Evaluation du risque préopératoire

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Anesthésie Réanimation

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Hôpital
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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

score Aristotle, 2004
score RACHS-1, 2005

JTCVS 2009

An empirically based tool for analyzing mortality associated with congenital heart surgery

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Methods: Mortality risk was estimated for 148 types of operative procedures using data from 77,294 operations entered into the European Association for Cardiothoracic Surgery (EACTS) Congenital Heart Surgery Database (33,360 operations) and the Society of Thoracic Surgeons (STS) Congenital Heart Surgery Database (43,934 patients) between 2002 and 2007. Procedure-specific mortality rate estimates were calculated using a Bayesian model that adjusted for small denominators. Each procedure was assigned a numeric score (the STS–EACTS Congenital Heart Surgery Mortality Score [2009]) ranging from 0.1 to 5.0 based on the estimated mortality rate. Procedures were also sorted by increasing risk and grouped into 5 categories (the STS–EACTS Congenital

TABLE 1. Procedure names, proposed scores and categories, and data for model development

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
ASD repair, patch	8	0.1	1	4035	4028	0.2% (0.1%–0.4%)	0.3% (0.1%–0.5%)
AVC (AVSD) repair, partial (incomplete) (PAVSD)	31	0.1	1	1064	1062	0.3% (0.1%–0.8%)	0.5% (0.2%–0.9%)
ASD repair, patch + PAPVC repair	38	0.2	1	438	438	0.2% (0.0%–1.3%)	0.6% (0.2%–1.4%)
Aortic stenosis, subvalvar, repair	42	0.2	1	1834	1828	0.5% (0.3%–1.0%)	0.6% (0.3%– 1.0%)
ICD (ARCD) implantation	14	0.2	1	391	384	0.3% (0.0%–1.4%)	0.7% (0.2%–1.6%)
DCRV repair	48	0.2	1	467	467	0.4% (0.1%–1.3%)	0.8% (0.2%–1.6%)
ASD repair, primary closure	7	0.2	1	2230	2229	0.8% (0.5%–1.3%)	0.9% (0.5%–1.3%)
VSD repair, patch	32	0.2	1	6717	6702	0.9% (0.7%–1.1%)	0.9% (0.7%–1.1%)
Vascular ring repair	19	0.2	1	899	895	0.8% (0.3%–1.6%)	0.9% (0.4%–1.6%)
Coarctation repair, end to end	24	0.2	1	1303	1302	0.9% (0.5%– 1.5%)	1.0% (0.6%–1.5%)
ICD (ARCD) procedure	15	0.2	1	127	126	0.0% (0.0%–2.9%)	1.0% (0.2%–2.9%)
PFO, primary closure	6	0.2	1	717	716	0.5% (0.0%–2.6%)	1.1% (0.3%–2.5%)
AVR, bioprosthetic	55	0.3	1	101	101	0.0% (0.0%–3.6%)	1.2% (0.2%–3.4%)
VSD repair, primary closure	30	0.3	1	754	752	1.1% (0.5%–2.1%)	1.2% (0.6%–2.1%)
PVR	44	0.3	1	683	680	1.2% (0.5%–2.3%)	1.3% (0.6%–2.3%)
Conduit reoperation	77	0.3	1	1303	1299	1.3% (0.8%–3.1%)	1.4% (0.8%–2.1%)
Pacemaker procedure	3	0.3	1	1411	1408	1.3% (0.8%–2.1%)	1.4% (0.9%–2.1%)
PAPVC repair	27	0.3	1	481	481	1.2% (0.5%–2.7%)	1.5% (0.7%–2.7%)
TOF repair, ventriculotomy, nontransmuscular patch	62	0.3	1	930	928	1.4% (0.7%–2.4%)	1.5% (0.8%–2.4%)
TOF repair, no ventriculotomy	81	0.3	1	862	860	1.4% (0.7%–2.4%)	1.5% (0.8%–2.5%)
Glenn (unidirectional cavopulmonary anastomosis; unidirectional Glenn procedure)	41	0.3	1	65	65	0.0% (0.0%–5.5%)	1.5% (0.2%–4.3%)
AVC (AVSD) repair, intermediate (transitional)	33	0.3	1	431	430	1.4% (0.9%–3.1%)	1.6% (0.7%–3.0%)
Coarctation repair, interposition graft	49	0.3	1	114	114	0.9% (0.0%–4.8%)	1.7% (0.4%–4.1%)
Fontan, TCPC, lateral tunnel, fenestrated	101	0.3	1	943	942	1.6% (0.8%–2.8%)	1.7% (0.9%–2.7%)
Sinus of Valsalva, aneurysm repair	61	0.3	1	53	53	0.0% (0.0%–6.7%)	1.7% (0.5%–5.2%)
AVR, mechanical	53	0.3	1	381	381	1.6% (0.6%–3.4%)	1.7% (0.7%–3.2%)
PDA closure, surgical	5	0.4	2	1922	1918	1.8% (1.3%–2.5%)	1.9% (1.3%–2.5%)
PA, reconstruction (plasty), main (trunk)	25	0.4	2	192	191	1.6% (0.3%–4.3%)	1.9% (0.6%–4.0%)
LV to aorta tunnel repair	90	0.4	2	42	42	0.0% (0.0%–8.4%)	1.9% (0.3%–5.9%)
Valvuloplasty, mitral	26	0.4	2	1731	1747	1.9% (1.3%–2.6%)	1.9% (1.3%–2.6%)
Valvuloplasty, aortic	72	0.4	2	861	861	1.9% (1.1%–3.0%)	1.9% (1.1%–2.9%)
1½ Ventricular repair	58	0.4	2	39	39	0.0% (0.0%–9.0%)	2.0% (0.3%–6.3%)

TABLE 1. Continued

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
Arrhythmia surgery, ventricular, surgical ablation	85	0.4	2	33	33	0.0% (0.0%–10.6%)	2.2% (0.3%–6.8%)
Pacemaker implantation, permanent	2	0.4	2	1086	1077	2.1% (1.4%–3.2%)	2.2% (1.4%–3.1%)
Ross procedure	127	0.4	2	630	617	2.1% (1.1%–3.6%)	2.2% (1.3%–3.4%)
Glenn + PA reconstruction	71	0.4	2	428	426	2.1% (1.0%–4.0%)	2.2% (1.1%–3.8%)
Autopsy	4	0.4	2	30	30	0.0% (0.0%–11.6%)	2.3% (0.3%–7.3%)
Fontan, atriopulmonary connection	94	0.4	2	30	30	0.0% (0.0%–11.6%)	2.3% (0.3%–6.9%)
Bilateral bidirectional cavopulmonary anastomosis (bilateral bidirectional Glenn procedure)	63	0.4	2	449	449	2.2% (1.1%–4.1%)	2.4% (1.2%–3.8%)
Aortic root replacement, mechanical	111	0.5	2	145	145	2.1% (0.4%–5.9%)	2.4% (0.7%–5.1%)
Conduit placement, LV to PA	73	0.5	2	25	25	0.0% (0.0%–13.7%)	2.4% (0.3%–7.9%)
Coarctation repair, end to end, extended	50	0.5	2	1965	1961	2.5% (1.9%–3.3%)	2.5% (1.9%–3.3%)
Anomalous origin of coronary artery repair	119	0.5	2	327	326	2.5% (1.1%–4.8%)	2.6% (1.2%–4.4%)
RVOT procedure	40	0.5	2	1591	1583	2.6% (1.9%–3.5%)	2.6% (1.9%–3.5%)
Aortic aneurysm repair	93	0.5	2	322	321	2.5% (1.1%–4.9%)	2.6% (1.3%–4.5%)
Congenitally corrected TGA repair, VSD closure	106	0.5	2	21	21	0.0% (0.0%–16.1%)	2.6% (0.3%–8.8%)
AP window repair	35	0.5	2	125	125	2.4% (0.3%–6.9%)	2.7% (0.9%–5.6%)
Valvuloplasty, pulmonic	26	0.5	2	387	387	2.6% (1.1%–5.1%)	2.7% (1.3%–4.7%)
TOF repair, ventriculotomy, transmuscular patch	79	0.5	3	2541	2535	2.7% (2.1% 3.4%)	2.7% (2.1% 3.4%)
Aortic root replacement, bioprosthetic	120	0.5	2	20	20	0.0% (0.0%–16.8%)	2.7% (0.3%–9.3%)
Bidirectional cavopulmonary anastomosis (bidirectional Glenn procedure)	43	0.5	2	2502	2492	2.7% (2.1%–3.4%)	2.7% (2.1%–3.4%)
Aortic stenosis, supravalvar, repair	64	0.5	2	336	335	2.7% (1.3%–5.0%)	2.8% (1.4%–4.6%)
Pericardiectomy	20	0.5	2	48	48	2.1% (0.1%–11.1%)	2.9% (0.3%–7.5%)
Conduit placement, other	75	0.5	3	16	16	0.0% (0.0%–20.6%)	2.9% (0.3%–9.8%)
Aneurysm, ventricular, left, repair	107	0.5	2	47	46	2.2% (0.1%–11.5%)	3.0% (0.3%–7.8%)
Fontan, TCPC, external conduit, fenestrated	96	0.6	2	1241	1238	3.0% (2.1%–4.1%)	3.0% (2.1%–4.0%)
Pulmonary artery origin from ascending aorta (homotaxia) repair	89	0.6	2	43	43	2.3% (0.1%–12.3%)	3.1% (0.6%–8.3%)

