Evaluation du risque préopératoire

Mirela Bojan
Anesthésie Réanimation
Necker Enfants Malades

La consultation d ’anesthésie : législation

1. L ’obligation de consulter dans les jours précédant l ’intervention : Décret du 5.12.1994
2. L’obligation d ’informer :

- Art 47 code de déontologie
- Décret 6.09.95 *:* obligation d ’information loyale, claire et appropriée sur l’état, les investigations, les soins
- la charge de la preuve en matière d’information incombe au médecin *par tout moyen, y compris témoignages et présomptions ;* Arrêt de la Cour de cassation 25.02.97
- Arrêt 29.06.99 *:* l’info en matière d ’infection nosocomiale
- Circulaire 15.12.2003 : l ’info en matière de transfusion
- Arrêt 20.06.2000 : le manquement à l’information constitue un préjudice si le patient correctement informé aurait pu refuser l’intervention et échapper au risque qui s’est ainsi produit
- Loi n°2002-303 du 4 mars 2002

Le prématuré et le nouveau-né : problèmes péri-opératoires

Axelrod, J Clin Invest 2016

Catégories de prématurité / faible poids de naissance	**Age gestationnel / Poids de naissance**
Preterm Extremely preterm Late preterm Early preterm	< 37 SA < 28 SA 34 – 36 SA 37 – 38 SA
Low birth weight Very low birth weight Extremely low birth weigth	< 2500 g < 1500 g < 1000 g

Immaturité cardiaque

Modifications physiologiques	**Conséquences pour la prise en charge**
Adaptation à la vie extra-utérine (débit pulmonaire, RVP)	Quantification des shunts
Le reticulum sarcoplasmique est peu développé	Assurer une calcémie normale
Le myocarde néonatal utilise exclusivement du glucose	Éviter les hypoglycémies
Myocarde néonatal peu compliant	Tolère mal la surcharge en volume et pression Débit cardiaque chrono-dépendant

Homéostasie ionique et acido-basique

Modifications physiologiques	**Conséquences pour la prise en charge**
Augmentation rapide des besoins hydriques et caloriques	Diurétiques ++
Filtration glomérulaire: - 40ml/min/m2 1ère sem, - 60 2ème sem, - > 90 après le 2ème mois	Risque de rétention hydrique
Perte tubulaire de sel (perte obligatoire de 10% du poids avant J10)	Surveiller natrémie
Perte tubulaire de bicarbonate	Difficultés à compenser seul une acidose métabolique

Immaturité cérébrale

Modifications physiologiques	**Conséquences pour la prise en charge**
Autorégulation déficiente chez les prématurés *Soul, Pediatr Res 2007*	Maintenir la PAM > valeur équivalente à l'âge gestationnel Vol diastolique par le canal artériel, collatérales…
	Eviter l'hypocapnie, l'hypotension, l'anémie
Jusqu'à 50% ont des anomalies de la substance blanche, ou AVC *Mahle, Circulation 2002*	Imagerie cérébrale préopératoire ?
Le cerveau utilise exclusivement du glucose	Eviter les hypoglycémies

Problèmes respiratoires

Modifications physiologiques	**Conséquences pour la prise en charge**
MMH et hypoxémie	Intubation, surfactant
Toxicité de l'oxygène	Maintien des pO2 plus basses est associé avec moins de bronchodysplasie selon *SUPPORT, NEJM 2010*
Hypercapnie permissive	Difficile dans le cas de certaines cardiopathies avec HTAP …
Risque d'apnées	Caféine

Cardiac surgery in infants with low birth weight is associated with increased mortality: Analysis of the Society of Thoracic Surgeons Congenital Heart Database

Christopher L. Curzon, DO,[a] Sarah Milford-Beland, MS,[b] Jennifer S. Li, MD, MHS,[a,b] Sean M. O'Brien, PhD,[b] Jeffrey Phillip Jacobs, MD,[c] Marshall Lewis Jacobs, MD,[d] Karl F. Welke, MD,[e] Andrew J. Lodge, MD,[f] Eric D. Peterson, MD, MPH,[b] and James Jaggers, MD[f]

JTCVS 2008

TABLE 3. Mortality data, diagnostic–procedure groups

	Mortality rate, overall (n = 3022)	Mortality rate, 1–2.5 kg (n = 517)	Mortality rate 2.5–4 kg (n = 2505)	Risk ratio (95% CI)	*P* value*
Single ventricle					
Norwood	22.4 (584)	30.0 (90)	21.1 (494)	1.43 (1.00–2.04)	.03
Conduit/shunt	10.5 (191)	24.4 (45)	6.2 (146)	3.97 (1.76–8.96)	<.01
TGA/IVS					
ASO	3.3 (212)	11.8 (17)	2.6 (195)	4.59 (0.96–21.90)	.01
TAPVC					
Repair	12.0 (226)	29.2 (24)	9.9 (202)	2.95 (1.39–6.23)	.01
PA/VSD					
Shunt	6.1 (99)	14.8 (27)	2.8 (72)	5.33 (1.04–27.46)	.02
Coarctation					
Arch repair	3.5 (594)	7.1 (112)	2.7 (482)	2.65 (1.12–6.24)	<.01

Quelle stratégie adopter chez les faibles poids ?

