Children after cardiac surgery in the school

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2009

Behavior and Development in Children and Age at the Time of First Anesthetic Exposure

Cor J. Kalkman, M.D., Ph.D.,* Linda Peelen, M.Sc.,† Karel G. Moons, Ph.D.,* Morna Veenhuizen, M.D.,‡ Marcel Bruens, R.N.,§ Gerben Sinnema, Ph.D.,|| Tom P. de Jong, M.D., Ph.D.#

Operation before 24 month of age causes learning difficulties
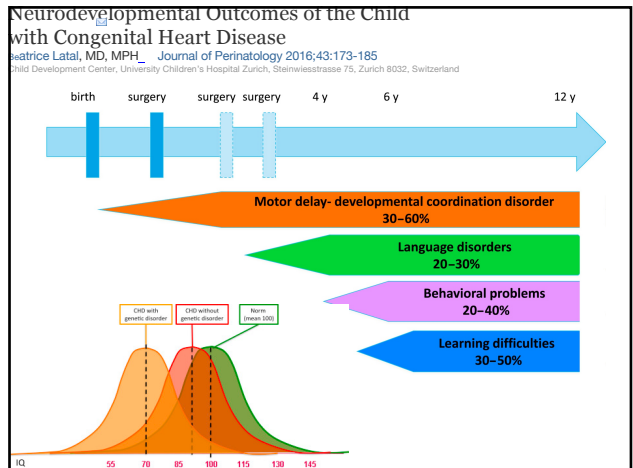
Memory problems

Learning difficulties

Social problems

Table 3. Characteristics of Potential Cognitive Impairment in the Total Cohort and Across the Two Age Groups

	Entire Cohort	By Age at the Time of First Anesthetic	
		< 24 months	> 24 months
n	243	178	65
Handicapped*	28 (11.6)	24 (13.5)	4 (6.2)
Problems at school	117 (48.3)	94 (52.8)	23 (35.9)
Repeat one or more grades	73 (30.0)	51 (28.7)	22 (33.7)
CBCL 4–18			
Total problem score	18.0 (9.0–34.5)	19.0 (10.0–34.8)	17.0 (8.0–31.0)
Internalizing score	5.0 (2.0–11.0)	5.0 (2.0–11.0)	5.0 (2.0–10.0)
Externalizing score	4.0 (1.0–9.0)	4.0 (1.0–8.8)	4.0 (1.0–9.0)
Clinically deviant score†	54 (22.2)	41 (23.0)	13 (20.0)

Values represent medians (interquartile range) for continuous variables and number (%) for categorical variables.
* Parents response to question: "Does your child have a handicap in the area of memory, learning or social behavior?"   † Clinically deviant: threshold values for total Child Behavior Checklist/4–18 (CBCL/4–18) problem score according to Dutch norms[14] are: boys 4–11 yr: 40; girls 4–11 yr: 36; all 12–18 yr: 37.

Neurodevelopmental Outcomes of the Child with Congenital Heart Disease

Beatrice Latal, MD, MPH   Journal of Perinatology 2016;43:173-185
Child Development Center, University Children's Hospital Zurich, Steinwiesstrasse 75, Zurich 8032, Switzerland

Slide 1 (2008)

Early Exposure to Anesthesia and Learning Disabilities in a Population-based Birth Cohort

Robert T. Wilder, M.D., Ph.D.,* Randall P. Flick, M.D., M.P.H.,† Juraj Sprung, M.D., Ph.D.,‡ Slavica K. Katusic, M.D.,§ William J. Barbaresi, M.D.,‖ Christopher Mickelson, M.D.,# Stephen J. Gleich, M.D.,** Darrell R. Schroeder, M.S.,†† Amy L. Weaver, M.S.,†† David O. Warner, M.D.‡

- 5357 children
  - 593 general anesthesia below 4 years of age
  - 4764 control arm
- One anesthesia (n=449) → no problem in learning
- Two exposure (n=100) → Significant learning difficult
- Three or more exposure (n=44) → learning disabilities
- Szívműtéten átesett (n=15) → ??

