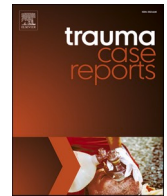




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Use of an iliac bone graft with the tensor fasciae latae for the reconstruction of capitellum and radial collateral ligament in wind swept elbow

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ABSTRACT

Traumatic elbow injuries often result in wounds and exposure of the nerves, tendons, and bone with defects in the soft tissue. A severe type of wind swept injury causes loss of the capitellum and radial collateral ligament (RCL), which leads to severe instability of the elbow. For reconstructing a defect of the capitellum and RCL, we applied an autogenous iliac bone graft with the fascia of the tensor fasciae latae muscle, which has never been reported with successful results. This bone-tendon unit may be a strong candidate for the reconstruction of defects of the radiocapitellar joint in a wind swept injury.

Introduction

A wind swept injury of the elbow may occur in a traffic accident when the elbow is ejected and sandwiched between the road and the car body, thereby leading to the loss of bone and soft tissue. In this paper, we report a case of a lateral wind swept elbow injury, which included loss of the capitellum and radial collateral ligament (RCL) and led to severe instability of the elbow. Reconstruction by using bone graft and tendon graft has been reported; however, reports of reconstruction using a bone-tendon unit of the elbow joint are rare. We treated the wind swept injury by using a unique method of applying an autogenous iliac bone graft with the fascia of the tensor fasciae latae muscle.

Case

A 71-year-old woman's right arm was injured in a motor vehicle accident. Her right upper limb got caught between her car body and a paved road. The skin from the lateral side of the elbow to her forearm and wrist was degloved, and many pieces of car window glass were mixed in her extensor muscles (Fig. 1). The elbow joint was exposed, most parts of the capitellum and the RCL were scraped and missing, and the joint was unstable. Fig. 1c is a radiograph of the deficit of the capitellum, comminuted fracture of her proximal radius, and a dislocated elbow joint. On admission, she underwent surgery, which included the removal of glass fragments, debridement, and stabilization with a temporary external fixation. After debridement, the extensor muscles and supinator muscles were partially deficient. Her extensor carpi radialis brevis muscle was missing, leaving approximately 3 cm of attachment at the second

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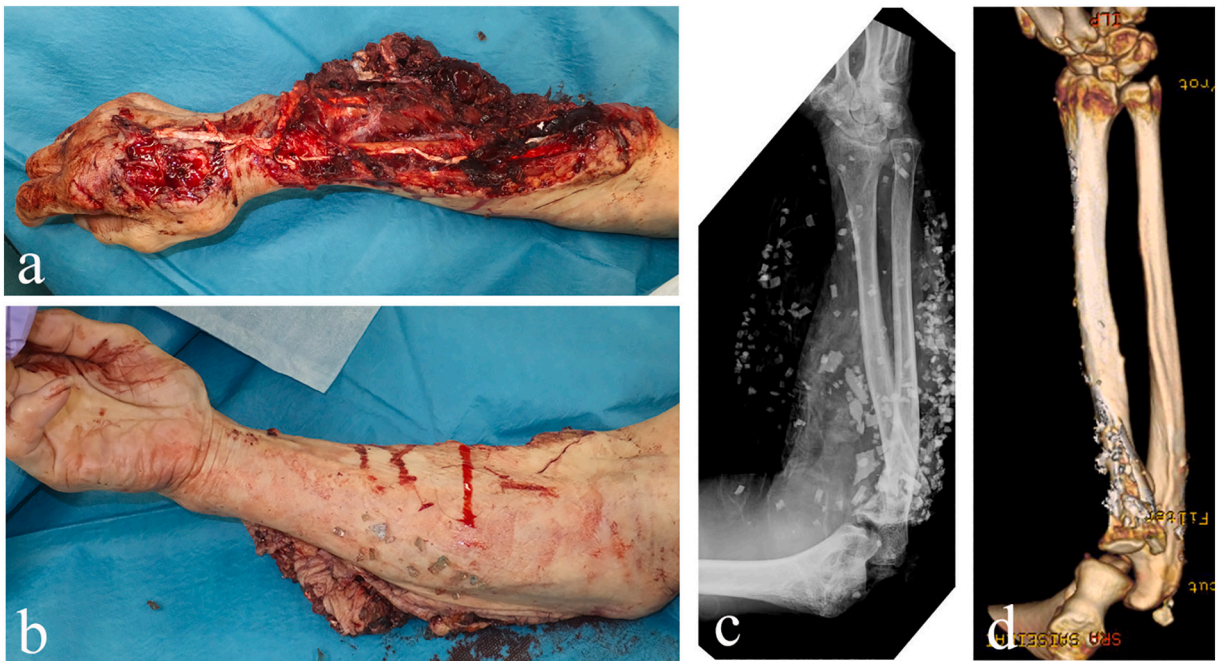


