

Relation of muscle size to function in neonatal brachial plexus palsy

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This commentary is on the original article by Ruoff et al. on pages 1050–1056 of this issue.

Neonatal brachial plexus palsy (NBPP) is a condition that results in paralysis/paresis and loss of sensation in the affected arm, with a reported incidence similar to that of cerebral palsy. Although some infants with NBPP recover spontaneously within the first 3 months of life, others experience long-term sequelae including muscle imbalance, subsequent deformity, and functional impairment. In cases of late presentation or when primary nerve reconstruction does not yield full functional recovery, residual impairments become the focus of musculoskeletal repair/reconstruction including tendon transfers. Such procedures are traumatic for both the patients and their caretakers, and can yield suboptimal results that often require further therapy or surgery. Consequently, the correlation of muscle size to function, if it exists, would be important to practitioners. Thus, Ruoff et al.¹ address a salient question regarding the interrelationship of muscle size, bone length, and function, i.e. whether the reduced growth of upper arm flexor and extensor muscles is related to humeral length and active elbow function.

Limb length discrepancy in NBPP has been established,² and the effect of mechanical factors upon limb growth is well known. In children without NBPP, the interrelationships between bone strength, body weight, bone length, and muscle cross-sectional area are complex;³ in infants with NBPP, the additional factor of lower motor neuron injury further complicates the picture. Regarding the shoulder of infants with NBPP, van Gelein Vitringa et al.⁴ previously demonstrated a strong relationship between shoulder muscle atrophy and shoulder subluxation. However, regarding the elbow, Ruoff et al. report that upper arm flexor and extensor muscle size is not a predictor of muscle function.

The results of this study must be interpreted within the context of the study methodology. All patients studied were scheduled for nerve reconstruction, so the study group repre-

sents a minority of all patients with NBPP, albeit those with nerve lesions thought to be severe and non-recovering. Although significant reduction in muscle cross-sectional area occurs within months of complete denervation, the single study group comprised patients with nerve injury/denervation of varying degrees and variable nerve root involvement. Changes in muscle size and composition become more apparent in chronic denervation (months to years); the study group included patients less than 6 months of age as prediction of function would be most valuable at this age group. Any or all of the above could affect the observed non-relationship between muscle size and muscle function.

A further consideration is the assessment of function in patients with NBPP. Mechanical factors affecting bone and muscle growth rely grossly upon constant spontaneous use of the limb. Patients with NBPP suffer from limb apraxia⁵ that may limit them to muscle use only upon stimulation or command, but without spontaneous use of the limb. Commonly used NBPP measures (e.g. the direct muscle power grading in the Gilbert and Tassin Muscle grading score or the standard Medical Research Council muscle grading scale) typically use stimulation or command, but these measures do not fully account for clinically meaningful changes in function. For example, a child may be able to activate certain muscles to an examiner's command or physical stimulation, but the inefficiency and weakness of the movement may preclude meaningful use of the arm in spontaneous activity. Therefore, it remains to be seen whether the correlation of muscle size to function is present when function is assessed by a potentially more relevant measure of spontaneous movements.

Finally, a commentary regarding this condition would be incomplete without mentioning the international variability in its name. Ruoff et al. refer to this condition as 'obstetric brachial plexus lesion, also known as birth brachial plexus injury.' These names imply obstetrical causation/fault although none may have occurred during the perinatal period. In the United States, the numbers of obstetricians may be decreasing in part because of unsustainable liability insurance premiums. Therefore, a recent survey of US-based practitioners demonstrated a strong (94%) preference for alternative terms, such as neonatal brachial plexus palsy.⁶

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