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Essex-Lopresti Injuries Seth D. Dodds, MD, Peter C. Yeh, MD, Joseph F. Slade III, MD Department of Orthopaedics and Rehabilitation, Yale University School of Medicine.*

Find articles by K. Dargel Find articles by J. Burkhart Find articles by K. Received Dec 7; Accepted Oct Abstract The Essex-Lopresti lesion represents a severe injury of the forearm unit. Over the course of time, the pathophysiology of the lesion was displayed in more detail. Therefore, an intensive analysis of the involved anatomic structures was done. The interosseous membrane was shown to play a major role in stabilising the forearm unit, in the situation of a fractured radial head, which is the primary stabiliser of the longitudinal forearm stability. Moreover, biomechanical analyses showed a relevant attribution of the distal radio-ulnar joint to the forearm stability. If, in the case of a full-blown Essex-Lopresti lesion, the radial head, the interosseous membrane and the distal radio-ulnar joint are injured, proximalisation of the radius will take place and will come along with secondary symptoms at the elbow joint and the wrist. According to actual studies, the lesion seems to occur more often than realised up to now. Thus, to avoid missing the complex injury, subtle clinical diagnosis combined with adequate imaging has to be undertaken. If the lesion is confirmed, several operative treatment options are available, yet not proofed to be sufficient. Essex-Lopresti lesion, Longitudinal forearm instability, Radial head fracture, Distal radio-ulnar joint, Interosseous membrane, Radial head prosthesis Introduction The human forearm is an essential working unit in daily life. Its enormous capacity of use is not solely facilitated by the movement in the wrist and elbow but also involves pivotal pronation and supination. With this combination of movements, the forearm forms a determining tool in human efficiency. The ability to pronate and supinate the forearm represents a deciding step forward in human processing [4]. In addition, injuries to the forearm can have a relevant impact on the wounded individual. In addition to Galeazzi fracture, Monteggia fractures complete forearm fractures and solitary radial head fractures, the Essex-Lopresti injury is a condition of dramatic changes to the structures and the function of the forearm following axial trauma [22 , 29 , 36 , 59]. This combination of radial head fracture, lesions of the interosseous membrane IM and lesions of the distal radio-ulnar joint DRUJ was first clinically described by Curr and Coe in [13]. However, the fracture combination was named after the British surgeon Peter Essex-Lopresti, who presented two cases in [22]. Essex-Lopresti recognised the relevance of the instability inherent in the complex lesion. He described proximalisation of the radius, which was worsened by radial head excision, as well as ulno-carpal impingement and radial deviation of the wrist [22]. He advised early recognition of the lesion to prevent chronic changes to the elbow and wrist. In , Trousdale et al. Trousdale made clear that the misdiagnosed and delayed treated Essex-Lopresti injuries clearly exhibit worse clinical outcomes. Like Essex-Lopresti, Trousdale found the instability to be the cause of the torturing symptoms of pain at the elbow and wrist and deformation of the forearm [84]. Several clinical and biomechanical studies have followed [6 , 63 , 64 , 68 , 76], but no definitive treatment strategy has yet been established for acute or chronic lesions, and poor clinical outcomes remain common [15 , 45 , 60 , 64 , 72 , 78 , 81 , 83]. Furthermore, the rate of undiagnosed Essex-Lopresti injuries may be high, as the study of Trousdale et al. Edwards and Jupiter [18] also pointed to the high risk of underdiagnosing the Essex-Lopresti lesions on first presentation. In a recent MRI study of acute low grade radial head fractures, Hausmann [32] identified involvement of the IM in 9 out of 14 patients. In this article, we provide further understanding of the stability of the forearm by an insight into its anatomy, illustrate the most likely mechanism of trauma of Essex-Lopresti injuries and review the treatment options for cases of acute and chronic instability. Anatomy of forearm stability and biomechanics Linked together via the proximal PRUJ and distal DRUJ radio-ulnar joint and connected by the IM, the human forearm works as a dynamic unit, contributing to the extraordinary mobility of the human upper limb. The forearm is subjected to axial, rotational and transverse forces [67]. In vivo, the most relevant forces are axial loads in the proximal direction. Under these conditions, the main stabiliser, referred to as the primary stabiliser, of the forearm is the radial head, articulating at the PRUJ with the radial notch of the proximal ulna. If articulating with an intact capitulum, there is no proximalisation of the radius [68]. The PRUJ is mainly stabilised by its bony configuration and the annular ligament, which keeps the radial head in the radial notch [44]. Due to its relatively incongruous bony components, which make a great range of motion possible, the DRUJ depends on tenuous ligamentous support. The pronator quadratus was identified as an active stabiliser that functions by pressing the ulnar head and the sigmoid notch together [30]. The IM has recently been characterised as a complex, partly membranous and partly ligamentous structure and has been linked to several critical roles in forearm function [3 , 36 , 67 , 68 , 75]. The IM can be distinguished into two layers of fibres, as so called anterior and a posterior division, which travel from the radius to the ulna Figs. The anterior division, which can be further divided into three groups, is comprised of descending fibres, including a noticeable central portion of fibres [67 , 68]. The IL exhibits an average width of 2. Several authors have characterised the IL as the major portion of the IM responsible for stabilising against proximalisation of the radius [36 , 67]. The dorsal division can be further subdivided into two groups consisting of fibres ascending from the radius to the ulna. By their ascending orientation from the radius to the ulna, the fibres are largely responsible for preventing distalisation of the radius [67].

