

OBSTETRICS

Neonatal brachial plexus injury: comparison of incidence and antecedents between 2 decades

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OBJECTIVE: We sought to compare the incidence and antecedents of neonatal brachial plexus injury (BPI) in 2 different 5-year epochs a decade apart following the introduction of specific staff training in the management of shoulder dystocia.

STUDY DESIGN: All infants with BPI were prospectively identified during 2004 through 2008. Injuries were correlated with maternal details and intrapartum events and compared with the earlier series.

RESULTS: Of 41,828 deliveries during 2004 through 2008, 72 infants with BPI were identified (1.7/1000), compared to 54 cases (1.5/1000)

from 1994 through 1998 ($P = .4$); 9 injuries (12.5%) were persistent from 2004 through 2008, compared with 10 (18.5%) earlier ($P = .4$). There were no significant differences between the 2 time periods with respect to maternal parity, obesity, or prolonged pregnancy, although the cesarean section rate had increased from 10.7 to 18.4%.

CONCLUSION: Despite training in the management of shoulder dystocia and a rising institutional cesarean section rate, the incidence of BPI has remained unchanged compared with 10 years earlier.

Key words: brachial plexus injuries, Erb's palsy, shoulder dystocia

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Injury to the brachial plexus comprising the ventral rami of spinal nerves C5-C8 and T1 is an uncommon but potentially serious form of neonatal neurological injury, often attributed to impaction of the anterior shoulder at vaginal delivery.¹ It is readily apparent on clinical examination following birth and is

manifest by the infant's inability to actively move the affected arm.² Historically, excessive downward traction by the birth attendant following delivery of the fetal head, particularly in cases of difficulty with delivery of the fetal shoulders, has been postulated as the commonest cause of such injuries. Indeed, the British obstetrician William Smellie³ is credited with the first clinical description of obstetric brachial plexus palsy in his 1768 report of transient bilateral arm paralysis in an infant following a difficult and protracted labor.

Several recent studies have questioned this traditional pathogenesis of brachial plexus injury (BPI). Unlike other forms of neonatal birth injury in modern times, the incidence of BPI has remained virtually unchanged in the last 50 years,⁴ despite an almost universally increasing cesarean section rate.^{5,6} In addition, a significant proportion of neonatal BPI appear to occur without documented shoulder dystocia.^{7,8} Some injuries have been attributed to factors, independent of the actions of the attending obstetrician or midwife, such as failure of normal rotation of the fetal shoulders into an oblique position, or impaction of the posterior shoulder against the sacral promontory.⁹

Nevertheless, even if some cases of neonatal BPI are not the direct result of excessive downward traction on the fetal head at delivery, this mechanism remains the most anatomically plausible pathogenesis. Documented shoulder dystocia remains the commonest antecedent, occurring in 26-64% of reported series of BPI,¹⁰ although most cases of shoulder dystocia have no brachial plexus sequelae. Bearing in mind the risk of persistent neurological injury to the infant, and the consequent medicolegal implications for the attendant supervising delivery, it is therefore the responsibility of obstetricians and midwives to implement any measures that may reduce the incidence of BPI. The Confidential Enquiry into Stillbirths and Deaths in Infancy 5th annual report¹¹ recommended "a high level of awareness and training for all birth attendants." Annual skill drills, including management of shoulder dystocia, have been recommended jointly by both the Royal College of Midwives and the Royal College of Obstetricians and Gynaecologists in the United Kingdom.^{12,13} Consequently, the vast majority of obstetric units now practice regular staff training and drills in maneuvers to prevent and alleviate shoulder dystocia. Because such

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measures are now standard practice it is not possible to subject their efficacy to a randomized trial, so that comparison with historic controls represents instead an appropriate method of assessing their impact.

At our institution we performed an analysis of all cases of neonatal BPI from 1994 through 1998 and showed an incidence of 1.5/1000 births.¹⁴ Following this, specific staff training in the management of shoulder dystocia was introduced. We hypothesized that this would result in a reduction in the incidence of neonatal BPI. We have now performed a further evaluation of all cases born from 2004 through 2008, enabling us, therefore, to compare both the incidence and antecedents of neonatal BPI in our institution in 2 different 5-year epochs a decade apart.

