MANAGEMENT OF SCAPHOID NON-UNION

An Essay

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Abstract

Key Words : 1-Scaphoid non-union 2- Diagnosis 3-Evaluation 4-Classification 5- Treatment 6-Bone grafting 7-Approaches

About 10-15% of all scaphoid fractures do not unite.

Most scaphoid nonunion occurs in proximal pole fractures .

Vessels entering the scaphoid through the dorsal ridge supply blood to 70% to 80% of the bone .

The classification of scaphoid nonunion can be simplified to stable and unstable types.

The routine evaluation for scaphoid nonunion should begin with a standard history and physical examination, supplemented by X-ray, computed tomography , magnetic resonance imaging and bone scans .

Treatments can be divided into reconstructive and salvage procedures. The reconstructive procedures include:

- Cast immobilization with electrical stimulation.
-Internal fixation with bone grafting.
-Vascularized bone grafting.

The salvage procedures include:
- Wrist denervation.
- Partial scaphoid excision.
- Limited intercarpal and midcarpal fusion.
- Proximal row carpectomy.
- Scaphoid excision and four-corner fusion.
- Arthroplasty.
- Total wrist fusion.

Approaches to scaphoid nonunion are volar and dorsal approaches.

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INTRODUCTION OF PROTOCOL

The scaphoid bone is the most commonly fractured carpal bone; this injury occurs most often in young men. Scaphoid fractures are rare in young children and the elderly because of the relative weakness of the distal radius compared with the scaphoid in these age groups.[1]

The primary mechanism of injury is a fall on the outstretched hand with an extended, radially deviated wrist, which results in extreme dorsiflexion at the wrist and compression to the radial side of the hand. Forces are transmitted from the hand proximally to the arm through the scaphoid [1-3]

A scaphoid fracture is part of a spectrum of injuries based on the following 4 factors:

- Direction of the 3-dimensional loading
- Magnitude and duration of the force
- Position of the hand and wrist at the time of injury
- Biomechanical properties of ligaments and bones [4]

The patient complains of a dull pain in the radial wrist. The pain, which often is mild, is worsened by gripping or squeezing. There may be mild wrist swelling or bruising and, possibly, fullness in the anatomic snuffbox, suggesting a wrist effusion.[1]

Scaphoid fractures are significant because a delay in diagnosis can lead to a variety of adverse outcomes that include nonunion, delayed union, decreased grip

strength, decreased range of motion, and osteoarthritis of the radiocarpal joint. [4]

A bone that fails to heal is called a nonunion. Nonunions are more common after scaphoid fractures because blood supply to the scaphoid bone is poor. Blood supply to the bone is very important in its healing. Bones need blood to carry oxygen and nutrients to the site of the fracture.

Fracture instability, often unrecognized, is a common cause of nonunion. Other factors that influence healing are fracture location, degree of displacement, instability, and osteonecrosis.[4]

The long term consequences of a failure of the scaphoid to unite are usually weakness and sometimes pain, but more importantly the high risk of developing arthritis. The scaphoid may stick together with fibrous tissue rather than bone and in this instance some stability may result which lessens the symptoms and reduces the risk of arthritis.[4]

When evaluating a patient with a non-union, the physician may order additional imaging studies. An MRI or bone scan may be requested to assess the blood supply of the fracture, and a CT scan may be ordered to determine the alignment of the two fragments. [4]

Radiographic hallmarks of nonunion are the following: sclerosis at the fracture site, cystic cavitation,

displacement of more than 1 mm, and a persistent, lucent line that is usually wider than 2 mm. [4]

The sclerotic margins, although characteristic, may become evident only after several months or years as the pseudoarthrosis matures. Osteonecrosis of the proximal pole may or may not be present. Fibrosis and adhesions may decrease mobility about the nonunion, but all nonunions are considered unstable.[4]

Sakuma and colleagues[5] evaluated magnetic resonance imaging (MRI) findings in scaphoid nonunion. They found no difference in the appearance of the MRI scan in 7 patients with a plain radiographic finding of increased opacity of the proximal pole and in 25 patients with normal opacity in the proximal pole.

