Chirurgie en réanimation

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QUEL TYPE DE CHIRUGIE ?

Urgente

Bas débit cardiaque extrême malgré les traitements agressifs

Arrêt cardiaque avec MCE

Assistance

Non urgente

Le transfert du patient au bloc peut dégrader l'hémodynamique

Gestes simples sur des patients complexes de réa

POURQUOI ?

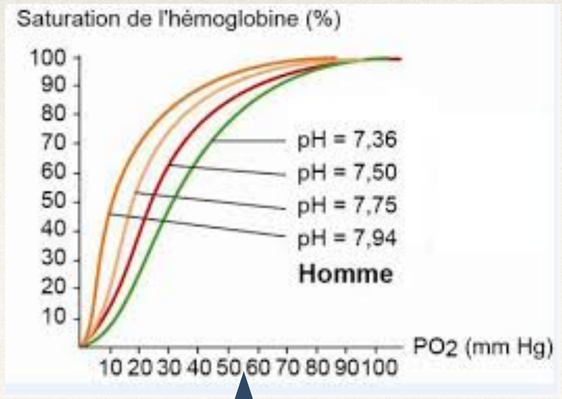
- déstabilisation du patient par le transport

Ventilation, température, hémodynamique

Modification Qp/Qs

- Rapport bénéfice / risque

HYPOTHERMIE



VASOCONSTRICTION
-Pulmonaire
-Systémique

Insuffisance rénale

Métabolisme du glucose

Hypocoagulabilité
Diminution agrégation plaquettaire

Augmentation risque infectieux

OUVERTURE STERNALE EN URGENCE

==> **altération hémodynamique majeure et brutale**

- Saignement massif dans les drains
Rupture de suture - ablation KT OG et KT AP

-Tamponnade

=>ACR post chir cardiaque = sternotomie < 5min

Dunning on behalf of the EACTS Clinical Guide- lines Committee. Guideline for resuscitation in cardiac arrest after cardiac surgery. Eur J Cardiothorac Surg 2009

- Signes ECG ± troubles du rythmeTV -FV + augmentation POG + ETT

=> Insuffisance coronaire aigüe Switch-Norwood-hydride

- chute des NIRS cérébrales et somatiques dans le cadre de thorax fermé + dégradation métabolique avec acidose et hyperlactatémie

=> défaillance cardiaque globale

DECOMPRESSION

- Tamponnade brutale et abondante : Epanchement péricardique sur drains obstrués
- Possible sur sternum ouvert :

  Bombement du patch -> ouverture

  Aspiration trop forte des drains médiastinaux : le patch comprime les cavités cardiaque et limite le remplissage
- Forte demande ventilatoire, ventilation agressive : compression cardiaque, baisse du remplissage

FERMETURE STERNALE RETARDEE

- 1ère publication en 1975
- 2 types :
    - sternum ouvert dès la sortie de bloc
    - réouverture
- Indications :
    - Hémodynamiques(oedème myocardique, dysfonction diastolique)
    - Respiratoires (compliance pulmonaire)
    - Hémostase en 2 temps

HEMODYNAMIC EFFECTS OF STERNUM CLOSURE AFTER OPEN-HEART SURGERY IN INFANTS AND CHILDREN

Peeter Jögi and Olof Werner

From the Departments of Thoracic Surgery and Anesthesiology, University Hospital, Lund, Sweden

(Submitted for publication July 1, 1984)

Table II. *Results in individual children with sternum open, closed, and reopened*

Case no.	Cardiac index, $l \times min^{-1} \times m^{-2}$			Mean arterial pressure mmHg			Central venous pressure, mmHg			Left atrial pressure, mmHg		
	Open	Closed	Re-opened	Open	Closed	Re-opened	Open	Closed	Re-opened	Open	Closed	Re-opened
1	2.44	2.17	2.34	58	50	58	18	20	18			
2	2.22	1.69	2.16	98	84	89	3	7	6	6	11	?
3	1.67	1.33	1.65	50	47	52	18	21	17	11	13	7
4***	2.46	2.36	2.60	68	65	67	13	?	14	17	17	16
5	1.82	1.53	1.64	61	55	63	13	15	15	14	16	15
6	3.15	2.64	3.00	75	69	70	17	16	11	17	16	17
7	2.52	2.23	2.44	55	49	54	?	13	11	9	10	9
8	2.46	2.14	2.42	74	76	73	10	13	11			
Mean	2.34**	2.01	2.28**	67*	62	66*	13*	15	13**	12	14	13
SD	0.46	0.45	0.46	15	14	12	5	5	4	4	3	4

*, ** Significant differnce ($p<0.05$ and $p<0.01$) compared with closed sternum.
*** Patient received dopamine 5 $\mu g \times kg^{-1} \times min^{-1}$ during measurements.