TABLE 1. Continued

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
ASD, common atrium (single atrium), repair	18	0.6	2	44	44	2.3% (0.1%–12.0%)	3.1% (0.5%–8.3%)
PAPVC, scimitar, repair	91	0.6	2	72	72	2.8% (0.3%–9.7%)	3.2% (0.8%–7.7%)
Fontan, TCPC, external conduit, nonfenestrated	97	0.6	2	809	807	3.2% (2.1%–4.7%)	3.2% (2.1%–4.6%)
Ligation, pulmonary artery	16	0.6	2	11	11	0.0% (0.0%–28.5%)	3.4% (0.4%–12.1%)
Coronary artery fistula ligation	17	0.6	2	39	38	2.6% (0.1%–13.8%)	3.4% (0.6%–9.2%)
Aortic root replacement, valve sparing	142	0.6	2	37	37	2.7% (0.1%–14.2%)	3.4% (0.6%–9.2%)
Mitral stenosis, supravalvar mitral ring repair	74	0.6	2	86	86	3.3% (0.7%–9.9%)	3.6% (1.0%–7.7%)
Arrhythmia surgery–atrial, surgical ablation	84	0.7	2	273	272	3.7% (1.8%–6.7%)	3.6% (1.9%–3.9%)
Systemic venous stenosis repair	56	0.7	2	59	59	3.4% (0.4%–11.7%)	3.7% (0.9%–8.6%)
PA, reconstruction (plasty), branch, peripheral (at or beyond the hilar bifurcation)	70	0.7	2	189	189	3.7% (1.5%–7.5%)	3.7% (1.6%–6.5%)
Valvuloplasty, tricuspid	37	0.7	2	1182	1178	3.7% (2.7%–5.0%)	3.7% (2.8%–4.9%)
TVR	65	0.7	2	133	133	3.8% (1.2%–8.6%)	3.8% (1.5%–7.3%)
Valve replacement, truncal valve	46	0.7	2	8	8	0.0% (0.0%–36.9%)	3.8% (0.4%–13.8%)
Fontan, TCPC, lateral tunnel, nonfenestrated	99	0.7	2	104	104	3.8% (1.1%–9.6%)	3.9% (1.3%–7.9%)
Atrial fenestration closure	38	0.7	2	29	29	3.4% (0.1%–17.8%)	3.9% (0.7%–11.3%)
Cor triatriatum repair	60	0.7	2	177	176	4.0% (1.6% 8.0%)	4.0% (1.8% 7.2%)
VSD, multiple, repair	111	0.7	2	725	724	4.0% (2.7%–6.8%)	4.0% (2.7%–6.7%)
Atrial baffle procedure (non-Mustard, non-Senning)	67	0.7	2	26	26	3.8% (0.1%–19.6%)	4.0% (0.7%–11.0%)
Coarctation repair, subclavian flap	33	0.7	2	219	219	4.1% (1.9%–7.7%)	4.1% (2.0%–6.9%)
Partial left ventriculotomy (LV volume reduction surgery; Batista)	133	0.7	2	26	26	3.8% (0.1%–19.6%)	4.1% (0.7%–11.3%)
TOF repair, RV–PA conduit	80	0.7	2	362	358	4.2% (2.4%–6.8%)	4.2% (2.4%–6.4%)
Transplantation, lung(s)	139	0.8	3	94	93	4.3% (1.3% 10.6%)	4.2% (1.4% 8.6%)
Occlusion MAPCA(s)	51	0.8	3	26	26	3.8% (0.1%–19.6%)	4.2% (0.7%–12.1%)
Coarctation repair + VSD repair	112	0.8	3	329	327	4.3% (2.4%–7.1%)	4.2% (2.4%–6.6%)
Konno procedure	131	0.8	3	162	162	4.3% (1.8%–8.7%)	4.3% (1.9%–7.6%)
Coarctation repair, patch aortoplasty	32	0.8	3	393	393	4.3% (2.5%–6.8%)	4.3% (2.6%–6.5%)

TABLE 1. Continued

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
PA, reconstruction (plasty), branch, central (within the hilar bifurcation)	68	0.8	3	646	644	4.3% (2.9% 6.2%)	4.3% (2.9% 5.9%)
Aneurysm, pulmonary artery, repair	53	0.8	3	23	23	4.3% (0.1%–21.9%)	4.3% (0.8%–12.2%)
Aneurysm, ventricular, right, repair	86	0.8	3	91	91	4.4% (1.2%–10.9%)	4.3% (1.4%–8.8%)
Ventricular septal fenestration	43	0.8	3	24	24	4.2% (0.1%–21.1%)	4.4% (0.8%–12.4%)
Shunt, ligation and takedown	11	0.8	3	65	65	4.6% (1.0%–12.9%)	4.5% (1.3%–9.9%)
Hemi-Fontan procedure	78	0.8	3	262	260	4.6% (2.4%–7.9%)	4.5% (2.4%–7.1%)
AVC (AVSD) repair, complete	87	0.8	3	3869	3860	4.6% (3.9% 5.4%)	4.6% (3.9% 5.4%)
Anomalous systemic venous connection repair	54	0.8	3	166	166	4.8% (2.1%–9.3%)	4.8% (2.2%–8.2%)
ASO	115	0.8	3	3869	3868	4.8% (3.9%–5.8%)	4.8% (3.9%–5.7%)
Valvuloplasty, truncal valve	59	0.8	3	20	20	5.0% (0.1%–34.9%)	4.8% (0.8%–13.5%)
Fontan, atrioventricular connection	102	0.9	3	2	2	0.0% (0.0%–84.2%)	4.9% (0.4%–20.1%)
Pulmonary embolectomy, acute pulmonary embolus	54	0.9	3	2	2	0.0% (0.0%–84.2%)	5.0% (0.4%–19.7%)
ASD partial closure	10	0.9	3	37	37	5.4% (0.7% 18.2%)	5.1% (1.1% 12.7%)
Rastelli operation	125	0.9	3	333	333	5.4% (3.2%–8.4%)	5.3% (3.3%–7.8%)
Conduit placement, ventricle to aorta	95	0.9	3	1	1	0.0% (0.0%–97.5%)	5.3% (0.5%–21.4%)
AVR, homograft	110	1	3	30	30	6.7% (0.8% 22.1%)	5.8% (1.3% 13.8%)
RRV	136	1.1	3	26	26	7.7% (0.9%–25.1%)	6.3% (1.3%–15.5%)
Pulmonary artery sling repair	105	1.1	3	88	86	7.0% (2.6%–14.6%)	6.4% (2.3%–11.9%)
Mustard procedure	100	1.1	3	25	25	8.0% (1.0%–26.0%)	6.4% (1.4%–15.9%)
Pulmonary atresia–VSD (including TOF, PA) repair	92	1.1	3	389	389	6.6% (4.0%–10.1%)	6.4% (4.0%–9.1%)
Conduit placement, RV to PA	66	1.2	3	965	964	6.7% (5.2%–8.5%)	6.7% (5.2%–8.4%)
Pulmonary embolectomy	57	1.2	3	9	9	11.1% (0.3%–48.2%)	7.1% (1.0%–22.1%)
MVR	69	1.3	4	637	636	7.4% (5.5%–9.7%)	7.3% (5.4%–9.4%)
Pericardial drainage procedure	1	1.3	4	258	256	7.8% (4.8%–11.8%)	7.3% (4.7%–11.0%)
Aortic arch repair	82	1.4	4	787	782	7.9% (6.1%–10.0%)	7.8% (6.1%–9.8%)
Fontan revision or conversion (redo Fontan procedure)	143	1.4	4	68	68	8.8% (3.1%–18.2%)	7.9% (3.1%–14.6%)
DORV repair	130	1.4	4	7	7	14.3% (0.4%–57.9%)	7.9% (1.0%–24.0%)
DORV, intraventricular tunnel repair	132	1.4	4	583	582	8.1% (6.0%–10.6%)	8.0% (6.0%–10.3%)

