Neonatology

新生儿学

Department of Pediatrics

Soochow University Affiliated Children's Hospital

Lecture I Introduction

Aim and claim of this class

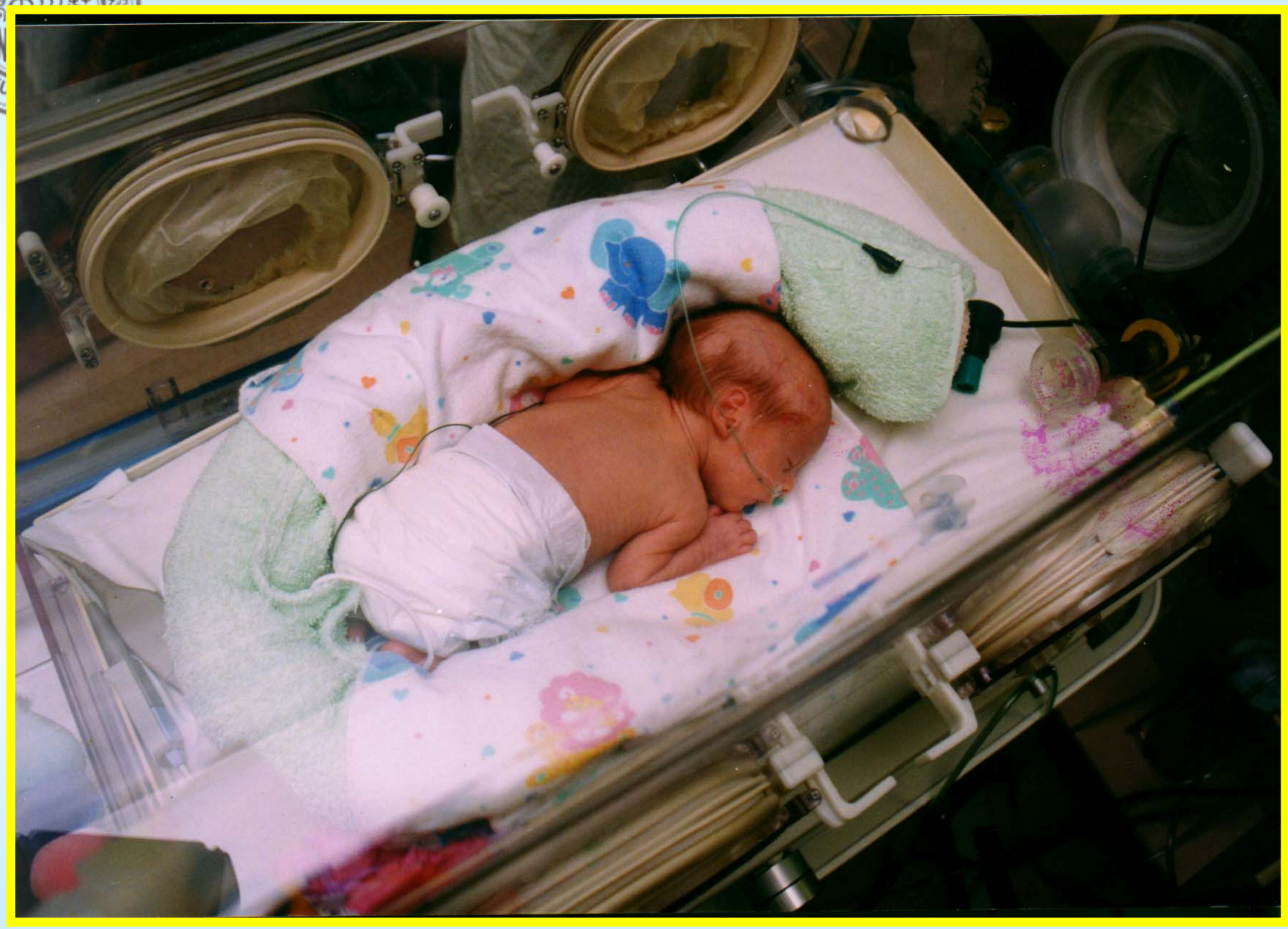
- Understand of perinatology (围产医学）& neonatology
- **Familiar with** the classification of neonates
- Understand of anatomy & physiology of normal neonates

Questions

- What is neonate?
- What is neonatology?
- What is perinatology?

