

Anesthésie che l'enfant “ex-prémature”

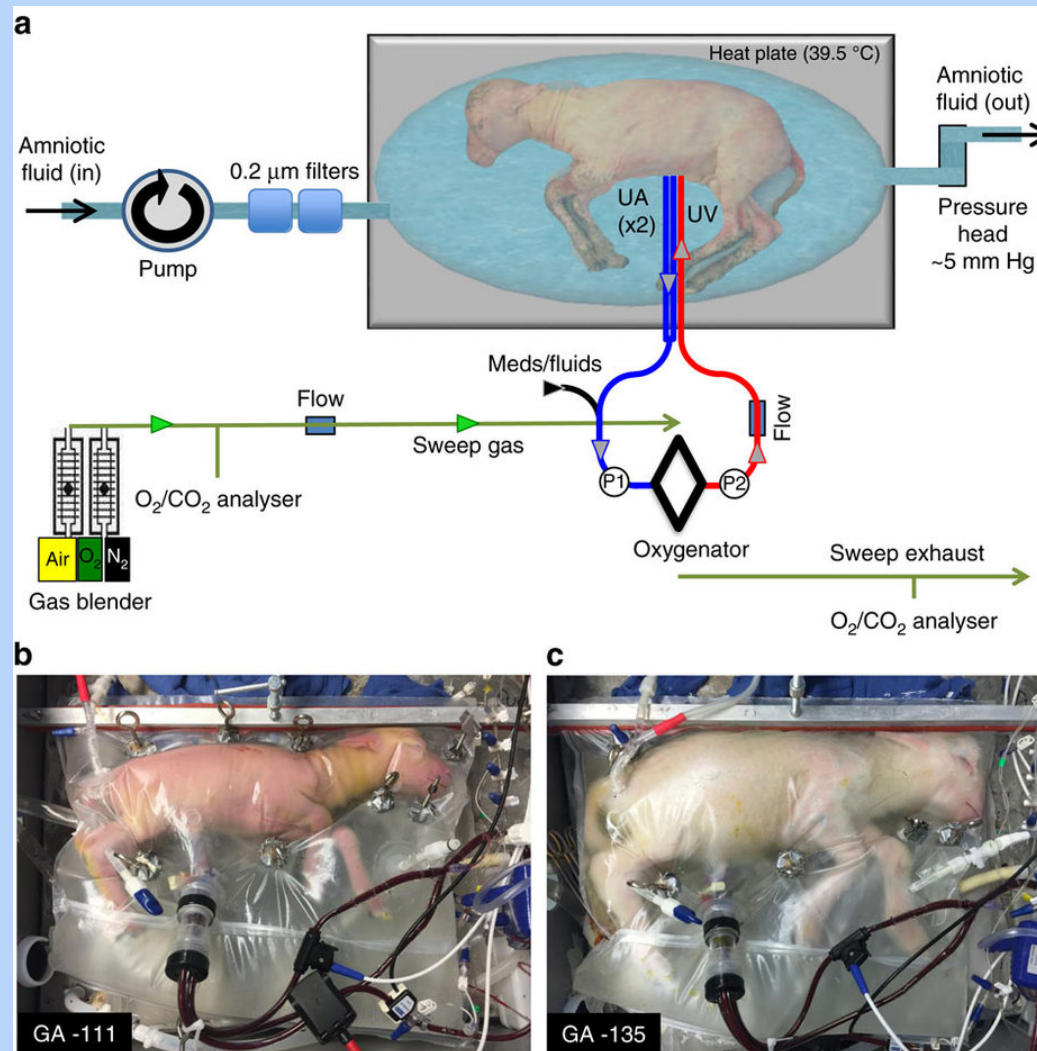
Prof LJ Van Obbergh MD PhD
Dpt of anesthesiology
CUB Hospital Erasme



RTBf: Un utérus artificiel pourrait réduire la mortalité des grands prématurés (27 avril)

An extra-uterine system to physiologically support the extreme premature lamb

Nature April 2017



Prématurité.....

- preterm (<37 gestational weeks)
- term (37 to 41 gestational weeks)
- post-term (≥ 42 gestational weeks). (WHO 1977)

Gestational age (GA): time elapsed between the first day of the last menstrual period and the day of delivery

Postmenstrual age (PMA): GA plus chronological age

Many studies of ex-premature patients refer to postconceptual age (PCA).

