Anesthesia and perioperative care of newborns with obstetrical brachial plexus injuries

Fatma Saricaoglu, MD, Altan Sahin, MD, Mehmet A. Yukselen, MD, Gursel Leblebicioglu, MD, Uku Aypar, MD.

ABSTRACT

Objectives: The perioperative period is a particularly dangerous time for babies with serious obstetrical brachial plexus injuries undergoing microsurgical reconstruction. The aim of this study was to evaluate the perioperative and early postoperative problems in these patients.

Methods: Anesthetic management and pre and postoperative medical records were retrospectively reviewed for infants who underwent microsurgical nerve reconstruction (n=46) at the Hacettepe University, Ankara, Turkey from 1995 to 2003.

Results: Anesthetic considerations include the positioning, long duration of operation, fluid administration, intra and postoperative fever, tachycardia and respiratory complications.

Conclusion: Respiratory management and fluid administration are the most important factors in anesthesia for brachial injuries. Care must also be taken for the long duration of the surgery, temperature, and loss of airway.

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Obstetrical brachial plexus palsy is an unfortunate complication of difficult delivery, occurring in 0.5-4.64 of every 1000 births. Brachial plexus birth injuries have been described in conjunction with shoulder dystocia and presumed traumatic birth.[1] Although multiple risk factors have been described, the primary risk factor for brachial plexus injury is dystocia of the anterior shoulder. Although most patients suffering from this lesion improve spontaneously or with physiotherapy during the first months of life, some patients do not demonstrate adequate recovery and suffer from permanent paralysis. In these persistent cases, early microsurgical nerve reconstruction is recommended.[2-4] Surgical reconstruction requires special anesthetic considerations. The responsibility of the anesthesiologist is to maintain physiologic and metabolic stability as well as to provide a humane perioperative environment for the babies. Possible increased mortality and morbidity associated with lengthy operations for brachial plexus reconstruction demands a high level of vigilance. In this report, which is based on our experience, the anesthetic problems encountered in the management of infants undergoing microsurgical reconstruction are evaluated.

Methods. From January 1995 to July 2003, 46 infants underwent surgical reconstruction at Hacettepe University, Turkey. After approval of the study protocol by the Hospital Ethical Committee, medical and anesthesia records were retrospectively reviewed to evaluate the perioperative and early postoperative problems in these patients. The data were analyzed using SPSS for Windows version 10.0.7. Results are expressed as mean ± SD.

From the Departments of Anesthesiology and Reanimation (Saricaoglu, Sahin, Yukselen, Aypar) and Orthopedics and Traumatology (Leblebicioglu), Faculty of Medicine, Hacettepe University, Ankara, *Turkey*.

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Address correspondence and reprint request to: Dr. Fatma Saricaoglu, Department of Anesthesiology and Reanimation, Faculty of Medicine, Hacettepe University, Ankara, *Turkey*. Tel/Fax. +90 (312) 3109600. E-mail: fatmasaricao@yahoo.com

Table 1 - Demographic features of patients undergoing surgical reconstruction.

Features	Number	
Birth weight		
2.5-4 kg	23	
>4 kg	23	
Age (months)	8 ± 5.5	
Weight (g)	8.9 ± 2.1	
Sex		
Male	15	
Female	31	
Side affected		
Left	11	
Right	35	
Birth complications		
Horner syndrome	7	
Cardiac anomalies	2	
Anal atresia	1	
Meningocele	1	
Neonatal jaundice	1	
Abnormal birth	**2.5- 4 kg**	**>4 kg**
Breech presentation	12	14
Vacuum extraction	5	3
Forceps delivery	2	3
Shoulder dystocia	0	6

Results. All subjects were referred from other hospitals for poor recovery of paralysis. The demographic data of the patients who underwent surgical reconstruction are shown in **Table 1**. All patients were delivered vaginally. Out of a total of 46 infants, 23 had a birth weight of more than 4000 g. Vacuum extraction was used for 3 patients. The other 23 had a birth weight between 2500-4000 g and one of the patients was a breech presentation. Anesthesia was induced and maintained with sevoflurane in 19 patients, and induced by halothane and maintained by sevoflurane in 17 patients. The trachea was intubated without muscle relaxants and the lungs were mechanically ventilated. Muscle relaxants were withheld to avoid the interference with the assessment of electrophysiological examination until the end of the tests. Monitoring included ECG, invasive blood pressure, pulse oximetry, end tidal partial CO_2 tension, temperature, urine output, and central venous pressure from the femoral vein. Duration of surgery was 391 ± 156 minutes, and duration of anesthesia was 417 ± 105 minutes. Average blood loss was 148 ± 56 ml, and urine output was 138 ± 85 ml. Five patients received blood transfusion. Seventeen patients had tachycardia and received digoxin treatment in the second or third postoperative day. We transported 7 patients to the reanimation after surgery and none of them had tachycardia. The operation was performed in the supine position with the head rotated to the contralateral side and a pad under the affected shoulder. Both legs were prepared and draped for possible harvest of the sural nerve. After exposure of the brachial plexus, electrophysiological examinations consisting of nerve action potential and evoked muscle response were conducted to determine the definitive operative procedures required. Thereafter microsurgical nerve reconstruction was performed.