Neonate & Neonatology

- Neonate --- Baby aged from delivery to first 28 days after birth
- Neonatology --- a new clinical subspeciality（亚专业） studied neonatal physiology, pathology
- Perinatology --- obstetrics & neonatology




BED

Three Important Definitions

- Perinatal period:

  from 28 weeks of gestational age (GA，胎龄) to first 7 days after birth

- Neonatal period

  first 28 days after birth

- Post-Neonatal period:

  28 days to 12 months of life

Perinatal Period

- Definition I: 28w to first 7 days
- Definition II: 20w to first 28d
- Definition III: 28w to 28d
- Definition IV: pregnancy to 7d

note: 20w the fetal weight about 500g

28w the fetal weight about 1000g

Definition of Neonate(1): related to GA

- Preterm/ premature:<37^{+6} w
- Term infant: 38 ~ 42 w
- Pos-term infant: >42 w


ACS-20-YE


Preterm

term

Post-term

Definition of Neonate(2): related to BW

（measure within 1st hour after birth）

Tiny baby	BW<1000g
Very low birth weight	BW<1500g
Low birth weight	BW<2500g
Normal birth weight	BW2500 ~ 4000g
Large baby	BW>4000g

Definition of Neonate(3): related to both GA & BW

Small for gestational age (< 10 percentile)
(SGA,小于胎龄儿)

Appropriated for gestational age (10 - 90 percentile)
(AGA,适于胎龄儿)

Large for gestational age (> 90 percentile)
(LGA,大于胎龄儿)

Definition of Neonate(4): related to age

- Early baby (perinatal baby): neonate aged in first 7 days
- Late baby : aged above 7 days

Definition of Neonate(4):

High risk baby

Those baby who have or should showed severe conditions and need intensive care after birth, usually are those with maternal disease or abnormal delivery history. e.g, preterm baby, asphyxia, congenital diseases, ect.

Levels of Neonatal Nursery

- Level I: for those normal baby
- Level II: for those sick but needn’t intensive care(重症监护） baby
- Level III: intensive care unit for high risk baby

Level II

Neonatal Intensive Care Unit, （NICU，重症监护室）

The highest level of neonatal care for the risk baby especially for those very low birth weight infants or with high risk disease to decrease the mortality. The organization of such unit requires special personnel and equipments.

Level III (NICU)

The Physiology of Normal Neonate

Appearance (p98, Table 5-2)

- Skin
- Hair
- Ear
- Nail
- Breast
- Plantar creases（足底纹理）
- Genitals（生殖器）

Respiratory System

- Fluid in the lung（ amniotic fluid，羊水 ）
- Pulmonary surfactant（表面活性物质）
- Abdominal breathing
- Respiratory center

Cardiology

- Fetal circulation to normal circulation
- Lung circulation establishment
- Heart murmur（杂音）
- Closure of foramen ovale（卵圆孔） & ductus arteriosus（动脉导管）
- Persistent fetal circulation

Gastroenterology

- Stomach －－ flat, vomiting
- Intestine －－ thinner intestinal wall, high absorption function
- Liver －－ deficiency of digestive enzymes
- Mecomium（胎粪）-- dark green, composed of amniotic fluid and intestinal secretions

  should be discharged in 12 hour, or indicated intestinal obstruction

Nephrology

- Premature function, easy result in unbalance of fluid and electrolytes

  should have urine in 1st 24 hour

Hemotology

- Blood volume – about 85 ~ 100ml/kg
- Red cell – HbF to HbA，then jaundice（黄疸）
- White cell – high count at birth,then decrease gradually
- Platelet – easy deficiency in premature

Neurology

- Brain – relative large(10 ~ 12％ W) but functional prematuraty（未成熟）
- Spinal Cord – relative longer (ended at 3 ~ 4S)
- Native Reflex（生理反射） – rooting,sucking, grasp, Moro
- Pathological reflex – Kernig, Babinski, Chvostek

Thermoregulation

- Vulnerable（敏感） to environment temperature

- Neutral temperature（中性温度） -- environment temperature with lowest metabolism rate & smallest oxygen consumption