Fig. 1. a. The extensor side of her forearm and wrist is degloved. Many pieces of car window glass are mixed in her extensor muscles. b. The flexor side of the forearm is not degloved. Radiographic findings show that the elbow joint is dislocated with a deficit in the capitellum and comminuted fracture of the proximal radius. Gross contamination of glasses is also shown. c. The x-ray image. d. The computed tomography (CT) image.

metacarpal bone. The radial nerve was not directly confirmed. Fig. 2a shows that the dislocated elbow was reduced and stabilized with external fixation. The skin defects are approximately $10 \times 20 \text{ cm}^2$. Fig. 2b is a radiograph of the comminuted fracture of the proximal radius, which was reduced and fixed with Kirschner wires. Computed tomography revealed a bone defect at the capitellum (Fig. 2c and d).

She underwent reconstructive surgery 5 days after the first surgery. To reconstruct the defect of the capitellum and the RCL, an iliac bone graft with fascia of the tensor fasciae latae muscle was used. A 3-cm \times 2-cm iliac bone graft was harvested at 3 cm posterior to the anterior superior iliac spine with 5 cm of the fascia of the tensor fasciae latae. The surface of the cortical bone of the iliac was then carved in a round shape to resemble the shape of capitellum and was attached to the humerus at the bone defect of the capitellum with cancellous screws (Fig. 2e). The tensor fasciae latae was sutured to the proximal radius with suture anchors (Fig. 2f). Fig. 3 shows the surgical scheme. The extensor carpi radialis tendon was diminished; therefore, the flexor carpi radialis tendon was transferred to the distal stump of the extensor carpi radialis tendon for the reconstruction of the wrist extension. To cover the skin defects from the elbow to the distal forearm, a split-thickness skin graft was harvested from the thigh.

After 2 weeks of immobilization of the elbow, she was allowed to exercise active flexion and extension. After 3 weeks, active pronation and supination exercises of the forearm with active flexion and extension of the wrist were started. The skin graft was perfectly adapted without infection. Three months postoperatively, the patient could extend her fingers, indicating improvement in the radial nerve paralysis.

At the 1-year postoperation follow-up, the bone graft had united and the congruity of radiocapitellar joint was preserved (Fig. 4a–c). Her elbow joint range of motion (ROM) improved to 140° in flexion and -5° in extension with no instability. Her forearm range of motion was 45° in supination and 80° in pronation; the ROM of the wrist joint was 65° in flexion and 60° in extension. Her grip strength was 13.3 kg but 23.0 kg on the uninjured side. The pain score on the visual analog scale (range, 0–10) was 0. The Quick Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) score was 29.5. The score of American Shoulder and Elbow Surgeons assessment was 86.5. She was satisfied with the recovery of function of the elbow and could use her right arm in daily life as her dominant side.

Discussion

We presented a case of a lateral wind swept elbow injury, which included loss of the RCL and bone defect at the distal humerus. To reconstruct the bone-tendon unit, an iliac bone graft with fascia of the tensor fasciae latae muscle was used. This method has never been reported with successful results.