Discussion. Large birth weight, abnormal birth including shoulder dystocia, breech presentation and use of forceps or vacuum extraction are the risk factors for brachial plexus birth injuries. Large birth weight increases the risk independent of delivery mode.[1] In our series of patients, 50% (23/46) had birth weight larger than 4 kg and there were no babies with birth weight less than 2.5 kg. Spontaneous recovery of obstetric brachial plexus occurs over a period of months extending to years, and surgeons repairing these nerves believe that earlier repair leads to better results. The operations are performed by the same surgical and anesthesia team.

Brachial plexus birth injuries are sometimes complicated by other injuries such as phrenic nerve injury, clavicular fracture, torticollis, and intracranial hemorrhage.[5] Four patients in our series had diaphragm elevation, one had torticollis and one had a clavicular fracture. The patients with diaphragm elevation had respiratory infections in the preoperative period and postoperative respiratory impairment, recurrent pulmonary infections occurred because of atelectasis. Among the anesthetic considerations, respiratory management is the most important and difficult course in these patients as they have difficulty in weaning and extubation. All the patient with diaphragm elevation and 3 patients without phrenic nerve paralysis, had pulmonary complications after the anesthesia (infections, secretions and decrease in periphery oxygen saturation (SpO_2) and atelectasis). Preoperative anesthetic evaluation should be carefully made for upper airway infection and atelectasis. We found 14/46 patients with copious tracheal secretion and 7/46 with postoperative pulmonary infections. During the operation, tracheal aspiration should be carried out and positive end expiratory pressure may be beneficial to avoid new atelectasis.

In our series, the most frequent [34% (14/46)] intraoperative episodes were low SpO_2 with or without end tidal CO_2. During the procedure, the neck and the arm can be pushed by the surgeons and the probe can be move off from the finger, but the intubation tube can be kinked by the covered drapes or by the assistant surgeons' arm or body. In our

opinion,, the flexible intubation tubes are more beneficial in these patients. Pulse oximetry, and especially capnograph, are essential monitors to detect these respiratory abnormalities.

The other most frequent intraoperative problem in our series was body temperature elevation. Body temperature can easily rise with all the drapes that cover the patients, buy spontaneous breathing can also cause this problem. The respiratory work at the respiratory muscles can produce fever. In our patients, 31% (12/46) had elevation of body temperature (rectally >38^{0}C) and 8 received antipyretic medication (acetaminophen). The operating room temperature was decreased to 18^{0}C and fluids were administered. Body temperature also decreased in some cases (19% [9/46]). In this instance, we used Bair Hugger forced-air warming unit (model 500/OR, Augustine Medical, Eden Prairie, Minn.) to warm the patients, and the room temperature was increased to 22-24^{0}C. We avoided cooling and warming under the patient, as it is difficult to control all parts of the patient surface.

The patients were supine intraoperatively and the effected side of the neck, arm and both legs scrubbed and almost the whole body covered with drapes. Only the contralateral arm can be used for peripheral intravenous and arterial lines. We preferred to insert a central way to measure central venous pressure in 32/46 patients via the femoral vein. We had blood samples for complete blood count, arterial blood gases and biochemical measurements during the operation. Twenty-nine percent of patients (13/46) required transfusion. Blood loss was 84 ± 45 ml. Blood transfusion was given to the patient with high level (C2-C3) root lesions. Nerve grafts such as sural nerve grafts are transplanted in these cases. The operation area is very large, and insensible fluid loss must be counted for fluid regiments. Fluids and blood must be warmed to body temperature before transfusing, and mixed glucose solutions (1/3-1/4 dextrose) are essential for the infants because of probable hypoglycemia. Intravenous fluid maintenance is strictly limited because of pulmonary edema. La Scala et al[6] reported 14 patients (8.1%) with postoperative fluid overload, 3 of which developed pulmonary edema. They recommended that the fluid administration be 4 ml.kg^{-1}.h^{-1} or less during the surgery. In our study, we calculated the starvation time fluid intake and then administered 4 ml.kg^{-1}h^{-1}D5$^1/_4$ mixed solution for maintenance. We were able to measure CVP in the majority of patients, so avoiding fluid overloading. Seventeen patients had received digoxin treatment, but this was not from the fluid overload, contrarily because of fluid shift. Blood loss from the incision or secondary to the daily requirement was not given to the patients, so tachycardia developed.

In the large series of La Scala et al,[6] the second most frequent complication was accidental extubation (2.9%), which they addressed by suturing the endotracheal tube to the membranous septum. We did not encounter this complication in our series.

Full recovery from anesthesia and the absence of laryngeal edema is mandatory prior to extubation. If there is suspicion from the airway, the patient must be taken to the reanimation with endotracheal tube. Steroid management can be useful for these patients. Grossman et al[7] reported on the retrospective records of 100 consecutive cases of brachial plexus repair and concluded that experienced personnel, careful intraoperative management and monitoring aids in preventing complications.

In conclusion, respiratory management and fluid administration are the most important factors in anesthesia for brachial injuries. Care must be taken for the long duration of surgery, temperature, and loss of airway.

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