TABLE 1. Continued

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
Arterial switch procedure + aortic arch repair	136	1.4	4	18	18	11.1% (1.4% 34.7%)	8.0% (1.7% 20.6%)
PA debanding	29	1.4	4	104	104	8.7% (4.0%–15.8%)	8.0% (3.7%–13.7%)
ASO and VSD repair	138	1.4	4	987	985	8.3% (6.7%–10.2%)	8.2% (6.6%–10.0%)
Cardiac tumor resection	88	1.4	4	223	220	8.6% (5.3%–13.2%)	8.3% (5.1%–12.2%)
Transplantation, heart	103	1.4	4	636	625	8.5% (6.4%–10.9%)	8.4% (6.3%–10.6%)
Coronary artery bypass	98	1.5	4	62	62	9.7% (3.6%–19.9%)	8.5% (3.5%–16.0%)
TOF–absent pulmonary valve repair	109	1.5	4	166	165	9.1% (5.2%–14.6%)	8.6% (5.0%–13.1%)
Valve excision, tricuspid (without replacement)	13	1.5	4	5	5	20.0% (0.5% 71.6%)	8.8% (1.2% 28.1%)
Shunt, systemic to pulmonary, MBTS	39	1.5	4	2793	2785	8.9% (7.9%–10.1%)	8.9% (7.9%– 10.0%)
TOF–AVC (AVSD) repair	122	1.6	4	145	144	9.7% (5.4% 15.8%)	9.1% (5.0% 14.1%)
Ross–Konno procedure	146	1.6	4	395	395	9.8% (6.1%–14.7%)	9.4% (5.8%–13.9%)
Senning procedure	108	1.6	4	45	45	11.1% (3.7%–24.1%)	9.4% (3.5%–18.6%)
Ebstein's repair	124	1.6	4	65	63	10.8% (4.4%–20.9%)	9.5% (4.0%–17.6%)
Aortic arch repair + VSD repair	123	1.7	4	339	338	10.1% (7.1% 13.8%)	9.8% (6.9% 13.1%)
PA banding	21	1.7	4	1298	1292	9.9% (8.3%–11.7%)	9.8% (8.3%–11.5%)
Aortic root replacement, homograft	121	1.7	4	104	102	10.8% (5.5%–18.5%)	9.9% (5.1%–16.2%)
Unifocalization MAPCA(s)	116	1.7	4	319	319	10.3% (7.2% 14.2%)	10.0% (7.1% 13.4%)
Aortic dissection repair	128	1.7	4	32	31	12.9% (3.6%–29.8%)	10.0% (3.0%–21.1%)
Congenitally corrected TGA repair, VSD closure and LV to PA conduit	135	1.7	4	12	12	16.7% (2.1%–48.4%)	10.1% (2.0%–25.9%)
Pulmonary atresia–VSD–MAPCA (pseudotruncus) repair	137	1.7	4	160	158	10.8% (6.4%–16.7%)	10.2% (6.1%–15.3%)
VSD creation/enlargement	83	1.8	4	107	106	11.3% (6.0%–18.9%)	10.4% (5.6%–16.6%)
HLHS biventricular repair	145	1.9	4	64	64	12.5% (5.6%–23.2%)	10.9% (4.8%– 18.8%)
TAPVC repair	104	1.9	4	1381	1379	11.2% (9.6%–13.0%)	11.2% (9.3%–12.8%)
Pulmonary venous stenosis repair	117	2	4	770	768	11.9% (8.7%–16.4%)	11.4% (8.0%–15.3%)
Shunt, systemic to pulmonary, central (from aorta or to main pulmonary artery)	47	2.1	4	663	661	12.3% (9.9%–15.0%)	12.1% (9.7%–14.6%)
Interrupted aortic arch repair	118	2.1	4	519	515	12.4% (9.7%–15.6%)	12.2% (9.6%–15.1%)
Arterial switch procedure and VSD repair + aortic arch repair	144	2.4	4	113	113	15.0% (9.0% 23.0%)	14.0% (8.5% 20.5%)
Truncus arteriosus repair	134	2.4	4	592	586	14.3% (11.6%–17.4%)	14.1% (11.4%–16.8%)
ASD creation/enlargement	9	2.5	4	138	136	15.4% (9.8% 22.6%)	14.5% (9.4% 20.9%)
Atrial septal fenestration	12	2.6	4	18	18	22.2% (6.4%–47.6%)	15.1% (4.5%–30.8%)

TABLE 1. Continued

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
Valve closure, tricuspid (exclusion, univentricular approach)	56	2.6	4	5	5	40.0% (5.3% 85.3%)	15.6% (2.7% 41.6%)
Damus–Kaye–Stansel procedure (creation of AP anastomosis without arch reconstruction)	114	2.9	5	344	343	17.3% (13.6%–21.9%)	17.1% (13.2%–21.5%)
Transplantation, heart and lung	141	3.2	5	13	13	30.8% (9.1% 61.4%)	18.7% (5.4% 39.8%)
Congenitally corrected TGA repair, atrial switch and Rastelli operation	139	3.2	5	18	18	27.8% (9.7%–53.5%)	18.9% (6.3%–37.2%)
Congenitally corrected TGA repair, atrial switch and ASO (double switch)	148	3.4	5	32	32	25.0% (11.5%–43.4%)	20.0% (9.1%–34.7%)
Norwood procedure	147	4	5	2383	2359	23.7% (22.0%–25.4%)	23.6% (21.9%–25.3%)
Truncus + IAA repair	140	5	5	43	43	34.9% (21.0%–50.9%)	29.8% (17.7%–44.3%)

ASD, Atrial septal defect; *AVC*, atrioventricular canal; *AVSD*, atrioventricular septal defect; *PAVSD*, partial atrioventricular septal defect; *PAPVC*, partial anomalous pulmonary venous connection; *ICD*, implantable cardioverter defibrillator; *ARCD*, automatic implantable cardioverter defibrillator; *DCRV*, double-chambered right ventricle; *VSD*, ventricular septal defect; *PFO*, patent foramen ovale; *AVR*, aortic valve replacement; *PVR*, pulmonary valve replacement; *TOF*, tetralogy of Fallot; *TCPC*, total cavopulmonary connection; *PDA*, patent ductus arteriosus; *PA*, pulmonary artery; *LV*, left ventricle; *RVOT*, right ventricular outflow tract; *TGA*, transposition of the great arteries; *AP*, aortopulmonary; *TVR*, tricuspid valve replacement; *RV*, right ventricle; *MAPCA*, major aortopulmonary collateral artery; *ASO*, arterial switch operation; *RRV*, repaired Ebstein's anomaly; *DORV*, double-outlet right ventricle; *MVR*, mitral valve replacement; *DOLV*, double-outlet left ventricle; *MBTS*, modified Blalock–Taussig shunt; *HLHS*, hypoplastic left heart syndrome; *TAPVC*, total anomalous pulmonary venous connection; *IAA*, interrupted aortic arch. *Dynamic 95% exact binomial confidence interval. †Bootstrap 95% bias-corrected confidence interval.

TABLE 1. Procedure names, proposed scores and categories, and data for model development

