FREE VASCULARISED BONE GRAFTS

E S S A Y

Submited For Partial Fulfilment Of The Degree Of

M.SC.

ORTHOPAEDIC

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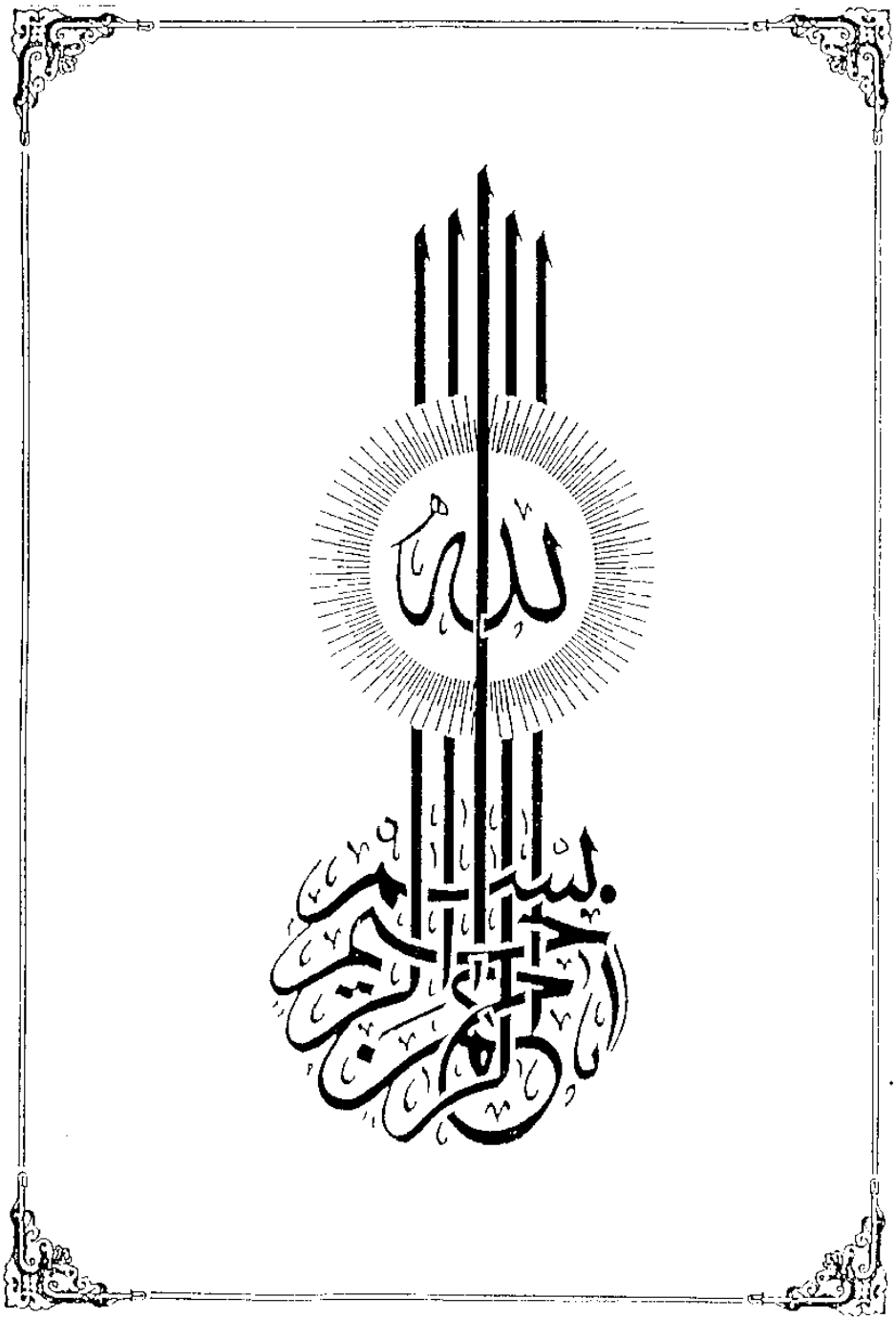
" TO

THE SOUL OF

MY MOTHER "



A K N O W L E D G E M E N T

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C O N T E N T S

CHAPTER 1

HISTORICAL REVIEW OF VASCULARIZED BONE GRAFTS

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Vascularised bone graft was the outcome of various surgical trials and through physiological studies on the cricteria of the most favourable type of bone graft.

While the concept of bone grafting was put forwards late in the nineteenth century by SIR. WILLIAM MACEWEN OF GLASGOE, and ARTHUR BARTH OF GERMANY, the exact role of bone grafting in bone repair has only been studied by many workers afterwards. (PESI B. CHACHA. 1984).[31]

Several theories were put forward to explain the reparative power of bone grafts, one of them,the metaplasia theory suggests, that bone transformation occurs under the influence of an osteogenic substance that diffuses from the transplant into the host's connective tissue. It was also suggested,that the new bone formation results from functional activity of osteogenic cells that survive in the graft. "CREEPING SUBSTITUTION" was the name given by PHEMISTER (1914) to the process of replacement of dead bone by new bone. This was first observed by BARTH (1895) who suggested, that this process indicated the penetration of newly formed

bone directly into the old bone with simultaneous removal of old bone and deposition of the new bone at the site of contact. Yet, as early as 1905 HUNTNGTON recognised the advantage of utilizin a bone graft with its own nutrient blood supply intact as a vascularised bone graft in the reconstruction of large tibial defects.