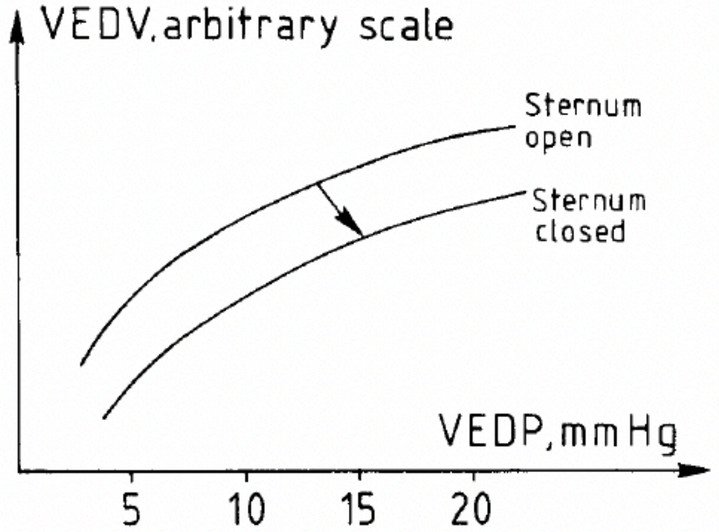
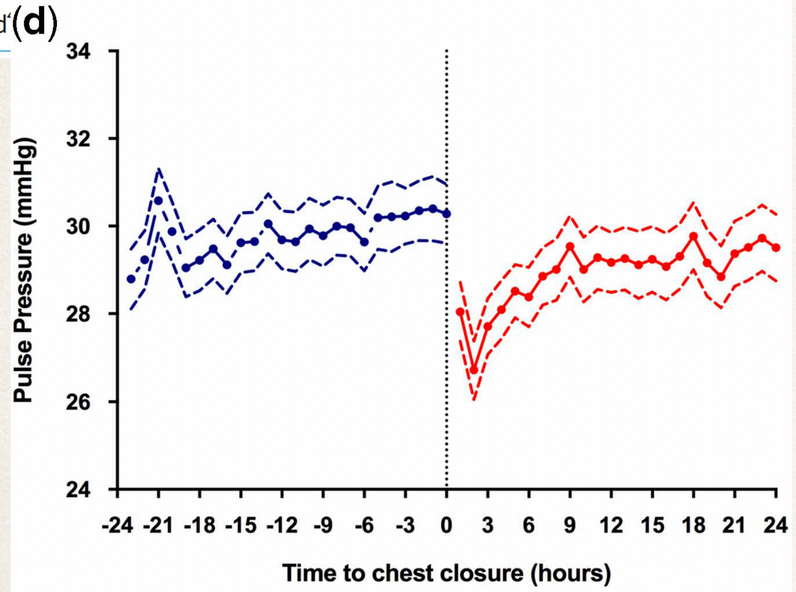


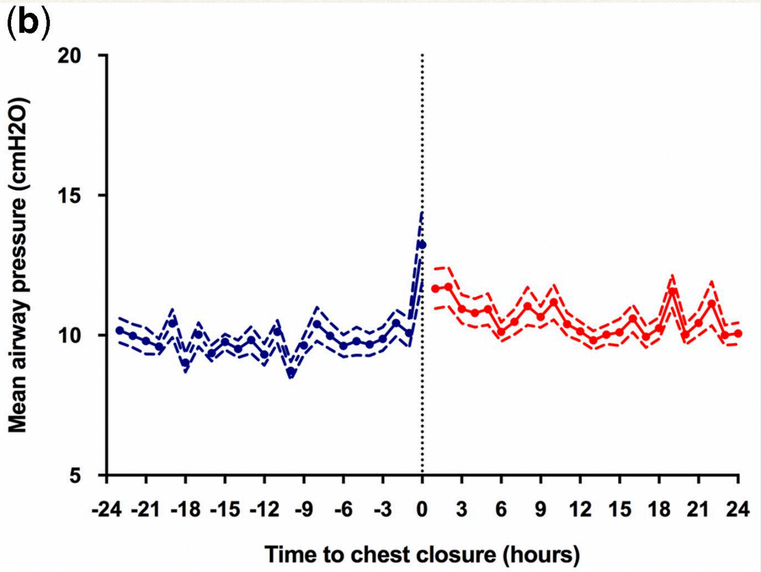
Fig. 1. Schematic explanation of the hemodynamic changes found in the study. Because of the limited space inside the thorax, extracadiac pressure increases as the sternum is closed. As a consequence, the relationship between ventricular end-diastolic pressure (VEDP) and ventricular end-diastolic volume (VEDV) is changed. The recorded mean values for central venous pressure are indicated in the diagram. The arrow thus represents our concept of what might have happened in a typical patient.

