonatology Module

Welcome to the study of neonatology. You are currently reading the Neonatology Module Introduction and Study Guide. This is the electronic version.

This is part of the Neonatology Module.

The Neonatology Module is comprised of  
Neonatology Module Introduction and Study Guide (Hard Copy and Electronic Versions available)

Neonatology Module Computer Assisted Learning Application (Electronic Version Only)  
Neonatology Module Multiple Choice Questions (Electronic Version Only)

You should use items 1 and 2 before using 3.

Copies of the CAL Application for the PC are available from Dr Hamilton (x53814). Please provide a formatted disc.

The electronic versions are available on the CAL Computers.

This module replaces the four weekly Neonatal tutorials which were previously held on Monday Afternoons. Although the formal teaching has been removed, this subject is still **very much part of your curriculum and will still be included in your final examination in Child Health**. You will still have ward-based teaching sessions and the teaching staff are still available to help you with your study.

## **What is Self-Directed Learning ?**

You are using selfdirected learning now ! The Neonatology Module is an example of a selfdirected learning module.

Self-Directed Learning is a form of learning which should encourage you to explore and understand a topic on your own rather than getting you to try and memorise facts from a textbook or lecture. It is intended to give you more control and responsibility over:

When you learn  
Where you learn  
What you learn

## **What is a Study Guide ?**

A study guide is an aid to assist you with your selfdirected learning. It is more than just a reading list or timetable of lectures and tutorials. It is designed to guide you through learning and understanding the subject and will help you to assess your progress. You should have a printed copy and there is a version on the CAL Computers in the Medical School Library at Foresterhill.

## **Where and When is a Study Guide used ?**

The study guide is available in hard copy and electronic form on the CAL Computers in the Medical School Library at Foresterhill. You can use them at your own pace and at any time you choose, although there will be specific personal study slots in your timetable. If you have access to a computer of your own you may wish to copy parts of the guide on to your own disc so that you can add notes to it or you may wish to print out parts of the guide. Advice and Assistance on this from Dr Hamilton (x53814) or Dr Furnace (x52475).

## **Multiple Choice Questions**

Multiple Choice Questions, (MCQ), are available on the CAL Computers in the Medical Faculty Library. You will probably want to tackle the MCQ questions after reading all the other parts of the neonatology module.

Launch the MCQ packages by clicking on the appropriate MCQ button on the CAL Main Menu.

## **Where are the CAL Computers ?**

The CAL Computers in the Medical School Library at Foresterhill are situated on each floor, with the exception of Floor 1 (the one with the issue desk). Twenty machines are available on the lower floor, three on floor Two and Six on Floor Three (in Computer Room 2).

## **I hate computers !**

If you have never used computers, are unsure about computers, or hate them outright, then please contact Dr Hamilton (x53814).



## **Your Views**

When you have used the Study Guide and CAL Application, please complete the questionnaire at the end of the end of this booklet to let us know your impressions. Improvement will only come with your feedback ! The questionnaires should be returned to the main desk of the Medical School Library.

## **Course Content and Overview**

1. Definitions of birth weight and maturity and how to apply these.
2. Epidemiology definitions of rate.
3. Common complications of the neonatal period

The study of neonatology is an integral part of learning about Child Health. This course will introduce you to new terminology and definitions used when discussing neonates, as well as dealing with the commoner problems encountered in this particular group of children. The CAL package and the Glossary contain the essentials of what you need to know about neonates but attendance at the clinical component of the course and some additional reading will greatly increase your understanding of these. Your knowledge and understanding of this subject will be assessed at the end of your 8 week block in Child Health and Obstetrics/Gynaecology as well as in the first part of the degree exam.

### **Key Words/Phrases:**

Neonate

Pre-Term

Stillbirths

Light For Dates

Neonatal Mortality Rate

Infant Mortality Rate

Apnoea

Jaundice

Respiratory Distress Syndrome

## **Prior Knowledge and Reading**

You may find it useful to **briefly** revise the *in utero* development of the human foetus concentrating on the timing of the development of the major body systems i.e. respiratory tract, cardiovascular system etc. Previous lecture notes or a simple text on human genetics may also be useful for reference.

