Transfer of Pectoral Nerves to Suprascapular and Axillary Nerves: An Anatomic Feasibility Study

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Purpose We conducted an anatomic study to provide detailed information on the pectoral nerves and anatomic data on the transfer of the pectoral nerves to the axillary nerve. Moreover, we experimentally determined the feasibility of transferring the pectoral nerves to the suprascapular nerve in upper brachial plexus injury.

Methods We dissected 26 brachial plexus from 15 fresh cadavers. The origin, location, course, and branching of the pectoral nerves were recorded. The length and the diameter of the pectoral nerves were measured. The diameter of the suprascapular and axillary nerves was recorded. In all dissections, we assessed the feasibility of directly transferring the pectoral nerves to the suprascapular and axillary nerves.

Results We found 3 constant branches of pectoral nerves arising from 3 distinct origins in 20 cases, and 3 constant branches arising from 2 distinct origins in 6 cases. The C7 sent nerve fibers to all 3 branches. The average length and diameter of the superior, middle, and inferior branches of the pectoral nerves were 65 mm, 110 mm, and 105 mm, and 2.0 mm, 2.3 mm, ad 2.4 mm, respectively. The average diameter of the suprascapular and axillary were 2.8 mm and 3.6 mm, respectively. The superior branch reached the suprascapular and axillary nerves in 17 and 8 cases. The middle and inferior branches reached the suprascapular and axillary nerve in all dissections.

Conclusions With an adequate length, diameter, and nerve composition, the middle and inferior branches of the pectoral nerves are suitable donor nerves to the axillary nerve and a potential source of reinnervation of the suprascapular nerve in upper brachial plexus injury.

Key words Anatomy, axillary nerve, brachial plexus injury, pectorals nerves, suprascapular nerve.

One of the main goals after upper brachial plexus injury is reconstruction of shoulder function.[1] To achieve this goal, the restoration of both suprascapular and axillary nerves function is required.[2,3] Donor nerves for restoration of the suprascapular nerve are limited; the spinal accessory nerve is the most frequently used for suprascapular nerve neurotization.[4–6] However, this nerve is functionally important, and this transfer creates the loss of lower trapezius function,[7] which is the most active trapezius part during shoulder abduction.[8] In the case of lower trapezius paresis, the serratus anterior pulls the scapula laterally, and normal shoulder abduction is never achieved.[9] To search for new donor nerves to the suprascapular nerve, we studied the anatomy of the pectoral nerves. To date, the anatomy of pectoral nerves is still unclear, especially for the lateral pectoral nerve. Many authors have reported the medial pectoral nerve as a donor nerve to the musculocutaneous and axillary nerves,[10–13] but none have reported the feasibility of transferring the pectoral

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nerves to the suprascapular nerve. The purpose of this study was 3-fold: to clarify the origin and the course of the pectoral nerves; to provide anatomic information on the transfer of the pectoral nerves to the axillary nerve; and to evaluate the feasibility of transferring the pectoral nerves to the suprascapular nerve in upper brachial plexus injury.

MATERIALS AND METHODS

We dissected 26 brachial plexus from 15 fresh cadavers, the suprascapular nerve, and the axillary nerve. (Four cadavers had only one arm available at the moment of dissection; the other one was already used by the department of anatomy). We removed the skin and subcutaneous fat from the entire supraclavicular and infraclavicular areas. The brachial plexus was dissected carefully from the roots to the clavicle. An infraclavicular dissection was performed; the pectoralis major muscle was reflected medially to allow the dissection of the superior and middle branches of the pectoral nerves (lateral pectoral nerve). The pectoralis minor muscle was released from the coracoid process to follow the course of the inferior branch of the pectoral nerves (medial pectoral nerve), which was dissected through the pectoralis minor to gain more length.

The location, course, and branching of the pectoral nerves were recorded. The lengths of the pectoral nerves were measured from their emergence points to the points where they would have to be transected if used for a neurotization. The point of transection was usually at the entry into the pectoral muscles, although sometimes an extensive premuscular arborization required a proximal point of transection. The diameter of the pectoral nerves was measured at the point of transection. The suprascapular nerve was identified next to the suprascapular notch, and its diameter was recorded. The axillary nerve was identified next to the quadrilateral space, and its diameter was recorded. In all dissections, we recorded whether the pectoral nerves were long enough to directly reach the suprascapular nerve next to the suprascapular notch. To realize this neurotization, the donor nerve was cut at its termination and slid under the clavicle to reach the suprascapular nerve. Moreover, we recorded whether the pectoral nerves were long enough to directly reach the axillary nerve next to the quadrilateral space. We did not section the ansa pectoralis when we made these transfers.

After the neurotization was completed, the clavicle was removed, and the brachial plexus was completely dissected to precisely determine the origin of each branch of the pectoral nerves. We took photographs and illustrated our findings in schematic drawings.

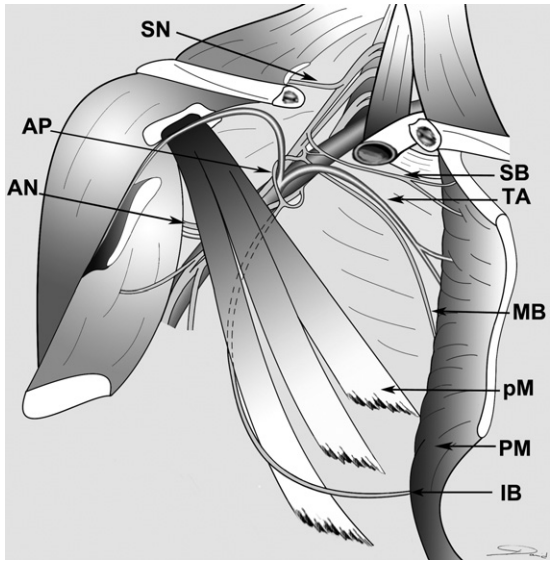

FIGURE 1: Schematic drawing of right brachial plexus showing the 3 branches of the pectoral nerves, the suprascapular nerve, and the axillary nerve. SN, suprascapular nerve; AP, ansa pectoralis; AN, axillary nerve; SB, superior branch of the pectoral nerves; TA, pectoral branch of the thoracoacromial artery; MB, middle branch of the pectoral nerves; pM, pectoralis minor; PM, pectoralis major; IB, inferior branch of the pectoral nerves.

RESULTS

In all the dissections, the pectoral nerves had 3 branches with a relatively constant course (Fig. 1). The superior branch appeared just distal to the clavicle at the lateral border of the axillary artery and showed a straight course to enter the clavicular portion of the pectoralis major, usually with 3 branches. The middle branch appeared next to the superior branch and followed the pectoral branch of the thoracoacromial artery. It coursed on the deep surface of the pectoralis major and entered into the pectoralis major distally to innervate its sternocostal part, usually with 2 branches (in 21 cases). We found an ansa pectoralis derived from the middle branch to the inferior branch in all dissections. The inferior branch appeared at the medial border of the axillary artery, close to the origin of the lateral thoracic artery. After receiving the ansa pectoralis, it coursed on the deep surface of the pectoralis minor and distributed 1 or 2 branches into it. In 17 cases, its lower and larger branch pierced the pectoralis minor to reach the pectoralis major, and in the other 9 cases, its branch passed around the lower border of the pectoralis minor to reach the pectoralis major.

The origin and the relationship of these 3 branches were ever changing, especially the superior and the middle branches. To clarify the relationship between the superior and the middle branches, we