Pilot-randomized study on intraventricular hemorrhage with midline versus lateral head positions

Sameer Y. Al-Abdi, MRCPCH, SSCP,
Maha S. Nojoom, MBBS, FRCR,
Hesham M. Alshaalan, MBBS, FRCPC,
Maryam Ali Al-Aamri, MBBS, SSCP.

Intraventricular hemorrhage (IVH) in preterm infants is one of many devastating consequences of prematurity that has both acute and long-term sequelae. The pathogenesis of IVH is multifactorial.[1] A supine midline head position of newborn favors cerebral venous drainage and helps to prevent elevation of cerebral blood volume.[2] Keeping preterm infants' heads in a slightly elevated midline position (side or supine) during the first 7 days of life (DOL) has been recommended as one of the 10 potentially better practices to reduce the incidence of IVH in preterm infants.[3] There has been no systematically collected clinical data quantifying the relationship between IVH and head position in preterm infants. We conducted a small sample size, randomized pilot study to compare the incidence of IVH in a supine flat midline head position (FM) with that of a supine flat lateral (FL) head position in preterm infants.

This study was conducted at King Abdulaziz Hospital (KAH), Al-Ahsa, Saudi Arabia. Patient recruitment started on July 2008 and completed on December 2009. Preterm infants were enrolled in the study if they met the following criteria: 1) born at KAH; 2) gestational age <30 weeks; and 3) postnatal age <2 hours. Exclusion criteria included the presence of lethal congenital anomalies, hypoxic ischemic encephalopathy, and the need for full cardiopulmonary resuscitation at birth. The study was approved by the Institutional Review Board at the National Guard Health Affairs. Written informed parental consent was obtained before enrollment.

Infants lying on flat (zero degree) beds were randomly assigned to be cared for either in a supine FM or a supine FL head position. In the FM position, the infant's chin was kept at a 90^0 angle to the bed. In the FL position, the head was tilted 90^0 to either side. At enrollment, it was left to the bedside nurse to place the head in the right-tilted or left-titled position. Since then, the infants' heads were kept in their primary assigned positions throughout the first 7 DOL. The correctness of the infants' head positions was checked every 6 hours by the bedside nurse using the built-in spirit (bubble) level of the open-bed warmer or incubators and an L-shaped ruler. Bedside nurses were asked to report changes in head positions for unavoidable medical indications and to record the duration of these changes if occurred.

Randomization was stratified based on gender (male or female) and GA (<27 or 27-29.86 weeks). Randomization was carried out using a predetermined computer-generated randomization sequence with consecutively numbered sealed envelopes, with a separate set of envelopes for each stratum. In the case of eligible multiple births, each infant was randomly assigned. The primary outcome was the rate of IVH of all grades. A standard set of head ultrasound (HUS) views were performed through the anterior fontanel.[4] The 2 radiologists (Nojoom and Alshaalan) were blinded to the head position assignments and they independently reported laterality and grade of IVH according to Papile's grading criteria. If there was discrepancy between the study radiologists' reports, the report of a non-study (attending) radiologist was used to determine the final decision regarding whether an infant had IVH or not. Timing of HUS examinations were carried out according to our established IVH screening guidelines: 1) An HUS examination was routinely performed in our unit at 5-7 DOL for stable preterm infants ≤32 weeks GA; 2) subsequent HUS follow-up examinations were performed at 14 and 28 DOL or before discharge; 3) the HUS examination was performed as soon as the clinical suspicion of IVH is raised; 4) if IVH is detected, a second HUS examination is repeated 5-7 days later; and 5) prior to commencement of indomethacin for treatment of patent ductus arteriosus (PDA).

An intention-to-treat analysis was used throughout this study. A Student's t-test or Mann-Whitney test, when appropriate, was used to compare continuous variables. A chi-squared test or Fisher's exact test, when appropriate, was used to compare categorical variables. A 2-sided *p*-value of less than 0.05 was considered statistically significant.

During the study period, 82 infants, <30 weeks gestation were born at KAH, and 48 were enrolled in the study within the first 15-30 minutes of life. There were no statistically significant differences in the baseline characteristics of the studied infants (**Table 1**). Out of 48, 23 were cared for in the FM head position and 25 infants in the FL head position. One infant in each group had no HUS due to their early deaths, and both were included in the analysis. Among infants in FL group, 12 were cared for in a left-tilted and 13 in a right-tilted FL head positions and their primary head positions were kept the same throughout the study. Baseline characteristics of infants in left-tilted and right-tilted head positions were similar (data not shown). In the first 7 DOL, the IVH incidence in the FM head position was 26% (6/23) versus 20% (5/25) in FL head position (risk ratio (RR) 1.30; 95% confidence interval (CI): 0.46–3.70; p=0.62). Among infants who

developed IVH, 4 in the FM and 3 in the FL head positions had normal first HUS that were carried out on the second day of life prior to indomethacin for PDA treatment. Grade III-IV IVH developed in 2 (9%) infants in the FM head position versus one (4%) infant in the FL head position (RR 1.4; 95% CI: 0.61-3.37, p=0.94). Bilateral IVH developed in 3 (13%) in the FM head position versus 2 (8%) in the FL head position (RR 1.6; 95% CI: 0.30-8.90; p=0.92). A secondary analysis showed that the IVH incidence in left-tilted FL head position was 25% (3/12) versus 15% (2/13) in right-tilted FL head position (RR 1.63; 95% CI: 0.33-8.11; p=0.92).