Procedure name	Procedure scores: Difficulty ranking	Procedure scores: Mortality score	Procedure scores: Mortality category	No. of operations: All operations	No. of operations: No. with nonmissing mortality	Estimated mortality risk: Unadjusted % (95% interval*)	Estimated mortality risk: Model based % (95% interval†)
ASD repair, patch	8	0.1	1	4035	4028	0.2% (0.1%–0.4%)	0.3% (0.1%–0.5%)
AVC (AVSD) repair, partial (incomplete) (PAVSD)	31	0.1	1	1064	1062	0.3% (0.1%–0.8%)	0.5% (0.2%–0.9%)
Arrhythmia surgery ventricular, surgical ablation	85	0.4	2	33	33	0.0% (0.0%–10.6%)	2.2% (0.3%–6.8%)
Pacemaker implantation, permanent (transitional)	2	0.4	2	1086	1072	2.1% (1.4%–3.2%)	2.2% (1.4%–3.1%)
Coarctation repair, interposition graft	49	0.3	1	114	114	0.9% (0.0%–4.8%)	1.7% (0.4%–4.1%)
Fontan, TCPC, lateral tunnel, fenestrated	101	0.3	1	343	342	1.6% (0.8%–2.8%)	1.7% (0.9%–2.7%)
Sinus of Valsalva, aneurysm repair	61	0.3	1	53	53	0.0% (0.0%–6.7%)	1.7% (0.3%–5.2%)
AVR, mechanical	53	0.3	1	381	381	1.6% (0.6%–3.4%)	1.7% (0.7%–3.2%)
PDA closure, surgical	5	0.4	2	1922	1918	1.8% (1.3%–2.5%)	1.9% (1.3%–2.5%)
PA, reconstruction (plasty), main (trunk)	25	0.4	2	192	191	1.6% (0.3%–4.3%)	1.9% (0.6%–4.0%)
LV to aorta tunnel repair	90	0.4	2	42	42	0.0% (0.0%–8.4%)	1.9% (0.3%–5.9%)
Valvuloplasty, mitral	26	0.4	2	1731	1747	1.9% (1.3%–2.6%)	1.9% (1.3%–2.6%)
Valvuloplasty, aortic	72	0.4	2	861	861	1.9% (1.1%–3.0%)	1.9% (1.1%–2.9%)
11/2 Ventricular repair	58	0.4	2	39	39	0.0% (0.0%–9.0%)	2.0% (0.3%–6.3%)
Bidirectional cavopulmonary anastomosis (bidirectional Glenn procedure)	43	0.5	2	2502	2492	2.7% (2.1%–3.4%)	2.7% (2.1%–3.4%)
Aortic stenosis, supravalvar, repair	64	0.5	2	336	335	2.7% (1.2%–5.0%)	3.0% (1.4%–4.6%)
Pericardiectomy	20	0.5	2	48	48	2.1% (0.1%–11.1%)	2.9% (0.5%–7.5%)
Conduit placement, other	75	0.5	2	16	16	0.0% (0.0%–20.6%)	2.9% (0.3%–9.8%)
Aneurysm, ventricular, left, repair	107	0.5	2	47	46	2.2% (0.1%–11.5%)	3.0% (0.5%–7.8%)
Fontan, TCPC, external conduit, fenestrated	96	0.6	2	1241	1238	3.0% (2.1%–4.1%)	3.0% (2.1%–4.0%)
Pulmonary artery origin from ascending aorta (homotaxia) repair	89	0.6	2	43	43	2.3% (0.1%–12.3%)	3.1% (0.6%–8.2%)
ASD, common atrium (single atrium), septation	18	0.6	2	44	44	2.3% (0.1%–12.0%)	3.1% (0.5%–8.3%)
Norwood procedure	147	4	5	2383	2359	23.7% (22.0%–25.4%)	23.6% (21.9%–25.3%)
Truncus + IAA repair	140	5	5	43	43	34.9% (21.0%–50.9%)	29.8% (17.7%–44.3%)
Sewing)							
Coarctation repair, subclavian flap	33	0.7	2	219	219	4.1% (1.9%–7.7%)	4.1% (2.0%–6.9%)
Partial left ventriculotomy (LV volume reduction surgery; Batista)	133	0.7	2	26	26	3.8% (0.1%–19.6%)	4.1% (0.7%–11.3%)
TOF repair, RV–PA conduit	80	0.7	2	362	358	4.2% (2.4%–6.8%)	4.2% (2.4%–6.4%)
Transplantation, lung(s)	139	0.8	3	94	93	4.3% (1.2%–10.6%)	4.2% (1.4%–8.6%)
Occlusion MAPCA(s)	51	0.8	3	26	26	3.8% (0.1%–19.6%)	4.2% (0.7%–12.1%)
Coarctation repair + VSD repair	112	0.8	3	329	327	4.3% (2.4%–7.1%)	4.2% (2.4%–6.6%)
Konno procedure	131	0.8	3	162	162	4.3% (1.8%–8.7%)	4.3% (1.9%–7.6%)
Coarctation repair, patch aortoplasty	32	0.8	3	393	393	4.3% (2.5%–6.8%)	4.3% (2.6%–6.5%)
PA, reconstruction (plasty), branch, central (within the hilar bifurcation)	68	0.8	3	646	644	4.3% (2.9%–6.2%)	4.3% (2.9%–5.9%)
Aneurysm, pulmonary artery, repair	53	0.8	3	23	23	4.3% (0.1%–21.9%)	4.3% (0.8%–12.2%)
Aneurysm, ventricular, right, repair	86	0.8	3	91	91	4.4% (1.2%–10.9%)	4.3% (1.4%–8.8%)
Ventricular septal fenestration	43	0.8	3	24	24	4.2% (0.1%–21.1%)	4.4% (0.8%–12.4%)
Shunt, ligation and takedown	11	0.8	3	65	65	4.6% (1.0%–12.9%)	4.5% (1.3%–9.9%)
Hemi-Fontan procedure	78	0.8	3	262	260	4.6% (2.4%–7.9%)	4.5% (2.4%–7.1%)
AVC (AVSD) repair, complete	87	0.8	3	3869	3860	4.6% (3.9%–5.4%)	4.6% (3.9%–5.4%)
Anomalous systemic venous connection repair	54	0.8	3	166	166	4.8% (2.1%–9.3%)	4.8% (2.2%–8.2%)
ASD	115	0.8	3	3869	3868	4.8% (3.9%–5.8%)	4.8% (3.9%–5.7%)
Valvuloplasty, truncal valve	59	0.8	3	20	20	5.0% (0.1%–24.9%)	4.8% (0.8%–13.5%)
Fontan, atrioventricular connection	102	0.9	3	2	2	0.0% (0.0%–84.2%)	4.9% (0.4%–20.1%)
Pulmonary embolectomy, acute pulmonary embolus	54	0.9	3	2	2	0.0% (0.0%–84.2%)	5.0% (0.4%–19.7%)
ASD partial closure	10	0.9	3	37	37	5.4% (0.7%–18.2%)	5.1% (1.1%–12.7%)
Rastelli operation	125	0.9	3	333	333	5.4% (3.2%–8.4%)	5.3% (3.3%–7.8%)
Conduit placement, ventricle to aorta	95	0.9	3	1	1	0.0% (0.0%–97.5%)	5.3% (0.5%–21.4%)
AVR, homograft	110	1	3	30	30	6.7% (0.8%–22.1%)	5.8% (1.3%–13.8%)
RVP	136	1.1	3	26	26	7.7% (0.9%–25.1%)	6.3% (1.3%–15.5%)
Pulmonary artery sling repair	105	1.1	3	88	86	7.0% (2.6%–14.6%)	6.4% (2.3%–11.9%)
Mustard procedure	100	1.1	3	25	25	8.0% (1.0%–26.0%)	6.4% (1.4%–15.9%)
Pulmonary atresia–VSD (including TOF, PA) repair	92	1.1	3	289	289	6.6% (4.0%–10.1%)	6.4% (4.0%–9.1%)
Conduit placement, RV to PA	66	1.2	3	965	964	6.7% (5.2%–8.5%)	6.7% (5.2%–8.4%)
Pulmonary embolectomy	37	1.2	3	9	9	11.1% (0.3%–48.2%)	7.1% (1.0%–22.1%)
MVR	69	1.3	4	637	636	7.4% (5.5%–9.7%)	7.3% (5.4%–9.4%)
Pericardial drainage procedure	1	1.3	4	258	256	7.8% (4.8%–11.8%)	7.3% (4.7%–11.0%)
Aortic arch repair	82	1.4	4	787	782	7.9% (6.1%–10.0%)	7.8% (6.1%–9.8%)
Fontan revision or conversion (exclo Fontan procedure)	143	1.4	4	68	68	8.8% (3.3%–18.2%)	7.9% (3.1%–14.6%)
DORV repair	130	1.4	4	7	7	14.3% (0.4%–57.9%)	7.9% (1.0%–24.0%)
DORV, intraventricular tunnel repair	132	1.4	4	583	582	8.1% (6.0%–10.6%)	8.0% (6.0%–10.3%)
Arterial switch procedure + aortic arch repair	136	1.4	4	18	18	11.1% (1.4%–34.7%)	8.0% (1.7%–20.6%)
PA debanding	29	1.4	4	104	104	8.7% (4.0%–15.8%)	8.0% (3.7%–13.7%)
ASD and VSD repair	138	1.4	4	987	985	8.3% (6.7%–10.2%)	8.2% (6.6%–10.0%)
Cardiac tumor resection	88	1.4	4	223	220	8.6% (5.3%–13.2%)	8.3% (5.1%–12.2%)
Transplantation, heart	103	1.4	4	636	625	8.5% (6.4%–10.9%)	8.4% (6.3%–10.6%)
Coronary artery bypass	98	1.5	4	62	62	9.7% (3.6%–19.9%)	8.5% (3.5%–16.0%)
TOF–absent pulmonary valve repair	109	1.5	4	166	165	9.1% (5.2%–14.6%)	8.6% (5.0%–13.1%)
Valve excision, tricuspid (without replacement)	13	1.5	4	5	5	20.0% (0.5%–71.6%)	8.8% (1.2%–28.1%)
Shunt, systemic to pulmonary, MBTS	39	1.5	4	2793	2785	8.9% (7.9%–10.1%)	8.9% (7.9%–10.0%)
TOF–AVC (AVSD) repair	132	1.6	4	145	144	9.7% (5.4%–15.8%)	9.1% (5.0%–14.1%)
Ross–Konno procedure	146	1.6	4	395	395	9.8% (6.1%–14.7%)	9.4% (5.8%–13.9%)
Senning procedure	108	1.6	4	45	45	11.1% (3.7%–24.1%)	9.4% (3.5%–18.6%)
Ebstein's repair	124	1.6	4	65	65	10.8% (4.4%–20.9%)	9.5% (4.0%–17.6%)
Aortic arch repair + VSD repair	123	1.7	4	339	338	10.1% (7.1%–13.8%)	9.8% (6.9%–13.1%)
PA banding	21	1.7	4	1298	1292	9.9% (8.3%–11.7%)	9.8% (8.3%–11.5%)
Aortic root replacement, homograft	121	1.7	4	184	182	10.8% (5.5%–18.5%)	9.9% (5.1%–16.2%)
Unifocalization MAPCA(s)	116	1.7	4	319	319	10.3% (7.2%–14.2%)	10.0% (7.1%–13.4%)
Aortic dissection repair	128	1.7	4	32	31	12.9% (3.6%–29.8%)	10.0% (3.0%–21.1%)
Congenitally corrected TGA repair, VSD closure and LV to PA conduit	135	1.7	4	12	12	16.7% (2.1%–48.4%)	10.1% (2.0%–25.9%)
Pulmonary atresia–VSD–MAPCA (pseudotruncus) repair	137	1.7	4	160	158	10.8% (6.4%–16.7%)	10.2% (6.1%–15.3%)
VSD creation/enlargement	83	1.8	4	107	106	11.3% (6.0%–18.9%)	10.4% (5.6%–16.6%)
HLHS biventricular repair	145	1.9	4	64	64	12.5% (5.6%–23.2%)	10.9% (4.8%–18.8%)
TAPVC repair	104	1.9	4	1381	1379	11.2% (9.6%–13.0%)	11.2% (9.3%–12.8%)
Pulmonary venous stenosis repair	117	2	4	770	768	11.9% (8.7%–16.4%)	11.4% (8.0%–15.3%)
Shunt, systemic to pulmonary, central (from aorta or to main pulmonary artery)	47	2.1	4	663	661	12.3% (9.9%–15.0%)	12.1% (9.7%–14.6%)
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Atrial septal fenestration	12	2.6	4	18	18	22.2% (6.4%–47.6%)	15.1% (4.5%–30.8%)
Valve closure, tricuspid (exclusion, univentricular approach)	56	2.6	4	5	5	40.0% (5.3%–85.3%)	15.6% (3.7%–41.6%)
Damus–Kaye–Stansel procedure (creation of AP anastomosis without arch reconstruction)	114	2.9	5	344	343	17.3% (13.6%–21.9%)	17.1% (13.2%–21.5%)
Transplantation, heart and lung	141	3.2	5	13	13	30.8% (9.1%–61.4%)	18.7% (5.4%–39.8%)
Congenitally corrected TGA repair, atrial switch and Rastelli operation	139	3.2	5	18	18	27.8% (9.7%–53.5%)	18.9% (6.3%–37.2%)
Congenitally corrected TGA repair, atrial switch and ASO (double switch)	148	3.4	5	32	32	25.0% (11.5%–43.4%)	20.0% (9.1%–34.7%)
Norwood procedure	147	4	5	2383	2359	23.7% (22.0%–25.4%)	23.6% (21.9%–25.3%)
Truncus + IAA repair	140	5	5	43	43	34.9% (21.0%–50.9%)	29.8% (17.7%–44.3%)