Slide 2 (2006)

Relationship of Surgical Approach to Neurodevelopmental Outcomes in Hypoplastic Left Heart Syndrome

William T. Mahle, MD*, Karen J. Visconti, PhD^b, M. Catherin Freier, PhD^c, Stephen M. Kanne, PhD^d, William G. Hamilton, PhD*, Angela M. Sharkey, MD^d, Richard E. Chinnock, MD^c, Kathy J. Jenkins, MD^b, Peter K. Isquith, PhD^e, Thomas G. Burns, PsyD*, Pamela C. Jenkins, MD, PhD*

*Children's Healthcare of Atlanta, Atlanta, Georgia; ^bChildren's Hospital, Boston, Massachusetts; ^cLoma Linda University Children's Hospital, Loma Linda, California; ^dSt Louis Children's Hospital, St Louis, Missouri; ^eDartmouth Medical School, Hanover, New Hampshire

The authors have indicated they have no financial relationships relevant to this article to disclose.

TABLE 1 Variables Analyzed for Association With Neurodevelopmental Outcomes	
Patient-Related	**Procedure-Related**
Birth weight	Age at surgery
Apgar scores	DHCA duration
Metabolic acidosis (pH < 7.1)	Cardiopulmonary bypass duration
Cardiac arrest	Cooling temperature
Preoperative clinical seizures	Length of stay
Serum creatinine concentrations	Postoperative length of stay
Ascending aorta dimensions	
Aortic atresia	
Socioeconomic status	
Grade of tricuspid insufficiency	

Mahle, W.T., et al., *Relationship of surgical approach to neurodevelopmental outcomes in hypoplastic left heart syndrome.* Pediatrics, 2006. **117**(1): p. e90-7.

Slide 3 (2007)

ARTICLE

Inattention, Hyperactivity, and School Performance in a Population of School-Age Children With Complex Congenital Heart Disease

Amanda J. Shillingford, MD*, Marianne M. Glanzman, MD^b, Richard F. Ittenbach, PhD^c, Robert R. Clancy, MD^d, J. William Gaynor, MD^e, Gil Wernovsky, MD*

Divisions of *Cardiology, ^bChild Development and Rehabilitation, ^cBiostatistics and Data Management Core, ^eCardiothoracic Surgery, and ^dNeurology, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

The authors have indicated they have no financial relationships relevant to this article to disclose.

- → ADHD, Hyperactivity (*Attention-Deficit/Hyperactivity Disorder Rating Scale-IV and Behavior Assessment System for Children*)
- → 109 neuroprotective treatment postoperatively
- → 30% attention deficit, memory problems
- → 50% additional learning after school and special learning requirements

Slide 4 (2010)

BJA

PAEDIATRICS

Early childhood general anaesthesia exposure and neurocognitive development

L. Sun*

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- Neurotoxicity of the anesthestics
- Problems in the neurodevelopments

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Neurotoxicity of sedative and analgesia drugs in young infants with congenital heart disease: 4-year follow-up

Gonzalo Garcia Guerra[1], Charlene M.T. Robertson[1,2], Gwen Y. Alton[1], Ari R. Joffe[1], Dominic A. Cave[1], Farzana Yasmin[3,2], Irina A. Dinu[3,2], Dianne E. Creighton[4], David B. Ross[1,5], Ivan M. Rebeyka[1,5] & Western Canadian Complex Pediatric Therapies Follow-up Group*

1 Department of Pediatrics, University of Alberta, Edmonton, AB, Canada
2 Pediatric Rehabilitation Outcomes Evaluation and Research Unit, Glenrose Rehabilitation Hospital, Edmonton, AB, Canada
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4 Cardiorespiratory Services, Alberta Children's Hospital and Department of Pediatrics, University of Calgary, Calgary, AB, Canada
5 Department of Surgery, University of Alberta, Edmonton, AB, Canada

91 children after CHD surgery

Analgetics and sedative drugs have no influence on the summerized and on the verbal intelligence(sufentanil, remifentanil, fentanil, morfin)

Long-term Differences in Language and Cognitive Function After Childhood Exposure to Anesthesia

