BIRTH INJURIES OF THE BRACHIAL PLEXUS

INCIDENCE AND PROGNOSIS

A. E. HARDY

From the Department of Orthopaedic Surgery, Auckland Hospital, Auckland

Between March 1969 and May 1978, 36 babies sustained birth injuries of the brachial plexus at the National Women’s Hospital, Auckland, New Zealand. This gives an incidence of 0.87 per 1000 live births. Nearly 80 per cent of these children had made a complete recovery by the age of 13 months, while none of those with significant residual defects has severe sensory or motor deficit of the hand.

In treating a child with a birth injury it is important to know the incidence and prognosis of that injury. In order to establish the incidence of birth-induced palsy of the brachial plexus and to study the prognosis for this injury in Auckland, the author reviewed the recent experience at the National Women’s Hospital.

MATERIAL AND METHODS

The National Women’s Hospital is the largest obstetric hospital in New Zealand, a major teaching centre and a referral centre for smaller hospitals. Between March 1969 and May 1978, there were 41,124 live births recorded, of which 4404 were delivered by caesarean section and 2051 were delivered by the breech, including 567 delivered by the breech at caesarean section. Thirty-six of these babies sustained injuries of the brachial plexus during delivery, giving an incidence of 0.87 per 1000 live births. The birth records and paediatric notes of all these children were analysed. Fifteen were assessed and examined in detail by the author between December 1977 and November 1979 and a full neurological examination of upper and lower limbs was performed. The passive range of movement of all joints of the upper limb was assessed with a goniometer and limb lengths were measured. An assessment of functional impairment was made.

RESULTS

Twenty-three children were white-skinned, 12 Polynesian and one Chinese; 17 were girls and 19 boys. The right side was affected in 18, the left in 15, and three were bilateral palsies. In 14 there was another associated birth injury: three fractured humeri, one fractured clavicle, two phrenic nerve palsies, four facial nerve palsies, one combined facial and phrenic nerve palsy, one fractured parietal bone and two with severe bruising of the scalp and face.

Delivery. Seventeen children were born to primiparous mothers with an average length of labour of 18.6 hours (range 1.3 to 40 hours). Nineteen were born to multiparous mothers with an average length of labour of 13 hours (range 3.0 to 20.5 hours). Thirty babies were cephalic deliveries, of whom 18 were assisted with Kielland’s forceps and six with other types of forceps.

Four (one of which was an undiagnosed twin) were delivered by the breech and two by caesarean section. Shoulder dystocia was noted in 10 instances. One of the bilaterally affected children was delivered by the breech, the other two were forceps-assisted cephalic deliveries. Six of the children were delivered to diabetic or prediabetic mothers, five mothers had pre-eclampsia and one was on corticosteroids. Ten babies had an Apgar score of less than four at one minute, but in none was it less than four at five minutes.

Gestational age and weight. The mean birth weight of the 36 babies was 4071 grams (SD 878 grams). The mean gestational age was 40 weeks (range 34 to 43 weeks). Measurement against the percentile table of birth weight versus gestation drawn up on the basis of 11,005 singletons of acceptable dates delivered at the National Women’s Hospital between 1969 and 1972 (Fig. 1) shows this mean is above the 90th percentile. The 30 babies delivered vaginally after a cephalic presentation had a mean birth weight of 4263 grams (SD 787 grams) and a mean gestational age of 40 weeks (range 34 to 43 weeks), while the six delivered by caesarean section or vaginally by breech presentation had corresponding values of 3111 grams (SD 542 grams) and 39 weeks (range 35 to 42 weeks), and were therefore significantly lighter (0.01 >P>0.001 using Student’s t test).

Recovery. Of the 21 babies followed by paediatricians but not examined by the author, six were noted to be “recovering”, “virtually completely recovered”, or “almost completely recovered” at the time of discharge from the National Women’s Hospital between the fourth and eleventh days of life, and no further follow-up was recorded. Ten more had recovered by four months of age and a further four recovered completely between four and 13 months of age (Fig. 2). The remaining child has not been seen since six weeks of age when she was noted to have a residual deficit. Of the 15 children examined by the author eight were normal.
time of follow-up (Table 1). None of these seven had Horner’s syndrome, abnormal neurological signs in the legs, any obvious sensory deficit of the hand, any joint contracture distal to the elbow, or a dislocated radial head. Losses of shoulder movement less than 30 degrees are not shown in the table but all other limitations of passive movement are shown. Muscle testing of these children was tedious, but an attempt was made to assign an MRC grade to each muscle group. Five of the children with a deficit at final assessment had extensive lesions involving roots C5, C6, C7 and C8, and two had lesions consistent with involvement of the C5 and C6 roots. Only two of the seven had obvious gross weakness of the serratus anterior or other parascapular muscles. None of the children has been subjected to a surgical procedure.

Before leaving the maternity hospital all mothers were instructed in putting the joints of the affected limb through a full range of passive movement three times daily. In 11 instances shoulder abduction splintage using cloth splints was introduced in the neonatal period and continued for up to three months. An abduction splint was used only once among the seven children with residual deficit and this was the only child to develop a medial rotational contracture of the shoulder.

**DISCUSSION**

**Historical analysis.** Specht (1975) traced 11 patients with birth injury of the brachial plexus from 19,340 new births in the San Francisco area between 1963 and 1972, an incidence of 0.57 per 1000 live births. Adler and Patterson (1967), studying deliveries at the Hospital for Special Surgery, New York, between 1939 and 1962, deduced the incidence to be 0.35 per 1000 live births in 1962 compared with 1.56 per 1000 live births in 1938. Gordon et al. (1973), reporting the results of a collaborative study, found 60 cases from 31,700 live births from throughout the USA, but suggested that this incidence of 1.89 per 1000 live births should not be considered as the national average, as the survey was heavily weighted with families of low income; the time span of this study was not clearly stated.