ASD, Atrial septal defect; AVC, atrioventricular canal; AVSD, atrioventricular septal defect; PAVSD, partial atrioventricular septal defect; PAPVC, partial anomalous pulmonary venous connection; ICD, implantable cardioverter defibrillator; AICD, automatic implantable cardioverter defibrillator; DCRV, double-chambered right ventricle; VSD, ventricular septal defect; PFO, patent foramen ovale; AVR, aortic valve replacement; PVR, pulmonary valve replacement; TOF, tetralogy of Fallot; TCPC, total cavopulmonary connection; PDA, patent ductus arteriosus; PA, pulmonary artery; LV, left ventricle; RVOT, right ventricular outflow tract; TGA, transposition of the great arteries; AP, aortopulmonary; TVR, tricuspid valve replacement; RV, right ventricle; MAPCA, major aortopulmonary collateral artery; ASO, arterial switch operation; RRV, rejection à l'étage ventriculaire (REV procedure); MVR, mitral valve replacement; DORV, double-outlet left ventricle; MBTS, modified Blalock–Taussig shunt; HLHS, hypoplastic left heart syndrome; TAPVC, total anomalous pulmonary venous connection; IAA, interrupted aortic arch. *Dennis 95% exact binomial confidence interval. †Bootstrap 95% Bayesian credible interval.

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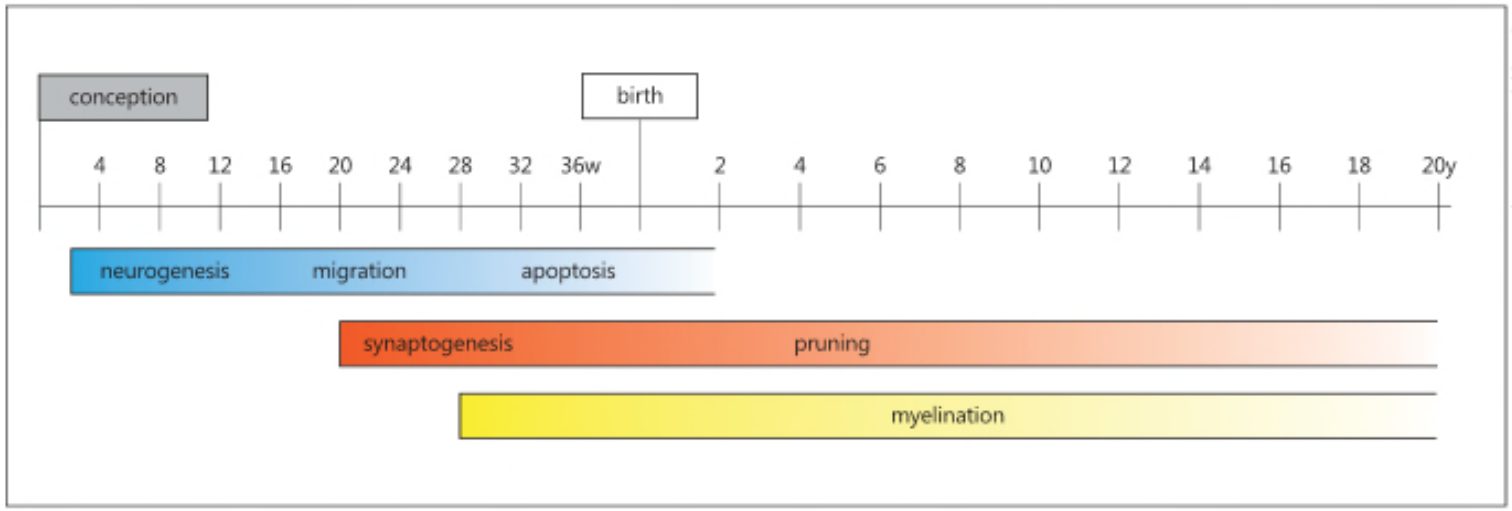
Perspective

MARCH 9, 2017

Anesthesia and Developing Brains — Implications of the FDA Warning

Dean B. Andropoulos, M.D., M.H.C.M., and Michael F. Greene, M.D.



Agent	GABA	NMDA	μ-Opioid	α_2-Adrenergic
Halogenated anesthetics (sevoflurane, isoflurane, desflurane)	+			
Nitrous oxide		–		
Benzodiazepines	+			
Propofol	+			
Barbiturates	+			
Etomidate	+			
Chloral hydrate	+			
Ketamine		–		
Opioids			+	
Dexmedetomidine				+

GABA, γ-aminobutyric acid; NMDA, N-methyl-D-aspartate; +, agonist; –, antagonist.

degenerative changes and long-term neurobehavioral changes with all common GABA- and NMDA-binding agents [1].

1 Rappaport BA, Suresh S, Hertz S, Evers AS, Orser BA: Anesthetic neurotoxicity – clinical implications of animal models. N Engl J Med 2015;372:796–797.

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/m^2 1ère sem, - 60ml/min/m^2 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 pO_2 plus basses est associé avec moins de bronchodysplasie *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 $P<.05$).

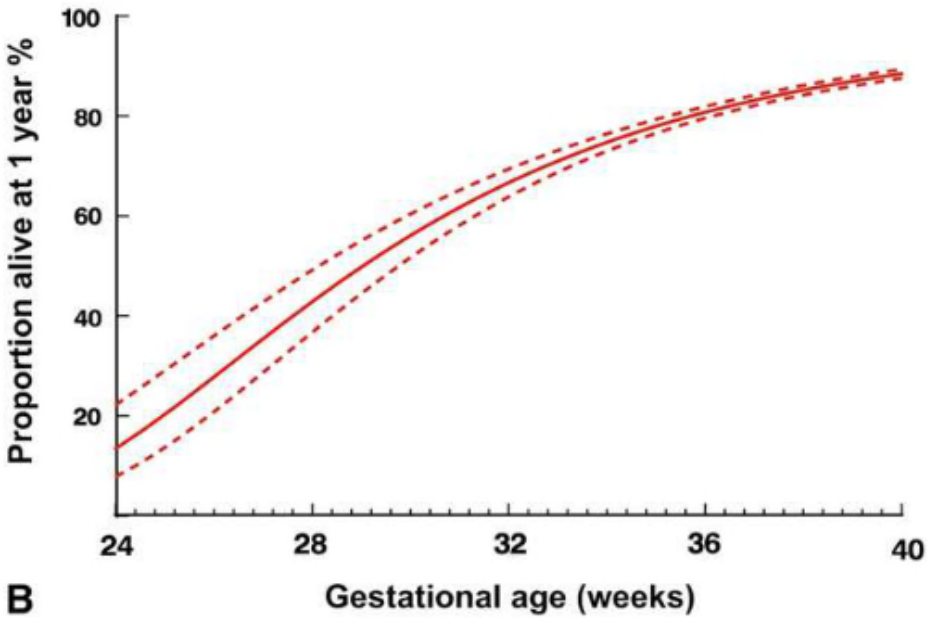
Quelle stratégie adopter chez les prématurés ?

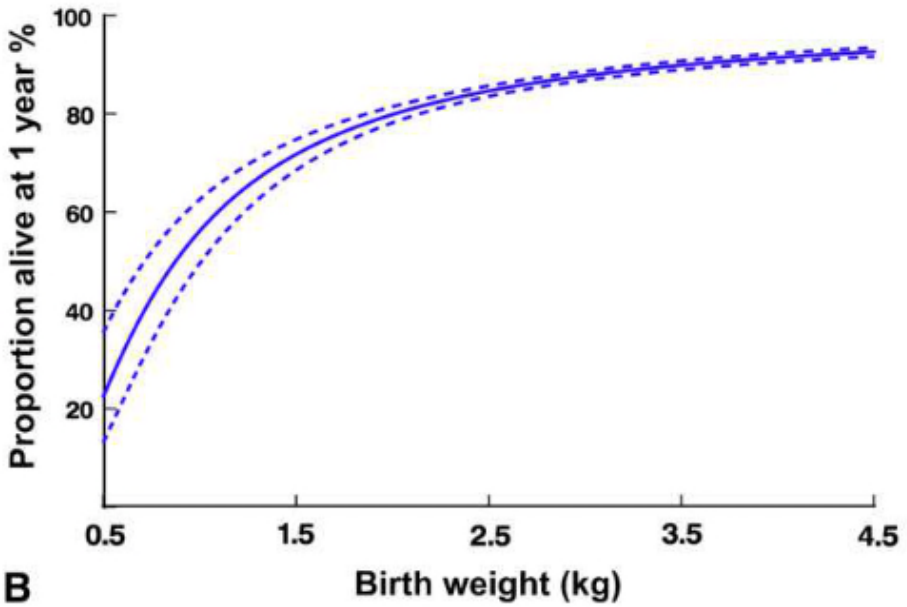
Very low-birth-weight infants with congenital cardiac lesions: Is there merit in delaying intervention to permit growth and maturation?

