TRANSPLANTATION OF LATISSIMUS DORSI AND GRACILIS MUSCLES

THESIS

(M. S. ORTH)

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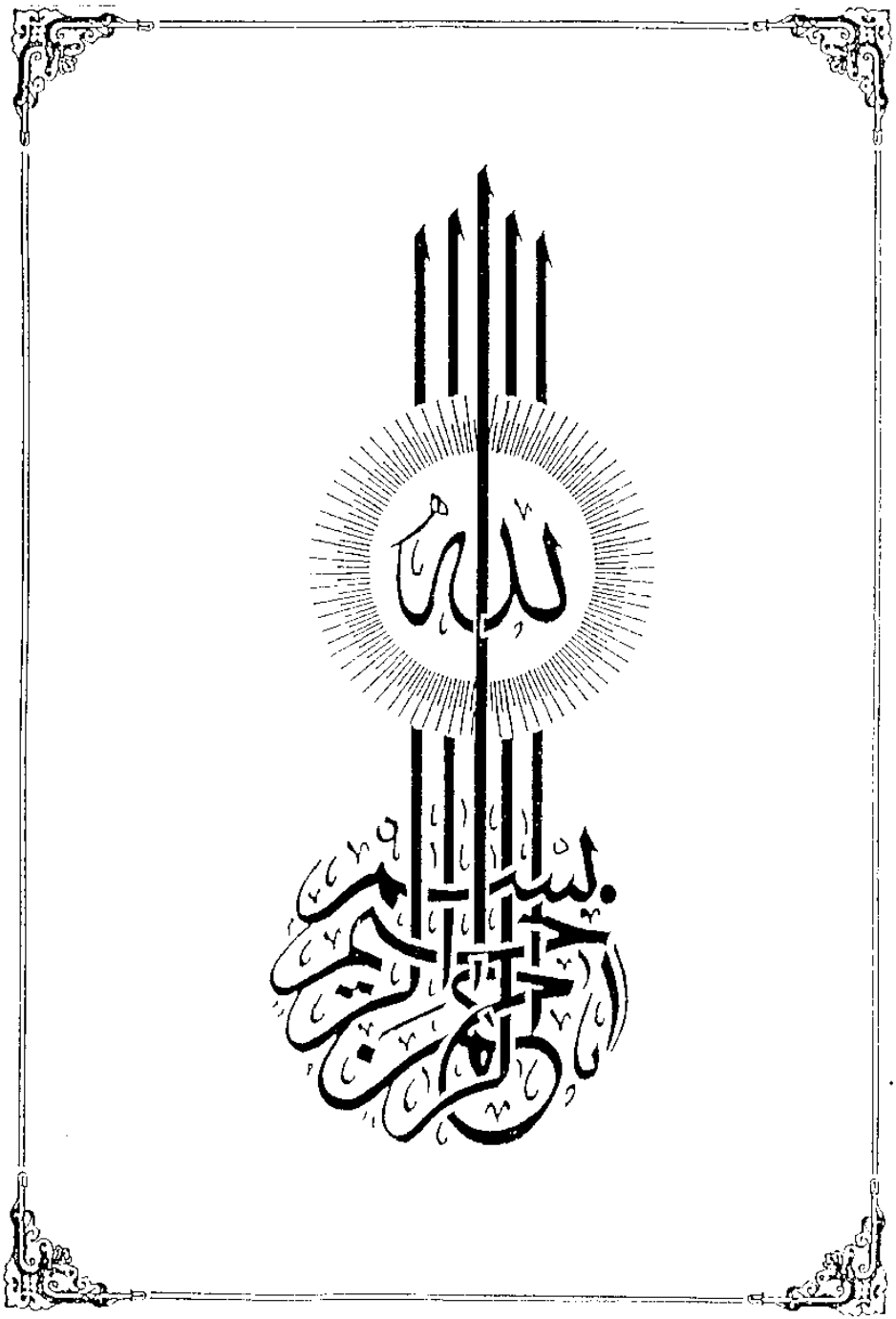

بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم
٣٢ م البقرة

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parts and shorten the hospital stay ; it has also an inherently better blood supply and actually improve the vascularity of the recipient bed .Abundant vascularization of the flap may make it easy to control residual infection and may accelerate bone union , Takami et al (1983) .