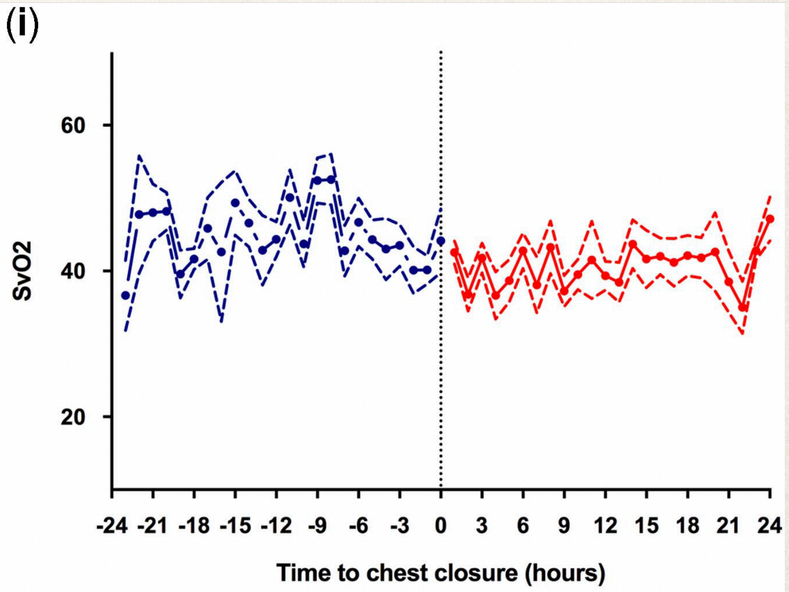
Physiologic effects of delayed sternal closure following stage 1 palliation

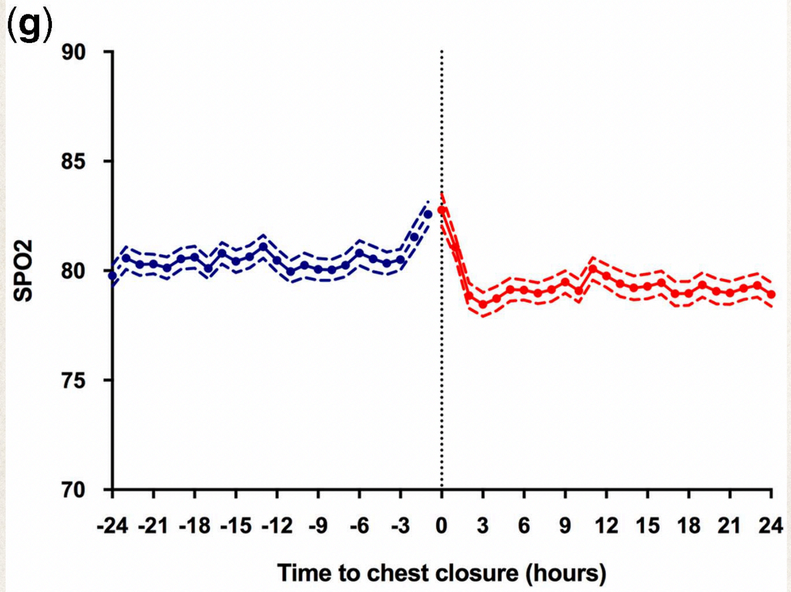
Kimberly I. Mills[1,2,3], Sarah J. van den Bosch[1,3], Kimberlee Gauvreau[1,3], Catherine K. Allan[1,3], Ravi R. Thiagarajan[1,3], David M. Hoganson[4,5], Christopher W. Baird[1]

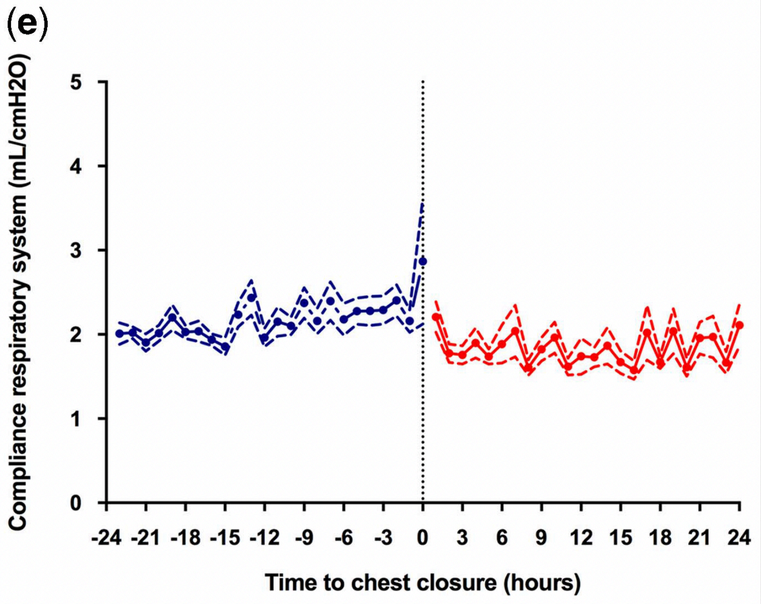
Mills, K. I.,(2018). *Physiologic effects of delayed sternal closure following stage 1 palliation. Cardiology in the Young,*











