USE OF VASCULARIZED FIBULAR GRAFTS AS A SALVAGE PROCEDURE FOR PREVIOUSLY FAILED ARTHRODESIS
Choll Kim, M.D., Ph.D., Reid Abrams, M.D., Gilbert Lee, M.D., David Hoyt, M.D. Steven Garfin, M.D.

Dept. Orthopaedic Surgery, Plastic Surgery, and General Surgery (Trauma)

UCSD Medical Center - San Diego, California
SPINAL ARTHRODESIS

- PAIN
- INSTABILITY
- DEFORMITY
SPINAL ARTHRODESIS

- TUMOR
- INFECTION
- TRAUMA
SPINAL ARTHRODESIS

• DIAGNOSIS
• METABOLIC CONDITION
• SURGEON EXPERIENCE
• TECHNIQUE
SPINAL ARTHRODESIS

- LENGTH
- SITE (BIOLOGY/ANATOMY)
- SUBSTRATE USED FOR FUSION
SUBSTRATES

AUTOGRAFT
Chips/Strips
Structural

ALLOGRAFT
Chips/Strips
Structural
VASCULARIZED AUTOGRAFT
GRAFT PROPERTIES

• AVAILABILITY

• MECHANICAL

• DONOR SITE MORBIDITY
GRAFT PROPERTIES

• INITIAL STRENGTH
• RATE OF INCORPORATION
• SUCCESS
LOCAL GRAFT

LOW DONOR SITE
MORBIDITY
EASY TO OBTAIN
LIMITED IN QUANTITY
NO STRUCTURAL SUPPORT
CANCELLOUS AUTOGRRAFT

EASY TO OBTAIN

HIGH FUSION RATE

LIMITED IN QUANTITY

DONOR SITE MORBIDITY

NO STRUCTURAL SUPPORT

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STRUCTURAL AUTOGRRAFT

EASY TO OBTAIN

HIGH FUSION RATE

LIMITED IN QUANTITY

DONOR SITE MORBIDITY

“CREEPING SUBSTITUTION”

Resorption and regeneration
STRUCTURAL ALLOGRAFT

NO DONOR SITE MORBIDITY

EASY TO OBTAIN

? FUSION RATE

? ↑ FRACTURE RATE

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VASCULARIZED AUTOGRRAFT

Equivalent to “two fractures”
Accelerated fusion
Responds to stress (Wolff’s Law)
Donor site morbidity
Limited quantity
Technically demanding
VASCULARIZED AUTOGRAFT

RIB (pedicle)
Curved, weak

ILIAC CREST (free)
Irregular
Lacks reliable nutrient foramen

FIBULA (free)
Straight, tubular
Both periosteal and endosteal circulation
Up to 20 cm length
VASCULARIZED FIBULAR GRAFT

PERONEAL ARTERY AND VEIN

NUTRIENT FORAMEN - MIDDLE THIRD OF SHAFT - 96%
VASCULARIZED FIBULAR GRAFT

OSTEOCYTES REMAIN VIABLE

BETTER TOLERATE XRT
FATE OF VASCULARIZED VS. NONVASCULARIZED AUTOGRAPH

ANIMAL MODEL

Xrays and Tetracycline markers

↑ Callus

↑ Osteocyte survival

↑ Tetracycline uptake into graft bone

Ostrup and Fredickson, PRS 1974
FATE OF VASCULARIZED VS. NONVASCULARIZED AUTOGRAFT

DOG MODEL

4.5cm tibial defects

Vascularized - 100% fusion

Nonvascularized - 50% fusion

Haw et al. JBJS 1978
FATE OF VASCULARIZED VS. NONVASCULARIZED AUTOGRAPH

45 BEAGLE DOGS

4cm fibular autograft - vasc/nonvasc

9/10 fusions - Vascularized

5/10 fusions - Nonvascularized

Shaffer et al. CORR 1985
FATE OF VASCULARIZED VS. NONVASCULARIZED AUTOGRAFT

MECHANICAL TESTING
2X ↑ Strength and stiffness - vascular
Equal at 1 yr

HISTOLOGY
↑ Bone turnover faster
↓ Bony necrosis

Shaffer et al. CORR 1985
VASCULARIZED FIBULAR GRAFTS

FIRST USED IN 1974

LONG BONE GAPS

Tumor, infection, trauma, AVN hip

Taylor et al. PRS 1979
Moore et al. CORR 1983
Weiland et al. CORR 1983
Goldberg et al. Orthop Cl N Am 1987
DONOR SITE MORBIDITY

247 VASCULARIZED FIBULAR GRAFTS

11% ankle pain
4% sensory disturbance
2% motor weakness

Vail and Urbaniak, JBJS 1996
VASCULARIZED FIBULAR GRAFT

CASE REPORTS - SPINE

MAINLY FOR KYPHOSIS
Freidberg et al., J Neurosurg 1989
Yoshizu et al., J Microsurg 1981 (abstract)
Hubbard et al., Spine 1985
Conley et al., J Neurosurg 1979
Whitecloud and La Rocca, Spine 1976
Nijland et al., CORR 1998
Wright et al., J Neurosurg 1999
VASCULARIZED FIBULAR GRAFT

16 patients (Kyphosis)

11 fusions

3 unable to anastamose

1 dislodged

1 death (dural leak, airway compromise)

Minami et al. JBJS-B 1997
VASCULARIZED FIBULAR GRAFT

5.5 mos (3-8) avg fusion

Surgery time 10.4 hrs (6-17)

Kyphosis 72 to 48 degrees

No donor site complications

Minami et al. JBJS-B 1997
L2 CORPECTOMY
L2-4 ANT FUSION
XRT
DISEASE FREE
GRAFT DISPLACED
23Y FEMALE

DISSEMINATED COCCI

C4 - T10
S/P REMOVAL OF HARDWARE

PSEUDARTHROSIS (MULTIPLE REVISIONS)

75 DEGREE KYPHOSIS
CONCLUSIONS

• HIGH FUSION SUCCESS RATE

• Viable strategy for difficult fusions
CONCLUSIONS

• TECHNICALLY DEMANDING

• MICROVASCULAR SURGERY TECHNIQUES

• DONOR SITE MORBIDITY

• LONGTERM OUTCOMES NEEDED