Specht (1975) suggested that the severity as well as the incidence of birth-induced brachial plexus injuries might well have decreased with the refinement of obstetric techniques: he followed up eight of his 11 patients and found no significant residual deficit. Gordon et al. (1973) reported complete recovery by one year in all but three of the 59 patients they followed up. Adler and Patterson (1967), reporting on the follow-up of 88 of their 123 patients seen between 1939 and 1962, noted 62 had had a total of 98 operations; 28 had developed fixed adduction and medial rotation of the shoulder, seven had pronation contractures, 11 had flexion contractures of the elbow greater than 45 degrees and 13 had less severe contractures of the elbow, 14 had dislocation of the radial head, and one had
Table 1. Abnormal examination findings of children with residual paralysis at final follow-up

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Functional deficit</th>
<th>Shoulder</th>
<th>Elbow</th>
<th>Wrist</th>
<th>Hand power (MRC)</th>
<th>Limb shortening (centimetres)</th>
<th>Reflexes</th>
<th>Roots involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3 8</td>
<td>M</td>
<td>Feeding, Playing</td>
<td>Abduction: 0–100 0, Flexion: 0–90 3, Extension: 0–20 0, Medial rotation: 0–30 3</td>
<td>Flexion: 15–135 3, Extension: 4, Supination: 2, Pronation: 4</td>
<td>Dorsiflexion: 4, Palmar flexion: 4</td>
<td>2</td>
<td>C5–8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>F</td>
<td>Playing</td>
<td>Lateral rotation: 0–40 2, Abduction: 2, Scapular abduction: 2</td>
<td>Flexion: 0, Extension: 3, Supination: 0, Pronation: 4</td>
<td>Dorsiflexion: 4, Palmar flexion: 4</td>
<td>4</td>
<td>C5–8</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>1 8</td>
<td>F</td>
<td>Playing</td>
<td>Abduction: 2, Lateral rotation: 1, Flexion: 2, Extension: 2, Medial rotation: 0–60 4</td>
<td>Flexion: 2, Extension: 4, Supination: 2, Pronation: 4</td>
<td>Dorsiflexion: 4, Palmar flexion: 5</td>
<td>4</td>
<td>C5–8</td>
<td></td>
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a complete disruption of the elbow. Wickstrom (1962), reporting on 87 children treated between 1944 and 1958, stated that 10 of the 75 who were first seen in infancy had excellent results, 32 had abduction of the shoulder greater than 90 degrees, but 33 never gained satisfactory function of the shoulder, forearm and hand. Eng (1971) reported on the follow-up of 20 infants born in Washington DC between 1967 and 1969, and noted three to have significant handicaps at one year, and another 11 to have moderate residua including persistent weakness, delay in bone growth, peculiar posturing and dislocation. Neither Wickstrom, nor Adler and Patterson, nor Eng reviewed patients from a consecutive series of live births, and for this reason possibly offer a false impression of the overall gravity of prognosis. Obstetric techniques have improved, and obstetricians have become more willing to proceed with caesarean section since the time when Wickstrom and Adler carried out their studies.

Present study. Analysing the results of this study to determine prognostic factors, the following points emerge. One of the seven with residual deficit was delivered by the breech. Six were delivered vaginally after cephalic presentation, and these six were not significantly heavier (birth weight 4576 grams, SD 363), than the other 24 delivered in this manner who recovered (birth weight 4184 grams, SD 872; 0.5 > P > 0.1 with Student's t test). Five of these six were delivered with Kielland's forceps; but there were 19 other palsies in children born by assisted vaginal cephalic delivery which recovered. There was no prognostic significance apparent on comparing the gestational age and Apgar score of those who recovered and those who did not recover. All the facial palsies developed in children delivered with the assistance of forceps, and all recovered completely. One child who had a transient facial palsy had a residual palsy of the brachial plexus. This association of birth-induced palsies of the facial nerve and the brachial plexus was also noted in four of the 25 patients reported by Eng (1971). No child with a residual deficit at the age of 13 months recovered completely, though minor improvements were noted between 13 and 24 months of age in the two children followed at intervals during that period. No child recovered further after two years of age.

Six babies recovered in the first two weeks of life, an additional 16 by four months of age, and a further six by 13 months of age (Fig. 2). Of the remaining eight, one child with a residual deficit was lost to follow-up at six weeks of age, five had a definite residual deficit, and a further two (Cases 6 and 7, Table I) will almost certainly have a residual deficit, having made little recovery during the four months before the final follow-up examination.

The author does not believe in the use of abduction splintage, and recommends that the parents be carefully instructed how to put all upper limb joints of the affected limb through a full range of movement, each time the child is fed after the first week of life. A physician should check that this technique is being properly practised at regular intervals.

On the basis of this study, the author agrees with the suggestion of Specht that the prognosis of birth-induced palsy of the brachial plexus is not as severe as previous reviews indicate (Wickstrom 1962; Adler and Patterson 1967; Eng 1971), and suggests that an approach of cautious optimism be taken in discussing the prognosis of this lesion with the parents in the neonatal period. Nearly 80 per cent of these children had made a complete recovery by 13 months of age while none of those with significant residual defects had severe sensory or motor deficits in the hand.

I would like to acknowledge the assistance and helpful advice of Professor Howie, Dr. J. D. Matthews and the other paediatricians at the National Women's Hospital. Professor Howie prepared the percentile chart of birth weight versus gestational age, part of which is shown in Figure 1.

REFERENCES