In most cases there is little doubt that the ideal bone graft is autogenous bone that remains organised and alive, defies resorption, and maintains its original size and structral characteristics. An unimpaired micro-circulation is the indispensable basis for the continued life and function of all bone cells. It is obvious, that this can be only achieved by preservation or immediate reconstitution of the primary blood supply to bone graft. The idea of preservation of the primary blood supply is not new as regional osteo-musclocutaneous flaps have been used as vehicles for section of a rib or clavicle. composite island flaps containing under lying rib have also been transfered on long intact vascular pedicles. But the idea of immediate reconstruction of the primary blood supply to a bone graft had to a wait the birth of microvascular surgical techinques. (ANDREW J. WEILAND. 1981).[1]

It was only when JACOB AND SAUREZ introduced microvascular surgery by demonstrating the value of operating microscope in

1960 and designed several special instruments and fine suture materials, that this challenge was accepted (microvascular surgery in orthopaedics and traumatology, (SUSUMU TAMAI ET AL 1972).[36]

TAYLOR[39] who adapted the technique in orthopaedic surgery in 1975.

He reported the first successful clincally free bone graft with microvascular anastomosis. He used a fibular segment of controlateral leg to reconstruct a large tibial defect. similary in 1982 BERGGREN A. WEILAND ET AL[4] used a rib graft to treat a non union of the mandible following radical resection of a tumour. Osteocutaneous flaps consisting of the rib and its overlying skin have been transfered by microvascular anastomosis to the tibia by (D.H. HARRISON 1986).[10] (The osteo-cutaneous free fibular graft).

TAYLOR ET AL[39] have described a one stage repair of composite leg defect with free vascularised flaps of skin and iliac bone in 1979 (WEILAND ET AL 1981)[1] have described the application of free vascularised bone grafts.

In the treatment of malignant or locally aggressive bone tumours, large troumatic bone defect, congenital

pseudarthrosis of the tibia as well as the application of the free vascularised fibular graft in surgery of the upper extremity. (ANDREW J. WEILAND 1981).[1]

With the revolution in vascular and microvascular surgery, another evolution was going on in the utilization of vascularised bone grafts with preserving their primary blood supply i.e. without the need of anastomosis. This started as early as 1984 when HAHN first described the transfer of ipsilateral fibular for non-union of the tibia with a large defect although he did not raise the fibular shaft on a vascularised muscle pedicle the procedure he described paved the way for the concept of pedicular grafts. However, HUNTINGTON (1905) has been given the credit for being the first to describ a pedicular bone graft.

COLE in 1940[8] described a pedicular graft of a cortical segment of the clavicle based on the platysma muscle to bridge a pathological non-union of the mandible with a large defect. Subsequently, in 1952 DAVIS and TAYLOR described after animal experiments, a pedicular graft of the anterior part of the iliac crest based on tensor fascia lata attachment with they used as a live strut for hip fusion they had only one failure out of nine cases.

In the early forties, the concept of a vascular muscle pedicle was able to maintain the viability of the graft periosteum, with proliferation of osteoblasts and laying down of new bone-neither of which occur to any extent in the free grafts. This resulted in abundant subperiosteal callus which enlarged the graft considerably and extended over the gap between the bones, greatly assisting union. The bone scans in this study showed greater uptake of radionuclide in pedicle grafts than in the free grafts, indicating that vasculrity and viability were superior in pedicle grafts.

Thought the assessment of the viability of bone by counting the number of osteocytes in lacunae is a well accepted method it is liable to error both on the part of the observer and in the technical preparation (BERGGREN ET AL 1982).[4] In our study graft viability was assessed by the same method in each group. In all the free grafts and in two pedicle grafts there were less than 15% osteocytes and the bone was therefore considered dead. The majority of bone grafts had more than 15% osteocytes and one pedicle graft of 12 weeks had 70% osteocytes which was the same as the number in the adjacent bone, this is different from a microvascular graft where, if the vessel anastomoses remain patent, almost all osteocytes survive; if the vessel thromboses, most of the osteocytes die. (DOI, TOMINAGA and SHIBATA 1977). (S.N. BELL, B.J. DOOLEY, BMCC. O'BRIEN, N.F. BRIGHT. 1985).[37]

With the advance of microsurgical techniques, free microvascular bone grafts can now be harvested and transfered to distant sites. (PESI. B. CHACHA 1984).[31]

CHAPTER 2

TYPES OF VASCULARIZED BONE GRAFTS

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INTRODUCTION:-

With refinements in technique of microvascular surgery it is now possible to transfer bone with its soft tissue coverings on its vascular pedicle to a distant recipient site, with immediate anastomosis of its nutrient vessels to those in the new bed. such living grafts are found to become in corporated rapidly, and this recent advance in grafting technique is valuable in major reconstructive procedures after extensive loss of bone and soft tissue. (WEILAND, ET AL1979).[41] these vascularised bone grafts may be:-

(A) VASCULARISED PEDICULAR GRAFTS.

(B) FREE VASCULARISED BONE GRAFTS.

(A) VASCULARISED PEDICULAR GRAFTS

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1) VASCULARISED PEDICULAR GRAFT OF IPSILATERAL FIBULA:-

Non union of the tibia with a large defect is a problem especially in the presence of low grade sepsis and dense adherent scars. If the defect cannot be bridged with a massive amount of bone, amputation is the only alternative.

Alive, strong, massive bone strut, fixed to the tibia in its long axis posteriorly, in the relatively uninfected healthy tissues, to bridge the defect, would be an ideal solution.

The fibular shaft is strong and can be raised as a vascularised graft from the same leg on a pedicle of the peroneal and anterior tibial muscles and the peroneal vessels. As much as 20 cm of the shaft can be raised on avascular pedicle which preserves the blood supply to the bone both through its nutrient vessel, arising from the peroneal artery, and from the rich circular anastomosis of the musculoperiosteal vessels. (PESI B. CHACHA 1984).[31]