  The smaller gestation,

  The higher neutral temperature

Immunology

- Both specific and non-specific immunological function are premature, so easy to be infected

Energy & Fluid

Related to GA, BW or Age

	day 1st		day 2nd		day 3rd	
	E	F	E	F	E	F
term	60 – 80	60 – 80	100 – 120	80 – 100	120 – 150	110 – 150
preterm	80 – 100	70 – 100	110 – 130	90 – 120	130 – 150	130 – 180

E(kcal/kg.d) F(ml/kg.d)

Special Phenomenon

- Physical jaundice
- Epstein peals(板牙)
- epulis(螳螂嘴)
- natal teeth（乳牙）
- Enlargement of breast(乳腺肿大)
- Menstruation(假月经)

Summary

- Classification of newborn
- Anatomy & physiology of normal newborn

Neonatal Septicemia

新生儿败血症

Aims and claims

- Understand the clinical manifestation of septicemia
- Familiar with the diagnosis of septicemia
- Understand the management of septicemia

Neonatal sepsis or septicemia(败血症）is a clinical syndrome characterised by systemic signs of infection accompanied by bacteremia（菌血症）.

Definition

- Bacteria invade into blood circulation of neonate (bacteremia) and result in damage by its products

Etiology

China: Staphylococcus（葡萄球菌）,

Escherichia coli(E.coli)

Western countries:

group B Streptococcus（链球菌）(GBS)

Listeria(李斯特菌）

Host Defence Mechanism

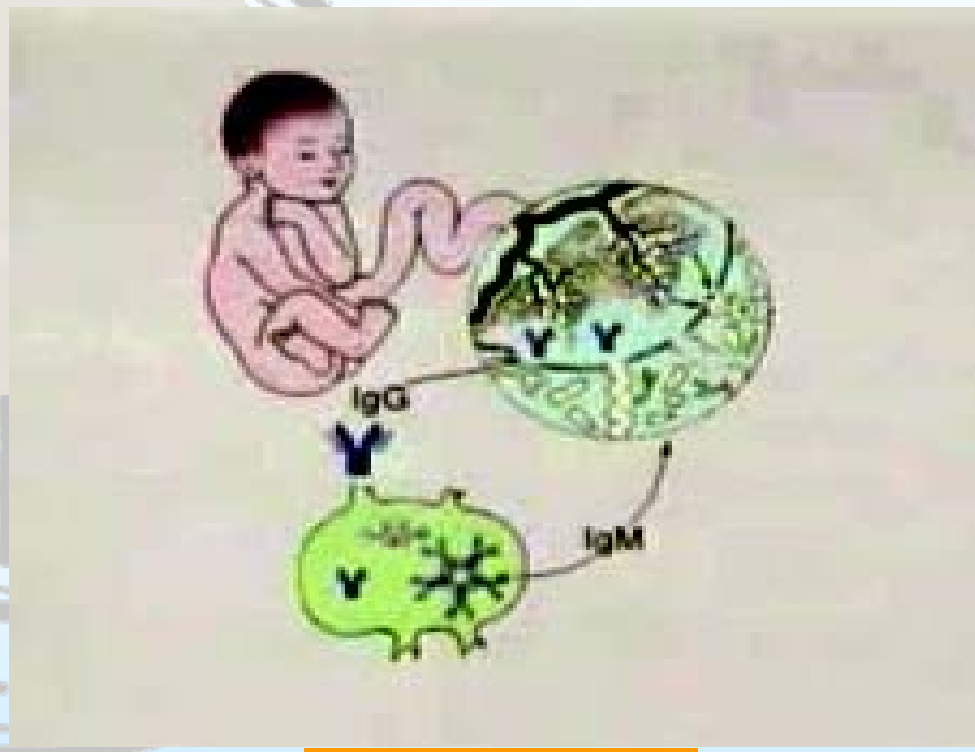
poor skin & mucosa barrier

- prematured lymphogranula(淋巴-单核细胞）
- complements(C_3、 C_5) ↓
- neutrophil（中性粒细胞） storage pool ↓
- cytokines（细胞因子） production ↓

Immunogenicity

- Ig G related to gestation
- IgM、IgA can't cross placenta
- T cell disfunction situation