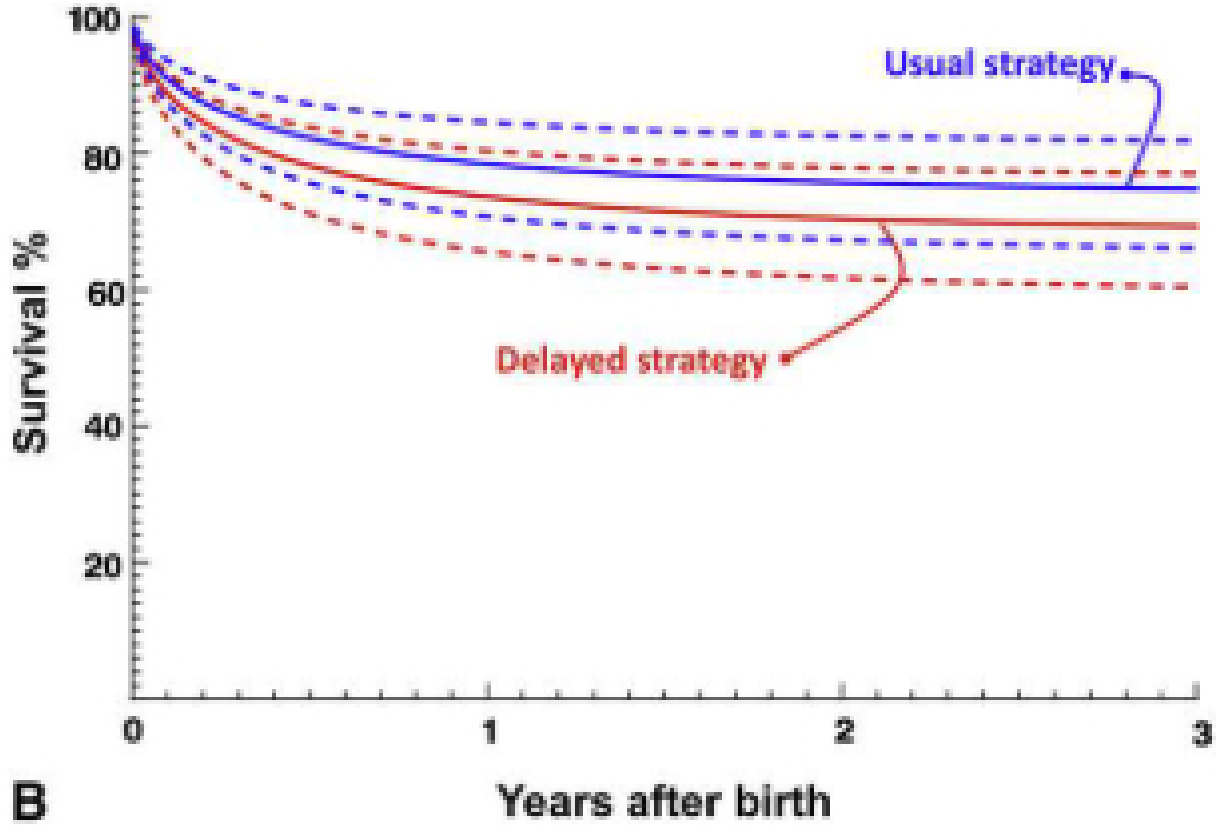
Edward J. Hickey, MD,[a] Yaroslavna Nosikova, BSc,[a] Hargen Zhang, MD,[a] Christopher A. Caldarone, MD,[a] Lee Benson, MD,[b] Andrew Redington, MD,[b] and Glen S. Van Arsdell, MD[a]

JTCVS 2012

n = 1618






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

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% ± 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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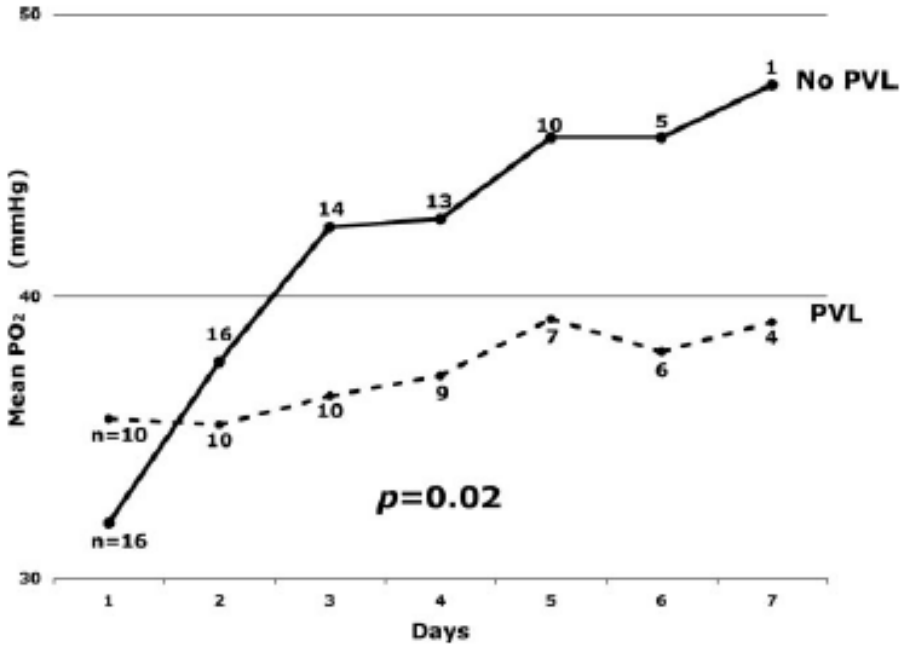

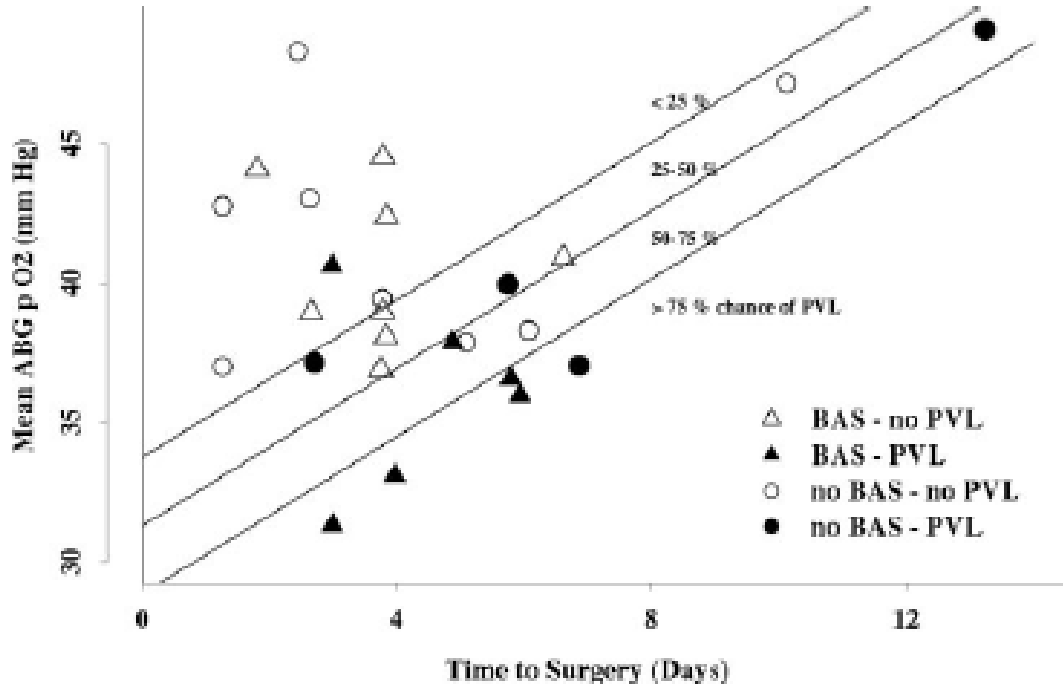

Earlier Arterial Switch Operation Improves Outcomes and Reduces Costs for Neonates With Transposition of the Great Arteries

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

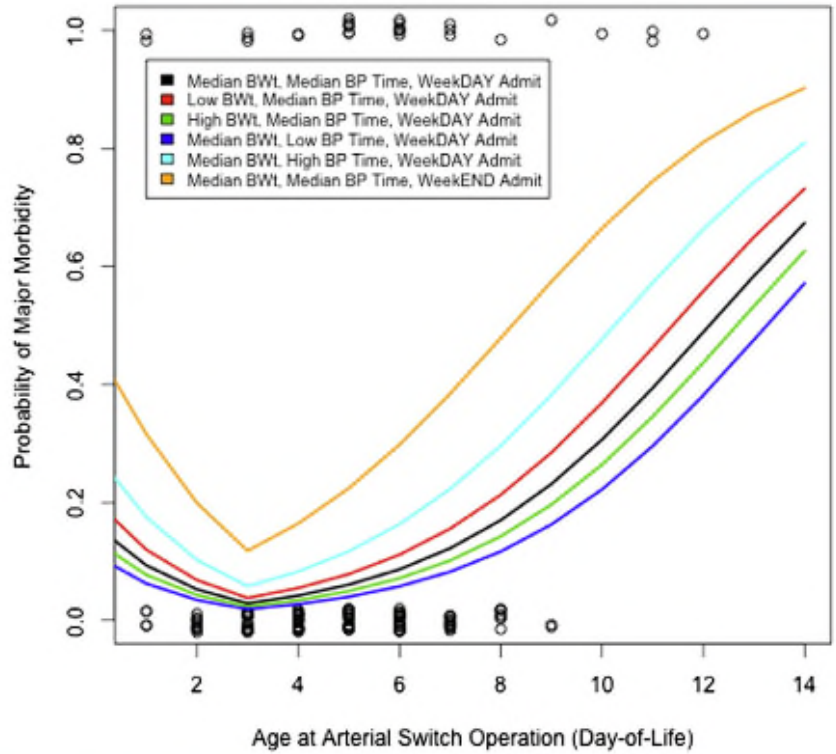

Figure 1 Effects of Age at Arterial Switch Operation on Major Morbidity

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) © 2014 by the American College of Cardiology Foundation