Previous reports used a bone-tendon allograft by using the Achilles tendon attached to calcaneus bone [1]. Calcaneus bone is fixed at the trough of the humerus and the Achilles strip is attached to the supinator tubercle of the ulna. The calcaneus and Achilles tendon may be a useful donor for reconstructing a bone-tendon unit; however, limited facilities can use allograft. In that situation, an

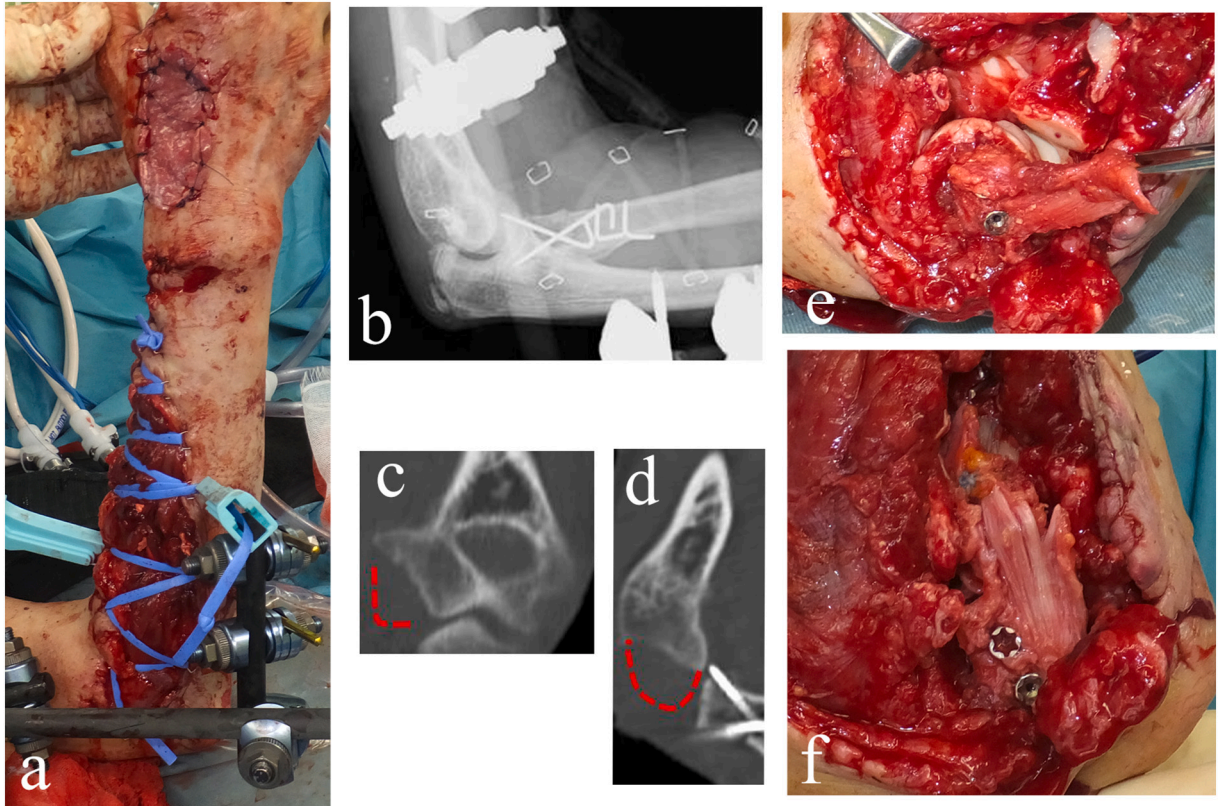


Fig. 2. a. The dislocated elbow has been reduced and stabilized with external fixation. The intact muscles are sutured, and the wound is closed with the shoelace technique. The skin defects are approximately $10 \times 20 \text{ cm}^2$. b. The postoperative x-ray image shows that the elbow is reduced, and the comminuted fracture of the proximal radius is fixed with Kirschner wires. c, d. The computed tomography (CT) image shows a defect at the capitellum of the distal humerus. The dotted line indicates the original form of the capitellum. c. The coronal view. d. The sagittal view. e. The iliac bone graft is fixed at the defect by using 4-mm cancellous screws. f. The fascia of the tensor fasciae latae muscle attached to the iliac bone graft is attached to the radius with suture anchors.