Chapter 2 : Essex-Lopresti Injuries â€” University of Miami's Research Profiles

TY - JOUR. T1 - Essex-Lopresti Injuries. AU - Dodds,Seth D. AU - Yeh,Peter C. AU - Slade,Joseph F. PY - /2. Y1 - /2. N2 - The Essex-Lopresti injury results from a high energy trauma to the upper extremity causing significant instability to the forearm joint.

Yeh, MD and Seth D. Hand fractures in children are a common injury. Early recognition and prompt diagnosis is necessary to achieve satisfactory outcome. A thorough history and physical examination along with adequate radiographic imaging are essential. The goal of treatment is to have children return quickly to their daily leisure and academic activities. In the pediatric population, most hand injuries can be treated nonoperatively. Modalities for nonoperative treatment include buddy taping, mallet splinting, intrinsic plus splinting, casting or observation. Several fractures, however, require prompt surgical intervention. These include Seymour fractures and any injury that cannot be suitably managed in a splint or cast, including those with residual deformity, intraarticular extension, displacement, and unacceptable alignment in the coronal, sagittal and rotational plane. In general, most surgical interventions consist of closed reduction and percutaneous pinning. With the thick periosteum and high remodeling potential that makes the pediatric population unique, rarely is anatomic reduction and rigid internal fixation ever needed. Early range of motion after reduction and stable fixation is a cornerstone to postoperative rehabilitation. Hand fracturesâ€"Finger injuriesâ€"Phalangeal fractures. The border rays, i. As children start to mature, thumb and index finger fractures increase in incidence. Children less than 10 years of age had a low incidence of thumb fracture, but a steep rise was noted after the age of 10, as the thumb became the second most common ray to be fractured after the little finger in adolescents. An overwhelming majority of these fractures, when appropriately treated, heal without complications. A poorly treated hand fracture, when displaced or unstable can have significant functional consequences and may result in chronic pain, stiffness, or deformity. It is not uncommon for stable fractures to be over treated and unstable fractures to be neglected, both potentially resulting in permanent dysfunction. Complications resulting from pediatric hand injuries are often a result of failure to identify and treat an injury requiring surgery. Accurate diagnosis and timely management of these injuries continues to be the cornerstone of optimal hand care. In general, it is a good rule of thumb that patients under one year of age avoid any unnecessary surgery as the risks of anesthesia may outweigh the benefits of fracture care procedures. In addition, infants have the surprising ability to remodel nearly any fracture deformity, especially in the hand. However, in the older pediatric population, there is a subset of fractures that benefit from prompt recognition and surgical intervention. The goal of any treatment is to have children return quickly to their daily leisure and academic activities. Restoration of bony anatomy is the basis for returning normal function; however, an anatomic reduction is not always necessary to achieve this goal, especially if it comes at the cost of soft tissue scarring and loss of motion. To initiate early hand motion, fracture stability must be present either through the inherent stability of the fracture, splinting, or internal fixation. Early motion prevents formation of adhesions of the gliding soft tissues of the extensor and flexor tendon systems and prevents joint capsule contracture. Immobilization of fingers well beyond four weeks may lead to long-term stiffness because of extensor tendon and joint capsular scarring. Closed, nondisplaced or minimally displaced fractures with acceptable alignment that are the result of a low-energy trauma usually have sufficient supporting tissues remaining intact making them stable and amenable to treatment by protected mobilization, either with local splinting of the fracture or buddy taping to adjacent fingers. Fractures with rotational or angular mal-alignment may be amenable to closed reduction and splinting, but these fractures are at risk for incomplete reduction and recurrent deformity. These more unstable fractures require careful and frequent clinical and radiographic follow-up. Surgical treatment is indicated for displaced fractures of the articular surface, open fractures, fractures with significant shortening or malrotation, and fractures which are unstable after closed reduction and splinting. Delayed treatment of surgically indicated fractures presents a clinical challenge, with worse functional outcomes because of stiffness, deformity, and even posttraumatic arthritis. The differential diagnosis for hand injuries includes fracture, dislocation, collateral ligament rupture, and tendon laceration or avulsion. A careful examination of the flexor tendons, extensor tendons, and neurovascular function must be performed. At a minimum, three radiographic views of the injured hand should be obtained with the imaging beam centered over the metacarpophalangeal MCP joint of the long finger. The posteriorâ€"anterior PA , lateral, and oblique views screen for trauma. PA and lateral views of the injured digit centered on the proximal interphalangeal PIP joint should be obtained when a particular digit is of concern. Although splinting at 90 degrees of MCP flexion is preferable, as little as 60 degrees of MCP flexion is likely adequate to place the collateral ligaments under sufficient strain, and may be easier to achieve. Postreduction radiographs should be obtained in two planes. Analysis of sagittal alignment on the lateral view is often difficult, particularly in plaster, and a series of oblique radiographs may be needed to confirm that correct alignment has been achieved. Follow-up at 1 week after initial