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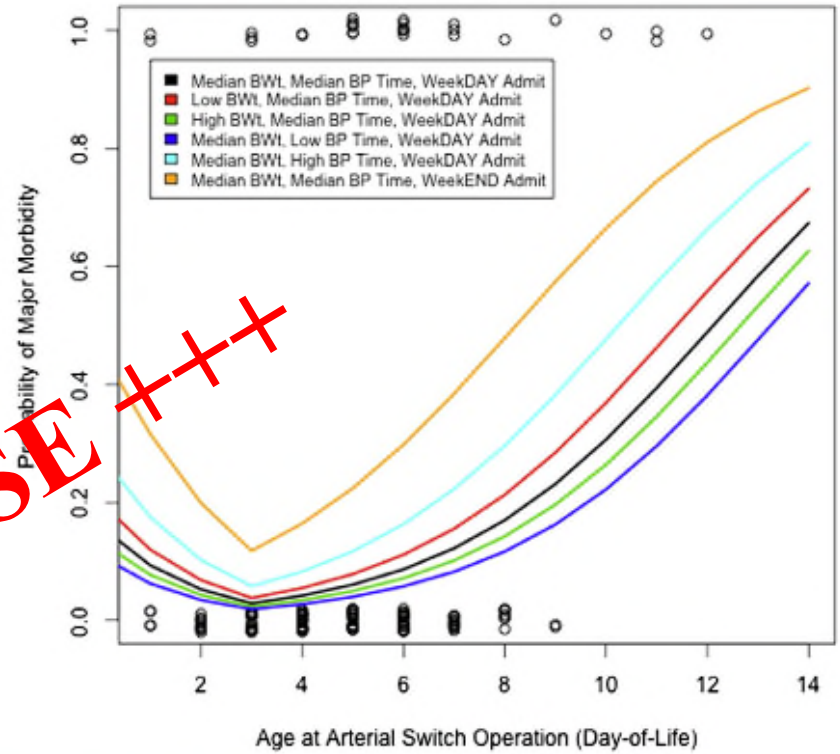
JACC 2014

CONTROVERSE +++



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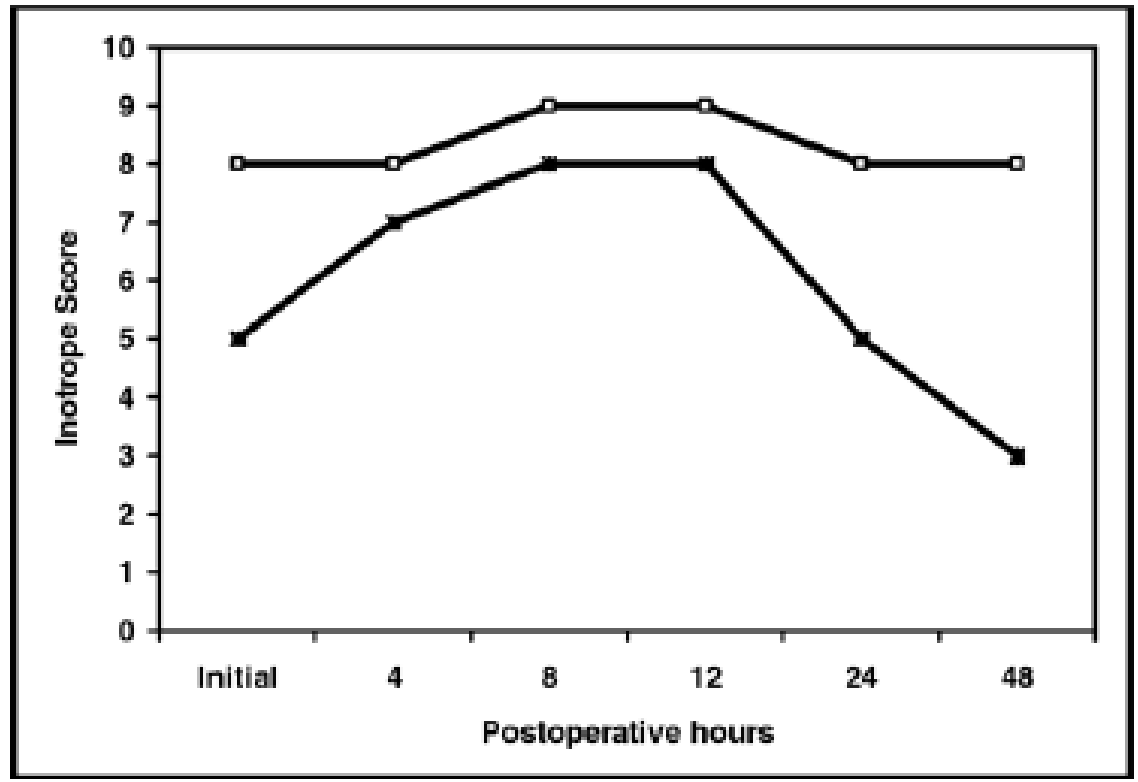
Le patient porteur de tétralogie de Fallot traité par B-bloquants

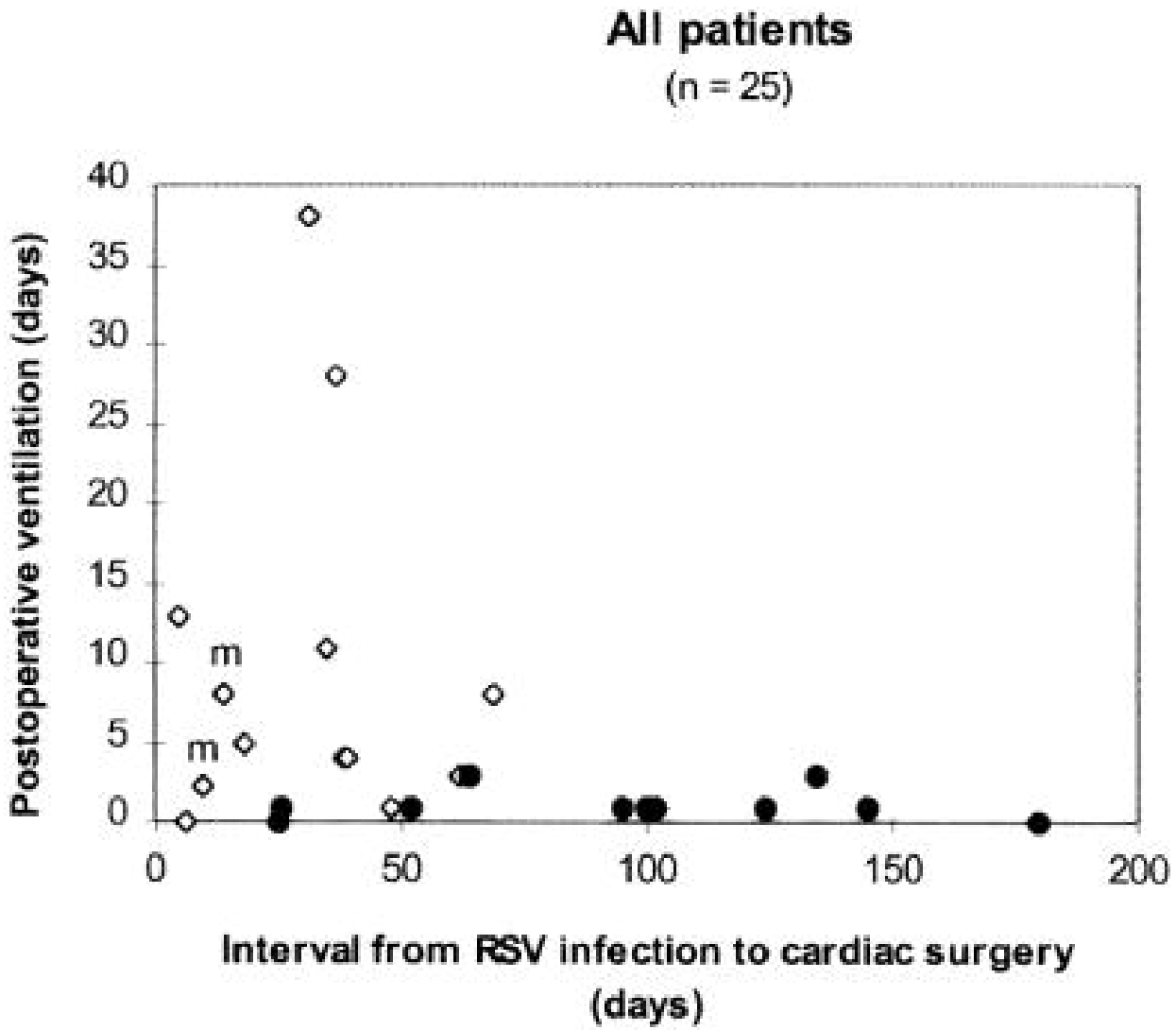
Effect of Preoperative Use of *Propranolol* on Postoperative Outcome in Patients With Tetralogy of Fallot