## **Objectives of the course**

**Objectives of the Course** - what you should be able to do on completion of the course.

To correlate the effects of prenatal events on the foetus with aspects of the neonatal period e.g. multiple pregnancy can lead to preterm delivery of light for dates infants. To use accurately the terminology and definitions of neonatology (the more important terms and definitions are in the glossary).

To be able to take a reliable history and perform a thorough and reliable physical examination of a neonate.

To handle and examine newborn babies comfortably and with confidence.

To identify what is 'normal' during the neonatal period and hence to recognise deviations from this e.g. biochemical and haematological values, organ size, neurological development, etc.

To recognise, with confidence, **common disorders** in this age group and those rare disorders where **early** recognition and treatment are of fundamental importance.

To recognise, with confidence, when a neonate requires more specialist assessment and treatment although you will not be expected to know the exact diagnosis or treatment of all disorders.

## **Available resources**

Tutors

Teaching Sessions

Recommended Text Books and Journals

Glossary Text

Audiovisual Aids

Computer Assisted Learning Application

## **Tutors**

As you will see from your Child Health timetable you have each been assigned to a smaller group of 2 or 3 students each of which has been allocated a named tutor.

You will meet at prearranged times each week of your attachment and during this time your tutor will be able to help you with any problems regarding the course.

You should also feel free to discuss the course with any members of staff you come into contact with during teaching sessions. Although most of your learning will be selfdirected the backup and support of the teaching staff is still there!

## Teaching Sessions

You should attend the tutorial on **Examination of the Newborn** and the 2 **Neonatal ward rounds**, details of which will be in your timetable.

The **Nursing Experience** sessions in the neonatal unit will provide you with invaluable experience of handling and examining neonates and you should make full use of this opportunity. From time to time you may be told by the teaching staff about specific patients with particular conditions whom you should make an effort to visit. Voluntary attendance at the Neonatal Unit is encouraged and you are welcome to visit when you wish but check first with staff and introduce yourself to whoever is in charge each time. You will have an opportunity to participate in an **oncall session** in the NNU to follow the admission of infants from the labour suite.

## **Recommended textbooks and journals**

Older editions of 1, 2, and 3 are available in the Foresterhill Medical Library but page nos. may be different.

### **1. *Essential Paediatrics 3rd Edition***

Hull D. , Johnstone D. I.

Churchill Livingstone 1993

Chapter 4 The Newborn pp 44 to 74

This text explains the bare essentials of neonatology in a relatively clear and easy to read format. The section on examination of the newborn, with reference to minor abnormalities is quite good, and the definitions section reinforces the information from our CAL package. Common neonatal problems such as RDS, jaundice etc. are discussed briefly.

**Estimated reading time 60 mins.**

### **2. *Lecture Notes On Paediatrics 6th Edition***

Meadows SR, Smithells RW

Blackwell 1991

Chapter 5 The Newborn pp 44 to 77

This contains a lot of useful information but the text is quite dense and detailed. Useful to look through for information on topics which you are not clear about.

**Estimated reading time 30 to 60 mins.**

### **3. *A Paediatric Vademecum 12th Edition.***

Insley J.

Edward Arnold 1990

Chapter 7 The Neonate: prevention and management of illness pp148-181

This is altogether a more practical text, designed for those who are dealing with neonates regularly. Practical guidelines for examination and resuscitation (pp148-151) may be helpful if you attend deliveries in the Labour Ward, and the section on screening for metabolic disorders (p154) is good. Otherwise the text is useful to learn the general approach to neonatal problems but the figures etc. do not need to be learned.

**Estimated reading time 30 to 45 mins.**

### **4. *Colour Guide Neonatology***

Thomas R, Harvey D.

Churchill Livingstone 1992

The Normal Newborn pp 1 to 23

This book contains photos of normal infants, and the process of neonatal examination, as well as common minor abnormalities. Useful to see conditions which you may not have had the opportunity to see in the Maternity Hospital.

**Estimated reading time 20 to 30 mins.**

(Updates of this information can be printed and made available for collection from the Medical Library or will be added to the computer)



## **Glossary Text**

This will give you the essentials of what you need to know. Try to see patients who fit into these definitions along with relevant test results. See the [Glossary of Terms](#)

## **Audiovisual Aids**

A collection of slides with accompanying selfassessment questions is available from the Main Desk of the Medical Library. It is entitled **Undergraduate SelfStudy Paediatrics**. The following slides and questions are particularly relevant to neonates.