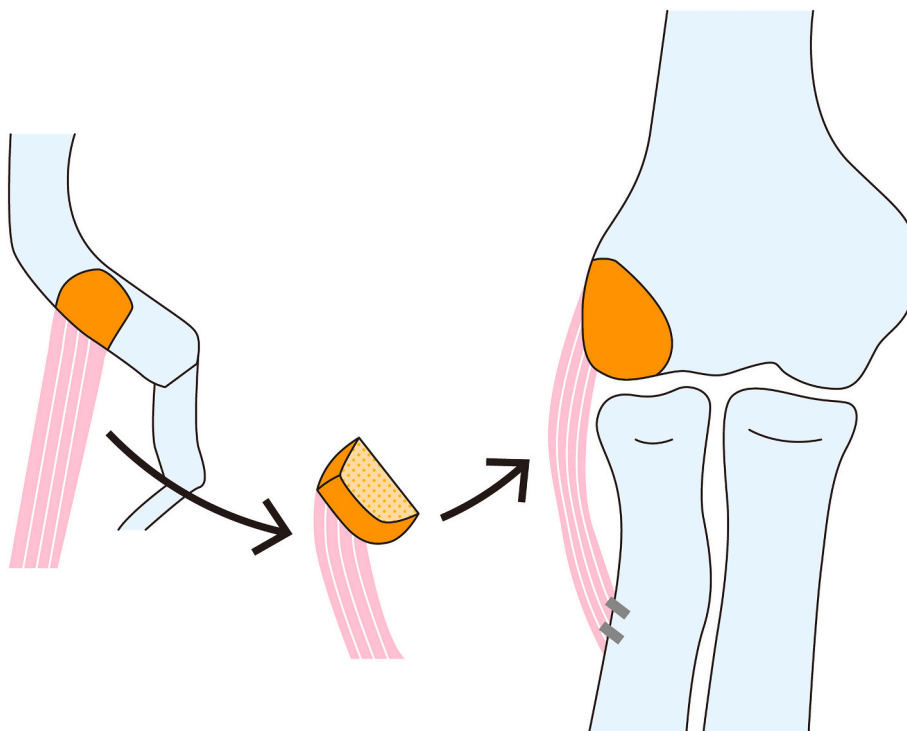


Fig. 3. Surgical scheme. The iliac bone graft is harvested with 5 cm of the fascia of the tensor fasciae latae. The surface of the cortical bone of the iliac is carved into a round shape and is attached with cancellous screws to the humerus at the bone defect of the capitellum. The tensor fasciae latae is sutured to the proximal radius with suture anchors.

autologous graft should be selected. Previous reports on the use of the bone-tendon autograft focus primarily on anterior cruciate ligament reconstruction. In these cases, the bone-patellar tendon-bone autograft is commonly used [2–4]. A meta-analysis showed that normal stability rates were significantly lower in the allograft than in the autograft. Therefore, for stability, the autograft has the advantage for the donor of RCL reconstruction [5].

An advantage of the bone-tendon unit of the iliac bone graft with fascia of the tensor fasciae latae muscle is that a large graft can be harvested and can be suitably carved in the shape of the original structure. Another advantage of the fascia of the tensor fasciae latae muscle is that it has sufficient strength and width, which is useful in achieving the function of RCL.

Our techniques have several limitations. Sacrifice of the tensor fasciae latae muscle has the potential risk of causing difficulty in walking. The patient had no difficulty in walking postoperatively; however, the application of this method should be avoided for individuals who have muscle weakness in the legs. Furthermore, the surface of the iliac bone graft at the radiocapitellar joint was not true articular cartilage, but the cortex. Therefore, long-term follow-up is necessary to check for osteoarthritis.

To treat a skin defect, a skin graft or skin flap should be considered [6]. When soft tissue cannot cover the bone and tendon, a skin flap should be selected, including free or local flaps. A free gracilis myocutaneous flap and radial forearm flap were used in a previous report [1]. In our patient, the extensor muscle remained and could cover the lateral side of the elbow joint. The skin defect area was longitudinally wide from the elbow to the distal forearm. Split-thickness skin grafting was applied.

In this paper, we reported a case of a defect of the capitellum and RCL, treated by using an autogenous bone-tendon unit of the iliac bone graft with fascia of the tensor fasciae latae muscle. The iliac bone can be modified manually, based on the original shape, and the tensor fasciae latae has the advantages of being thin and having sufficient strength that is suitable for reconstructing the RCL. Therefore, iliac bone with fascia of the tensor fasciae latae muscle can be a strong candidate for reconstructing a lateral wind swept injury.