Younger gestational age is associated with worse neurodevelopmental outcomes after cardiac surgery in infancy

Donna A. Goff, MD, MS[a], Xianqun Luan, MS[b], Marsha Gerdes, PhD[b], Judy Bernbaum, MD[b], Jo Ann D'Agostino, DNP[b], Jack Rychik, MD[a], Gil Wernovsky, MD[a], Daniel J. Licht, MD[c], Susan C. Nicolson, MD[d], Robert R. Clancy, MD[c], Thomas L. Spray, MD[e], and J. William Gaynor, MD[e]

JTCVS 2012

Results—ND outcomes and GA were available for 378 infants. Median GA was 39 weeks (range, 28–42 weeks) with 351 born at 36 weeks or more (near-term/term). In univariate analysis of the near-term/term subgroup, older GA predicted better performance for cognition, visual-motor, and fine-motor skills. After covariate adjustment, older GA predicted better performance for fine-motor skills ($P = .018$). Performance for cognition, language, executive function, social skills, visual-motor, and fine-motor skills was better for those born at 39 to 40 weeks of GA or more versus those born at less than 39 weeks (all $P<.05$).

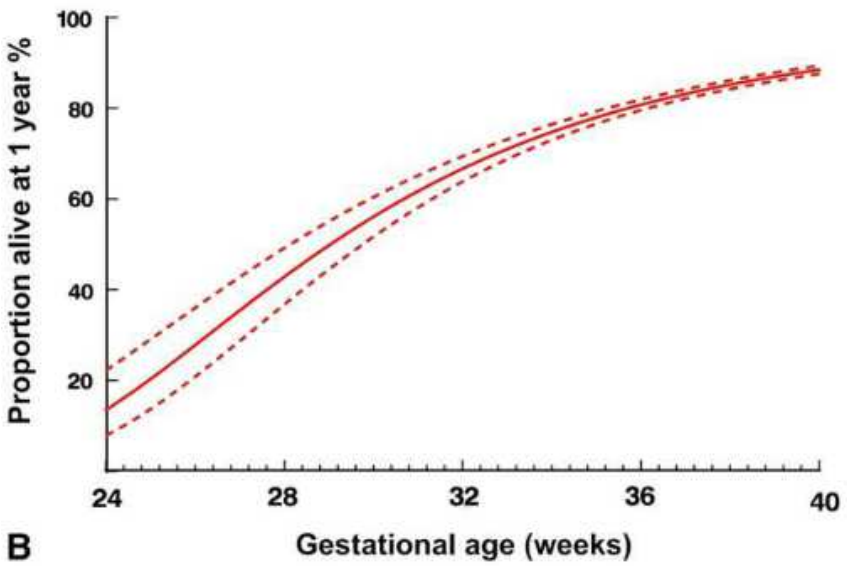
Quelle stratégie adopter chez les prématurés ?

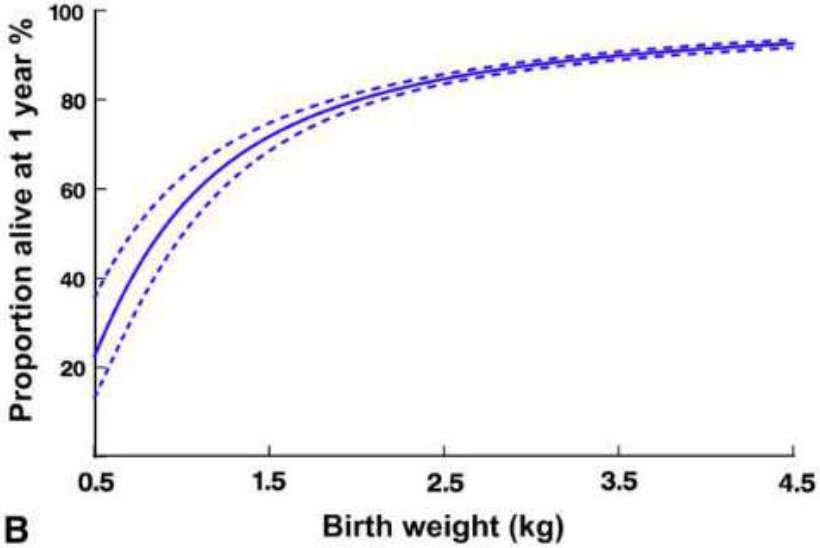
Very low-birth-weight infants with congenital cardiac lesions: Is there merit in delaying intervention to permit growth and maturation?

Edward J. Hickey, MD,[a] Yaroslavna Nosikova, BSc,[a] Hargen Zhang, MD,[a] Christopher A. Caldarone, MD,[a] Lee Benson, MD,[b] Andrew Redington, MD,[b] and Glen S. Van Arsdell, MD[a]

JTCVS 2012

n = 1618






100
80
60
40
20
Survival %
Usual strategy
Delayed strategy
0
1
2
3
Years after birth
B

Results: Low birth weight is a strong, robust and independent predictor of death within the first year of life ($P < .0001$; 99.6% bootstrap resamples). The relationship is nonlinear with an inflection point at approximately 2.0 kg, below which decrements in survival are increasingly pronounced. Prematurity is also associated with poor outcome but less reliably so ($P < .0001$; 53% resamples); its variance appears partially mitigated by colinearity with multiple factors including diagnosis and chromosomal aneuploidy. Of the 149 infants with birth weight less than 2.0 kg (highest risk and most likely to receive delayed care in this cohort), care was USUAL in 34 and DELAYED in 46. The remaining children received comfort care only (27), were not considered for intervention owing to severe noncardiac problems (12) or were routinely observed for nonurgent lesions (30). Survival between the children weighing less than 2.0 kg and receiving USUAL or DELAYED care was identical (78% $\pm$ 2% at 1 year; $P = .88$), even when adjusted via propensity score ($P = 0.65$) or multivariable analysis ($P = 0.55$). Major determinants of death in this very low-birth-weight population were antenatal diagnosis ($P = .01$), presence of congenital gastrointestinal defects ($P = .07$), or lesion type (all higher risk: anomalous pulmonary venous drainage, $P = .03$; pulmonary atresia and intact septum, $P = .05$; and truncus, $P = .01$).