Set 1 slides and questions 1 6, 8, 10 16 and 21

Set 2 slides and questions 1,3,9,11,12,13,20 and 21

You should spend about 30 minutes on this.

**The class exam contains 10 slides which may include some examples of neonates.**

## **Computer Assisted Learning Application**

A CAL application entitled **Neonatal Definitions** is available on most of the computers in the Medical School Library at Foresterhill (it can also be accessed from the computers available at Raigmore in Inverness) and will provide you with most of the basic information that you need to know. It should not be used in isolation but in conjunction with further reading and other sources of information. This particular part of your learning should take about 1 hour to complete.

## **Advice on how to learn**

Although you may study the subject in any order you wish it is recommended that you attempt the CAL package first including the selfassessment questions and do some background reading in particular the glossary, before the neonatal ward rounds. This will give you a chance to bring up any queries at the time and also to see clinical examples of the conditions you have read about. You should keep a record of specific conditions you have encountered and make short notes of any features you feel will help you to remember and identify such conditions. Try not to exceed the recommended times to be spent on any of the learning material. If you are having problems understanding particular areas or need further clarification then use the small group tutorials to get advice.

## **Self-Assessment**

As part of the CAL package you will find a series of self-assessment questions including an MCQ. Your answers will be marked immediately so that you get instant feedback on how well you appear to have understood the subject. **These questions are not part of any formal assessment, they are only intended to give you an idea of your progress and to highlight areas of weakness in your knowledge and understanding.**

Low scores would suggest that you need to go through the package again or do some more background reading or seek advice from a member of staff. **Please do not ignore the self-assessment questions** and don't be discouraged if you do not do well the first time.

## **Other forms of assessment**

You will be given specific assignments during your Child Health attachment, some of which may test your knowledge of Neonatology. These in course assessments will count towards 20% of the class assessment at the end of the teaching block.

## **Further Study**

During your 5th year you will have a further 4 week attachment in Child Health during which you will again encounter neonates. You should therefore try to keep abreast of any updates to the reading list contained in the study guide these will be either printed out and distributed or changed on the computer from time to time. You should also do some brief revision of the subject before starting your 5th year attachment.

## **Record Of Personal Progress**

This part of the guide is designed to show you how well or otherwise you are learning and understanding. If you are having particular problems it may also give your teachers a clearer indication of how to help.

Please complete the record which is given in the hard copy version of your Study Guide.



## **Glossary of Terms**

Definitions of Birth Weight and Maturity

Definitions Of Rate

Complications During the Neonatal Period

## **Definitions of Birth Weight and Maturity**

Extremely Low Birth Weight, (ELBW)

Very Low Birth Weight, (VLBW)

Light For Dates, (LFD)

Low Birth Weight, (LBW)

Heavy For Dates, (HFD)

Term Birth

Pre-Term Birth

Post-Term Birth

## **Extremely Low Birth Weight, (ELBW)**

Extremely Low Birth Weight infants weigh less than 1000g at Birth.

## **Very Low Birth Weight**

An infant born with a weight less than 1500g is defined as having a VLBW.

In some cases such an infant may be preterm, Light for Dates,(LFD), and also Very Low Birth Weight,(VLBW). Such an infant is at risk of all the complications of prematurity, and may have additional problems related to the cause (e.g. chromosomal abnormality, intrauterine infection, maternal smoking or consumption of alcohol) and effect (refractive hypoglycaemia etc.) of being LFD.

Potential Complications: Hypoglycaemia, Hypothermia, RDS (Respiratory Distress Syndrome), Feeding, IVH (Intraventricular Haemorrhage), Infection, Apnoea, Jaundice.

Possible causes: Chromosomal (e.g. Down's Syndrome), TORCH (see section on infection), PET (preeclamptic toxemia), Maternal Disease, Environmental, Bacterial Infection, Premature Rupture of Membranes, Abruption

## **Light For Dates, (LFD)**

The birth weight of such an infant is below the 10th centile for gestational age, as plotted on an appropriate chart for population. Definition the same as Low Birth Weight, (LBW).

LBW/LFD infants are commoner in mothers in lower socioeconomic classes, and in mothers who smoke or drink alcohol during pregnancy.