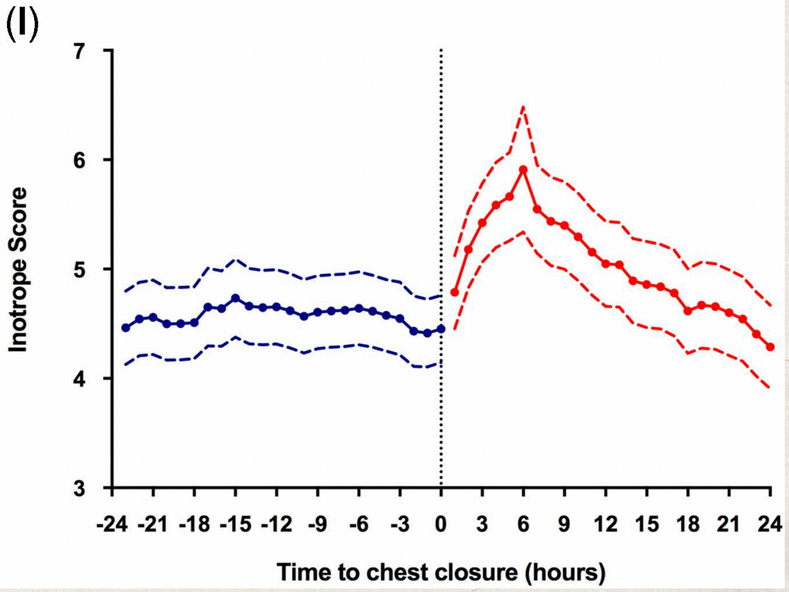
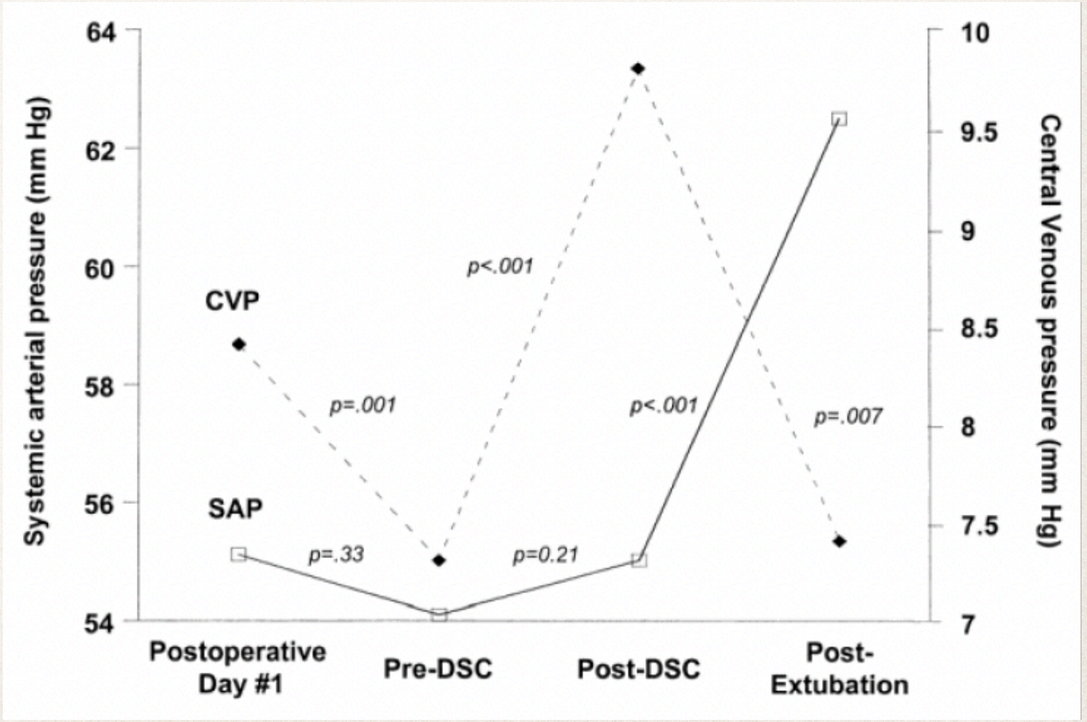


Table 2. Indications for open sternotomy

Indication	No. Patients[a]	Deaths (%)
Elective (Stage 1 HLHS repair)	16	6 (38%)
Hemodynamic considerations	75	12 (16%)
Respiratory compromise	14	1 (7%)
Persistent bleeding	25	3 (12%)
VAD/ECMO placement	5	5 (100%)

[a]Indications total greater than 128 because two indications were listed for 7 patients.