Conclusions: For very low-birth-weight neonates (<2.0 kg) with congenital heart defects, imposed delays in intervention neither compromise nor improve survival. Other factors instead appear to account for survival differences, including lesion type, associated noncardiac congenital defects, and antenatal diagnosis. (J Thorac Cardiovasc Surg 2012;143:126-36)

Balloon Atrial Septostomy Is Associated With Preoperative Stroke in Neonates With Transposition of the Great Arteries

Patrick S. McQuillen, MD; Shannon E.G. Hamrick, MD; Marta J. Perez, BA; A. James Barkovich, MD; David V. Glidden, PhD; Tom R. Karl, MD; David Teitel, MD; Steven P. Miller, MD

Background—Preoperative brain injury is common in neonates with transposition of the great arteries (TGA). The objective of this study is to determine risk factors for preoperative brain injury in neonates with TGA.

Methods and Results—Twenty-nine term neonates with TGA were studied with MRI before cardiac surgery in a prospective cohort study. Twelve patients (41%) had brain injury on preoperative MRI, and all injuries were focal or multifocal. None of the patients had birth asphyxia. Nineteen patients (66%) required preoperative balloon atrial septostomy (BAS). All patients with brain injury had BAS (12 of 19; risk difference, 63%, 95% confidence interval, 41 to 85; $P=0.001$). As expected on the basis of the need for BAS, these neonates had lower systemic arterial hemoglobin saturation (Sa_{O_2}) ($P=0.05$). The risk of injury was not modified by the cannulation site for septostomy (umbilical versus femoral, $P=0.8$) or by the presence of a central venous catheter ($P=0.4$).

Conclusions—BAS is a major identifiable risk factor for preoperative focal brain injury in neonates with TGA. Imaging characteristics of identified brain injuries were consistent with embolism; however, the mechanism is more complex than site of vascular access for BAS or exposure to central venous catheters. These findings have implications for the indications for BAS, timing of surgical repair, and use of anticoagulation in TGA. (***Circulation***. **2006;113:280-285.**)

Preoperative Brain Injury in Transposition of the Great Arteries Is Associated With Oxygenation and Time to Surgery, Not Balloon Atrial Septostomy

Christopher J. Petit, MD; Jonathan J. Rome, MD; Gil Wernovsky, MD; Stefanie E. Mason, BS; David M. Shera, ScD; Susan C. Nicolson, MD; Lisa M. Montenegro, MD; Sarah Tabbutt, MD, PhD; Robert A. Zimmerman, MD; Daniel J. Licht, MD

Background—Preoperative brain injury is an increasingly recognized phenomenon in neonates with complex congenital heart disease. Recently, reports have been published that associate preoperative brain injury in neonates with transposition of the great arteries with the performance of balloon atrial septostomy (BAS), a procedure that improves systemic oxygenation preoperatively. It is unclear whether BAS is the cause of brain injury or is a confounder, because neonates who require BAS are typically more hypoxemic. We sought to determine the relationship between preoperative brain injury in neonates with transposition of the great arteries and the performance of BAS. We hypothesized that brain injury results from hypoxic injury, not from the BAS itself.

Methods and Results—Infants with transposition of the great arteries (n=26) were retrospectively included from a larger cohort of infants with congenital heart disease who underwent preoperative brain MRI as part of 2 separate prospective studies. Data collected included all preoperative pulse oximetry recordings, all values from preoperative arterial blood gas measurements, and BAS procedure data. MRI scans were performed on the day of surgery, before the surgical repair. Of the 26 neonates, 14 underwent BAS. No stroke was seen in the entire cohort, whereas 10 (38%) of 26 patients were found to have hypoxic brain injury in the form of periventricular leukomalacia. Periventricular leukomalacia was not associated with BAS; however, neonates with periventricular leukomalacia had lower preoperative oxygenation (P=0.026) and a longer time to surgery (P=0.028) than those without periventricular leukomalacia.