IgG



IgM

Clinical Findings

	early-onset	late-onset
Onset time	< 7d	> 7d
Source of infection	ante- or during delivery	during or post-delivery
Etiology	usual G^-	usual G^+
Complication	multisystem	focal
Progress	poor	slowly
Mortality	high	low

Usual presentation

- Non-specific
- Poor feeding
- Lethargy （嗜睡）
- Weak cry
- Temperature instability
- Poor weight gain

Should consider diagnose if

- Jaundice
- Hepatosplenomegaly（肝脾肿大）
- Bleeding tendency
- Shock tendency
- Other signs: vomit, abdominal distension, apnea, tachypnea, cyanosis
- Complications: pneumonia, meningitis, enterocolitis, ect.

Lab Investigation

Blood routine

WBC $< 5 \times 10^9$ /L or $> 20 \times 10^9$ /L

Platelet counter $< 100 \times 10^9$ /L

Lab Investigation

Etiology

1. bacterium culture:

   blood, cerebral spinal fluid (CSF), urine, etc

2. antigen test:

   e.g, polymerase chain reaction (PCR)

C-reactive protein: high (>10mg/dl)

Diagnosis

- High risk factors
- Clinical findings
- Blood route
- CRP increase
- Etiology investigation

Management

- **Antimicrobial agents**

  early

  combined

  intravenous

  enough course

  keep eye on side functions

- **Treat complications**

  anti-shock

  treat local infection

  treat acidosis & hypoxia

  treat cerebral edema

- **Immunological therapy**

  immunoglobulin

  blood or its components transfusion (plasma, granulocyte, platelet)

- **Supporting therapy**

  keep warm

  energy & fluid

  maintain serum glucose

  balance of electrolytes

Neonatal Jaundice

(新生儿黄疸)