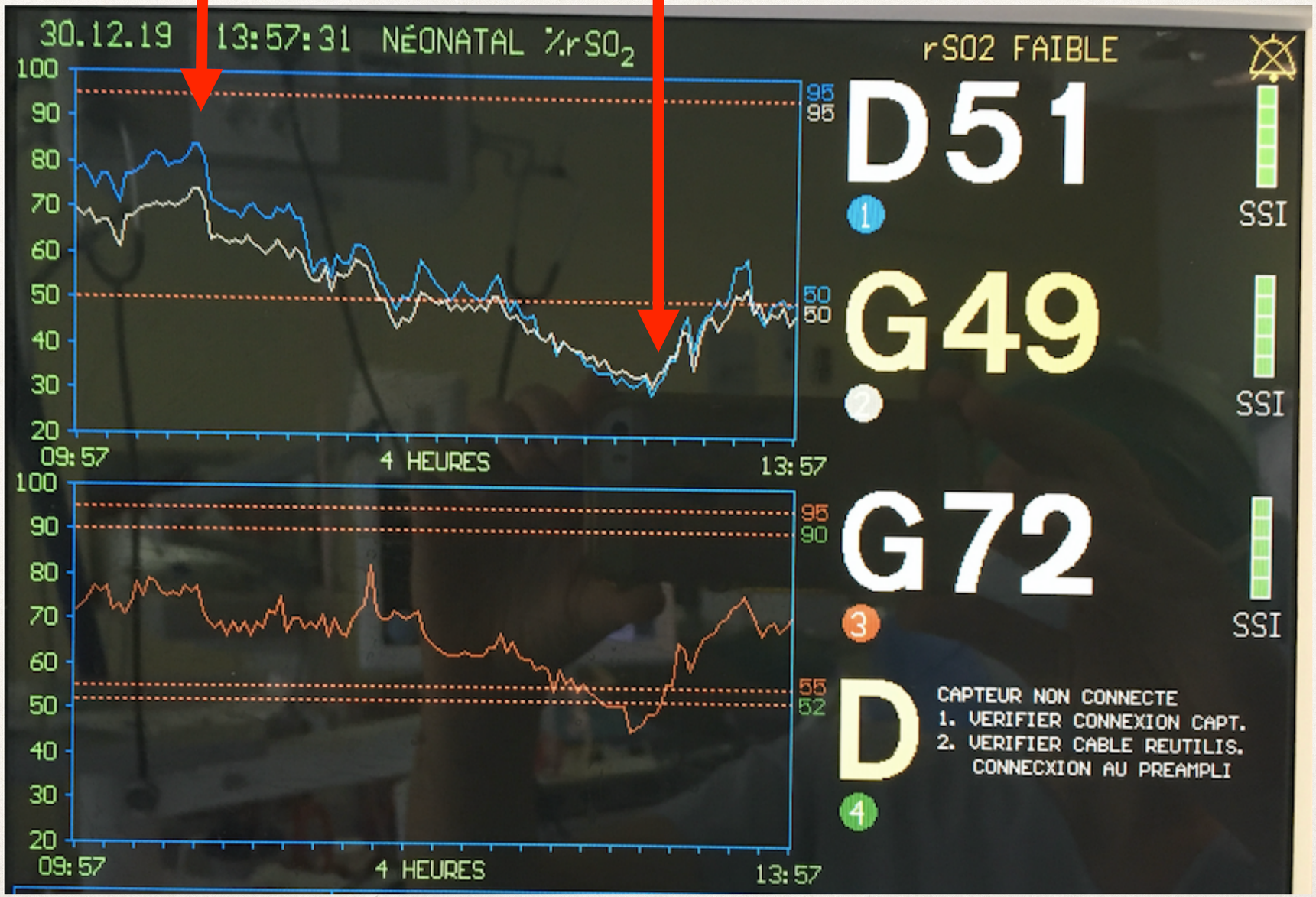
HLHS, hypoplastic left heart syndrome; VAD/ECMO, ventricular assist device or extracorporeal membrane oxygenation.



McElhinney, D. B.,et al. (2000). Management and outcomes of delayed sternal closure after cardiac surgery in neonates and infants. Critical Care Medicine, 28(4), 1180–1184

FERMETURE

OUVERTURE



Elective delayed sternal closure portends better outcome in congenital heart surgery: a retrospective observational study

Kundan et al., Indian Journal of Thoracic and Cardiovascular Surgery (October–December 2019)

Table 3 Reason for leaving the sternum open

Indication for leaving the sternum open	*N*	Percentage (%)	Mortality
Hemodynamic instability	100	45.5	21
Bleeding	110	50	10
Central ECMO	10	4.5	2

< 1 month	123	55.9%
1 month–3 month	31	14.1%
3 month–1 year	39	17.7%
1 year	27	12.3%