Potential Complications: None, Hypoglycaemia, Hypothermia, Infection

Possible causes of LBW/LFD Delivery include: Multiple Pregnancy, Chromosomal Abnormality (eg. Down's Syndrome), TORCH, PET, Maternal Disease, Environmental Factors, Normal

## **Low Birth Weight, (LBW)**

The birth weight of such an infant is below the 10th centile for gestational age, as plotted on an appropriate chart for population. Definition the same as Light For Dates, (LFD).

LBW/LFD infants are commoner in mothers in lower socioeconomic classes, and in mothers who smoke or drink alcohol during pregnancy.

Potential Complications: None, Hypoglycaemia, Hypothermia, Infection

Possible causes of LBW/LFD Delivery include: Multiple Pregnancy, Chromosomal Abnormality (eg. Down's Syndrome), TORCH, PET, Maternal Disease, Environmental Factors, Normal

## **Heavy For Dates, (HFD)**

An infant of birth weight above the 90th Centile for gestational age, as plotted on an appropriate chart for the population, is said to be Heavy for Dates, (HFD). Maternal Diabetes is a predisposing factor but often no cause is found. Because of their large size, labour may become obstructed, eg. with shoulder dystocia, there may be foetal distress and instrumental or operative delivery may be required. Infants of poorly controlled diabetic mothers may have had high blood sugars prior to delivery, with resultant high endogenous insulin secretion. After delivery, the blood sugar falls to normal but the high insulin secretion may take longer to fall, resulting in hypoglycaemia. Other complications include hypocalcaemia and jaundice.

Potential Complications: None, Hypoglycaemia, Meconium Aspiration, Infection,

Possible Causes: Infants of a diabetic mother, Normal

## **Term Birth**

Term extends from 37 weeks up to 42 weeks and is the period in which most births occur.

The normal length of a term newborn is 50cm (48cm to 53cm).

The normal head circumference of a term newborn is 35cm (34–37cm)



## **Pre-Term Birth**

An infant born when it is less than 37 weeks old is defined as preterm.

Preterm Delivery is the most important cause of neonatal death when malformation is excluded, accounting for over two-thirds of first week deaths in the UK, and considerable longterm morbidity in survivors.

In 50% of cases there is no apparent cause for preterm labour. It is common in lower socioeconomic groups and can be associated with multiple pregnancy, maternal UTI, intrauterine infection, or cervical incompetence or delivery may be undertaken because of preeclampsia or antepartum haemorrhage.

Complications are manifold. The best results occur in infants where delivery is elective because of maternal or foetal factors, and the incidence of RDS can be reduced by giving the mother steroids for 24 to 48 hours prior to delivery. The poorest survival rates occur in infants delivered after placental abruption who have all the problems of prematurity plus asphyxia and blood loss.

Potential Complications: Hypoglycaemia, Hypothermia, RDS, Feeding, IVH, Infection, Apnoea, Jaundice

Causes of Preterm Delivery include: Multiple Pregnancy, TORCH, PET, Maternal Disease, Bacterial Infection, Premature Rupture of membranes, Abruption

## **PostTerm Birth**

Any infant born after 42 weeks is defined as being postterm

Approximately 10% of all pregnancies are prolonged, (> 42 weeks), although uncertainty with dates makes it difficult to be exact. Perinatal mortality after 42 weeks is nearly double that of term babies and so labour is generally induced.

The foetus may be large and the head harder and more resistant to moulding during labour, making operative delivery more likely. Alternatively, chronic foetal malnutrition may develop, with a thin postmature infant with low stores of glycogen and fat. In both cases there is a risk of perinatal asphyxia, and meconium may be present, with the attendant risk of meconium aspiration. Less commonly, the infant is stillborn, with no apparent cause

Potential Complications: None, Meconium Aspiration, Infection, Hypoglycaemia

Possible causes of Postterm birth: No specific identifiers

## **Definitions of Rate**

Infant Mortality Rate, (IMR)

Neonatal Mortality Rate, (NMR)

Early Neonatal Death Rate, (ENDR)

Late Neonatal Death Rate, (LNDR)

Perinatal Mortality Rate, (PMR)

Still Birth Rate, (SBR)

Post-Neonatal Mortality Rate, (PNMR)

## **Infant Mortality Rate**

The number of deaths under one year of age per 1, 000 live births.