reduction with new radiographs is optimal to confirm the maintenance of alignment. Delay of follow-up beyond 1 week can make salvage of a lost reduction more difficult as callus develops quickly in the pediatric population. Early motion is important in the management of hand injuries. For example, nonarticular phalangeal fractures treated with closed reduction and splinting should be mobilized after 3 to 4 weeks, as soon as the fractured phalanx is less tender. Even if splinting of one joint is needed, splints should be made small enough to allow early motion of uninjured joints, if possible. The following are described indications and techniques in the application of appropriate buddy taping, mallet splinting, and intrinsic-plus splinting. A, A rotationally mal-aligned hand. B, A rotationally aligned hand after operative correction Oetgen et al. For finger fractures, it is often helpful to decrease muscle forces contributing to the fracture deformity. For example, the intrinsic muscles can be relaxed by flexion of the MCP joints. Once a reduction is performed, the digit is examined to determine the alignment and the stability of the reduction. Rotational alignment is checked by active finger flexion, observing the planes of the nail beds, and assessing for digital overlap. The fingers should all point toward the scaphoid tubercle Fig. If pain limits active flexion, use of the tenodesis effect with gentle wrist extension resulting in passive finger flexion and wrist flexion leading to passive finger extension can be helpful. The main purpose of buddy taping is to use an adjacent finger to act as a splint for the injured finger. It is ideal to buddy tape to a digit that is generally longer than the injured digit. In this fashion, the longer digit also acts to protect from minor, inadvertent axial trauma. A nonreactive skin tape should be used and the tape should be circumferentially wrapped over the proximal and middle phalanges, taking care to avoid the PIP and DIP joint creases both volarly and dorsally Fig. Tape immobilization is not required over the distal phalanx for several reasons: If necessary, a thin, dry gauze can be inserted between the fingers to keep this area dry as well as pad the PIP and DIP joint prominences. Mallet Splint Mallet splints are indicated for mallet injuries, both soft tissue and bony mallets. Splinting using a dorsal, volar, or prefabricated Stack type splint are all reasonable treatment methods. Care must be taken to avoid dorsal skin ischemia and potential breakdown seen in cases of extension splinting of the DIP joint. Ischemia can occur from direct pressure on the skin by a splint that is applied too tightly or by hyperextension of the DIP joint. Hyperextension will completely blanch the dorsal skin making it avascular. When increased external pressure and www. Buddy taping between index and long finger: The following materials are our preference in making a mallet splint: A properly sized aluminum splint should be selected that spans the width of the finger. The length of the splint should ideally be crafted to cover the whole distal length of the finger, just stopping short of the PIP joint proximally. The PIP joint should be spared to allow for joint motion. The foam on the aluminum splint is removed. The reason for this is to provide better stability to the DIP joint, but great care must be taken to avoid excess pressure on the dorsal skin with the foam removed. Moleskin should be applied to the side of the splint that was denuded of the foam. The splint should be positioned dorsally, centered over the DIP joint. Ensure that the DIP joint is fully extended. Hyperextension of even 5 degrees may be unacceptable. Cloth tape should then be applied over the distal phalanx as well as the middle phalanx, ensuring that the DIP joint is free from tape. The tape should be applied such that the splint is snug, but not tight on the finger. An assistant to help in taping makes the process easier as it is important that the DIP not be flexed during the entire 8 weeks treatment period. This most commonly occurs during www. A, The finger is kept extended by resting at the edge of a surface such as a table. B, A properly applied mallet splint. It is prudent to rest the tip of the finger at the end of a table to keep the DIP extended while the splint is being changed Fig. The splint should be changed daily to check for dorsal skin breakdown. Should this occur, the splint should be applied to the volar aspect of the finger surface until the dorsal skin has healed sufficiently. Intrinsic-Plus Splint Intrinsic-plus splinting can be used for acute immobilization of nearly any hand fracture. Some or all of the fingers can be incorporated depending on the location of the injury, i. The standard intrinsic-plus splint is volarly based from the fingertips to the forearm with the IP joints in full extension, the MCP joints in flexion, and the wrist slightly extended. Unless there is an associated thumb ray injury, the thumb is not immobilized. Sometimes, a dorsal and volar splint is required to completely immobilize these joints in a satisfactory position. Intrinsic-Plus Splintingâ€"the wrist is extended 30 degree, the MCPs at 90 degrees, IP joints at 0 degrees extension, with the thumb free. We prefer plaster over fiberglass as it is easier to mold in the acute setting. Placement of one or two tongue depressors volar to the fingers may aid in holding the intrinsic-plus position while the splint is drying. There are instances, however, where surgical treatment is indicated. Correct recognition of finger injuries that require operative intervention for optimal outcome is as important as proper treatment of stable finger fractures to maintain function. Attempted nonoperative treatment of these injuries will result in the delay of appropriate care, which in most instances will negatively affect the ultimate outcome.

Chapter 3 : Pediatric Hand Fractures I R A

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