Treatment of a scaphoid non-union is dependent on several factors including the patient's age, function, current symptoms (pain, stiffness), associated conditions, patient factors such as tobacco use / smoking, and general medical condition. Despite optimal treatment, unfortunately, some scaphoid fractures may fail to heal. The goals of treatment include the re-establishment of a pain-free and functional wrist joint and to hopefully prevent later development of arthritis.

In cases without significant arthritis, the goal is to restore scaphoid alignment and to achieve bone healing. Typically, this will entail surgery to clean out scar at the fracture site, possibly place some form of bone graft to

encourage bone healing, and to stabilize the fracture with pins or a screw.

If the scaphoid has collapsed “humpback deformity”, a structural bone graft may be required such as from the iliac crest (edge of the pelvis) in order to restore the size and shape of the scaphoid.

In the presence of avascular necrosis or in certain fractures refractory to treatment, a vascularized bone graft – a piece of bone from the radius or the hand with its blood supply still attached – may be placed at the fracture site in the hopes of revitalizing the bone .

For those fractures associated with advanced arthritis or for persistent non-unions despite reconstructive efforts, further surgery to heal the scaphoid may no longer be indicated. In such cases, surgical and non-surgical treatment goals are focused on improving pain while maintaining a functional wrist. Options for wrist reconstruction are determined by the stage of wrist arthritis; those areas affected by loss of cartilage may be removed or fused together, attempting to preserve healthy joints and their associated motion. Such treatment may include radial styloidectomy (removal of a local piece of arthritic bone at the tip of the radius), proximal row carpectomy (removal of the proximal row of wrist bones), scaphoid removal and limited wrist fusion, or, in the case of widespread wrist arthritis, wrist arthroplasty (joint replacement) or total wrist fusion.[6]

The treatment of choice for a symptomatic nonunion is the placement of a bone graft and fixation [6].

INTRODUCTION

The scaphoid bone is the most commonly fractured carpal bone, The primary mechanism of injury is a fall on the outstretched hand with an extended, radially deviated wrist.

Anatomically,the scaphoid is divided into proximal and distal poles, a tubercle, and the waist. Eghity percent of the scaphoid is covered with articular cartilage.

The vascularity of the scaphoid is based primarily on retrograde blood flow. vessels entering the scaphoid through the dorsal ridge supply blood to 70% to 80% of the bone, and vessels that enter it through the volar branches of the artery supply the remaining 20% to 30%.

One of the most common complications of scaphoid fractures is nonunion .

A bone that fails to heal is called a nonunion.

Factors that may lead to nonunion are fracture location (proximal pole 30-40 %, waist 10-20 %, distal third rare), degree of displacement, instability, and osteonecrosis.

Diagnosis of scaphoid non-union can be done by Plain X-ray, CT scan, MRI scan and Bone scans .

The goals of treatment are :-

1-Healing the nonunion site.

2-Correcting any carpal collapse deformity .

3-Stabilizing the carpus .

4-Relieving any symptoms .

5-Improve range of motion .

6-Halt the progression of osteoarthritis .

-Treatment failure rates are 25% to 45% .

- Treatments can be divided into reconstructive and salvage procedures.

AIM OF THE WORK

The aim of this work is to review the literature and discuss pathology and causes of Scaphoid fracture non-union, to review methods of diagnosis of non-united Scaphoid fractures and to review and discuss different methods of treatment of non-united Scaphoid fractures.

Chapter 1

Pathology and causes of Scaphoid non-union

Pathology and causes of Scaphoid non-union

A bone that fails to heal is called a nonunion. [4]

About 10-15% of all scaphoid fractures do not unite. Some degree of delayed union or nonunion occurs in nearly all proximal-pole fractures and in 30% of scaphoid waist fractures. [4]

Scaphoid nonunions are rarely symptomatic in the early stages, and the success rate of management decreases with the duration of the nonunion.[7-10]

Scaphoid nonunions occur when fractures are not diagnosed and managed initially or when they have not healed with cast immobilization within 6 months of injury. [11,12]

Fractures that do not show signs of radiographic healing after 6 to 8 weeks of cast immobilization and fractures diagnosed 6 weeks after injury are less likely to heal. After an even longer duration, unmanaged scaphoid nonunions frequently cause wrist pain and lead to progressive arthrosis.[11,12]