*NB: The PMA can be estimated by adding two weeks to the PCA

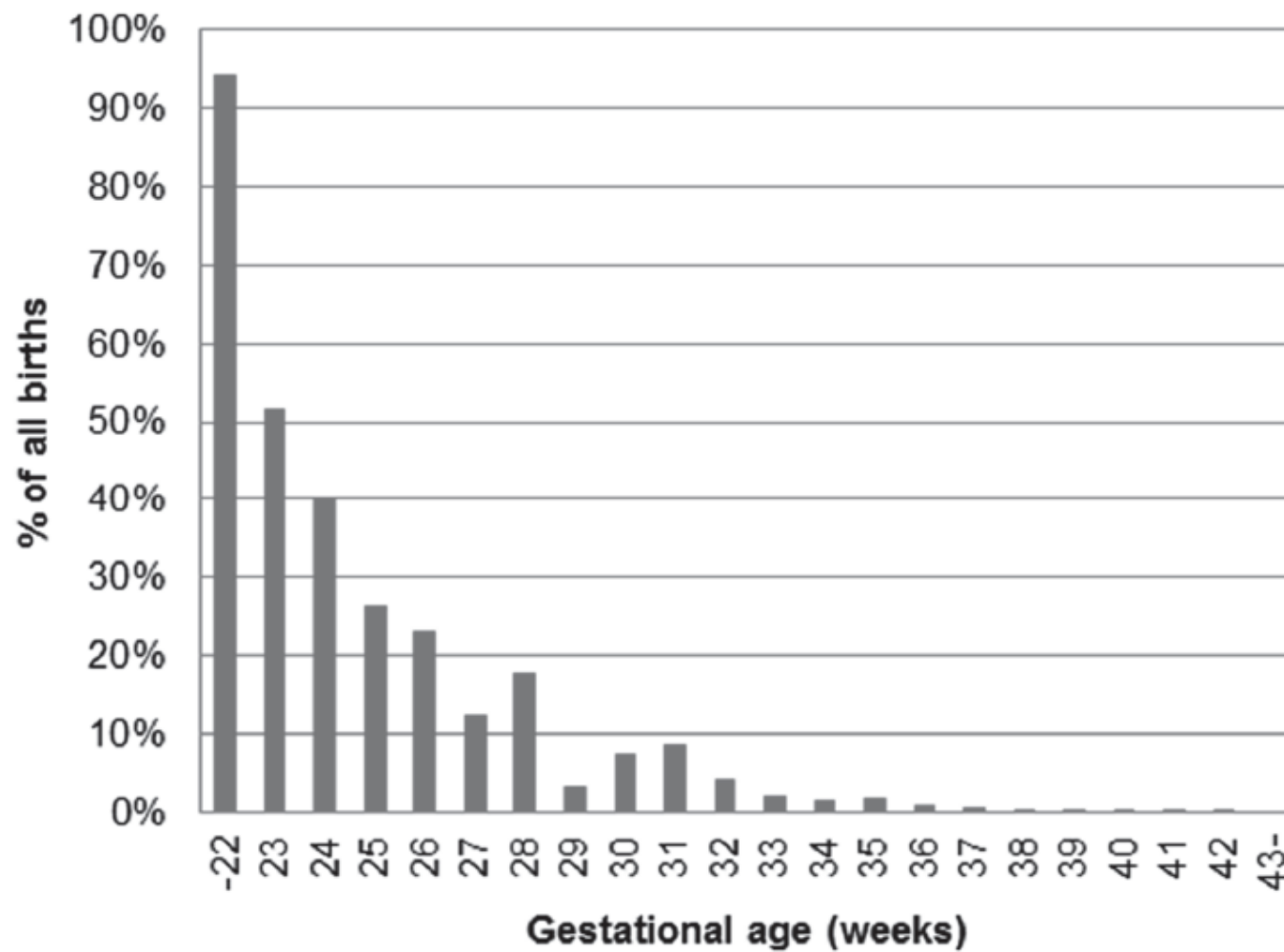
En age

- extremely preterm (<28 weeks)
- very preterm (28 to 31 weeks)
- moderately preterm (32 to 36 weeks)

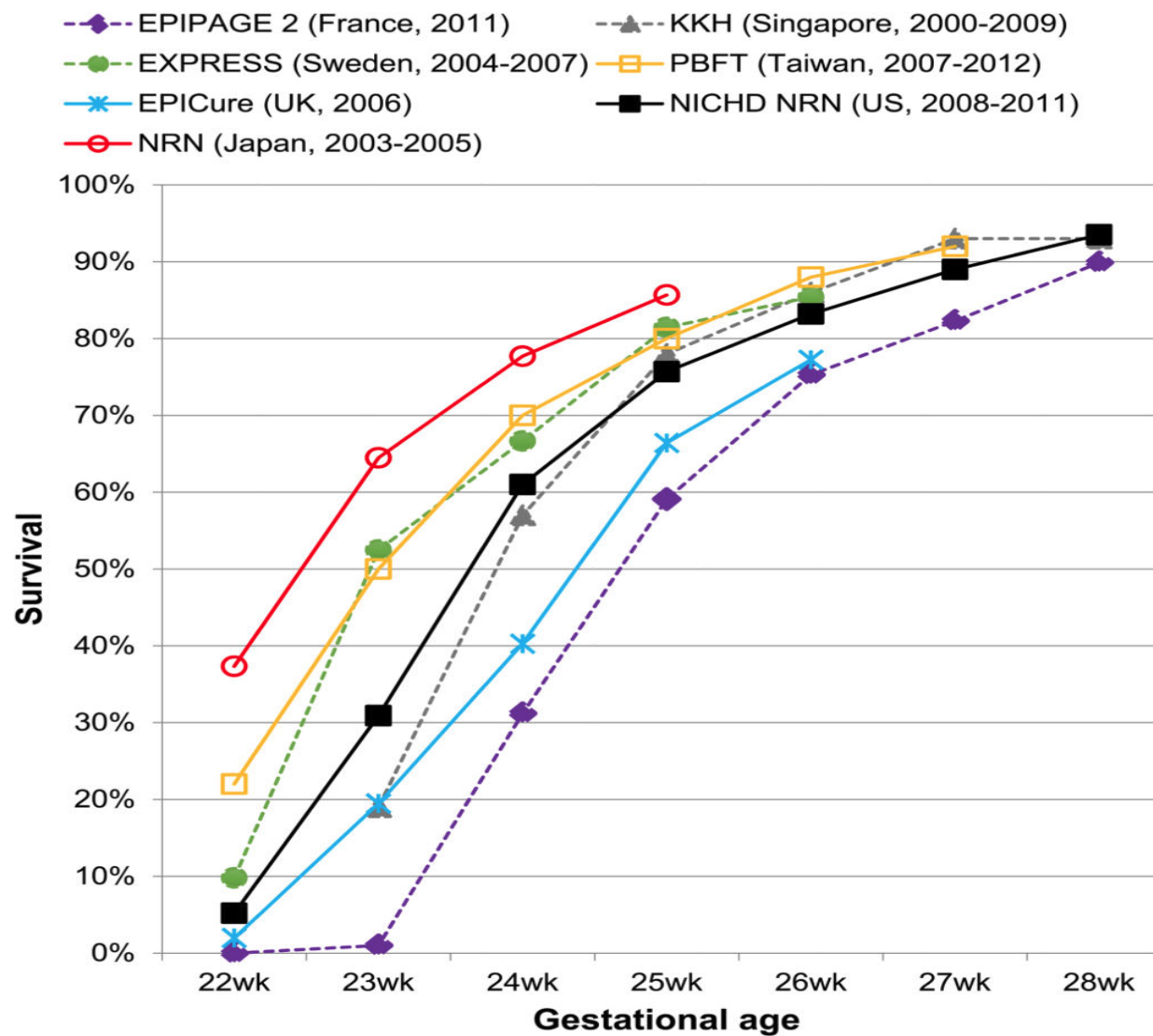
(Engle *et al.* 2007, Blencowe *et al.* 2012).

En poids

- extremely low birth weight, ELBW (<1000 g)
- very low birth weight, VLBW (<1500 g)
- low birth weight, LBW (<2500 g)
- small for gestational age, SGA (more than two standard deviations (SDs) below the mean, or <10th percentile)
- appropriate for gestational age, AGA (within $\pm$ 2SDs around the mean, or within the 10th and 90th percentiles) –
- large for gestational age, LGA (more than 2SDs above the mean, or >90th percentile)