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Previous presentations

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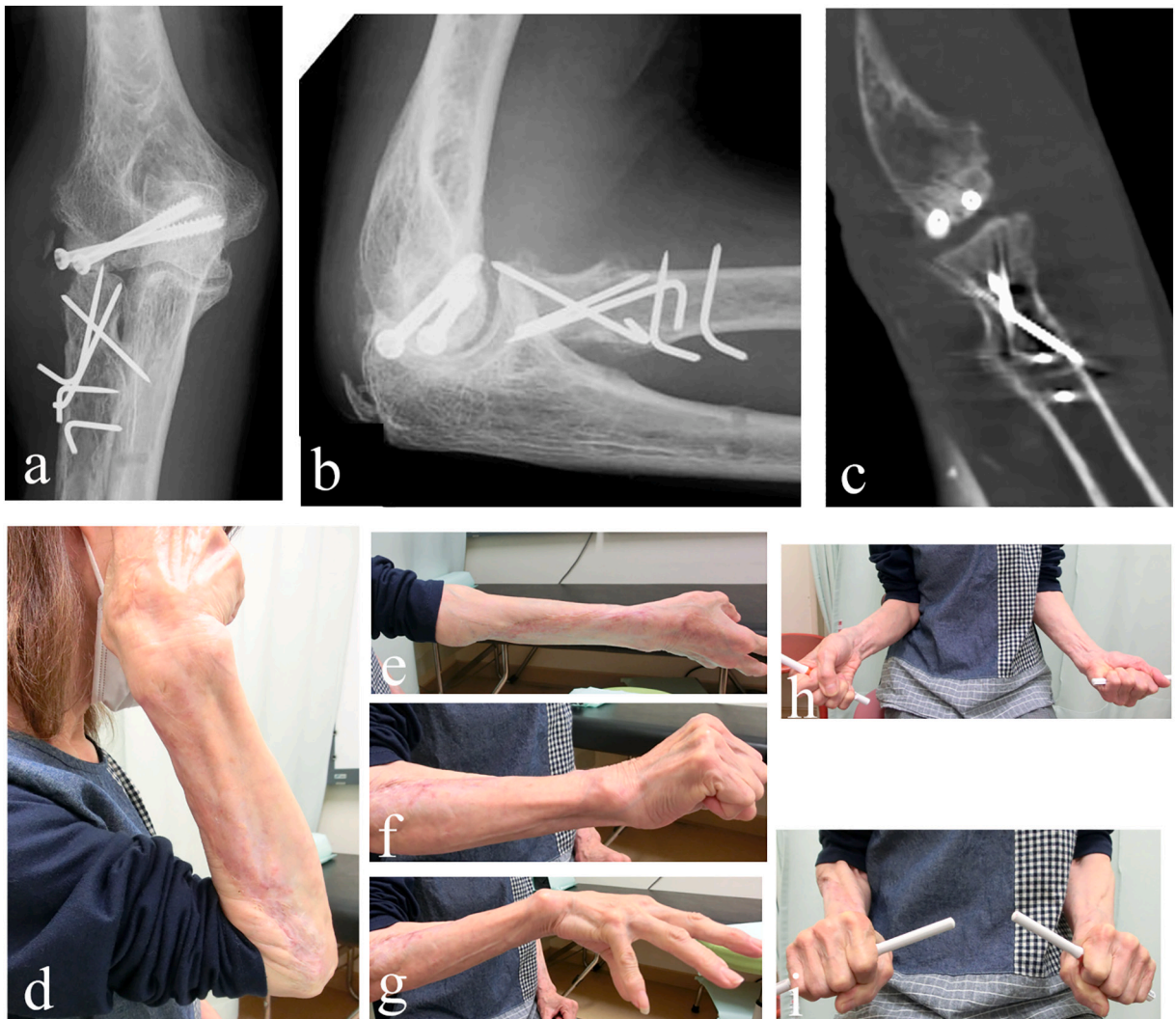


Fig. 4. The x-ray image at 1 year postoperatively shows that the iliac bone graft and the proximal radius had successful bone healing (a) in the anteroposterior view and (b) in the lateral view. The sagittal view of the computed tomography image shows that the congruity of radiocapitellar joint is preserved (c). At the final follow up, the patient can flex her elbow (d) and extend her elbow (e), as well as extend her wrist (f) and finger (g). The patient has limited supination (h) but no limitation in pronation (i).

Declaration of competing interest

None.

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