WHAT'S KNOWN ON THIS SUBJECT: Immature animals exposed to anesthetics display apoptotic neurodegeneration and long-term cognitive deficiencies. In children, studies of cognitive deficits associated with anesthesia exposure have yielded mixed results. No studies to date have used directly administered
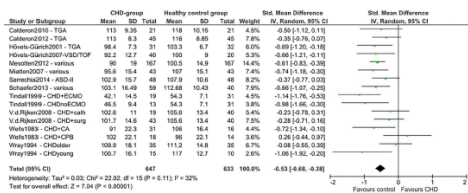
AUTHORS: Caleb Ing, MD,[a] Charles DiMaggio, PhD,[a,b,c] Andrew Whitehouse, PhD,[d] Mary K. Hegarty, MBBS, FANZCA,[e] Joanne Brady, MS,[a,b,c] Britta S. von Ungern-Sternberg, ProfPhD,[e,f] Andrew Davidson, MD,[g] Alastair J.J. Wood, MD,[h] Guohua Li, MD,[a,b,c] and Lena S. Sun, MD[a,i]

	Disability	
	Unadjusted, RR (95% CI)	Adjusted, aRR* (95% CI)
Overall cohort		
CELF Total	2.31 (1.56–3.41)	2.11 (1.42–3.14)
CELF Receptive	2.15 (1.37–3.37)	1.87 (1.20–2.93)
CELF Expressive	1.84 (1.21–2.80)	1.72 (1.12–2.64)
CPM Total	1.65 (1.12–2.43)	1.69 (1.13–2.53)
Number of exposures		
CELF total		
Unexposed (0)	Reference	Reference
Single exposure (1)	2.82 (1.74–4.57)	2.36 (1.47–3.79)
Multiple exposure (≥2)	2.49 (1.05–5.88)	2.88 (1.07–6.72)
CELF receptive		
Unexposed (0)	Reference	Reference
Single exposure (1)	2.99 (1.72–5.19)	2.41 (1.40 – 4.17)
Multiple exposure (≥2)	3.29 (1.37–7.89)	3.52 (1.38 – 9.00)
CELF expressive		
Unexposed (0)	Reference	Reference
Single exposure (1)	1.80 (1.05–3.15)	1.55 (0.88–2.68)
Multiple exposure (≥2)	2.27 (0.96–5.35)	2.35 (0.97–5.70)
CPM total		
Unexposed (0)	Reference	Reference
Single exposure (1)	1.81 (1.12–2.94)	1.73 (1.04–2.88)
Multiple exposure (≥2)	1.78 (0.76–4.15)	1.92 (0.81–4.55)

RR, risk ratio.
* Adjusted risk ratios (aRR) adjusted for sex, low birth weight (<2500 g), race, income, and maternal education.

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openheart Neurocognition after paediatric heart surgery: a systematic review and meta-analysis

Caroline Sterken,[1] Jurgen Lemiere,[2,3] Ilse Vanhorebeek,[1] Greet Van den Berghe,[1] Dieter Mesotten[1]

Study or Subgroup	CHD-group Mean	SD	Total	Healthy control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Calderon2010 - TGA	113	9.35	21	118	10.15	21	4.5%	-0.50 [-1.12, 0.11]
Calderon2012 - TGA	113	8.3	45	116	8.85	45	7.8%	-0.35 [-0.76, 0.07]
Hövels-Gürich2001 - TGA	98.4	7.3	31	103.3	6.7	32	6.0%	-0.69 [-1.20, -0.18]
Hövels-Gürich2007 -VSD/TOF	92.2	12.7	40	100	9	20	5.3%	-0.66 [-1.21, -0.11]
Mesotten2012 - various	90	19	167	100.5	14.9	167	14.4%	-0.61 [-0.83, -0.39]
Miatton2007 - various	95.6	15.4	43	107	15.1	43	7.4%	-0.74 [-1.18, -0.30]
Semechia2014 - ASD-II	102.9	15.7	48	107.9	10.6	48	8.2%	-0.37 [-0.77, 0.03]
Schaefer2013 - various	103.1	16.49	59	112.68	10.43	40	7.9%	-0.66 [-1.07, -0.26]
Tindal1999 - CHD+ECMO	42.1	14.5	19	54.3	7.1	31	4.5%	-1.14 [-1.76, -0.53]
Tindal1999 - CHDnoECMO	46.5	9.4	13	54.3	7.1	31	3.8%	-0.98 [-1.66, -0.30]
V.d.Rijken2008 - CHD+cath	102.6	11	19	105.6	13.4	40	5.4%	-0.23 [-0.78, 0.31]
V.d.Rijken2008 - CHD+surg	101.7	14.6	43	105.6	13.4	40	7.5%	-0.28 [-0.71, 0.16]
Wells1983 - CHD+CA	91	22.3	31	106	16.4	16	4.4%	-0.72 [-1.34, -0.10]
Wells1983 - CHD+CPB	102	22.1	18	96	22.1	14	3.6%	0.26 [-0.44, 0.97]
Wray1994 - CHDolder	109.9	18.1	35	111.2	14.8	35	6.7%	-0.08 [-0.55, 0.39]
Wray1994 - CHDyoung	100.7	16.1	15	117	12.7	10	2.6%	-1.06 [-1.92, -0.20]
Total (95% CI)			647			633	100.0%	-0.63 [-0.68, -0.38]

