An Anatomical and Histological Intercostal Nerve Study to Determine Optimal Recipient Site for Sensory Reinnervation in Autologous Breast Reconstruction

Anita T Mohan, MRCS BSc,
Marissa Suchtya, BA,
Osman Akdag
Lin Zhu, MD
Nirusha Lachman, PhD,
Samir Mardini, MD,
Michel Saint-Cyr, MD,

Abstract Text:
Purpose:Some developments in the evolution of perforator flaps in autologous breast reconstruction include attempts to reinnervate the harvested tissue. There is a paucity of data on sensory reinnervation but it has been reported that the use of innervated autologous flaps in breast reconstruction can provide stability, protection from direct trauma, recovery of erogenous sensation and higher patient satisfaction.1,2,3 Previous studies have evaluated the anterior abdominal wall intercostal nerve anatomy as a donor nerve to be raised with autologous abdominal based flaps.3 This study provides the anatomical basis to determine the optimum recipient site choice for sensory coaptation in microsurgical breast reconstruction.

Methods:Twelve hemi-chests were dissected from six fresh (non-frozen) cadaveric females, with a median age of 79 years (range 63-100) and BMI of 26.8.Dissections were carried out from the anterior midline proceeding laterally to identify subcutaneous portions of cutaneous branches of the anterior cutaneous intercostal nerve and then exposure of the first six ribs. Costal cartilage was sequentially removed to expose the internal mammary vessels and the anterior cutaneous intercostal nerve (ACB) and the lateral (subcutaneous) branch of the anterior cutaneous intercostal nerve (LACB). Anatomical measurements were recorded and nerve samples from both branches were reviewed histologically. Specimens were cross-sectioned and stained with H&E and Karnovsky and Roots Staining to differentiate sensory fascicles.4

Results: A lateral subcutaneous branch of the anterior cutaneous branch of the intercostal nerve (LACB) was noted consistently in the 2nd to 4th rib space (96% cases), with a median length of 43mm, 37.5mm and 37mm respectively. These nerves perforated the intercostal muscles within 1cm from the sternal edge, and the length and diameter of the LACB diminished caudally, with the largest diameter nerves at the 2nd-4th intercostal spaces. Histological analysis demonstrated that the LACB nerves had consistently a greater average total fascicular area than ACB nerves (18513um2 versus 5420um2). In addition, LACB nerves had a larger area per fascicle than the ACB nerves (6784um2 versus 5420um2), demonstrating differences in individual fascicle size between LACB and ACB nerves.

Conclusions: A better understanding of characteristics of the anterior cutaneous intercostal nerve branches can optimize the site of recipient site coaptation. On

preparation of the internal mammary vessels, preservation of the LACB can provide better size, with good sensory innervation for coaptation.

Reference Citations: 1. Blondeel PN, Demuynck M, Mete D et al. Sensory nerve repair in perforator Xaps for autologous breast reconstruction: sensational or senseless? (1999) Br J Plast Surg 52:37–44
2. Mori H, Akira K, Hata Y. Anatomical study of innervated transverse rectus abdominis musculocutaneous and deep inferior epigastric perforators flaps. Surg Radiol Anat (2007). 29:149-154

3. Yap LH, Whiten SC, Forster A, Stevenson JH. The anatomical and neurophysiological basis of the sensate free TRAM and DIEP flaps. Brit J Plast Surg (2002): 55;35-45.

4. Kugler, P. (1987). Improvement of the method of Karnovsky and Roots for the histochemical demonstration of acetylcholinesterase. Histochemistry,86(5), 531-532