Objectives: Surgical neurectomy is a useful strategy in the management of recalcitrant spasticity. Adduction and internal rotation contractors at the shoulder cause pain and difficulty with activities of daily living. Total neurectomy is indicated in spasticity with early contracture and selective partial neurectomy in patients with volitional control and no contracture as an alternative to repeated chemodenervation. The surgical approach should avoid the axillary skin where hygiene is often compromised as a result of the contracture and spasticity.

Methods: Using a cadaveric model we adapted the pectoralis major (PMaj) muscle-splitting approach to the brachial plexus to afford access to the infraclavicular motor branches to the shoulder. The superficial dissection identifies an avascular plane between the clavicular and sternocostal heads of the PMaj medial to the coracoid process (Figure 1). The lateral (LPN) and medial (MPN) pectoral nerves can be identified in the clavipectoral fascia (CPF) and in the interval between PMaj and pectoralis minor (PMin) respectively. The LPN is found 5-10cm from the midline as it pierces the CPF (Figure 3a). The MPN is found 8-11cm from the midline as it pierces the PMin. A double pedicle is found within the PMin in 50% of cases. A further direct branch to PMaj is found lateral to the PMin in 20% of cases. Tracing all the branches to their parent cords allows complete denervation when indicated (Figure 2). The PMin tendon is released at its insertion to the coracoid process exposing the rest of the infraclavicular brachial plexus and accompanying vessels. The interval between the lateral cord and the axillary artery is developed with inferior retraction on the vessel using a vessel loop, allowing exposure of the posterior cord. The thoracodorsal nerve is identified at its take-off between the upper and lower sub scapular nerves (Figure 3b). This branching anatomy is variable and nerve stimulation should be used to confirm the anatomy. Cadaveric dissection confirms the variant anatomy (Figure 4). Neurectomy of these three nerves results in reduction of the internal rotation and adduction contracture from subscapularis, teres major and the latissimus dorsi. The approach can be performed through a small incision and does not compromise any sensory nerves, reducing the risk of neuropathic pain.

Results: The procedure has been used for total neurectomy in 4 non-functional limbs with axillary contractures and painful shoulder spasticity without complications. Three patients had post-stroke spasticity and one quadriplegic cerebral palsy. All patients reported improvements in shoulder posture and reduction in pain with increased passive brachiothoracic angle facilitating washing and dressing. The improvements have been maintained at 12 months follow-up.

Conclusion: Management of the painful adducted and internally rotated spastic shoulder is challenging. A mini-incision pectoralis major splitting incision provides access to the key motor nerves to the shoulder for neurectomy.

Figure 1: The Pectoralis Major interval

Figure 2: Nomenclature for neurectomy in spasticity

Figure 3: Left Pectoralis Major splitting infraclavicular exposure

3a: Superficial exposure demonstrating LPN

3b: Deep exposure of posterior cord with target branches tagged

Figure 4: Left posterior cord branching anatomy - Double thoracodorsal nerve pedicle from both upper and lower sub-scapular nerves

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