MATERIALS AND METHODS

This prospective study of consecutive cases of neonatal BPI was conducted at the National Maternity Hospital, Dublin, Ireland, a tertiary referral institution in which >9000 women are delivered annually, during the 5-year epoch from 2004 through 2008. All infants born there undergo comprehensive neonatal examination on the second day of life. All cases of neonatal BPI were clinically identified and treated in collaboration with the physiotherapy department. The primary outcome measure was the incidence of neonatal BPI. Secondary outcomes measures were the antecedent factors associated with injuries including parity, maternal weight and gestational weight gain, gestation at and mode of delivery, and whether or not difficulty in delivering the shoulders was documented.

Data collection

During the 5-year period 2004 through 2008 all infants who were found to have evidence of BPI were clinically identified and assigned prospectively to a follow-up physiotherapy program. In every case data on maternal age, weight and height at first antenatal consultation, gestational weight gain, the presence of diabetes mellitus (either gestational or preexisting), and, in multiparous

women, history of shoulder dystocia or a previous birthweight >4 kg were documented. In addition, intrapartum details relating to gestational age, mode of onset of labor, oxytocin augmentation, duration of labor, mode of delivery, infant birthweight, and whether or not a shoulder dystocia was noted were recorded.

Labor ward management

At our institution, first labors are managed according to an active management of labor protocol¹⁵ and progress recorded on standardized partograms. Spontaneous vaginal deliveries are generally conducted by midwives and instrumental deliveries or cesarean deliveries, when indicated, are performed by attending obstetric residents or consultants. Routine management at vaginal delivery includes waiting for the next contraction following delivery of the fetal head and its restitution, before attempts at shoulder delivery.

Management of shoulder dystocia

Shoulder dystocia was defined as "failure to deliver the shoulders at the first attempt in singleton cephalic vaginal deliveries." If the shoulders were not delivered at the first attempt a second attempt was not undertaken until appropriate assistance had been called and specific maneuvers to alleviate shoulder dystocia were in place. This represented a significant change in practice from the previous 1994 through 1998 epoch, during which time a second attempt to deliver the fetal shoulders by the midwife or obstetrician conducting the delivery would have been commonplace. Regular training and retraining sessions were conducted at 6 monthly intervals in the appropriate management of shoulder dystocia for both midwives and obstetric residents in training. These training sessions were conducted by senior obstetric attendants and midwifery tutors to include education regarding the identifiable risk factors for and appropriate recognition of shoulder dystocia. Specifically, midwives and obstetric residents were trained to call for senior help immediately if signs of shoulder dystocia (tight shoulders at the perineum, or a turtle sign) were noted following deliv-

ery of the fetal head or if the fetal shoulders were not delivered at the first attempt at downward traction. The use of McRoberts' maneuver combined with suprapubic pressure was promoted as the first-line procedure when signs of shoulder dystocia were noted following delivery of the fetal head, followed by internal rotation maneuvers and delivery of the posterior arm if the head was not delivered following the first attempt at downward traction.

All cases of shoulder dystocia were reported to the hospital's risk management committee and outcomes were continuously audited. A diagrammatic report form was completed immediately following each case of shoulder dystocia that included documentation of the time of delivery of the head, the number of attempts at downward traction before additional maneuvers were employed, the time at which each maneuver was attempted, and the time of delivery of the infant.

Management of BPI

All identified cases of neonatal BPI received standard neonatal physiotherapy that included a passive stretching, limb positioning, and tactile stimulation program. Following discharge all infants were followed up every 2 weeks as outpatients. Infants whose limb function was not improving with physiotherapy were referred to the Central Remedial Clinic, Dublin, Ireland, a specialized center for children and adults with physical disabilities offering further neurological assessment involving neurologists, physiotherapists, and occupational therapists.

Injuries were categorized as transient (transient neurological impairment resolving within the first year of life) or persistent (neurological impairment persisting >1 year). Records of all cases of neonatal BPI referred to the Central Remedial Clinic during the study period were reviewed to ensure that any additional cases, born in the National Maternity Hospital but not identified prior to postnatal discharge, were included in the analysis.

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