Perinatal mortality rate by gestational age in weeks in Finland in 2013



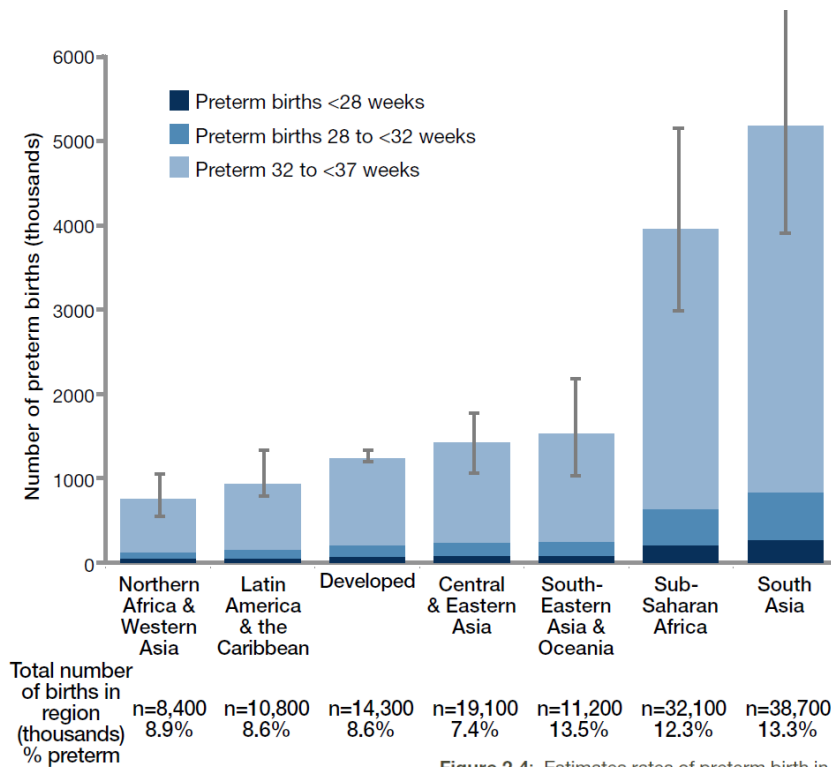


Figure 2.4: Estimates rates of preterm birth in 2010

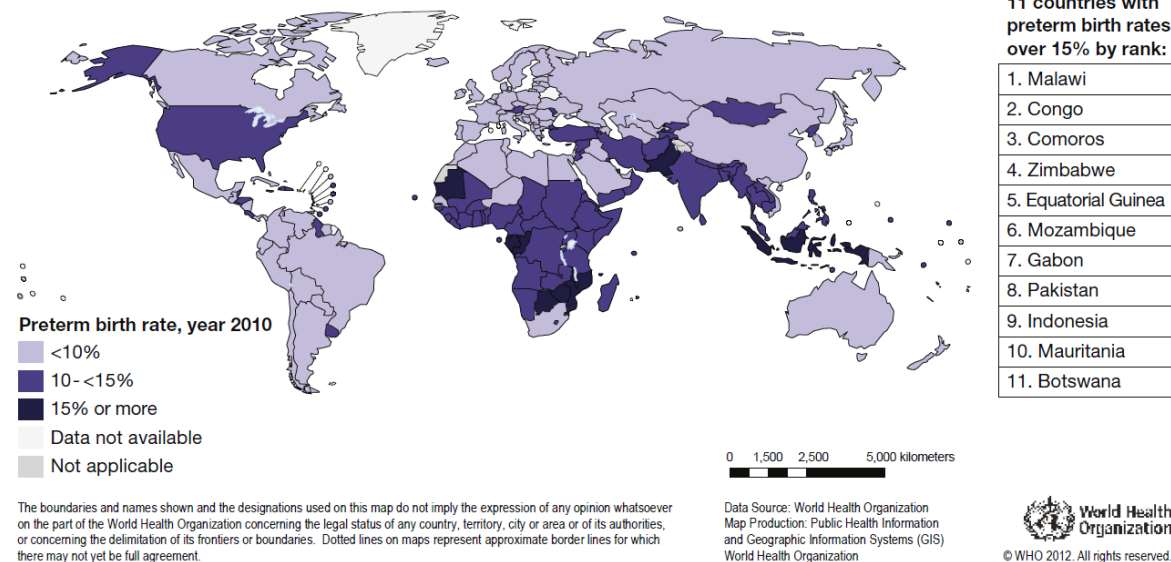
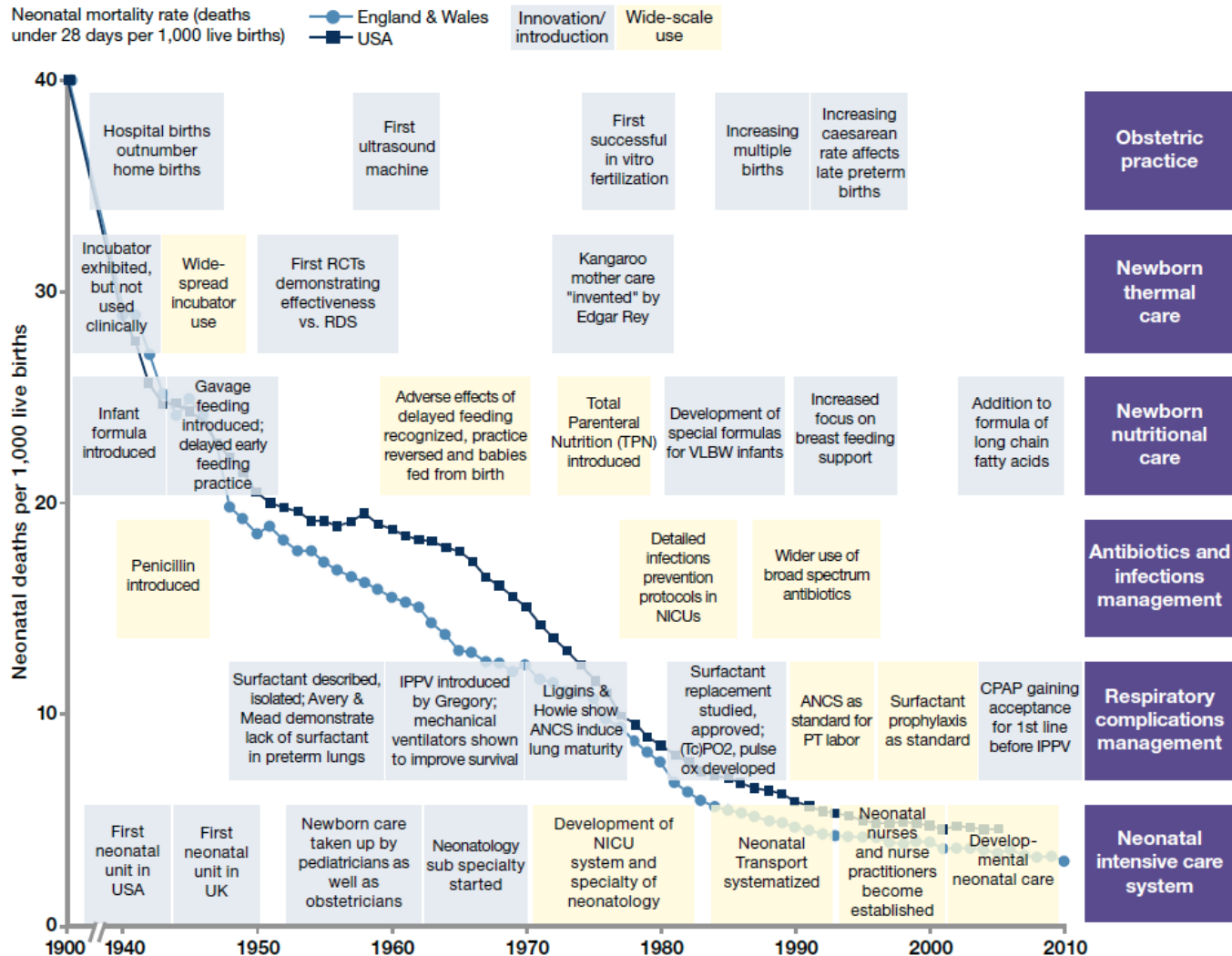


Figure 5.5: The history of neonatal care in the United Kingdom and the United States shows that dramatic declines in neonatal mortality are possible even before neonatal intensive care is scaled up



Acronyms used: ANCS = antenatal corticosteroids, CPAP = continuous positive airways pressure, NICU = neonatal intensive care, IPPV = intermittent positive pressure ventilation, VLBW = very low birth weight
Sources: (Smith et al., 1983; NIH, 1985; Baker, 2000; Wegman, 2001; Philip, 2005; Jamison et al., 2006; Lissauer and Fanaroff, 2006; CDC, 2012; Office for National Statistics, 2012) with thanks to Boston Consulting Group

Table 2. Common neonatal complications after preterm birth.