IMR can be subdivided into Neonatal Mortality Rate and Post-Neonatal Mortality Rate

The Infant Mortality Rate in Scotland has shown a gradual fall over the past decade mainly due to the decreasing Neonatal Mortality Rate. Over the past few years the PostNeonatal Mortality Rate has also been falling.

The infant Mortality Rate in Grampian from 1980 until 1988 was probably reasonably constant apart from random variation. However, the rate has been decreasing rapidly since 1988 mainly due to a decreasing death rate from the Sudden Infant Death Syndrome.

A similar decreasing death rate form the Sudden Infant Death Syndrome since 1988 was also apparent for all of Scotland.

## Neonatal Mortality Rate

Definition: The number of deaths before the 28th day of life per 1, 000 live births.

This can be subdivided into: Early Neonatal Death Rate and Late Neonatal Death Rate. The Neonatal Mortality Rate has shown a gradual decrease over the past 10 years, mainly due to a fall in the number of early neonatal deaths during the first week of life.

The main factors responsible for Neonatal Deaths in Scotland during the past 5 years were:

- |    |                                   |     |
|----|-----------------------------------|-----|
| a) | Congenital anomalies              | 36% |
| b) | Immaturity and related conditions | 33% |
| c) | Perinatal asphyxia                | 15% |
| d) | Infection                         | 7%  |

## **Early Neonatal Death Rate**

Early neonatal Death Rate: The number of deaths in the first week of life per 1,000 live births.

## **Late Neonatal Death Rate**

The number of deaths between the 8th and the 28th day of life per 1, 000 live births.

## **Perinatal Mortality Rate**

Definition: The number of stillbirths and deaths in the first week of life per 1,000 total births (i.e. both live and stillbirths).

This can be subdivided into Still Birth Rate and Early Neonatal Death Rate

Perinatal mortality rates used to be regarded as sensitive indicators of the quality of the health services. However, most developed nations now have such low perinatal mortality rates that perinatal morbidity is a more important indicator, but this is much more difficult to measure.

Factors:

1. Multiple Births. The perinatal mortality rate for multiple births is significantly higher than that for singletons. Over the past 5 years in Scotland the perinatal mortality rate for multiple births was on average 5.5 times that of singletons.
2. Congenital Anomalies. Congenital anomalies accounted for 18% of the perinatal mortality during the last 5 years in Scotland.
3. Hypertension in Pregnancy;
4. Antepartum Haemorrhage;
5. Maternal disorders
6. Perinatal Asphyxia/Birth Trauma
7. Prematurity
8. Unexplained

In the past most statistics have been based on birth weight as that was easy to measure accurately. However, when faced with a decision about the elective delivery of a preterm infant, the Obstetrician generally knows the gestational age accurately; estimation of the birth weight prior to delivery is inaccurate even when assessed by ultrasound scan. For the Obstetrician Gestational Age specific Mortality Rates would be more helpful and these are now beginning to be allowed.

The International Federation of Obstetricians and Gynaecologists have recommended that perinatal mortality data is best presented as "unavoidable" and "potentially avoidable" deaths.

"Unavoidable" includes congenital anomalies and extremely low birthweight infants (< 1000 g).

"Potentially avoidable" includes all normally formed infants weighing more than 1000 g at birth.

In Scotland during 1991 21% of Stillbirths and 64% of the Neonatal Deaths were "unavoidable". The corresponding figures for Grampian were better than the Scottish average.



## **Still Birth Rate**

Stillbirth Rate: The number of stillbirths per 1, 000 total births.

Until last year a Stillbirth was defined as a baby born dead at 28 weeks gestation. A baby born dead at 27 weeks gestation was classified as an Abortion and not recorded, whereas an infant born alive at 27 weeks who subsequently died was classified as a Neonatal Death and therefore included in the Perinatal Mortality Rate.

With the increasing number of survivors in infants born at 27 weeks gestation, the definition of a stillbirth was becoming increasingly unsatisfactory. Therefore, the definition of a Stillbirth was changed as from October 1992 to include all babies born dead at 24 weeks gestation.

In Scotland during 1990 and 1991 59% of the Stillbirths were unexplained; many despite a full postmortem.

## **PostNeonatal Mortality Rate**

PostNeonatal Mortality Rate: The number of deaths after the 28th day of life and before one year of age per 1,000 live births.