Conclusions—Preoperative brain injury in neonates with transposition of the great arteries is associated with hypoxemia and longer time to surgery. We found no association between BAS and brain injury. (***Circulation*. 2009;119:709-716.**)

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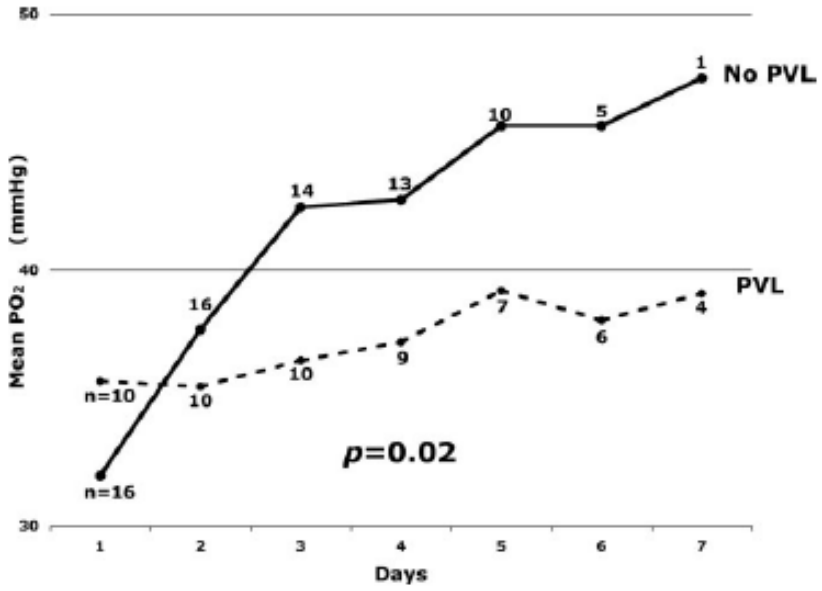

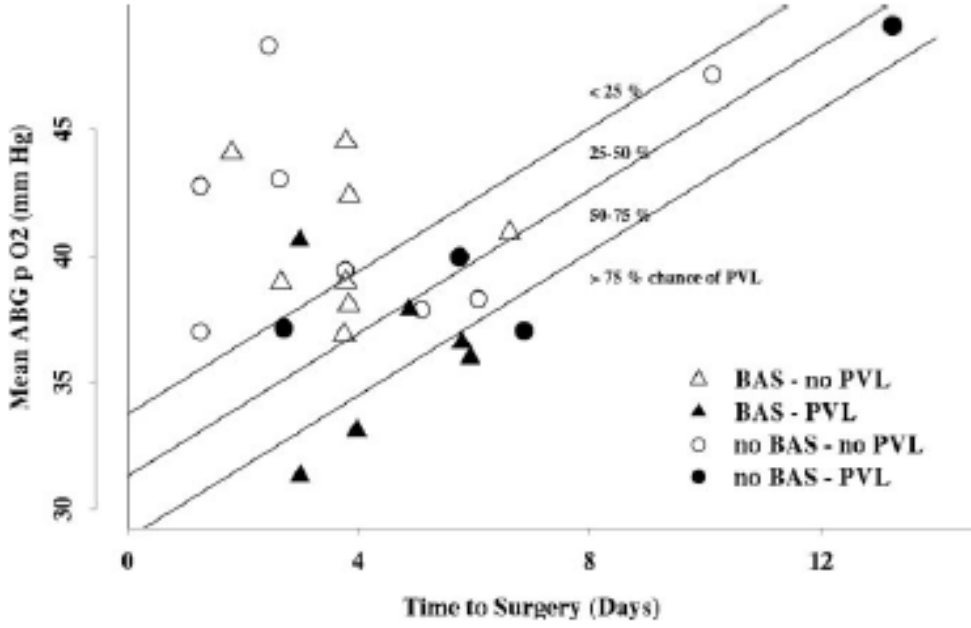

Earlier Arterial Switch Operation Improves Outcomes and Reduces Costs for Neonates With Transposition of the Great Arteries

Brett R. Anderson, MD, MBA,* Adam J. Ciarleglio, PhD,† Denise A. Hayes, MD,* Jan M. Quaegebeur, MD, PhD,‡ Julie A. Vincent, MD,* Emile A. Bacha, MD‡