Respiratory distress syndrome and bronchopulmonary dysplasia

Persistent pulmonary hypertension of newborns

Pneumothorax

Patent ductus arteriosus

Apnea/bradycardia

Hyperbilirubinemia

Intraventricular or periventricular hemorrhage

Sepsis and other infections

Temperature instability

Hypoglycemia

Dehydration

Feeding difficulties and under-nutrition

Necrotizing enterocolitis

References: Wang *et al.* 2004, Philip 2005, Engle *et al.* 2007, Saigal & Doyle 2008.

Table 4. Morbidity Risks

ELBW morbidity	Risk	95% CI
Acute/NICU		
Any ROP	63.7	60.6–66.6
Severe ROP	12.3	11.3–13.3
IVH (Grade III–IV)	14.1	13.1–15.2
Surgical NEC	10.1	9.3–11.0
Chronic problems		
BPD (O ₂ at 28 weeks)	42.2	40.4–43.9
BPD (O ₂ at 36 weeks)	38.7	36.9–40.5
Blindness	0.8	0.36–1.62
Hearing loss	3.1	2.1–4.4
Cerebral palsy	6.1	4.7–7.7
Cognitive delay	7.4	5.2–9.4

ROP : Retinopathy prematurity
IVH: Intraventricular hemorrhage
BPD: Bronchodysplasia

NEJM 2012
JAMA 2013
NEJM 2013

Major steps

Innovation	Time
CPAP, Mechanical ventilation	1980s
Exogenous surfactant	Early 1990s
Antenatal steroids	Mid/late 1990s
Avoiding postnatal steroids	Early 2000s
Targeted oxygen therapy	Mid 2000s
Systematic care/experience	Continuous

LES APNÉES DU PRÉMATURÉ

Pourquoi en parler.....

- Chirurgie mineure chez un préma
 - Examen ophtalmo
 - Hernie inguinale
 - Procédures diverses

Definition of apnoea

- Apnea has been variably defined:
 - most commonly as a pause in breathing ≥ 15 seconds,
 - or one < 15 seconds associated with bradycardia (ie, heart rate < 80 beats/minute [bpm])

Pathophysiology and incidence

- Immaturity and/or depression of the central respiratory drive to the muscles of respiration have been accepted as key factors in the pathogenesis of apnea of prematurity
- 70% of babies born before 34 weeks of gestation have clinically significant apnea, bradycardia, or O₂ desaturation.
- Apnea may occur during the postnatal period in 25% of neonates who weighed less than 2500 g at birth and in 84% of neonates who weigh less than 1000 g.

Apnea after Awake Regional and General Anesthesia in Infants

(ANESTHESIOLOGY 2015; 123:38-54)

What We Already Know about This Topic

- Whether awake regional anesthesia reduces the risk of apnea compared to general anesthesia in infants is unclear

What This Article Tells Us That Is New

- In a secondary analysis of over 700 infants less than 60 weeks postmenstrual age randomized to regional or general anesthesia for inguinal herniorrhaphy, there was no difference in the incidence apnea in the first 12 postoperative hours (primary outcome measure), although early apnea in the first 30 min was less with regional

Postoperative Apnea in Former Preterm Infants

General Anesthesia or Spinal Anesthesia—Do We Have an Answer?

C. Dean Kurth, M.D., Charles J. Coté, M.D.

Anesthesiology 2015; 123:15-7



“The main difference between [general and regional anesthesia] was the timing of the apnea, being more common in the PACU after [general anesthesia].”

Notre pratique.....

- Les apnées peuvent survenir jusqu'à 60 semaines PC.
- Générale ou ALR ???
 - Hernie inguinale
 - Surtout tandem anesthésiste chirurgien
 - ALR
 - Si problèmes pulmonaires récents
 - Nous favorisons la caudale (« awake » caudal)

Pratique...

- Apnée et anémie
 - Risque augmenté
 - Pas si hématoците sous 30% et chirurgie non urgente
- Avant 60 semaine PC surveillance intensive durant

Charmant, C ; Veyckemans,
Francis ; Vanobbergh, LJ..
*Caudal block in awake
high-risk neonates &
infants: Prone versus lateral
decubitus position.*

*British Journal of
Anaesthesia*, Vol. 76, 1
A313-A313 (1996)



BRONCHOPULMONARY DYSPLASIA AND PULMONARY HYPERTENSION

Bronchopulmonary Dysplasia: Chronic Lung Disease of Infancy and Long-Term Pulmonary Outcomes