## **Complications during the neonatal period**

Apnoea

Feeding

Hypoglycaemia

Hypothermia

Infection

Intraventricular Haemorrhage, (IVH)

Jaundice

Meconium Aspiration

Respiratory Distress Syndrome, (RDS)

## **Apnoea**

Apnoea, or absence of breathing for 20 seconds or more is very common in preterm infants, and decreases in frequency with increasing gestational age, suggesting an impairment of respiratory control mechanism. It occurs in 78% of infants at 27 weeks gestation and 7% at 34 weeks gestation.

Treatment with respiratory stimulants such as theophylline, caffeine or doxapram, or the use of continuous positive airway pressure (CPAP) can be helpful, but apnoea of prematurity can be a major problem until the infant 'grows out of it.'

Apnoea can also be a sign of infection, asphyxia or intracranial haemorrhage, particularly when it occurs in more mature infants.

## **Feeding**

Every effort should be made to encourage a mother to breastfeed.

The sucking reflex appears at around 32 weeks gestation so preterm infants of less than this gestation will generally require tube feeds, and some infants will not be able to suck adequately until 36 weeks gestation or more. Infants with severe birth asphyxia, those who are infected, with respiratory problems, or with chromosomal abnormalities such as Down's syndrome, will often have feeding difficulties and may require tube feeds, or in sick infants, parenteral nutrition.

Although the milk of mothers of preterm infants is different from that of the mothers of term infants, in that it contains more calories and more minerals, the composition changes throughout lactation and because preterm infants have increased demands for many substrates for growth, breast milk alone may not be adequate for such infants, and supplements, particularly of calories, protein, vitamin D, calcium and iron may be required.

## **Hypoglycaemia**

Abnormally low level of blood glucose (sugar), the body's chief energy source (hence the term low blood sugar). It is most often caused by an over secretion of insulin from the pancreas triggered by stress, exercise, fasting, or disorders of the adrenal or pituitary glands, liver, or pancreas; in persons with diabetes it may result from an overdose of insulin. Symptoms range from weakness, fatigue, shakiness, and anxiety to mental disturbances, convulsions, and coma. Acute episodes are relieved by ingestion of glucose or sucrose. Longterm treatment involves control of causative factors and diet regulation.

### **Neonatal Relevance**

Although there has been recent controversy about normal blood glucose level in the new born, it has now been suggested that the lower limit of normal for all infants should be 2.6 mmol/l, so a value less than this would be hypoglycaemic.

Hypoglycaemia may be symptomatic or asymptomatic. Symptoms include tremor or 'jitteriness', apnoea, cyanosis, hypotonia, pallor, irritability, feeding difficulties, convulsions coma and sudden death. Hypoglycaemia should be treated promptly in order to prevent potential permanent neurological damage. Treatment consists of early feeding, with high calorie feeds if necessary, and intravenous dextrose infusions may sometimes be required.

## **Hypothermia**

The 'normal' body temperature of a newborn infant is around 37 degrees Celcius, but factors such as a low body weight to surface area ratio, less developed physiological and behavioural responses to heat or cold, lack of cutaneous fats (particularly in LFD or preterm infants) or thin permeable skin (in preterm infants) mean that they are less able to maintain this temperature.

Severe hypothermia (< 34 degrees Celcius) may be associated with coagulation disorders, impaired surfactant function and production with the resultant hypoxaemia and acidaemia, and there may be associated hypoglycaemia.

Efforts should be made to maintain the temperature above 36 degrees Celcius by reducing heat loss from convection, radiation, conduction and evaporation by the use of radiant warmers at resuscitation and subsequently the provision of clothing, especially hats, and by nursing infants in the thermoneutral range in an incubator.

## **Infection**

Infection should be suspected in all sick neonates, as it can present with all of the commonly seen symptoms hypothermia/pyrexia, poor feeding, vomiting, respiratory distress, jaundice, bleeding disorders etc.

Early or late intrauterine infection can occur with the TORCH organisms (Toxoplasma, rubella, cytomegalovirus, or herpes) but other viruses such as varicella can also cause problems.

Prolonged rupture of the membranes can predispose to bacterial infection with vaginal 'commensals' such as group B streptococci or with coliforms.

Group B streptococcal infection has been reduced by the administration of penicillin to all at risk or symptomatic infants in the first 48 hours of life but can still be a major cause of morbidity or mortality.