Heterogeneity: Tau² = 0.03; Chi² = 22.92, df = 15 (P = 0.11); I² = 32%
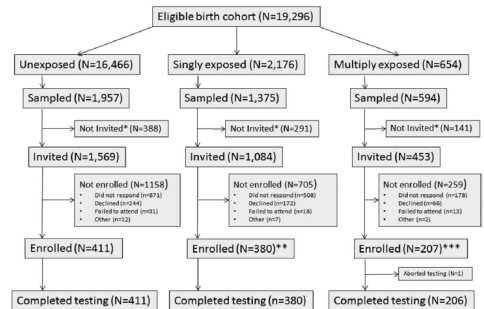Test for overall effect: Z = 7.04 (P < 0.00001)

Favours control Favours CHD

Verbal memory, attention deficit, fine motoric function are all significantly worse

Sterken C, Lemiere J, Vanhorebeek I, *et al. Open Heart* 2015;2:e000255. doi:10.1136/openhrt-2015-000255

Neuropsychological and Behavioral Outcomes after Exposure of Young Children to Procedures Requiring General Anesthesia

The Mayo Anesthesia Safety in Kids (MASK) Study

David O. Warner, M.D., Michael J. Zaccariello, Ph.D., L.P., Slavica K. Katusic, M.D., Darrell R. Schroeder, M.S., Andrew C. Hanson, B.S., Phillip J. Schulte, Ph.D., Shonie L. Buenvenida, R.N., Stephen J. Gleich, M.D., Robert T. Wilder, M.D., Juraj Sprung, M.D., Danqing Hu, M.D.,

Eligible birth cohort (N=19,296)

Unexposed (N=16,466) → Sampled (N=1,957) → Not Invited* (N=388) / Invited (N=1,569) → Not enrolled (N=1158): Did not respond (n=871), Declined (n=244), Failed to attend (n=31), Other (n=12) / Enrolled (N=411) → Completed testing (N=411)

Singly exposed (N=2,176) → Sampled (N=1,375) → Not Invited* (N=291) / Invited (N=1,084) → Not enrolled (N=705): Did not respond (n=508), Declined (n=172), Failed to attend (n=18), Other (n=7) / Enrolled (N=380)** → Completed testing (n=380)

Multiply exposed (N=654) → Sampled (N=594) → Not Invited* (N=141) / Invited (N=453) → Not enrolled (N=259): Did not respond (n=178), Declined (n=66), Failed to attend (n=13), Other (n=2) / Enrolled (N=207)*** → Aborted testing (N=1) → Completed testing (N=206)

Neuropsychological and Behavioral Outcomes after Exposure of Young Children to Procedures Requiring General Anesthesia

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Stephen J. Gleich, M.D., Robert T. Wilder, M.D., Juraj Sprung, M.D., Danqing Hu, M.D.,
Robert G. Voigt, M.D., Merle G. Paule, Ph.D., John J. Chelonis, Ph.D., Randall P. Flick, M.D., M.P.H.

- IQ no difference
- Multiple exposure did not differ from the single exposure, but IQ was lower than the IQ of unexposed children
- Differences in reading and behavior in multiply exposure
- Slight differencies in the speech and fine motor coordination

Anesthesiology 2018

Take home message

- We should follow the pediatric patients after cardiac surgery
- They have frequently multiple operations
- The first deep screening is only in the school ages

İlginiz için teşekkür ederim
Köszönöm a figyelmet!

imagination at work