Anesthesia for Cerebral Hemispherectomy in Infants and Young Children

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Introduction: Children with epilepsy unresponsive to medical management may present for surgical intervention. Increasingly, these procedures are being performed on infants and young children. (1) A standard description of hemispherectomy performed in children describes the occurrence of severe cardiovascular, pulmonary, neurologic and coagulopathic complications. (2) We present our institution's experience of 9 children less than 3 years of age, who underwent hemispherectomy for intractable seizures without evidence of many of the complications previously noted. (2,3)

Methods: Cases of surgical treatment for epilepsy since January 2004 were reviewed. Hospital charts of those who underwent hemispherectomy were reviewed for demographic data and post-surgical outcome. The anesthetic chart and ICU notes were analyzed for data including anesthetic technique, monitoring, blood loss, transfusion requirements, fluid administration, urine output, timing of extubation, time in ICU, laboratory analyses, outcome and complications.

Results: 9 patients aged 26 days to 33 months underwent hemispherectomy surgery between 10/2003 and 6/2006. All procedures were successfully completed and all children survived. Balanced anesthesia with a volatile agent and opioids was provided in all cases. An arterial catheter was placed in all patients, a central venous catheter in 2. Intraoperative complications were limited to blood loss and its sequelae, although blood loss did not exceed one blood volume in any patient. All but 1 patient received transfusion of packed red blood cells and 4 patients received fresh frozen plasma; one patient with an INR of 4.5 also received cryoprecipitate postoperatively. Additional fluid administration included crystalloid in all patients (39-160ml/kg) and 5% albumen in 3 patients (10-46ml/kg). Urine output was acceptable in all patients (0.7-5.8ml/kg/hr).

All patients were extubated on the day of surgery or the first post-operative day. All patients spent 1-2 days in the ICU. One patient required ICU re-admission for the treatment of diabetes insipidus complicated by hyponatremia and seizures. 1 patient developed an infected bone flap requiring removal and subsequent cranioplasty. Since October 2004, all cases routinely had placement of a ventriculostomy that was removed 4-7 days post-operative. The youngest patient developed plagiocephaly. At last follow-up, 7 patients remained seizure-free (78%) and 2 had infrequent seizures.

Discussion: Early surgery for intractable seizures has been previously shown to be associated with improved functional outcomes, and anesthesiologists should be prepared to care for young children undergoing hemispherectomy surgery. (1) Previous report have highlighted numerous potential complications including, arrhythmias, cardiac arrest, significant changes in SVR and PVR, neurogenic pulmonary edema, cerebral edema, seizures, massive blood loss and coagulopathy. (2,3,4)

Our results affirm that blood loss may be significant, though not as severe as previously reported. Therefore, invasive blood pressure monitoring and appropriate intravenous access are advised in all patients. No other intraoperative complications were seen despite the young age of these patients.

We conclude that young children may be safely anesthetized for major seizure surgery with the intention that they will derive considerable benefits in terms of seizure frequency and subsequent neurodevelopment.

Case No Age	Intraoperative blood loss (ml/kg)	PRBC's transfused intraoperatively (ml/kg)	FFP transfused intraoperatively (ml/kg)	Postoperative Course	Subsequent Course
1 10 months	70	76	7 (INR 1.5)	Extubated day 1 ICU stay 2 days	Uncomplicated Occasional seizures (1-2 per month)
2 5 months	43	29	0	Extubated day 1 ICU stay 2 days	Uncomplicated Seizure-free
3 19 months	67	58	0	Extubated in OR ICU stay 2 days Transfused 5u FFP (INR 1.8)	Uncomplicated Seizure-free
4 32 months	4.3	0	0	Extubated ICU, day 0 ICU stay 1 day	Uncomplicated Seizure-free
5 26 days	37.9	47		Extubated day 1 ICU stay 2 days Subsequent plagiocephaly	Uncomplicated Seizure-free
6 5 months	24.7	30.9	0	Extubated ICU day 1 ICU stay 2 days	Uncomplicated Seizure-free
7 16 months	46.2	53.8	0	Extubated ICU day 1 ICU stay 2 days Transfused 7.7ml/kg PRBC 4.6ml/kg cryo, 15.4ml FFP (INR 4.5)	D. Insipidus on day 3 requiring ICU readmission for 4 days. Seizure-free
8 8 months	11	12.1	10.1 (INR 1.6)	Extubated ICU day 0 ICU stay 1 day	Infected bone flap requiring removal and subsequent cranioplasty. Seizure-free
9 29 months	5.5	23.4	0	Extubated in OR ICU stay 2 days	Occasional seizures (2-4 per month)

Intraoperative, Postoperative and Subsequent Course

PRBC's=packed red blood cells; FFP=fresh frozen plasma; ICU= intensive care unit; OR= operating room; INR=international normalized ratio; cryo=cryoprecipitate

References:

1. Cross JH., Epilepsia 2002
2. Carson BS. et al., Neurosurgical Operative Atlas. Vol 6
3. Brian JE. et al., J Clin Anesth 1990
4. Piastra M. et al., Childs Nerv Syst 2004