J. Clin. Med. 2017, 6, 4;

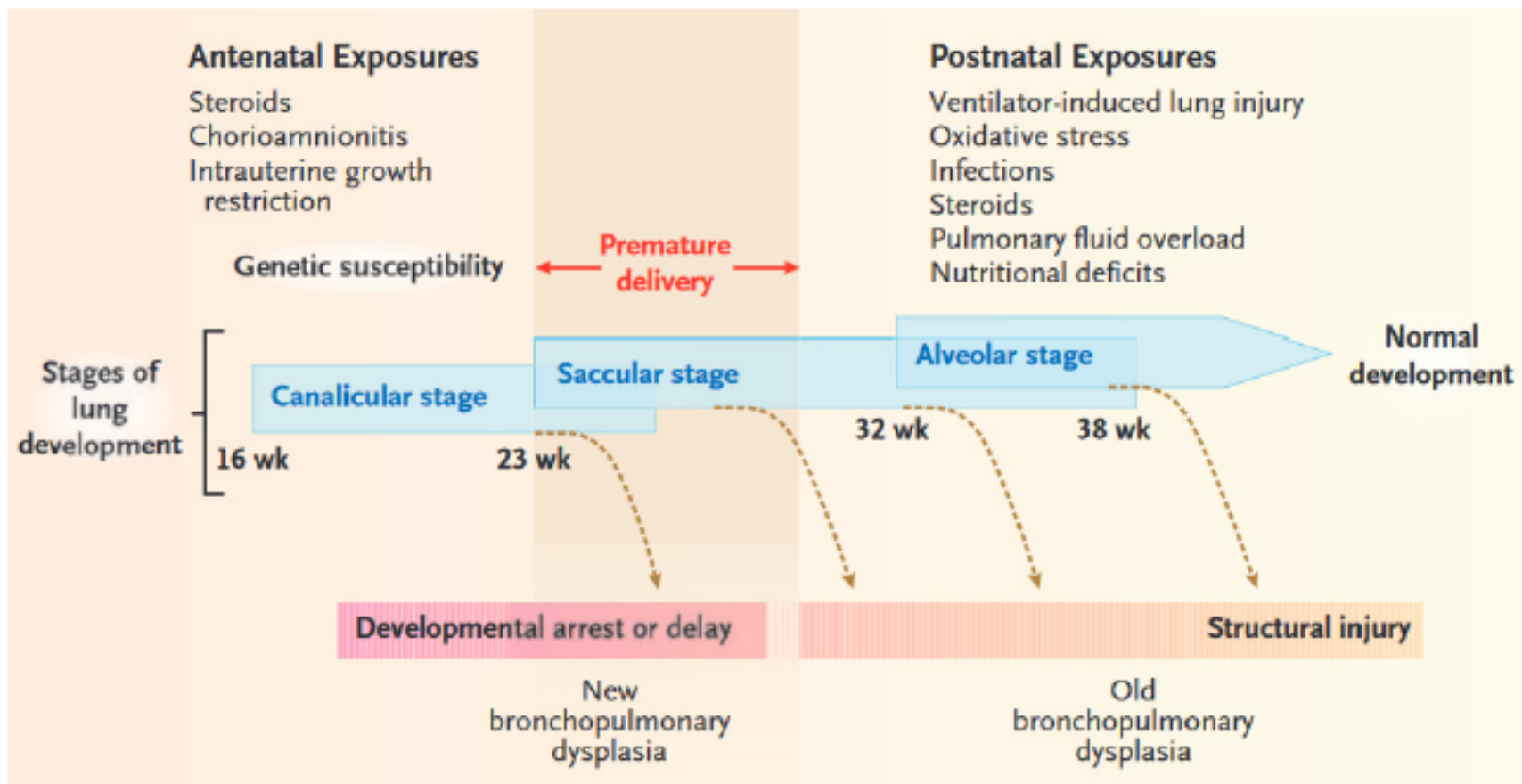


Tableau 1. Différences histopathologiques entre «ancienne» et «nouvelle» dysplasie broncho-pulmonaire (DBP)

(Adapté de réf.⁸).

«Ancienne» DBP	«Nouvelle» DBP
Fibrose interstitielle	Altérations épithéliales minimales
Hypertrophie du muscle lisse bronchique	Peu d'anomalies du muscle bronchique
Zones d'atélectase et d'hyperinflation	Lésions pulmonaires plus homogènes
Diminution de la surface alvéolaire	Alvéoles plus larges et moins nombreuses
Lésions vasculaires hypertensives	Vascularisation pulmonaire anormale

Table 1. Definition of Bronchopulmonary Dysplasia: Diagnostic Criteria. Reprinted with permission of the American Thoracic Society. Copyright © 2016 American Thoracic Society. Jobe, A.H.; Bancalari, E. Bronchopulmonary Dysplasia. *Am. J. Respir. Crit. Care Med.* 2001, 163, 1723–1729. The *American Journal of Respiratory and Critical Care Medicine* is an official journal of the American Thoracic Society.

Gestational Age	<32 wk	≥32 wk
Time point of assessment	36 wk PMA or discharge to home, whichever comes first	>28 d but <56 d postnatal age or discharge to home, whichever comes first
	Treatment with oxygen > 21% for at least 28 d plus	
Mild BPD	Breathing room air at 36 wk PMA or discharge, whichever comes first	Breathing room air by 56 d postnatal age or discharge, whichever comes first
Moderate BPD	Need * for <30% oxygen at 36 wk PMA or discharge, whichever comes first	Need * for <30% oxygen at 56 d postnatal age or discharge, whichever comes first
Severe BPD	Need * for ≥30% oxygen and/or positive pressure, (PPV or NCPAP) at 36 wk PMA or discharge, whichever comes first	Need * for ≥30% oxygen and/or positive pressure (PPV or NCPAP) at 56 d postnatal age or discharge, whichever comes first

Tableau 2. Critères diagnostiques de dysplasie bronchopulmonaire

(Adapté de réf.⁷).

	Age gestationnel < 32 SAG	Age gestationnel ≥ 32 SAG
	O ₂ pendant au minimum 28 jours de vie	
	ET	
Légère	Air ambiant à 36 SAG	Air ambiant à 56 jours de vie
Modérée	FiO ₂ < 30% à 36 SAG	FiO ₂ < 30% à 56 jours de vie
Sévère	FiO ₂ > 30% ou support ventilatoire (CPAP) à 36 SAG	FiO ₂ > 30% ou support ventilatoire (CPAP) à 56 jours de vie
SAG : semaines d'âge gestationnel.		

Évolution des pratiques néonatales

- Eviter l'intubation-ventilation assistée
- Recours au surfactant en curatif uniquement quand ventilation mécanique nécessaire
- Etudes sur les différents modes ventilatoires
- Canule nasale à haut débit
- Choix des cibles de saturations

Fisher, pediatrics 2013

Shmolzer BMJ 2013

Yoder, Pediatrics 2013

Royas-Reyes, Cochrane 2012

Support Study Group, NEJM 2010

Outcomes for Extremely Premature Infants

Hannah C. Glass, MDCM, MAS,* Andrew T. Costarino, MD,†‡ Stephen A. Stayer, MD,§
Claire M. Brett, MD,|| Franklyn Cladis, MD, FAAP,¶ and Peter J. Davis, MD¶

(Anesth Analg 2015;120:1337–51)

Table 5. Incidence of BPD (%)

	23 Weeks	26 Weeks	28 Weeks	Total
Mild	26	35	16	27
Moderate	35	26	15	23
Severe	39	17	8	18

Lung Function and Respiratory Symptoms at 11 Years in Children Born Extremely Preterm

The EPIcure Study

Joseph Fawke^{1*}, Sooky Lum^{2*}, Jane Kirkby², Enid Hennessy³, Neil Marlow^{1,4}, Victoria Rowell¹, Sue Thomas¹, and Janet Stocks²

Am J Respir Crit Care Med Vol 182. pp 237–245, 2010

What This Study Adds to the Field

At 11 years of age, 56% of children born before 25⁺₆ weeks of gestation had abnormal baseline spirometry, 27% had a positive bronchodilator response, and 25% had a diagnosis of asthma (twice that observed in classmates). Among the 65% of extremely preterm children who had been asymptomatic over the previous 12 months, 48% had abnormal baseline spirometry, of whom 81% had prior bronchopulmonary dysplasia, emphasizing the need for continued monitoring of these children.

Preterm Versus Term Children: Analysis of Sedation/Anesthesia Adverse Events and Longitudinal Risk

A total of 57 628 cases were entered

PEDIATRICS Volume 137, number 3, March 2016

WHAT'S KNOWN ON THIS SUBJECT: Preterm infants and children <3 years of age receiving sedation/anesthesia are more likely to develop adverse events related to the airway and pulmonary systems.