In conclusion, this pilot study was inconclusive due to its small sample size (underpowered). A large-scale study comparing IVH incidence associated with FM and right-tilted FL head positions should be undertaken. The results of this study will permit an ideal sample-size calculation for such large-scale study. For instance, the ideal sample size for comparing IVH incidence associated with FM and right-tilted FL head positions was calculated to be 229 infants per study arm, assuming 80% statistical power and a 2-sided 5% significance level.

Table 1 - Baseline and clinical characteristics of the study infants and their mothers.

Characteristics	Midline head position (n=23)	Lateral head position (n=25)
Gestational age (week)		
Mean ± SD	27 ± 1.3	27 ± 2
Median (interquartile range)	27 (26-28)	26 (25-28)
Birth weight, (g)		
Mean ± SD	820 ± 182	847 ± 244
Median (interquartile range)	826 (652-922)	800 (702-964)
SNAP-PE II		
Mean ± SD	45 ± 28	34 ± 21
Median (interquartile range)	36 (24-68)	31 (24-46)
Gender: Male/Female	12/11	15/10
Multiple births	11	7
Twin	4	4
Triplet	5	1
Quadruplet	2	2
Received surfactant	22	24
Mechanical ventilation		
Conventional	21	22
High frequency	8	5
Patent ductus arteriosus*	19	13
Pneumothorax	1	2
Platelet <50 x 10^9/L	3	3
Vasopressors usage	7	8
Mothers		
Racial background	Saudi	Saudi
IVF pregnancy	6	3
Cesarean section delivery	16	13
Age (years) (mean±SD)	28 ± 7	32 ± 7
Antenatal steroid	20	22
Preeclampsia or eclampsia	2	5
Tocolytics within 7 days before delivery	2	3
Preterm premature rupture of membrane	9	7

Values are expressed as number of patients unless otherwise indicated.
All p-value >0.05.
SNAP-PE II - Score for Neonatal Acute Physiology-Perinatal Extension II.
*in infants who had echocardiography performed
(Flat midline: n=20, flat lateral: n=17)

Acknowledgment. *We gratefully acknowledge the parents of the infants who took part in the study and the Neonatal Intensive Care Unit teams at King Abdulaziz Hospital, Al-Ahsa, Saudi Arabia particularly Fatimah Al-Hay and Maria Cristina Masangkay for their assistance. We also would like to thank Dr. Arne Ohlsson and Dr. Zakariya Al-Salam for their revising and editing the manuscript.*

Received 1st January 2011. Accepted 10th January 2011.

From the Department of Pediatrics (Al-Abdi, Al-Aamri), King Abdulaziz Hospital for National Guard and the Department of Medical Imaging (Nojjom, Alshaalan), King Abdulaziz Medical City, Riyadh, Kingdom of Saudi Arabia Address correspondence and reprints request to: Dr. Sameer Y. Al-Abdi, Consultant Neonatologist, Neonatology Division, Department of Pediatrics, MC 315, King Abdulaziz Hospital for National Guard, PO Box 2477, Al-Ahsa 31982, Kingdom of Saudi Arabia. Tel. +966 (3) 5910000 Ext. 33386. Fax. +966 (3) 5910000 Ext. 33844. E-mail: abdis@ngha.med.sa

References

1. Volpe JJ. Neurology of the Newborn. 5th ed. Philadelphia (PA): WB Saunders/Elsevier; 2008. p. 524-537.
2. Pellicer A, Gayá F, Madero R, Quero J, Cabañas F. Noninvasive continuous monitoring of the effects of head position on brain hemodynamics in ventilated infants. ***Pediatrics*** 2002; 109: 434-440.
3. Carteaux P, Cohen H, Check J, George J, McKinley P, Lewis W, et al. Evaluation and development of potentially better practices for the prevention of brain hemorrhage and ischemic brain injury in very low birth weight infants. ***Pediatrics*** 2003; 111 (4 Pt 2): e489-e496.
4. van Wezel-Meijler G. Neonatal cranial ultrasonography: guidelines for the procedure and atlas of normal ultrasound anatomy. 1st ed. Berlin (Heidelberg): Springer; 2007. p. 17-22.