FREE VASCULARIZED FIBULAR GRAFT

THESIS

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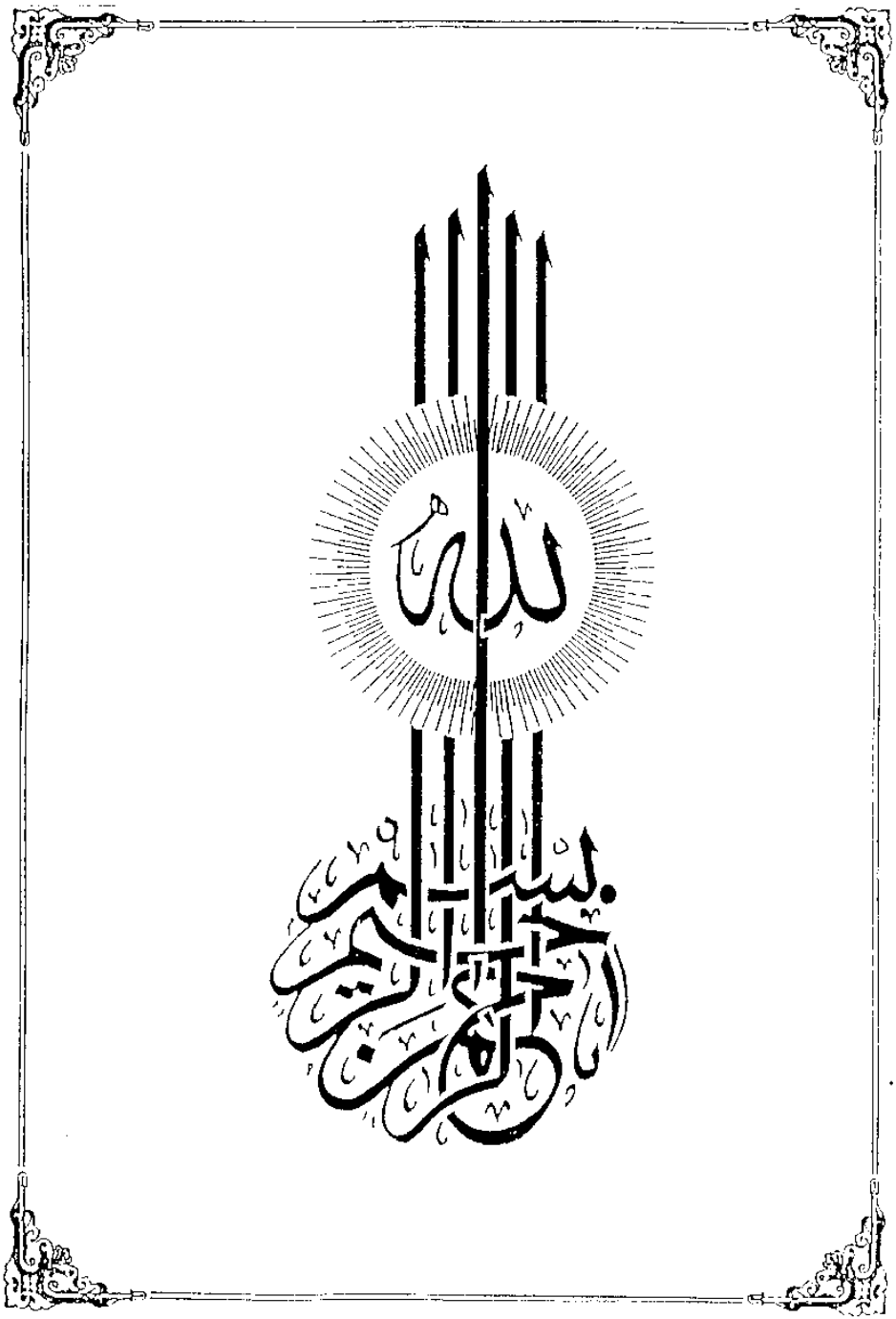

C O N T E N T

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INTRODUCTION

Microsurgery is one of most challenging developments in reconstructive surgery in the last 25 years which have made it possible to provide continuing circulation to bone grafts used in the reconstruction of extremities with massive segmental bone loss. e.g. The dilemma of a large skeletal dificiency of the tibia has been resolved clinically by the successful free transfer of a pedicled fibula graft from the opposite leg with maintenance of its circulation.

The aim of this work is to review the present situation of microsurgical techniques and their effect on the advancement in orthopaedic surgery.

The broad application of microsurgery has evolved with increasing success but further evaluation and refinement in case selection is still required.
Microsurgery is no longer a luxury but a therapy which must be at least electively available. It also must be performed by surgical specialists who have training in microsurgical techniques as well as their own speciality.

One must be able to achieve both end-to-end anastomoses and end-t0-side anastomoses of 1 mm vessels

HISTORICAL REVIEW AND DEVELOPMENT OF MICROSURGERY

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The compound microscope was invented in 1590 by Zacharia Janssen.

It was subsequently used for many centuries in microbiology. Histology and pathology. The microscope was first utilized in clinical surgery by Bylen in 1921 for drainage of Middle ear infection. Immediatley there after. Holmgren realized that increased magnification and illumination would open to awide variety of surgical procedures.

In 1953 Carl Ziess introduced the modern operating microscope, which was widely accepted because of its illumination, variable magnifications and adjustability for various types of surgery.

Ophthalmology quickly accepted the operating microscope.