WHAT THIS STUDY ADDS: Children born preterm receiving sedation/anesthesia for nonoperating room procedures are nearly twice as likely to develop adverse events compared with children born at term. The longitudinal risk analysis suggests that children born preterm remain at increased risk into adulthood.

Pulmonary Hypertension in Preterm Infants with Bronchopulmonary Dysplasia

PH IN PRETERM INFANTS WITH BPD

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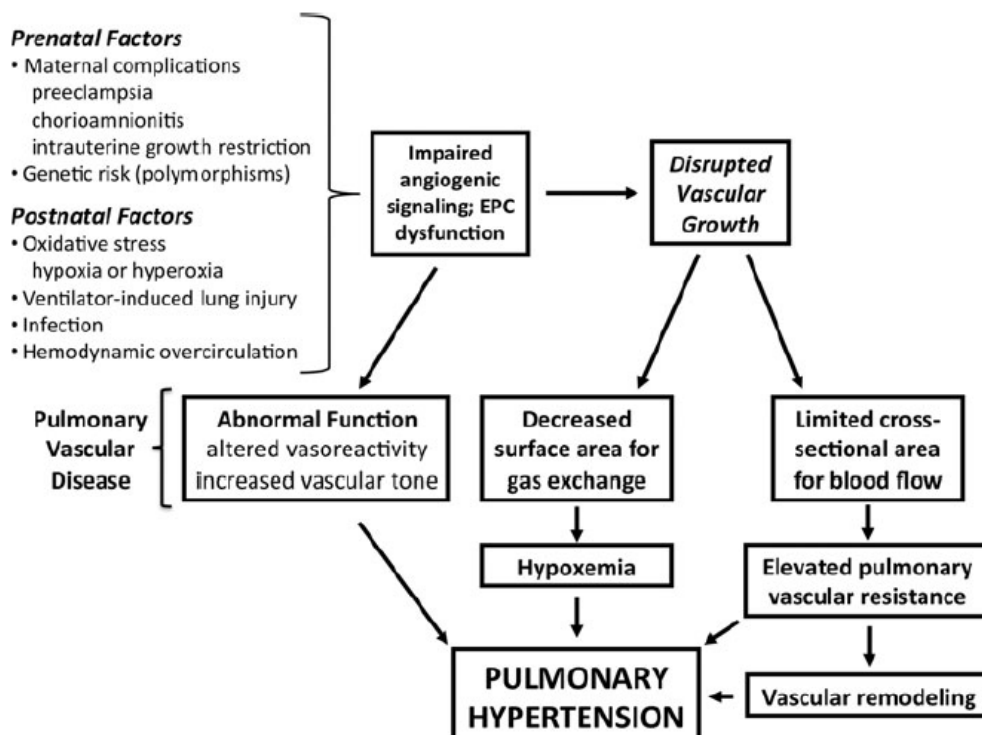


FIG. 1. Pathophysiology of pulmonary hypertension (PH) in bronchopulmonary dysplasia (BPD). Prenatal and postnatal factors impair angiogenic signaling, resulting in disrupted vascular growth, abnormal vascular function, and ultimately, PH.

Incidence of PAH after BPD

- PAH in the BPD population usually resolves with age and catch-up lung growth
- only one-third of these cases had echocardiographic evidence of PAH at four weeks of age
- An anesthesia consult should be obtained prior to any surgery or anesthesia in a BPD infant/child with a history of PAH since these children are at risk for a PAH crisis and death during any anesthetic procedure

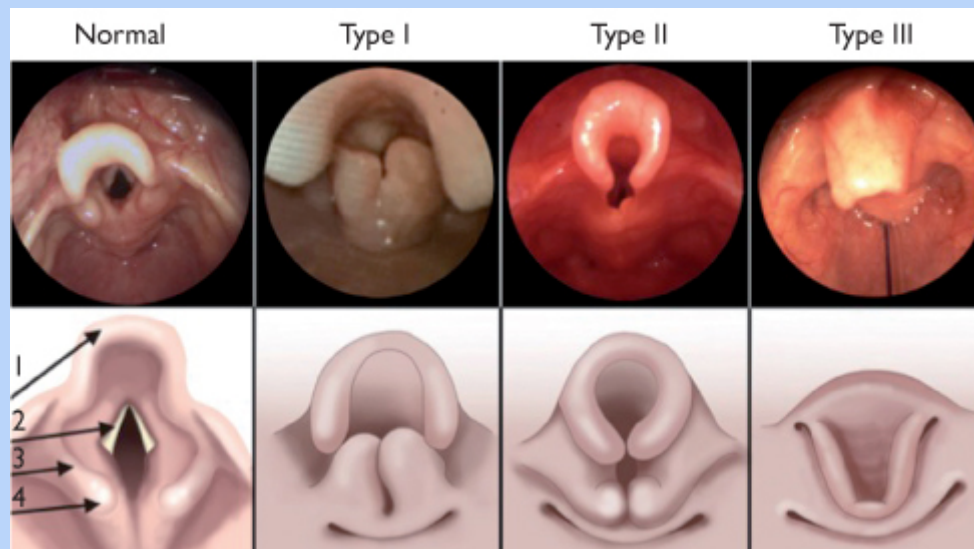
Pulmonary Hypertension in Premature Infants
Sharpening the Tools of Detection

January 1 2015

Anesthésie et BDP

- Anamnèse approfondie pour détecter la BDP et ses éventuelles séquelles
- Eviter les périodes d'exacerbation
- Hypersensibilité bronchique
- Evaluer les risques de la chirurgie de jour
 - Prévenir les parents
- Si dyspnée inexpliquée penser à une éventuelle Htpulm et faire évaluer

Laryngomalacie



- La majorité (80-90%) des LM sont légères et sont caractérisées par un stridor isolé ou intermittent, sans dyspnée, sans troubles de la déglutition et sans retentissement sur la croissance staturo-pondérale. Ces cas de LM légères sont traités conservativement avec contrôle clinique régulier
- Très rarement supraglottoplastie

Acquired tracheobronchomalacia

- *In* infants with classic BPD, tracheomalacia was found in 45 percent of those undergoing bronchoscopy, and bronchomalacia was found in 34 percent .
- Infants who require prolonged intubation can develop subglottic stenosis or tracheomalacia
- This incidence is decreasing with the more prudent ventilation strategies

Anesthésie

- Prévoir plusieurs diamètres de tube
- CPAP induction
- Réveil reprise de réflexe
- Souvent accompagné de Reflux Gastro Oesoph
- Prévoir réintubation

Effects of Preterm Birth on the Kidney

Mary Jane Black, Megan R. Sutherland and Lina Gubhaju
*Department of Anatomy and Developmental Biology, Monash University
 Australia*