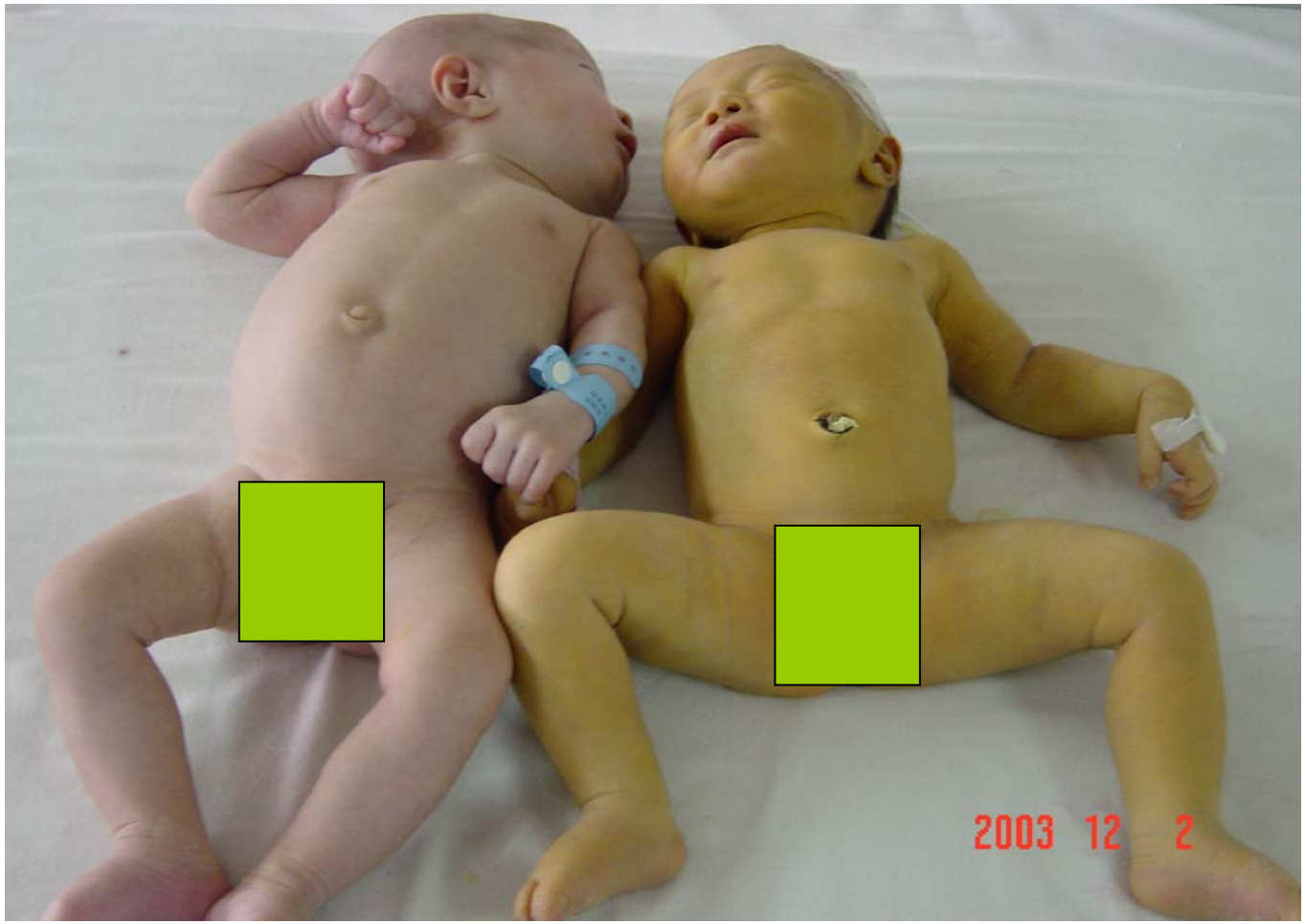
Aims and claims

Distinguish physiological or

pathological neonatal jaundice

Definition

The yellow skin and/or sclera(巩膜）because of too high concentration of bilirubin in the blood.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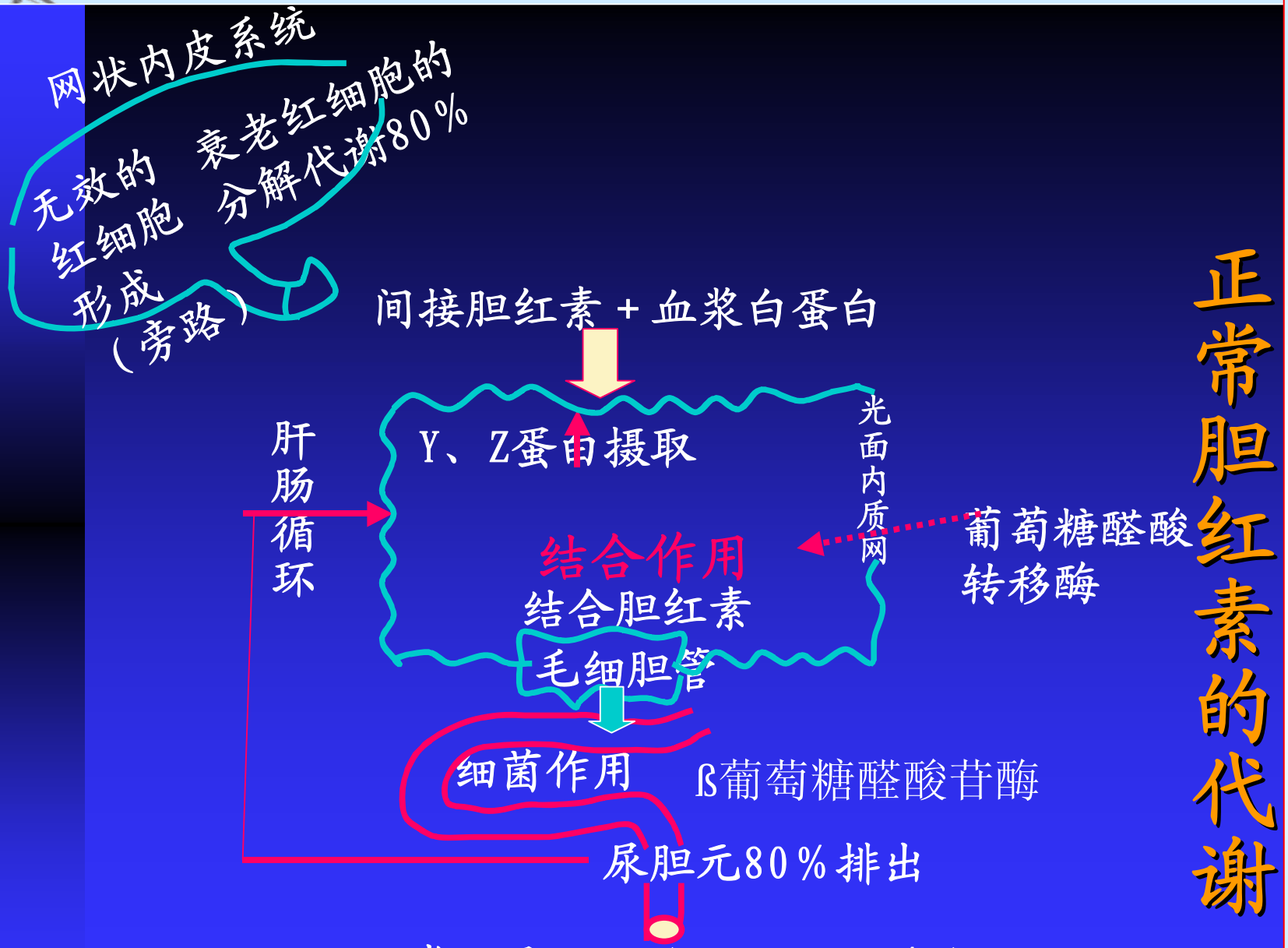
Characteristics of Neonatal Bilirubin Metabolism