The disadvantages of conventional treatment can be outlined as follows . In order to reconstruct skin over exposed bones and joints , free skin graft operations must be postponed until sound granulation tissue has covered such raw surfaces'which prolongs the period of hospitalization . The use of cross-leg or distant flaps sufficently large to cover the defects may be difficult to obtain . Furthermore , skin reconstructed by conventional methods is susceptible to minor trauma , and most patients require devices aimed at protection of the reconstructed skin . Free vascularized flaps resolve these disadvantages. Unnatural posturing , inevitable in the use of cross-leg flaps is avoided . The exposed bones and joints can directly be covered and the transfered skin-muscle is susceptible to neither minor trauma nor scar contractures ,Iwaya(1982) .

If adequate coverage can be provided by either a kin graft or simple flap transposition , a free flap is rarely justified . For the experienced micro-surgeon , the risk of failure decreases significantly , permitting a wide range of indications . Therefore , free transplantation of muscle or musculocutaneous flap is a technique reserved for problems not readily solved by the simpler more direct methods of flap transposition , Mathes and Nahai (1982) .

The greatest advantage of free muscle transfer is acquired muscle contraction if the muscle is transfered with neurovascular anastomoses . Paralyzed hands or faces in which all other measures have totally failed , has been reconstructed by such free muscle transfer ,Harii et al (1983) .

The gracilis and latissimus dorsi muscles are presently the most popular muscles for transfer as stated by Takami et al ,(1983) and Manktelow and Ikuta (1983) . They have a suitable consistent vascular pattern and large area of overlying skin available for musculocutaneous flap , Mathes and Vasconez (1982) .

The latissimus dorsi has a large caliber and long stalked nutrient vessels and can cover a large soft tissue defect .

The ribs beneath it can be included in the flap , Harii et al (1982). The gracilis muscle has a reliable nerve and vascular pedicle , good length and good functional capability including strength and range of excursion , and its removal is accompanied without significant cosmetic or functional deficit ; so it is preferred to provide motor power to finger flexion . Latissimus dorsi and gracilis muscles have a range of contraction that will provide full finger flexion throughout normal wrist excursion , Manktelow et al (1984) .

The main goal of this dissertation is to review the present state of art in muscle transplantation , through the utilization of the latissimus dorsi and gracilis muscles . Detailed microanatomy and operative techniques of these two key transfers with results of others are described .

Anatomy of Donor Muscles

ANATOMY OF THE DONOR MUSCLES

Anatomy of the latissimus dorsi muscle:

The latissimus dorsi muscle is a large, triangular, flat muscle, extending over the lumbar region and the lower half of the thorax.

Origin: It arises from the spines of the lower six thoracic vertebrae anterior to the trapezeus, and from posterior layer of the thoraco-lumbar fascia, through which it is attached to the tips of the spines of the lumbar and sacral vertebrae, to the supraspinous ligament, and to the posterior part of the crest of the ilium. In addition it arises by msucular fibres from the posterior part of the outer lip of the iliac crest, lateral to the margin of the erector spinae, and by fleshy slips from the lower three or four ribs, the latter interdigitate with the lower slips of the external oblique.

From this extensive origin the fibres pass laterally with variable degree of obliquity, the upper ones horizontally, the middle obliquely upwards, and the lower almost vertically upwards, to converge into a thick fasciculus, the upper part of which crosses and usually receives a few fibres from the inferior angle of the scapule.

Insertion: The muscle belly turns around the lower border of the teres major, curving round to its anterior surface. Here it ends in a quadrilateral tendon - about 7 cm long, 2 cm width and 3 mm thickness, which passes infront of the tendon of the teres major, and is attched to the bottom of the intertubercular sulcus of the humerus, giving an expansion which blends with the deep fascia of the upper arm. The lower border of the tendon is united with the tendon of the teres major, the surfaces of the two being separated near the attachment by a bursa. On account of the way in which the muscle curves round the lower border of the teres major, its constituent fibres which were lowest at the midline attachment are attached highest on the humerus, while the highest midline fibres pass into the lower part of the tendon. The vertebral and costal attachment of the muscle may be reduced or, more rarely, increased [Warwick and Williams, 1973].

Nerve supply:

Neural motor anatomy: The latissimus dorsi muscle is supplied by the thoracodorsal nerve from the posterior cord of the brachial plexus, $C_{6,7 \text{ and } 8}$. This nerve is a large nerve which runs down the posterior wall of the axilla, crosses the lower border of the teres major

and enter the deep surface of the muscle half an inch from its free lateral border at a point midway between the chest wall and the abducted arm. It comes from high-up behind the suprascapular artery, but as it descends to enter the muscle it lies infront of the artery. It is thrown into prominence in the position of lateral rotation of the humerus, and is in danger in operations on the axilla [Last, 1978].