Nosocomial infection in neonatal nurseries with multiresistant staphylococci and more rarely with Enterobacter, Citrobacter or fungal organisms are a major problem and should be preventable by scrupulous attention to handwashing and hygiene.



## **Intraventricular Haemorrhage, (IVH)**

Germinal matrix intraventricular haemorrhage occurs almost exclusively in preterm infants. The incidence correlates with the degree of prematurity, and is a particular problem in ELBW (extremely low birth weight) infants (< 1000g B.Wt). 50% occur within the first day of life and 90% before 4 days of age.

Haemorrhage originates within the subependymal germinal matrix and may remain localised there (subependymal haemorrhage), but may extend into the lateral ventricles (intraventricular haemorrhage) or into the brain itself (intracerebral haemorrhage), resulting in permanent brain damage.

Predisposing factors in the preterm infant include hypotension, hypothermia, hypocapnia, acidosis and bleeding disorders, so these should be prevented as far as possible.

## **Jaundice**

Socalled 'physiological' jaundice occurs around the 3rd day of life particularly in preterm infants. It is due to a combination of haemolysis of the large red cell mass which is no longer required with the higher arterial oxygen tensions of extrauterine life, and the relative immaturity of the liver's conjugation system of bilirubin. The resulting unconjugated hyperbilirubinaemia is potentially dangerous as at high levels the fatsoluble unconjugated bilirubin can cross the bloodbrain barrier and be deposited in the brain, particularly in the basal ganglion resulting in the condition 'kernicterus'.

Conditions causing more severe haemolysis, such as rhesus or ABO incompatibility, spherocytosis or infection can exacerbate the problem. The unconjugated bilirubin can be broken down in the skin by the use of strong lights, particularly U.V. lights (phototherapy) but in severe cases exchange transfusion to remove the bilirubin and restore the haemoglobin, may be necessary.

Conjugated bilirubin is watersoluble, is not deposited in the brain and therefore does not cause kernicterus, but its presence suggests an obstruction such as biliary atresia, or a hepatitis.

## **Meconium Aspiration**

Meconium passed before or during delivery is a sign of foetal distress. For an infant to develop meconium aspiration syndrome the meconium must be passed, then inhaled and the inhaled material has to damage the lungs. Meconium staining of the liquor is uncommon in preterm pregnancies.

Inhalation may occur before or during delivery, but M.A.S. is more likely with inhalation before delivery, when the meconium is more likely to reach the small airways it can cause airtrapping, with the risk of pneumothorax, it displaces surfactants from the alveolar surface, causes chemical irritation and can predispose to infection.

Affected infants develop signs of respiratory distress (tachypnoea  $> 60/\text{min}$ , indrawing of intercostal muscles and recession  $\pm$  grunting and cyanosis). Careful removal of meconium from the trachea at delivery is important, but in severe cases the damage has occurred before delivery and the infant may require oxygen therapy  $\pm$  ventilation.

## **Respiratory Distress Syndrome, (RDS)**

The basic aetiology of RDS is global immaturity of the lungs, and in particular of the surfactant synthesising systems. It is very common in infants < 32 weeks gestation and almost invariable in infants < 28 weeks gestation. Although the immature lung structure (increased connective tissue and poorly developed alveoli) may contribute to the respiratory difficulties, the main problem seems to be insufficient production of surfactants, leading to alveolar collapse, epithelial cell necrosis and sloughing, and formation of hyaline membranes on the denuded basement membranes.

Affected infants develop respiratory difficulties with tachypnoea, indrawing and hypoxaemia within the first 24 hrs of birth and symptoms reach a peak at around 72 hours of age. Accompanying hypothermia and hypoglycaemia can worsen the problems.

Surfactant synthesis is stimulated by glucocorticoids and the severity of R.D.S. can be lessened by the administration of steroids to the mother for 48 hours prior to preterm delivery. Conditions causing intrauterine stress, such as intrauterine growth retardation, maternal narcotic addiction and alcohol ingestion can also protect against R.D.S.

Affected infants require careful oxygen therapy and may require ventilation. Artificial surfactant administered down the endotracheal tube can lessen the severity of this condition.

## **Questionnaire**

Please complete the Neonatology Module Questionnaire which is at the back of the Neonatology Study Guide (Hard Copy).

Thank you for your co-operation.