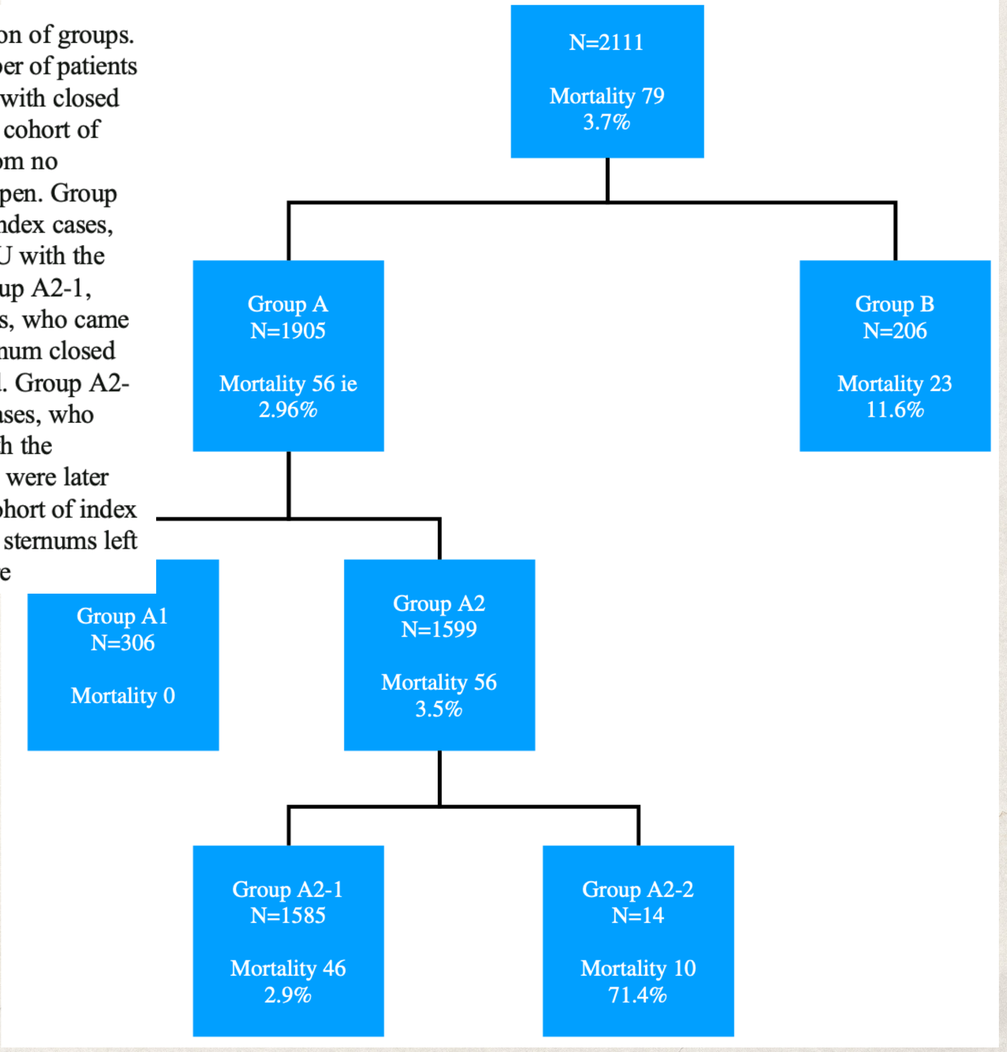


Chart 1 Classification of groups. Group A, total number of patients received in the ICU with closed sternum. Group A1, cohort of simple cases, in whom no sternums were left open. Group A2, cohort of total index cases, who came to the ICU with the sternum closed. Group A2-1, cohort of index cases, who came to the ICU with sternum closed and remained closed. Group A2-2, cohort of index cases, who came to the ICU with the sternums closed and were later opened. Group B, cohort of index cases, who had their sternums left open from the theatre

Table 3
Characteristics of patients with DSC[a]

	DSC	PDSC	SDSC
No. of patients	140	119	21
Patient age at time of operation (days)	9.6 (<1–27)	8.7 (2–23)	12.3 (4–25)
Patient weight at time of operation (kg)	3.4 (1.8–4)	3.3 (1.8–3.8)	3.7 (2.9–3.9)
Cardiopulmonary bypass time (min)	147 (39–238)	151 (49–238)	140 (39–201)
Aortic clamping time (min)	71 (35–162)	76 (41–162)	60 (35–112)
Mortality	30 (21.4%)	22 (18.5%)	8 (38%)

[a] Data presented are median with range in parentheses (mortality no. and%).

< 7 days (P . 0:014)
diagnosis of IAA and TAPVD (P , 0:05),
CBP duration >185 min (P . 0:048),
clamping > 98 min (P . 0:039)
SvO2 < 51% (P . 0:024).

Samir, K. (2002). Delayed sternal closure: a life-saving measure in neonatal open heart surgery; could it be predictable? European Journal of Cardio-Thoracic Surgery, 21(5), 787–793

RISQUE INFECTIEUX ?

