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SUBSPECIALTY PROCEDURES

Technique for Insertion of the Conventus Cage for Distal Radial Fracture Fixation

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Introduction

Use of the intramedullary Conventus DRS Cage and fragment-specific screw fixation of distal radial fractures minimizes soft-tissue trauma, leading to earlier and improved wrist and finger motion while reducing traditional complications seen with internal fixation of distal radial fractures.

The technique of Conventus cage fixation of distal radial fractures involves first reducing the fracture with closed or, if necessary, open methods and then stabilizing the reduction with longitudinal finger-trap traction or radial and ulnar axial wires. The intramedullary metaphyseal aspect of the distal part of the radius is then prepared via either a dorsal (preferred by most surgeons) (Video 1) or a radial (Video 2) minimally invasive approach. Through a 2 to 3-cm incision, the distal aspect of the radial shaft is exposed and the soft tissue is retracted. The medullary cavity in then prepared with a series of drill-bits followed by a cavity preparation tool. The Conventus cage is then inserted into the subcortical medullary space, expanded, locked, and secured to the radial shaft with a side-plate and cannulated screws. Through small stab incisions, fracture fragments are then secured to the cage and radial shaft with cannulated bicortical screws.

Video 1 The dorsal approach, with provisional finger-trap fracture stabilization, for insertion of the Conventus cage with fragment-screw fixation for a displaced 2-part fracture.
Video 2 The radial approach, with provisional Kirschner wire fracture stabilization, for insertion of the Conventus cage with fragment-screw fixation in a patient with a displaced radial styloid fragment.

Disclosure: On the **Disclosure of Potential Conflicts of Interest** forms, *which are provided with the online version of the article,* one or more of the authors checked "yes" to indicate that the author received payment or services from Conventus Orthopaedics (the manufacturer of the DRS Cage) for an aspect of the submitted work and "yes" to indicate that the author had a relevant financial relationship in the biomedical arena outside the submitted work (http://links.lww.com/JBJSEST/A155).

The longitudinal finger-trap traction and all provisional wires are removed, and the stability of the fracture fixation is assessed radiographically. The incision and stab wounds are closed, a dressing is applied, and a temporary splint is applied if needed.

Indications & Contraindications

Indications

- Distal radial fracture

Contraindications

- Active infection at the operative site
- Active systemic infection
- Suspected or known sensitivity or allergies to nickel or titanium
- Distal radial fracture in a child with open physes
- Mental conditions that preclude cooperation with the rehabilitation regimen

Step 1: Reduce the Fracture

Reduce the fracture with closed or, if necessary, open methods to achieve anatomic restoration of articular congruity, radial inclination, radial length, volar tilt, and coronal shift.

- Position the patient supine with the arm extended on the hand table.
- Apply a tourniquet about the proximal part of the arm if you choose to use one.
- Position the C-arm.
- Prepare and drape the arm.
- Inflate the tourniquet.
- Apply manual longitudinal traction to the hand and wrist.
- Overaccentuate the fracture displacement.
- Apply external pressure on the fracture fragments to achieve reduction.

Step 2: Provisionally Stabilize the Fracture

Provisionally stabilize the reduced fracture for insertion of the cage and fragment-specific screws with either longitudinal finger-trap traction or longitudinal Kirschner wires.

- Position the wrist over a small "bump."
- Apply 10 lb (4.5 kg) of longitudinal traction through finger traps attached to the index and long fingers or, if preferred, insert Kirschner wires.
- If Kirschner wires are preferred over finger-trap traction, insert a 0.062-in (1.574-mm) Kirschner wire through the dorsal-radial aspect of the radius parallel with the radial shaft at approximately a 30° angle and exiting the volar cortex 5 to 8 mm proximal to the fracture. Then insert a second 0.062-in Kirschner wire in exactly the same manner.

Step 3: Prepare for Cage Fixation

Prepare the distal part of the radius for cavity preparation and insertion of the Conventus DRS Cage.

- Insert a 0.045-in (1.143-mm) Kirschner wire into the subchondral area just ulnar to Lister's tubercle perpendicular to the longitudinal axis of the radial shaft.
- Using the Conventus template, mark the skin on the dorsum or radial aspect of the forearm for a 2 to 3-cm longitudinal incision for a radial or dorsal approach as preferred by the surgeon.
- Incise the skin, expose the radial shaft, and insert the Conventus banded tissue retractor.
- Insert a 2.5-mm side-cutting drill-bit through the first cortex.
- With the drill-bit spinning, advance it to the target wire under fluoroscopic control.
- Insert the solid post into the track created by the 2.5-mm drill-bit and, over this post, advance the 5-mm cannulated drill-bit to the target wire.
- Insert the Conventus implant-site-preparation instrument into the track and gradually deploy until the device meets the dorsal and palmar cortical bone under fluoroscopic control.