New York, New York

JACC 2014

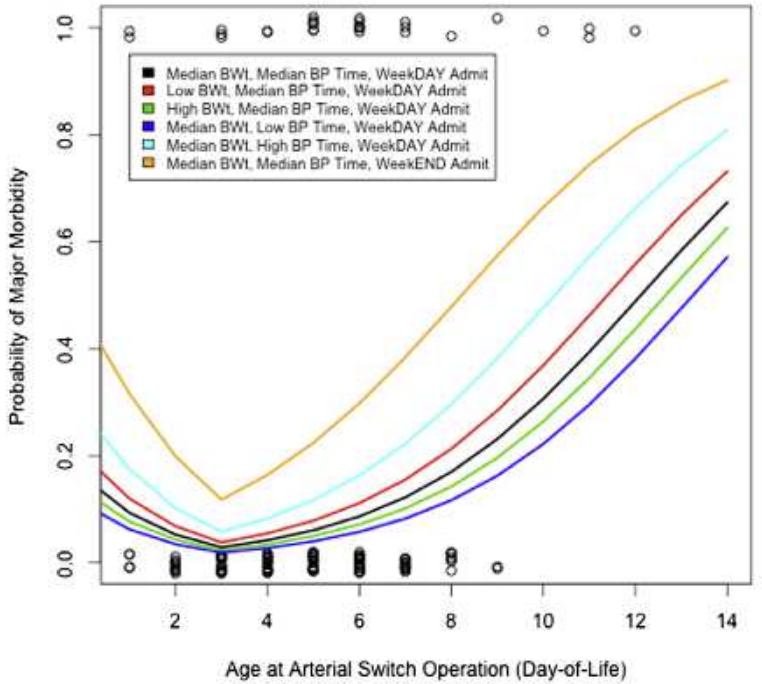

Figure 1 **Effects of Age at Arterial Switch Operation on Major Morbidity**

Results A total of 140 infants met inclusion criteria. Reimbursement data were available for them through January 1, 2012 (n = 128). The mortality rate was 1.4% (n = 2). Twenty percent (n = 28) experienced a major morbidity. The median costs were $60,000, in 2012 dollars (range: $25,000 to $549,000). The median age at operation was 5 days (range: 1 to 12 days). For every day later that surgery was performed, beyond day of life 3, the odds of major morbidity increased by 47% (range: 23% to 66%, $p < 0.001$) and costs increased by 8% (range: 5% to 11%, $p < 0.001$), after considering the effects of sex, birth weight, gestational age, year at which surgery was performed, transfer, weekend admission, insurance, surgeon, septostomy, bypass and cross-clamp times, and the presence of ventricular septal defects or abnormal coronary anatomy.

Conclusions Delay of neonatal arterial switch operation beyond 3 days is significantly associated with increased morbidity and healthcare costs. (J Am Coll Cardiol 2014;63:481–7)

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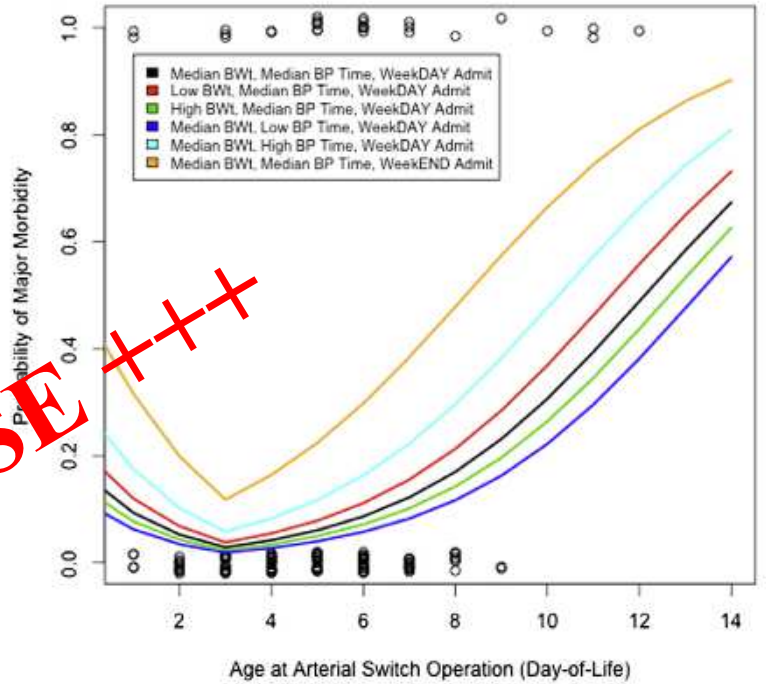
JACC 2014

CONTROVERSE +++



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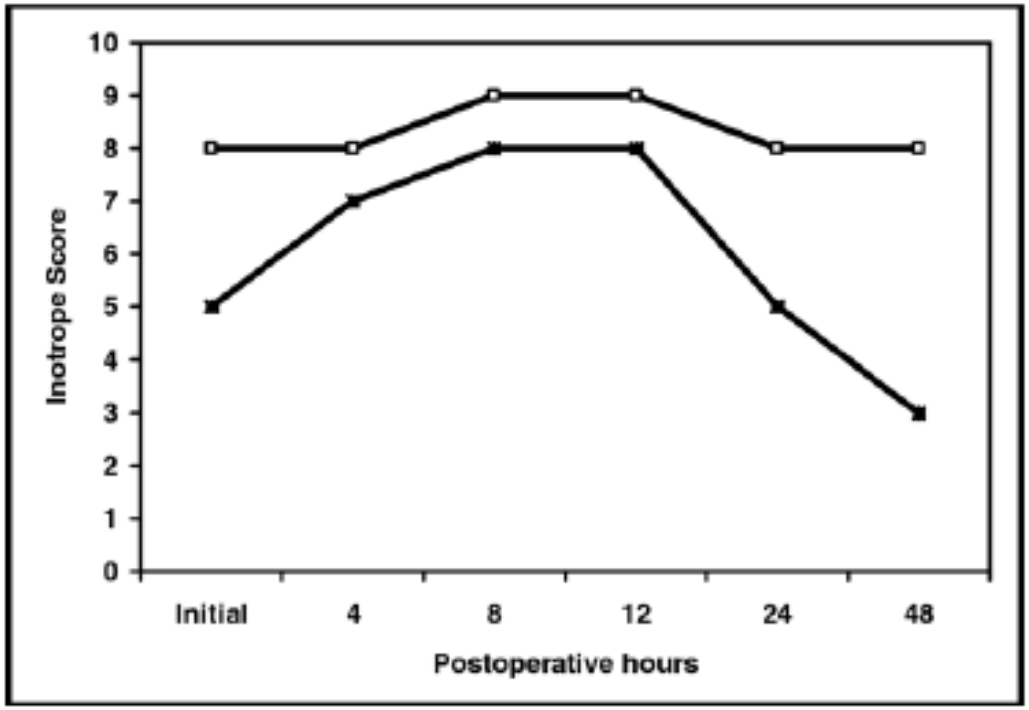
Le patient porteur de tétralogie de Fallot traité par B-bloquants