1046 patients de 2005 à 2015

==> 46 réouvertures, 98,3 % fermés en réa

59 patients avec infection de cicatrice traités par ATB IV

==> 46 reprises

42 d'écouvillons + à la fermeture (SCN)

==> 19 infections avec reprise

	DSC < 5days	DSC ≥ 5 days	p-value
ECMO	35 (4)	68 (38)	<0.001
Infectious Complication	61 (7)	33 (19)	0.0008
Wound infection	47 (6)	12 (7)	0.73
Major Morbidity	122 (15)	94 (53)	0.0009
Mortality	34 (4)	29 (16)	<0.0001

Kumar, S.(2018). Liberal Use of Delayed Sternal Closure in Children Is Not Associated With Increased Morbidity. The Annals of Thoracic Surgery, 106(2), 581–586.

Number of patients	**1,000**
Male sex	569 (57)
Age at surgery (days)#	7 (3-19)
Weight (kg)*	3.4 ± 0.04
Gestational age (weeks)#	38 (37-39)
Associated Genetic Abnormalities/ Syndrome	232 (23)
Non-cardiac anatomic abnormality	164 (16)
Preoperative risk factor present	572 (57)
Surgical procedure	
STAT 3	185 (19)
Arterial Switch Operation	168 (17)
Other	17 (2)
STAT 4	483 (48)
Switch/±Arch/±VSD	129 (13)
Repair obstructed TAPVR	168 (17)
Arch/VSD	90 (9)
Truncus arteriosus repair	46 (5)
Other	50 (5)
STAT 5	332 (33)
Norwood Operation	286 (29)
Truncus/Arch repair	18 (2)
Other	28 (3)
Deep hypothermic circulatory arrest	812 (81)

Delayed Sternal Closure in Infant Heart Surgery—The Importance of Where and When: An Analysis of the STS CongenitalHeart Surgery Database

NELSON-MCMILLAN ET AL, Ann Thorac Surg 2016

n=6127 patients
Âge=8.0 jours (5.0, 24.0)
endocarditis, pneumonia, wound infection, wound dehiscence, sepsis, or mediastinitis

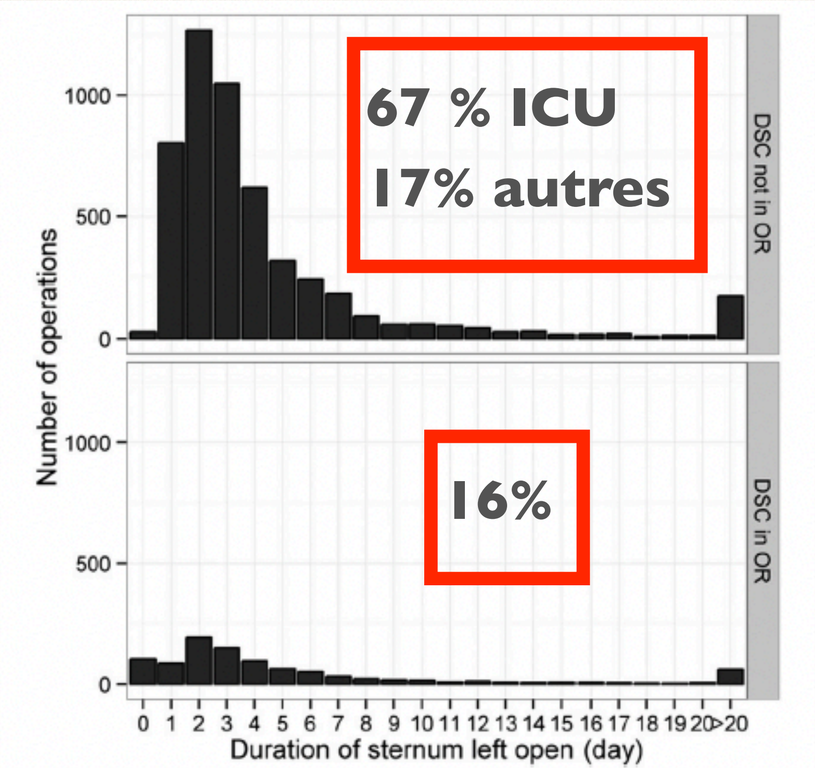


Fig 1. Number of operations (count), by duration of sternum left open (days), and by location of last DSC procedure. (DSC = delayed sternal closure; OR = operating room.)

Table 2. Infection Complication Rates

Characteristic	Any Infection Complication Unadjusted %	Adjusted Odds Ratio (95% CI)
DSC procedure in OR	20%	REFERENCE
DSC procedure not in OR	18%	1.10 (0.86, 1.41)
Duration of SLO (days)		
0-1	14%	REFERENCE
2	15%	1.08 (0.83, 1.39)
3	17%	1.29 (1.00, 1.68)
4–6	16%	1.21 (0.94, 1.58)
7+	35%	3.87 (3.00, 4.99)

CI = confidence interval; DSC = delayed sternal closure; OR = operating room; SLO = sternum left open.

Wald test of overall effect of duration categories, $p < 0.001$.