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

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*

report de 2-6sem si < 1an, >1an avec signes associés (toux, >38°C) si intubation nécessaire

SYNAGIS

PALIVIZUMAB PROPHYLAXIS REDUCES HOSPITALIZATION DUE TO RESPIRATORY SYNCYTIAL VIRUS IN YOUNG CHILDREN WITH HEMODYNAMICALLY SIGNIFICANT CONGENITAL HEART DISEASE

TIMOTHY F. FELTES, MD, ALLISON K. CABALKA, MD, H. CODY MEISSNER, MD, FRANCO M. PIAZZA, MD, MPH, DAVID A. CARLIN, PHD, FRANKLIN H. TOP, JR, MD, EDWARD M. CONNOR, MD, AND HENRY M. SONDHEIMER, MD, FOR THE CARDIAC SYNAGIS STUDY GROUP*

Study design A randomized, double-blind, placebo-controlled trial included 1287 children with CHD randomly assigned 1:1 to receive 5 monthly intramuscular injections of 15 mg/kg palivizumab or placebo. Children were followed for 150 days. The primary efficacy end point was antigen-confirmed respiratory syncytial virus (RSV) hospitalization.

Results Palivizumab recipients had a 45% relative reduction in RSV hospitalizations ($P = .003$), a 56% reduction in total days of RSV hospitalization per 100 children ($P = .003$), and a 73% reduction in total RSV hospital days with increased supplemental oxygen per 100 children ($P = .014$). Adverse events were similar in the treatment groups; no child had drug discontinued for a related adverse event. Serious adverse events occurred in 55.4% of palivizumab recipients and 63.1% of placebo recipients ($P < .005$); none were related to palivizumab. Twenty-one children (3.3%) in the palivizumab group and 27 (4.2%) in the placebo group died; no deaths were attributed to palivizumab. The rates of cardiac surgeries performed earlier than planned were similar in the treatment groups.

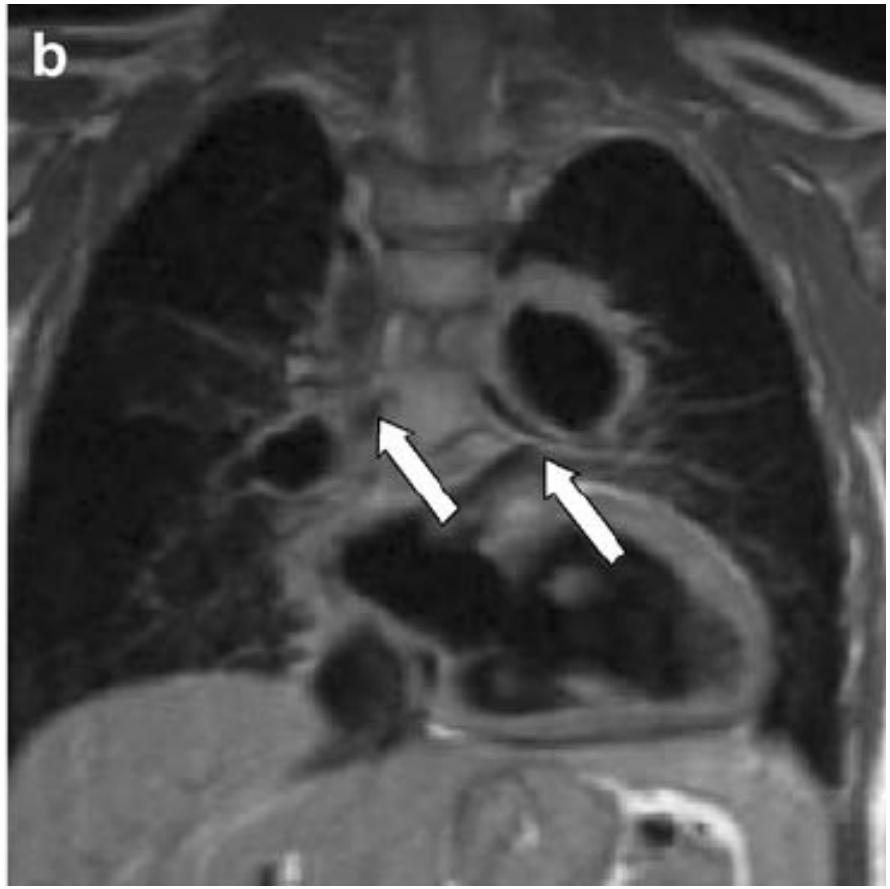
Conclusions Monthly palivizumab (15 mg/kg IM) was safe, well-tolerated, and effective for prophylaxis of serious RSV disease in young children with hemodynamically significant CHD. *(J Pediatr 2003;143:532-40)*

CLINICAL PRACTICE GUIDELINE

Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

10b. Clinicians should administer palivizumab during the first year of life to infants with hemodynamically significant heart disease or chronic lung disease of prematurity defined as preterm infants <32 weeks 0 days' gestation who require >21% oxygen for at least the first 28 days of life (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

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*

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%

Necker : anti-staphylococcique topique intranasal pdt 5 jours 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*

Necker : 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% des nourrissons porteurs de cardiopathies ont un poids < 3éme 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 : …? -> intérêt du Fe ± EPO ?

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

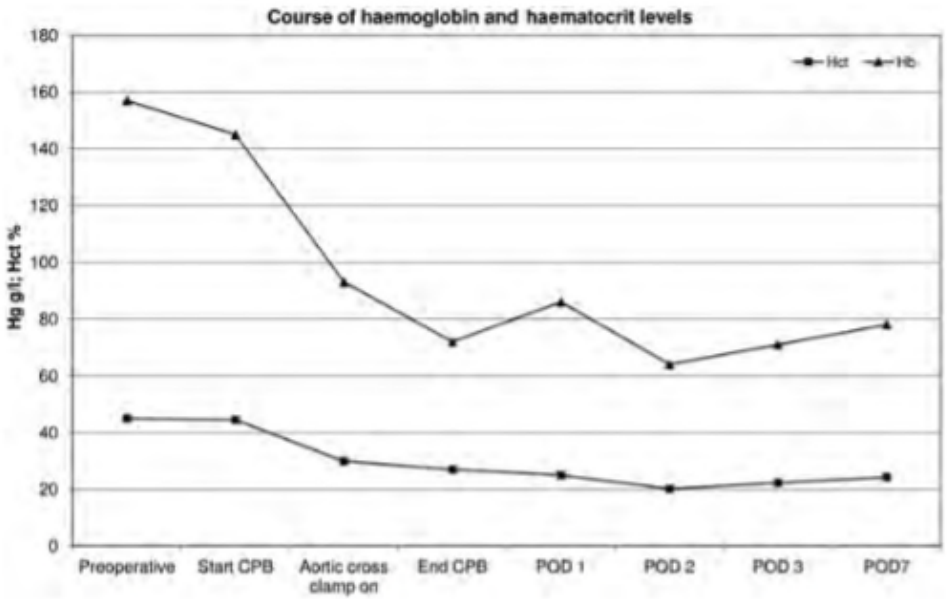


Figure 1: Course of haemoglobin (Hb) and haematocrit (Hct) levels; CPB: cardiopulmonary bypass; POD: postoperative day.

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
- ionogramme sanguin, urée, créatinine
- CRP
- TP, TCA, fibrinogène
- groupe sanguin, RAI
- cartographie ORL et digestive (recherche BMR), virus (octobre-> janvier)
- Cs stomato
- Radio thorax

Selon terrain : test de falciformation, bilan des défaillances viscérales

Trisomie 21

Syndrome de Down

- cardiopathie à type de Shunt G->D
- hypotrophie
- hypothyroïdie
- macroglossie et rétrecissement sous-glottique
- hypotonie

Syndrome de Di George

Syndrome velo-cardio-facial

Catch 22 :

- C = cardiac anomaly = anomalie cono-troncale
- A = abnormal facies, micrognatie
- T = Thymic hypoplasie -> déficit immunité cellulaire
- C = cleft palate
- H = hypocalcemia
- 22 = délétion chr 22

Syndrome de Williams-Beuren

- dysmorphie: faciès d ’elfe
- cardiopathie = sténose supravalvulaire aortique +/- pulmonaire
- possible anomalies vasculaires des artères cervicales et cérébrales avec AVC spontanés, sténose artère rénale avec HTA
- retard mental

Syndrome de Noonan

- petite taille : pseudo Turner
- dysmorphie, hypertélorisme, ptosis
- cou court et palmé
- cardiopathie = sténose pulmonaire, CMH
- déformation thoracique, sternum saillant, scoliose
- Retard des acquisitions

Syndrome de Marfan

mutation fibrilline-1
myopie, luxation cristallin
grande taille, arachnodactylie, laxité ligamentaire
cardiopathie = dilatation progressive aorte ascendante, risque dissection et rupture +/- IAo, IM
pneumothorax

CHARGE

C = colobom
H = heart = anomalie cono-troncale
A = atrésie choanale
R = retard croissance et mental
G = genital
E = ear