- More production: most derived from RBC degradation
- Poor transport : deficiency of albumin
- Premature of liver enzyme
- Active “enterohepatic” circulation （肠肝循环）
- Others： hunger, dehydration, hypoxia, acidosis , etc

正常胆红素的代谢


网状内皮系统
无效的红细胞形成（旁路）
衰老红细胞的分解代谢80%
间接胆红素＋血浆白蛋白
肝肠循环
Y、Z蛋白摄取
光面内质网
葡萄糖醛酸转移酶
结合作用
结合胆红素
毛细胆管
细菌作用
ß葡萄糖醛酸苷酶
尿胆元80％排出
粪：尿胆元（40－250mg/L）

Two types of neonatal jaundices

neonatal jaundices

physiological ***pathological***

Physiological jaundice

	term	preterm *
Onset	2 ~ 3d	3 ~ 5d
Bilirubin	<12.9mg/dl	<15mg/dl
Progress	<5mg/dl.d	<5mg/dl.d
Disappear	2w	3 ~ 4w
D.bilirubin	<2mg/dl	<2mg/dl

* 尚有争议

Pathological jaundice

- Too early: <24h
- Too high : >12.9mg/dl（term）
  or >15mg/dl（preterm）*
- Too fast : >5mg/dl.d
- Too late : >2w（term）
  or >4w (preterm）
- D.bilirubin: >2mg/dl
- Return

Classification of jaundice

- More bilirubin: hemolysis，infection，RBC abnormality, “liver-gut” circulation
- Immaturity of liver enzyme: prematurity, asphyxia, congenital disease
- Poor discharge: obstructed biliary tract, hepatitis, “TORCH” syndrome, metabolic disease, Dubin-Johnson syndrome

Classification of jaundice

- ***Unconjugated hyperbilirubinemia***
- ***Conjugated hyperbilirubinemia***
- ***Combined hyperbilirubinemia***

TORCH syndrome

Congenital infections composed of:

- T(Toxoplasma)：弓形体
- O(Others)：Hepatitis virus, syphylis, EB virus, HIV virus, etc
- R(Rubella)：风疹病毒
- C(Cytomegalovirus)：巨细胞病毒
- H(Herpes)：疱疹病毒

Diagnosis

- History : emphasis on onset of jaundice & its progress
- Physical examination: severity of jaundice
- Lab : etiology

Management

Unconjugated hyperbilirubinemia

a. Phototherapy：wavelength 450nm

b. Albumin therapy

c. Activator of enzyme：phenobarbital（鲁米那） 5mg, nikethamide（可拉明） 100mg，tid for 3 ~ 5d

d. Blood transfusion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- Conjugated hyperbilirubinemia

  usually need etiological treatment

  or surgery operation

Summery

- Neonatal bilirubin metabolism
- Two types of neonatal jaundice:

  physiological or pathological

Question

- How can we distinguish physiological or pathological neonatal jaundice?

Thank you all!