EN PRATIQUE

- Indication DSC à discuter tous les jours

- Fermeture quand patient stabilisé

  HD : amines en cours de sevrage amélioration ETT, lactates, NIRS, tropo, BNP

  Respiratoire

- Fermeture en 1 ou plusieurs temps

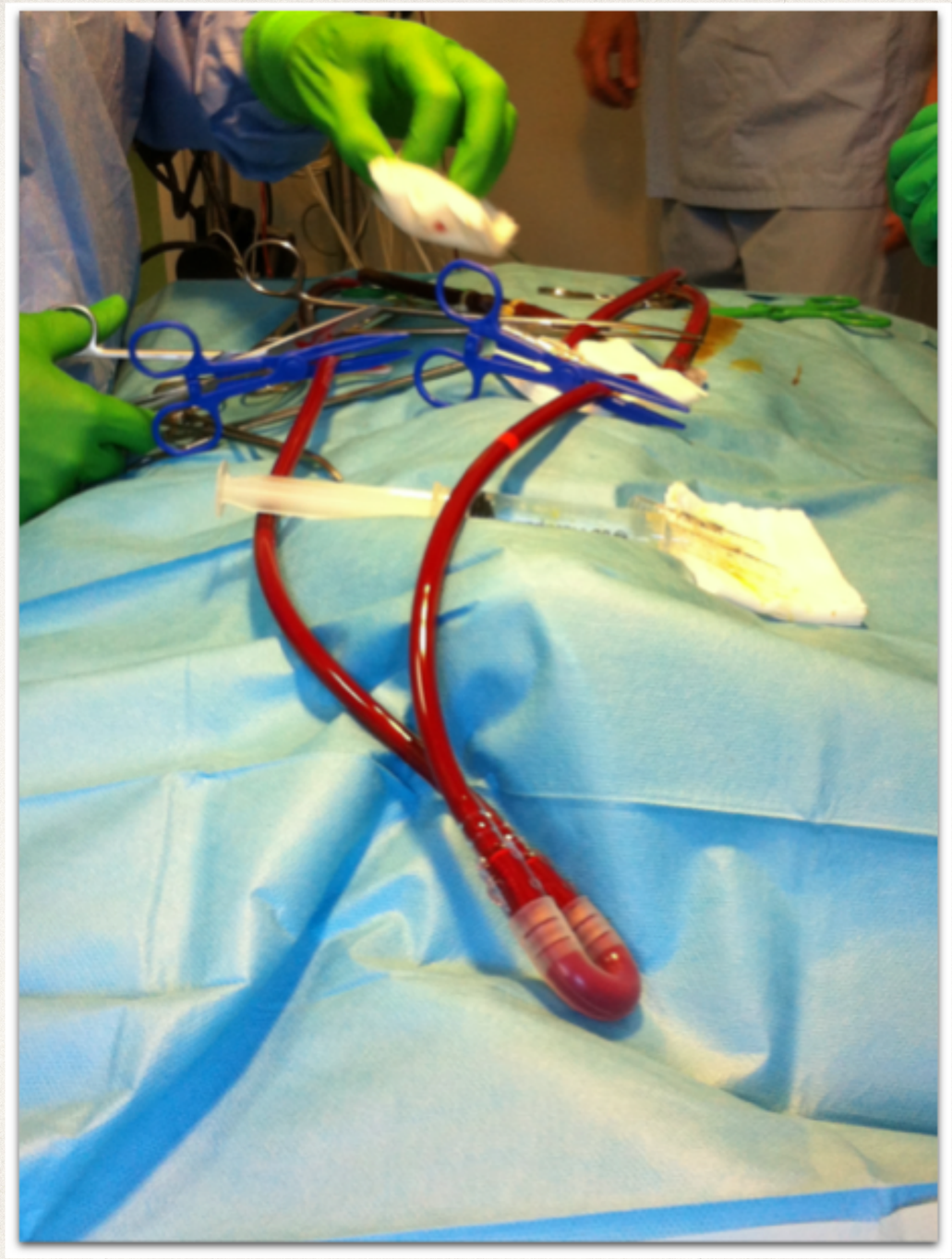
EN PRATIQUE

- scope, NIRS, respirateur visibles
- PSL en réserve
- Bistouri électrique
- PM branché et accessible
- Drogues d’urgence prêtes
- Voies accessibles pour injection et prélèvements

ECMO

- Pose, ablation, changement de circuit
- 2 médecins, 1 perfu
- Stérile
- Bicar ==> GDS du priming

CALCIUM



BERLIN HEART

BERLIN HEART

- Réouverture pour hémostase
- Changement de ventricule

    VD : le VG reste actif

    VG : arrêt de l'assistance

    Laps de temps : max 1 minute==>Entrainement obligatoire !!

    Synchroniser l'arrêt de la console


156
100
63
117/83 (97)
Attente

Asepsie

Installation, anticipation

Toutes les chirurgies sont possibles

Rapport bénéfice /risque