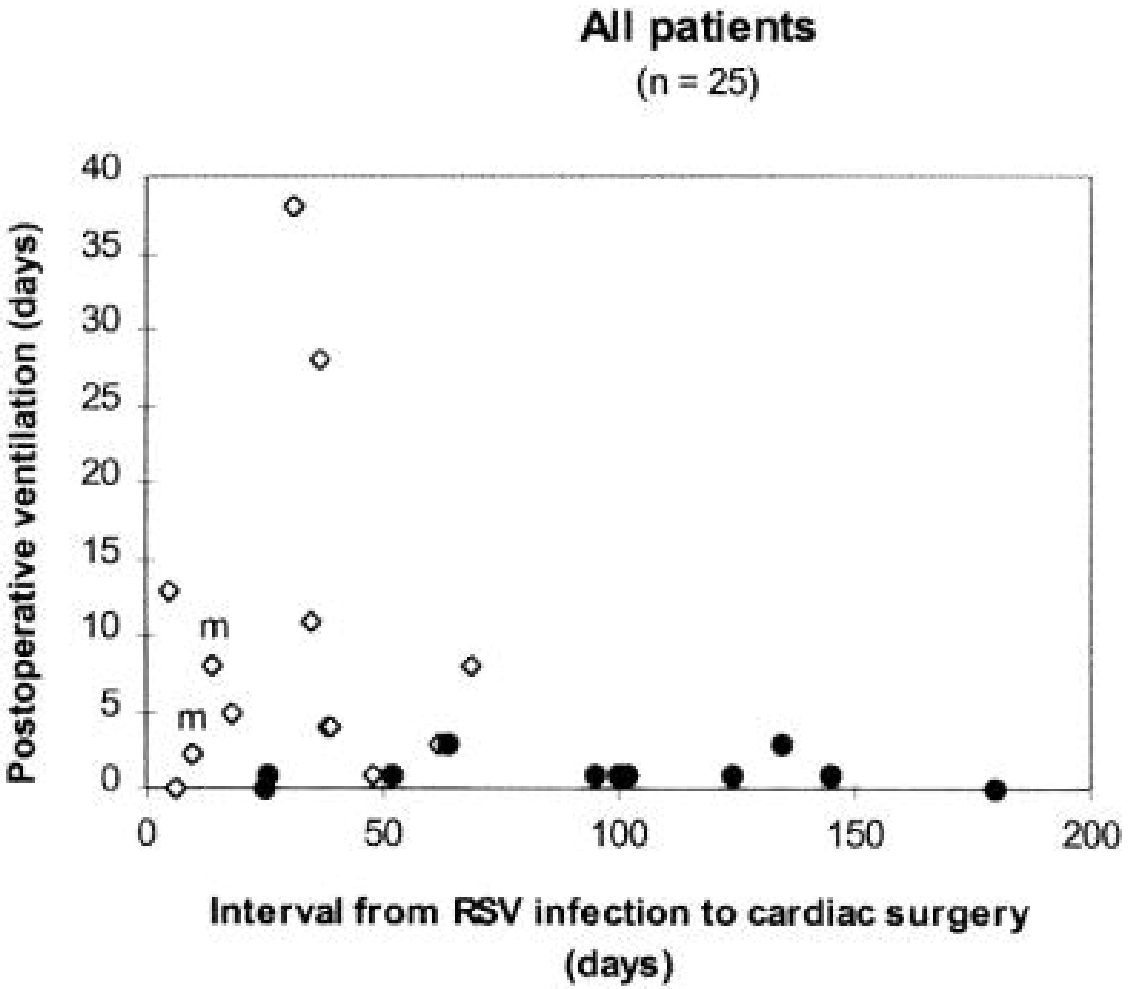
Effect of Preoperative Use of *Propranolol* on Postoperative Outcome in Patients With Tetralogy of Fallot

Eric M. Graham, MD[a,*], Varsha M. Bandisode, MD[a], Scott M. Bradley, MD[b], Fred A. Crawford, Jr., MD[b], Janet M. Simsic, MD[a], and Andrew M. Atz, MD[a]

