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Shoulder function following partial spinal accessory nerve transfer for brachial plexus birth injury

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Summary Over a 5-year-period, 26 infants underwent a partial transfer of the spinal accessory nerve into the suprascapular nerve using a nerve graft, as part of the repair of a brachial plexus birth injury. At a minimum follow-up of 2.5 years, all children had shoulder function of Grade 4 or better using a modified Gilbert Scale. Average lateral rotation was measured at 53°.

Introduction

Although the transfer of the spinal accessory nerve into the suprascapular nerve has been well described for adult brachial plexus injuries, there is little available information on the use of this technique for infants with brachial plexus birth injuries.

Methods and materials

Over a 5-year period (1997–2001) 26 infants underwent a partial spinal accessory nerve into suprascapular nerve transfer as part of the primary reconstruction for a brachial plexus birth injury.

All patients were available for a minimum of two and a half years of follow-up. The average follow-up time was 4.3 years. There were 13 male and 13 female infants. The right upper limb was involved in 16 and the left in 10. The injury pattern is summarised in Table 1.

Technique

All procedures were performed using the operating microscope and a reversed nerve graft (sural or cervical plexus sensory) with a modified end-to-side technique at the proximal end. The spinal accessory nerve was entered using a diamond knife under high magnification after the take-off of 1–2 motor

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Table 1 Injury pattern ($N=26$)

C5/C6/C7	7
C5/C6	9
Global	10

branches to the upper/middle trapezius and the graft placed within deep neurotomy. The suprascapular nerve was opened after its take-off from the upper trunk, well outside of the zone of injury for a direct coaptation. In all cases the upper trunk divisions were reconstructed using available spinal nerve donors C5 and/or C6 and sural nerve grafts.

All repairs were done using fibrin sealant, without sutures. The average follow-up time was 4 years. Shoulder function was evaluated using the modified Gilbert system[1] (Table 2). Active external rotation was measured at the most recent follow-up. This was done with the child in the standing or sitting position and observing their multiple attempts to remove a sticker from behind the ear. Data was confirmed by a review of videos taken at each evaluation.

Results

No operative complications occurred. No infant has exhibited any evidence of trapezius atrophy. Out of 26 patients, only two infants with poor recovery of external rotation of less than or equal to 10° have required a subsequent muscle transfer to maximize shoulder function. Both advanced to Gilbert Grade 5 with active shoulder external of 45°. Shoulder function at the most recent follow-up for the series is summarised in Table 3. The average active shoulder external rotation in the group was calculated at 53° (range 10°–90°).

Table 3 Pre- and postoperative shoulder evaluation (modified Gilbert)

Stage	Preoperative	Postoperative
0	19	0
I	4	0
II	2	0
III	1	0
IV	0	10
V	0	7
VI	0	9

Discussion

In 1994, Kawabata[2] reported the use of a spinal accessory transfer for 13 infants with brachial plexus palsy. However, in only two of these patients was the transfer into the suprascapular nerve. Birch has reported three cases of late transfer of the spinal accessory nerve into the suprascapular nerve for repair of a brachial plexus birth injury with excellent results.[3] Many other reports[4–8] discuss the use of the spinal accessory nerve into a variety of recipients for repair of traction injuries to the brachial plexus in adults.

The results of the study suggest that this is a useful transfer in cases of brachial plexus birth trauma with intraoperative findings of limited spinal nerve donors (C5/C6) for reinnervation of the suprascapular nerve.

The decision to use an interposition graft with the end-to-side technique is undoubtedly controversial.[9] We undertook using this technique to minimize any potential weakening of the trapezius[10] because many of these children are already subject to scapular instability.[11] We were encouraged by our favourable clinical outcome using this type of end-to-side repair in other brachial plexus reconstructions in infants,[1,12] and by the growing clinical[13] and experimental[14] data supporting this technique. Although considerably longer follow-up

Table 2 Modified Gilbert shoulder evaluation scale

Grade 0	Completely paralysed shoulder or fixed deformity	
Grade 1	Abduction $=45°$	No active external rotation
Grade 2	Abduction $<90°$	Bi active external rotation
Grade 3	Abduction $=90°$	Active external rotation $<30°$
Grade 4	Abduction $<120°$	Active external rotation 10°–30°
Grade 5	Abduction $>120°$	Active external rotation 30°–60°
Grade 6	Abduction $>150°$	Active external rotation $>60°$

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is necessary to confirm the value of this method, the low incidence of secondary muscle transfers for shoulder reconstruction during the study period supports its use in plexus repair in infants.

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