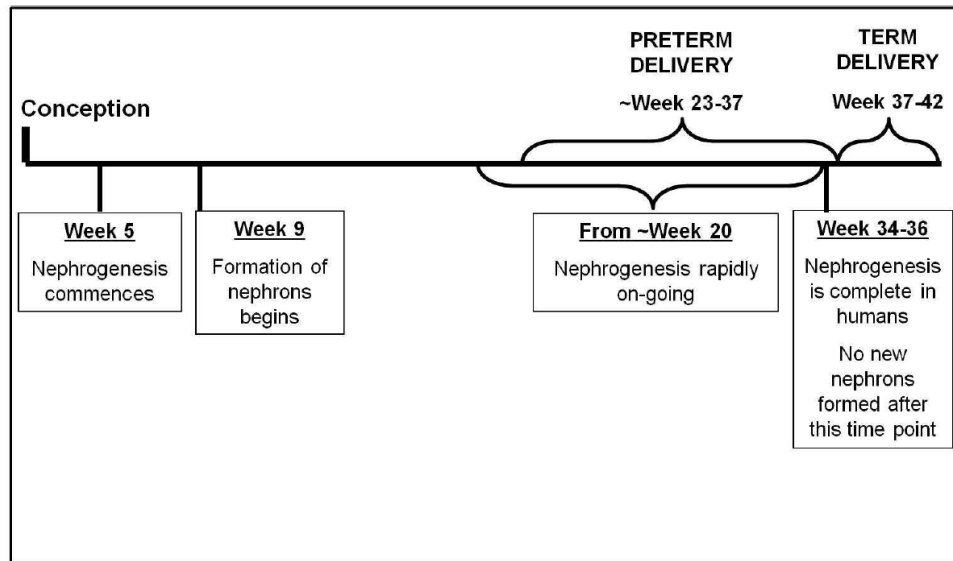
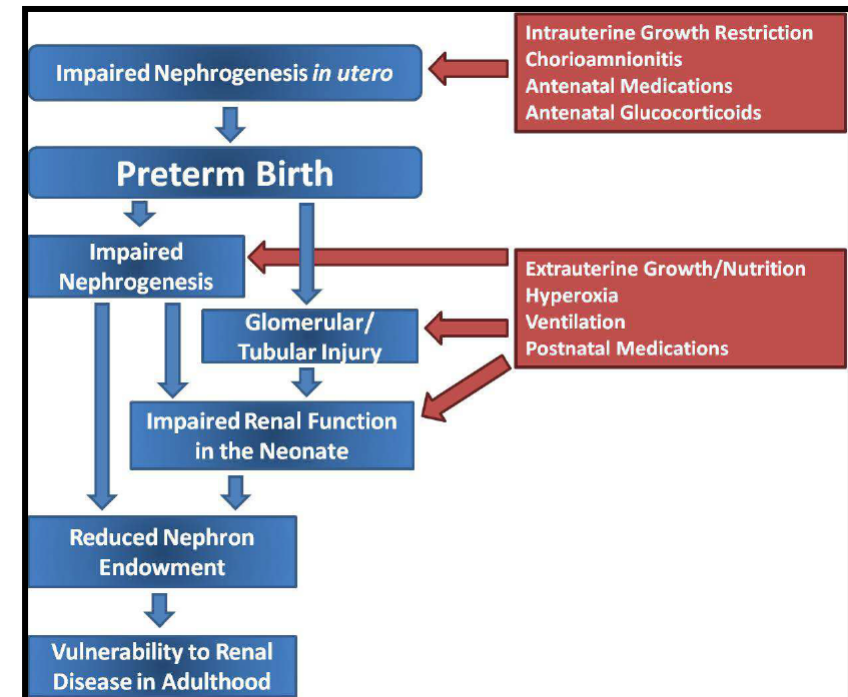


Fig. 1. A timeline of human nephrogenesis during gestation. Nephrogenesis is rapidly on-going at the time when most preterm neonates are delivered.



Author & Year	Gestational age at birth (weeks), range	Age at assessment	Study Groups and sample size	Outcomes on renal size
Huang (2007)	24-36	14-96 days	Preterm (n=56) Gestational controls (n=44)	Larger relative volume in preterm <31 weeks PCA Smaller relative volume in preterm >31 weeks PCA
Van Venrooij (2010)	23-30	1, 4, 8 weeks	ELBW (n=14) VLBW (n=16)	No differences in volume or length
Kent (2009)	25-28	37-40 weeks (term equivalent)	Preterm (n=17) Term (n=13)	No differences in volume
Drougia (2008)	28-41	36 and 40 weeks (term equivalent) 3, 6, 12 and 24 months	Preterm 28-34 weeks (SGA: n=100 AGA: n=54) Preterm 34-36 weeks (SGA: n=80 AGA: n=61) Term (AGA: n=90 SGA: n=81)	Smaller right kidney length in preterm SGA 28-34 week group compared to AGA group at all postnatal time points
Schmidt (2005)	<37	40 weeks 3 and 18 months	Preterm (n=59) Term (n=801)	Smaller relative volumes at 3 and 18 months
Zaffanello (2010)	26-31	5-6 years	ELBW (n=36) VLBW (n=43)	ELBW have smaller volumes (Right, Left, Total) ELBW have smaller length (Right and Left)
Kwinta (2011)	26-29	6-7 years	ELBW (n=78) Term (n=38)	ELBW have smaller volume
Rakow (2008)	<32 (mean=27)	9-12 years	Preterm (n=33) Term (n=37)	Smaller absolute volume; not significant when adjusted for body surface area
Rodriguez-Soriano (2005)	23-35	6-12 years	Preterm (n=27)	Length and volume appeared to be in normal range; no comparison group
Keijzer-Veen (2010)	<32 (mean=31)	20 years	Preterm SGA (n=22) Preterm AGA (n=29) Term AGA (n=30)	Smaller length and volume in preterm (SGA and AGA) female group compared to term

Short-Term Gestation, Long-Term Risk: Prematurity and Chronic Kidney Disease

Pediatrics 2013;131:1168–1179

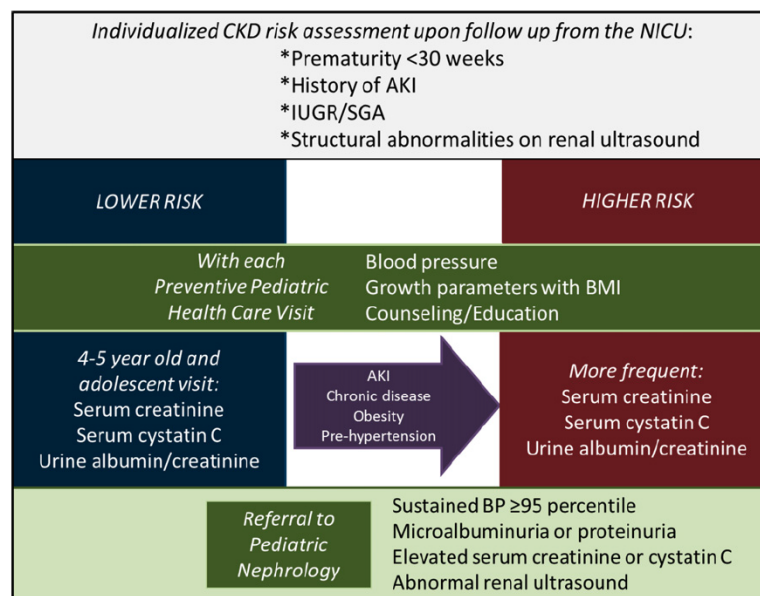


FIGURE 3

Follow up strategies for NICU graduates. In the absence of high-quality evidence, physicians must make an individualized risk assessment of each patient and balance the risks and benefits of any screening strategy. IUGR, intrauterine growth retardation; SGA, small for gestational age.