In 1960s, Neurosurgeons employed the microscope. Plastic surgeons initiated experimental studies and clinical attempts at free tissue transfers, peripheral nerve repair and reimplantation surgery. Those pioneer reconstructive microsurgeons extrapolated the original work of Jacobson and Buncke in microvascular surgery as well as Smith and Millesi in microneural surgery.

ANATOMY

A N A T O M Y

THE FIBULA

The fibula, the lateral bone of the leg, is much more slender than the tibia, for it is not called upon to share in the transmission of body weight. It possesses an upper end or head, a shaft, and a lower end the lateral malleolus. The slightly constricted part of the shaft adjoining the head is sometimes called the neck of the fibula. The shaft shows considerable variation in its form, for it is moulded by the muscles to which it gives attachment; and these variations may prove confusing.

THE HEAD OF THE FIBULA is slightly expanded in all its diameters, and projects beyond the shaft in front, behind and on the lateral side. On its upper surface is a nearly circular facet, which articulates with the inferior surface of the lateral condyle of the tibia; it faces upwards, and slightly forwards and medially. A blunt elevation the apex of the head (styloid process), projects upwards from the lateral part of its posterior surface. The head of the fibula can be felt through the skin on the posterolateral aspect of the knee, nearly 2 cm. below the level of the knee joint. Immediately below the head the common peroneal nerve crosses the posterolateral aspect of the neck and can be rolled against the bone in the living subject.

The head of the fibula affords origin to fiber, of the extensor digitorion longus in frount, peroneous longus antrolaterally, and soleus from belind. The fibular collateral ligament of the knee joint is attached just in front of the apex and embraced by the principal insertion of the biceps femoris. The margins of the articlar faect provide attachment for the capsular ligament of tibofibular articulation.

The shaft of the fibula:

Possesses, three borders and three surface. The borders are:

Anterior, posterior and interosseos.

The surfaces are:

The lateral surface is bounded by the anterior and posterior borders. It is associated with the peroneal muscles and is directed laterally in its upper three-fourths. Its lower quarter inclines backwards and becomes continuous with the groove on the back of the lateral malleolus.

The medial surface is bounded by the anterior and the interosseous borders. It is usually directed forwards and medially, but frequently faces directly forwards. Wider below, it becomes very narrow in its upper half, and

may be reduced to little more than a rounded ridge. It is associated with the extensor muscles of the leg.

The posterior surface is the largest of the three and is placed between the interosseous and the posterior borders. It is associated with the flexor muscles of the leg. In its upper two-thirds it is divided into two areas by a longitudinal ridge, termed the medial crest, which is separated from the interosseous border by a grooved surface, directed medially. The rest of the posterior surface faces backwards in its upper half or more, but its lower part curves round on to the medial aspect and faces medillay.

The medial crest, is intimately related to peroneal artery, and the nutrient foramen of fibula is situated either on the crest or in it's immediate vicinity near the middle of the shaft which is directed downwards and transmits a branch from the peroneal artery.

Arterial vascularization of the proximal Epiphysis and diaphysis of the fibula. J.Restrepo. D. Katz. A.Gilbert (1980).

An observation was found in most cases dissected (20 cases):

That: Vascularization varied greatly

However 2 arteries were found to be constant.

1. The lateral inferior genicular art (LIGA):

Branches off from the popliteal artery at variable levels either on the post side of femoral condyles or right at the level of the femorotibial space.

As it runs over the fibular head, the LIGA always one or two smaller posterior branches which assure vascularization of the postero-superior part of the head, They are five, however do not perforate the bone and only concern. Vascularization of the capsule the LIGA also always has a few fine twings in front of the head which anastomose with the ant. tibial art on the antero-lateral side of the tibia (upper end).

Giving some times a few branches to the fibular periosteum. Restrepo. et al., (1980).

2. The ant tibial art (ATA):

Always vascularize the head by 2 net works

a) Post network:

In 11 cases, a quite different artery existed, branching from the origin of the ATA when it passes over the interosseous membrance. It runs along the posterior side of the neck of the fibula with many twigs branching off to the periosteum and often anastomosing with LIGA branches, and with other that perforate the bone through many vascular foramina. Then, on the lateral side of the fibula, it stops running along the bone and ends in the bony insertions of the peroneus longus muscle.

However, this artery of the neck, the posterior recurrent peroneal artery of Delmas stmmed, in 6 cases, from the popliteal artery, and in 3 cases from the tibio-peroneal trunk.

Moreover, its caliber varies greatly, from 0.2 to 0.5 mm. In addition to that artery, behind it, originating in the ATA, three times they found a small branch running behind the upper tibio-peroneal joint and branching off into fine twigs in the fibular periosteum, sometimes anastomosing the LIGA further up. In the last 4 cases, they

Fig. 1 : A plastic model showing:
Blood supply of upper 1/3 of the fibula
(lateral, anterior, posterior views).

In summary, there are 2 main nutrient systems for the fibular head:

1. A superior network supplied by the LIGA, which is constant but limited to capsular vascularization.
2. An inferior network, in over half of the cases studied dependent on the ATA and assuring periosteal and anastomoseous vascularization.

Their studies lead us to beleive that the latter net work predominates, particularly in the growing plate area.

The existance of several periosteal anastomoses between both networks, as well as in the periosteum of diaphysis, should be emphasized.

In the 25-day-old infant studied, a large caliber arting of the neck originated from the ATA and predominated the LIGA, while the ARPA branches directly from the ARTA.

II. THE FIBULAR DIAPHYSIS:

The 100 fibulae studied measured 30 to 41 cm., with an average of 34 cm.

The fibular diaphyses were very well vascularized, essentially by the peroneal artery.