Am J Cardiol 2008



Le patient enrhumé



Chang, Crit Care Med 1999

Rajouter McDonald, NEJM 1982

Eajouter Feltes, Cabalka 2003: palivizumab prophylaxis
J pediatr

Patient No.	Surgery	Cardiopulmonary Bypass	Interval After RSV Infection (days)	Days of Postoperative Ventilatory Support	Days of Postoperative Inotropic Support	Postoperative Pulmonary Hypertension and Treatment	Other Postoperative Complications
Group I							
1	COA repair	N	5	4	4		Recurrent RSV pneumonia, bacterial sepsis
2	Repair of double aortic arch	N	6	0	0		
3	Total repair of TOF	Y	10	2 (death)	2 (death)	Y	Sepsis, DIC, necrotizing bacterial pneumonia, RV failure, death
4	Total repair of TOF	Y	14	8 (death)	8 (death)	Y (NO, PGE_1)	Bronchopneumonia, RV failure, death
5	VSD, ASD repair	Y	18	5	2		Stridor, reintubation
6	VSD, ASD repair	Y	31	38	27		SVC thrombosis, chylothorax, pericardial effusion, bacterial and fungal sepsis
7	VSD, ASD repair PDA division	Y	35	11	12	Y (PGE_1)	LV dysfunction of unknown etiology, bacterial pneumonia
8	VSD repair PDA division	Y	37	28	21	Y (NO, PGE_1)	ARDS, bacterial pneumonia, bacterial tracheitis, tracheal stenosis
9	AV canal repair	Y	38	4	6	Y	
10	DORV repair (VSD patch only)	Y	39	4	4		
11	ASD repair	Y	48	1	0		Bacterial pneumonia, candidal and bacterial UTI
12	VSD repair	Y	62	3	3		
13	VSD repair	Y	69	8	2		Bacterial pneumonia, bacterial (staphylococcal) sepsis
Group II							
14	COA repair	N	25	0	0		
15	Bidirectional Glenn	Y	26	1	2		Transient SVC syndrome
16	VSD repair PDA division	Y	52	1	1		
17	AV canal repair	Y	64	3	4		Reactive airway disease
18	VSD repair	Y	95	1	1		
19	VSD repair	Y	100	1	1		
20	Total repair of TOF	Y	101	1	3		
21	AV canal repair	Y	102	1	2		
22	Central shunt, PA band atrial septectomy	Y	124	1	2		
23	VSD repair	Y	135	3	2		
24	VSD repair	Y	145	1	2		
25	PDA division	N	180	0	0		

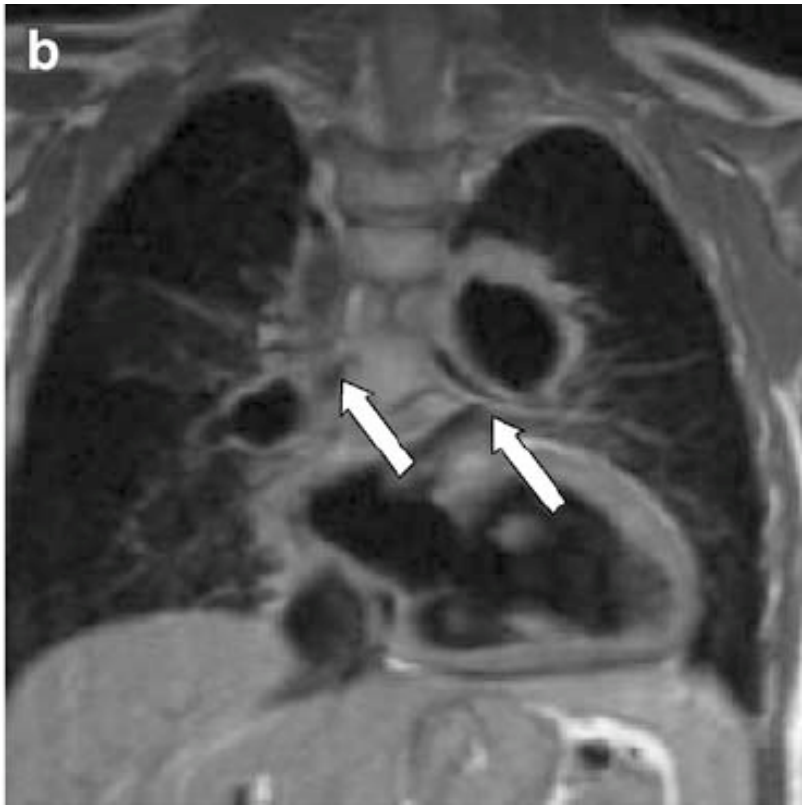
L’enfant enrhumé

Conséquences d ’une virose respiratoire:

- Hyper-réactivité bronchique persistant 6-8 sem, *Empey, Eur J Resp Dis 1983*
- Bronchospasme x 10, *Olsson, Acta Anaesthesiol Scand 1984*
- Surinfections, atélectasie, œdème glottique, *Olsson, Acta Anaesthesiol Scand 1987*
- Laryngospasme x 5, *Rolf J Clin Anest 1992*

Attitude consensuelle en anesthésie pédiatrique : report de 2-6sem si < 1an, >1an avec signes associés (toux, >38°C) si intubation nécessaire

Le patient porteur de compressions bronchiques



L ’agénésie des valves pulmonaires

- trachéo-bronchomalacie, DV
- surinfections
- le pronostic est lié à l ’état respiratoire préopératoire

Brown Ann Thorac Surg 2006 : 2 DC précoces, seul FdR = ventilation préop.

Mais aussi les autres pathologies avec Qp élevé et/ou collatéralité aorto-pulmonaire

optimisation préop : décubitus ventral

Le portage ORL

Chez l'enfant : « Preoperative bacterial colonisation of the upper airways does not predict postoperative airway infection in children », *Gardlund, Acta Paediatr 1987*

Moraxella catarrhalis, Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus

Chez l 'adulte : *Perl, NEJM 2002,* n=891 porteurs de Staphylococcus aureus

Mupirocine nasale vs placebo :

- infection du site opératoire : idem
- infection nosocomiale à Staph : 4% vs 7,7%

notre attitude : anti-staphylococcique topique intranasal pdt 5jours préop

Le portage digestif

Durant la CEC chez l 'adulte, 42% patients présentent une endotoxinémie par perméabilité intestinale accrue *Riddington, JAMA 1996*