TABLE 2 Estimates of GFR With “Normal” Creatinine Values for a Hypothetical 2-Year-Old Child With Height 86.4 cm Using the Revised Schwartz Equation^a

Serum Creatinine (mg/dL)	Estimated GFR (mL/min/1.73 m ²)	Interpretation ^{148,150}
0.3	119	Normal
0.4	89	Normal
0.5	71	Stage 2 CKD
0.6	59	Stage 3 CKD

^a GFR = 0.413 × height(cm) / creatinine(mg/dL).¹⁴⁸

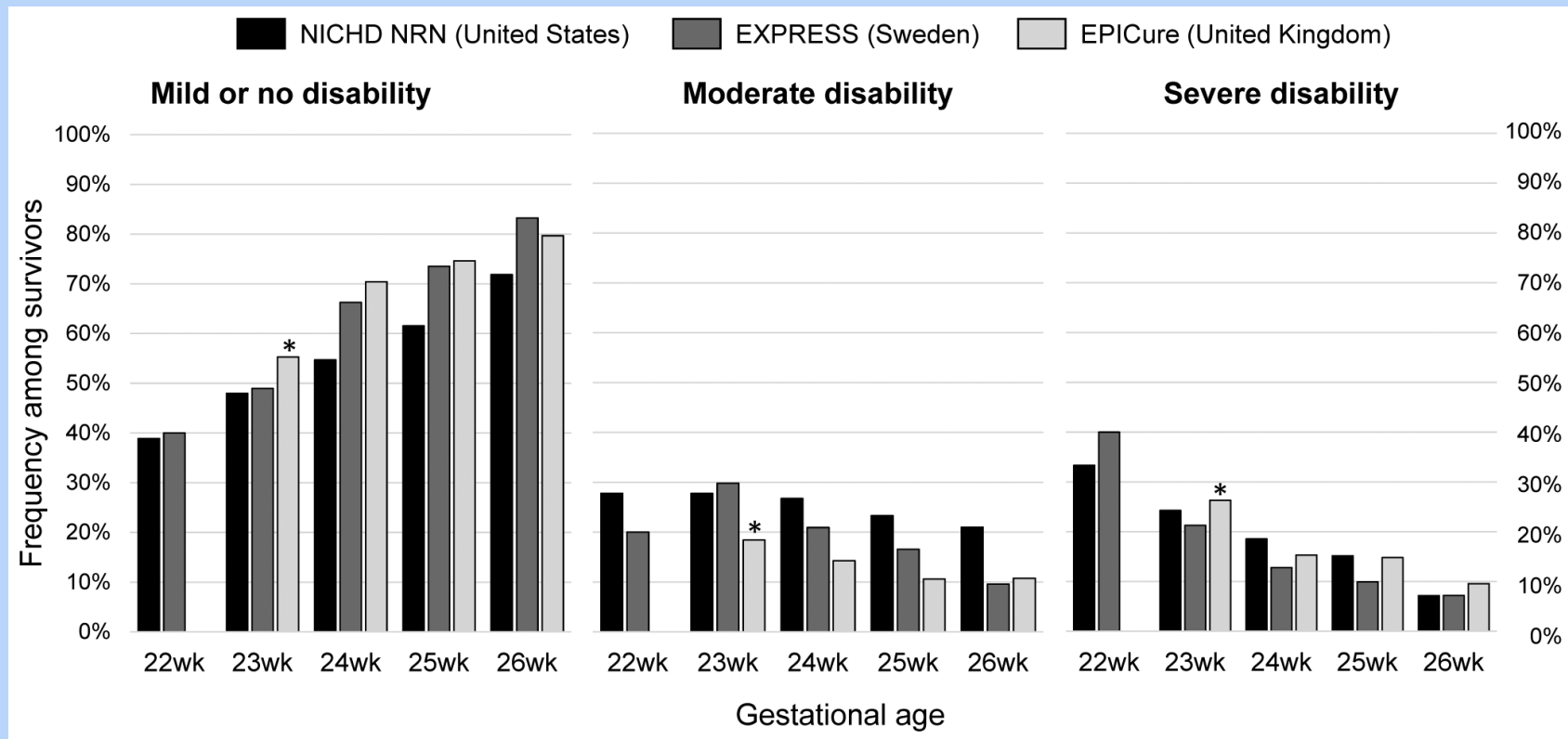
Divers...

- Allergie au latex (*Journal of Perinatology* (2007) **27**, 533–534
 - Multi opération
- Diabète précoce
- HTA

Does Preterm Birth Influence Cardiovascular Risk in Early Adulthood?

Conclusions Young adults born preterm might have a higher risk for CVD than those born term. (*J Pediatr* 2012;161:390-6).

DÉFICIT NEUROLOGIQUE



Chirurgies chez l'enfant expréma et porteur d'un handicap

- Fréquentes et souvent multiples
 - Orthopédiques
 - Digestives
 - Urologiques
 - Neurochirurgicales
 -
- Fausses déglutitions
- Hypersalivation
- Eviter suxamethonium ????
- ANALGESIE
 - Évaluation
 - Traitement
- Discussion avec les parents
 - Ils connaissent leur enfant
 - Un projet thérapeutique

REVIEW

Assessing pain in children with intellectual disabilities

Lynn M Breau PhD R Psych¹, Chantel Burkitt²

Pain Res Manage Vol 14 No 2 March/April 2009

“Psychology Works” Fact Sheet: Pain in Children with Cognitive Impairments who are Nonverbal

Assessing Children with Disabilities (About Kids Health: Trusted answers from The Hospital for Sick Children):

<http://www.aboutkidshealth.ca/En/ResourceCentres/Pain/PainAssessment/PainAssessmentbyAge/Pages/Assessing-Children-with-Disabilities.aspx>

*Pain Assessment in the Nonverbal Patient: Position Statement with Clinical Practice Recommendations (MedScape) *Not solely directed to children with cognitive impairments*:*

<http://www.medscape.com/viewarticle/533939>

*Understanding Pain in Patients with Intellectual Disabilities (MedScape) *Not solely directed to children*:*

<http://www.medscape.com/viewarticle/752725>



Conclusions

- Les progrès récents augmentent significativement la survie des prématurés nés avant 28 semaines.
- Malgré la diminution d'incidence des autres séquelles, la bronchodysplasie reste la complication majeure chez ses enfants.
- Les complications respiratoires sont les plus fréquentes en post opératoire