The thoracodorsal nerve is located a mean distance of 3.1 cm proximal to the subscapular artery and vein, joining them within 3 to 4 cm, and paralleling the vasculature between the subscapular artery and vein [Bartlett et al., 1981]. The thoracodorsal nerve courses adjacent to the thoracodorsal artery and vein entering the muscle 10 cm inferior to its insertion into the intertubercular groove of the humerus [Mathes and Nahai, 1982].

Neural (sensory) anatomy: The sensory nerves to the posterior cutaneous territory of the hatissimus dorsi muscle, enter the muscle with the secondary segmental vascular pedicles, from the posterior intercostal arteries. These nerves are branches of the intercostal nerves coursing with the perforating branches of the posterior intercostal arteries. These nerves are small, with one or two fascicles, and short, with length of 2 cm depending on

the thickness of the posterior hatissimus dorsi muscle and subcutaneous tissue [Mathes and Nahai, 1982].

Action: The latissimus dorsi is an expendable muscle. It is active in adduction, extension and especially medial rotation of the humerus [Mathes and Nahai, 1979].

Further it acts with the sternocostal part of the pectoralis major and teres major muscle to depress the raised arm against resistance. It is active also in backward swinging of the arm. The muscle takes also part in all violent expiratory movements, such as coughing or sneezing. Electromyography suggests that it aids in deep inspiration. When the fibres of the muscle are stretched, as in elevation of the arm, sufficient pressure is exerted on the inferior angle of the scapula to keep it in contact with the chest wall [Warwick and Williams, 1973].

It is helpful in elevating and stabilizing the pelvis. This is quite apparent in patients with polio or paraplegia [Schottstaedt, 1955].

Fisher et al.(1983), after his study on the latissimus dorsi dissection, described tests of latissimus function:

1] Visual evaluation: A patient with a denervated latissimus exhibits winging of the scapula as well as upward and outward rotation of the inferior angle of the scapula when the hands are pressed against the iliac crests. The definition of the lateral border of the muscle is lost.

2] Resistance test: The patient's arm is abducted 90° at the shoulder and supported by the examiner's hand. The patient pushes downward with his arm while the examiner palpates the lateral edge of the latissimus dorsi muscle below the inferior angle of the scapula. Contractions of the functioning latissimus dorsi muscle can be felt. In thinner patients, the lateral margin of a contracting latissimus dorsi muscle is readily identifiable.

3] Cough test: The latissimus dorsi contracts during a strong cough. The examiner stands behind the patient and places a hand over the lateral aspect of each latissimus dorsi muscle just below the level of inferior angle of the scapula, the patient is requested to inhale and cough with moderate effort. A functioning latissimus dorsi is easily identified. Comparison with the opposite side can indicate a denervated latissimus dorsi muscle.

Relations:

Latissimus dorsi is a flat triangular muscle with a broad origin. It covers almost half the back, superiorly it is related to the trapezuis medially, and the teres major and minor muscles laterally. Deep to the latissimus lies the erector spinae, serratus posterior inferior, and serratus anterior muscle. The tendon of the latissimus dorsi is lateral to the subscapullaris muscle in the axilla [Mathes and Nahai, 1979].

The latissimus dorsi muscle, and intimately related teres major, together produce the posterior fold of the axilla. The axillary arch is a muscular slip varying from 7-10 cm in length, and from 5 to 15 mm in breadth, occasionally springs from the edge of the latissimus muscle about the middle of the posterior fold of the axilla, and crosses the axilla in front of the axillary vessels and nerves, to join the undersurface of the pectoralis major, the coracobrachialis or the foscia over the biceps. It is present in about 70% of subjects and may be multiple.

A fibrous slip usually passes from the lower border of the tendon of the latissimus near its insertion to the long head of triceps. This is occasionally

muscular and is homologue of the dorso-epitrochlearis brachii of apes.

The lower part of the lateral border of the muscle is commonly separated from the posterior free border of the external oblique by a small triangular interval named the lumbar triangle. Another triangle sometimes termed the triangle of auscultation is situated medial to the inferior angle of the scapula [Warwick and Williams, 1973].