40% des enfants porteurs d 'une cardiopathie complexe, surtout cyanogène, présentent une endotoxinémie préop *Lequier, Chest 2000*

Pneumopathies nosocomiales après chirurgie cardiaque chez l 'enfant :

- 86% BGN : Ps aeruginosa, Acinetobacter, Kl pneumoniae, E coli, Xanthomonas maltophilia
- 2;5% Staphylocoque doré, 2,5% Staphylocoque epidermidis
- 6,3% Candida *Tan, Chest 2004*

notre attitude : antibioprophylaxie adaptée à la colonisation digestive pdt 24h

L'enfant dénutri

- ⇑ des besoins énergétiques de 35% en postopérataoire

Van der Kuip, Acta Pediatr 2003

- 25% ont un poids < 3^{éme} perc
- associé à un déficit immunitaire
- ⇑ complications postop infectieuses, respiratoires
- rénutrition préop +++

L ’intubation difficile

- T21 : 40% rétrecissement sous-glottique, protrusion de la langue
- Di George : petite bouche, trachéomalacie
- APSO : trachéo-bronchomalacie et compression vasculaire
- Arc vasculaire anormal : compression trachéale

facteurs prédictifs :

- dysproportion langue-pharynx
- limitation de l ’extension atloido-occipitale
- réduction de la distance thyro- mandibulaire

La transfusion

- < 10kg, pratiquement toujours transfusés (hémodilution +)
- > 20kg, souvent pas transfusés
- 10-20kg : shunt G-D transfusés dans 60% -> intérêt du Fe (± EPO ?)
  cyanosés toujours transfusés -> intérêt du Fe

Témois de Jehovah : parents prévenus de la transfusion

Interact Cardiovasc Thorac Surg. 2013 Jun;16(6):890-1. doi: 10.1093/icvts/ivt010. Epub 2013 Mar 4.

Strategic and operational aspects of a transfusion-free neonatal arterial switch operation.

Schweiger M[1], Dave H, Kelly J, Hübler M.

Tex Heart Inst J. 2011; 38(5): 562–564. PMCID: PMC3231527

Transfusion-Free Complex Cardiac Surgery with Use of Deep Hypothermic Circulatory Arrest in a Preterm 2.96-kg Jehovah's Witness Neonate

Michael Huebler, MD, Helmut Habazettl, MD, Wolfgang Boettcher, ECCP, Hermann Kuppe, MD, Roland Hetzer, MD, and Matthias Redlin, MD

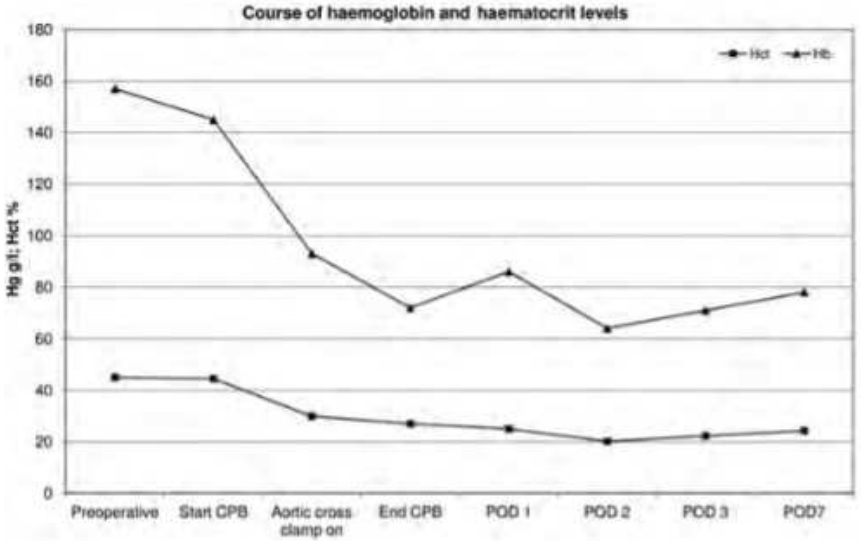


Figure 1: Course of haemoglobin (Hb) and haematocrit (Hct) levels; CPB: cardiopulmonary bypass; POD: postoperative day.

D130, Sorin Group) were used. The total priming volume of the circuit consisted of 95 mL of Deltajonin

lines and 1/8" for the arterial lines. Vacuum-assisted drainage was implemented with a peak negative pressure of 50 mmHg. A hollow-fiber membrane oxygen-

Choix de l ’abord vasculaire

Lié au geste chirurgical :

- redux -> possibile cannulation fémorale
  -> vérifier la perméabilité des principaux axes veineux

- ATCD d ’anastomose systémico-pulmonaire -> possible sténose sous-clavière homolatérale

- ATCD de plastie aortique -> vérifier si sacrifice de la sous-clavière gauche
- ne pas aborder les vaisseaux dont la thrombose pourrait mettre en danger un montage chirurgical futur (ex: thrombose jugulaire interne et dérivation cavo-pulmonaire)

Examens complémentaires

Les indispensables :

- NFS
- inonogramme sanguin, urée, créatinine
- CRP
- TP, TCA, fibrinogène
- groupe sanguin, RAI
- cartographie ORL et digestive (recherche BMR), VRS (octobre-> janvier)
- Cs ORL > 1mois, Cs stomato
- Radio thorax

Selon terrain : test de falciformation, bilan des défaillances viscérales