Step 4: Insert the Conventus DRS Cage

Insert the previously chosen small or large Conventus DRS Cage.

- Insert the Conventus DRS Cage to the target wire with the arrow on the device pointing dorsally or radially depending on the approach chosen for insertion.
- Deploy the cage and confirm its position fluoroscopically.
- Lock the cage in the deployed state.
- Apply the side-plate with 2-headed cannulated 2.7-mm screws.
- Remove the banded tissue retractor.

Step 5: Fix the Fracture Fragments

Anatomically fix the fracture fragments to the cage and radial shaft.

- Insert a 0.045-in (1.143-mm) guidewire obliquely through the radial styloid fragment such that it passes through the cage and across the fracture, and exits the far ulnar cortex proximal to the fracture.
- Perform a cutdown to the radial styloid dorsal rim while protecting the soft tissues.
- Measure for screw length.
- Drill over the guidewire to the far radial cortex.
- Operate the drill in the oscillating mode as the drill-bit passes through the cage.
- Remove the drill, taking care to not remove the guidewire.
- Insert the headless cannulated screw, confirming under direct vision that the screw head is buried within the bone.
- Insert a second screw from the dorsal-ulnar corner of the distal part of the radius obliquely through the cage, exiting the radial shaft proximal to the fracture in the same manner as described above.

Step 6: Confirm Fracture Stability

Move the wrist through a full range of motion while assessing fluoroscopically whether the fracture has been stabilized with the cage-and-screw construct.

- Remove the provisional stabilization finger traps or longitudinal wires and the target wire.
- Under fluoroscopic control, assess the stability of the fracture construct.
- If desired, insert additional screws to the construct to enhance stability.

Step 7: Close the Wound

Close the skin incision and cutdown wounds and apply dressings.

- Deflate the tourniquet if one was used.
- Close all wounds with sutures as desired.
- Apply a soft dressing.
- Depending on the level of osteopenia, fracture type, and stability obtained, a splint may be applied for 7 to 10 days.

Results

The Conventus DRS Cage has been used for treatment of distal radial fractures in the U.S. for >3 years. The results continue to mirror the excellent early and 1-year results that we have previously reported in a group of 100 patients followed for 1 year[1]. In that report, both Disabilities of the Arm, Shoulder and Hand (DASH) and Patient-Rated Wrist/Hand Evaluation (PRWHE) scores were found to average 21 points at 12 weeks, whereas the DASH score averaged 9 points and the PRWHE score averaged 11 points at 1 year. There was also minimal or no loss of reduction throughout the healing process, with evidence of callus formation at the fracture as early as 2 weeks after surgery and 100% of the fractures found to be healed at 3 months. Pain relief was such that few patients required prescription pain medication after the first 3 postoperative days. These results are either superior to or compare favorably with reports in the literature of distal radial fractures treated with other means of internal fixation[2-8].

In our preliminary study[1], in which the radial approach was used (Video 2), 5 subjects had an adverse event related to the technique or device: 2 experienced radial nerve symptoms, and 3 experienced tendon irritation related to ≥1 fragment-specific screws. No radial nerve-related adverse events have been reported after use of the dorsal approach (Video 1). Performing cutdowns at the time of screw insertion with careful inspection for screw head prominence has eliminated the problem with tendon irritation about prominent screws.

The dorsal approach is now more popular than the radial approach as it is more familiar to surgeons and avoids potential injury to the branches of the radial nerve. The radial approach, however, is favored for patients with a high body mass index (BMI) (Figs. 1 through 4).


Fig. 1


Fig. 2


Fig. 3


Fig. 4

Figs. 1 and 2 Preoperative posteroanterior (**Fig. 1**) and lateral (**Fig. 2**) radiographs of a 3-part distal radial fracture.
Figs. 3 and 4 Postoperative posteroanterior (**Fig. 3**) and lateral (**Fig. 4**) radiographs of the fracture fixed with a Conventus cage and multiple screws.

Pitfalls & Challenges

- Radial nerve symptoms associated with the radial approach.
- Tendon irritation associated with screws not inserted fully beneath the bone surface.

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