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Long-term results after simple rotational osteotomy of the radius shaft for congenital radioulnar synostosis

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Background: The present study was conducted to clarify the long-term (≥10 years) results of simple rotational osteotomy for congenital radioulnar synostosis (CRUS).

Methods: Twelve forearms in 9 Asian patients with CRUS who underwent simple rotational osteotomy of the radius shaft were monitored for an average of 13.6 years (range, 10-19 years) postoperatively. Before surgery, the forearm fixation averaged 51.3° of pronation (range, 30°-90°). The true position of the forearm in ankylosis was measured by a line through the styloid processes of the radius and the ulna. Palm pronation and supination angles were also measured. The osteotomy was performed at the insertion of the pronator teres to the shaft of the radius. The pronation position was then corrected manually to allow 90° of palm supination with compensatory rotation around the wrist, and a cast was applied. We evaluated activities of daily living items at a mean of 5.2 years after surgery. At the final follow-up, the 11-item version of the Disability of the Arm, Shoulder and Hand score was recorded.

Results: After surgery, the forearm was fixed at an average of 4.2° of supination. At the final follow-up, the palm was able to achieve an average motion arc ranging from 26° of pronation to 62° of supination. There were no neurologic or circulatory complications after surgery. Ability to perform daily activities was markedly improved, and all patients were satisfied with the results of surgery. The average score on the 11-item version of the Disability of the Arm, Shoulder, and Hand was 3.79 points at the final follow-up.

Conclusion: Our procedure for forearm rotation in patients with CRUS is simple, reliable, satisfactory, and safe.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Congenital; radioulnar synostosis; rotational osteotomy; long-term; elbow anomaly; follow-up

Congenital radioulnar synostosis (CRUS) is an uncommon malformation. Most patients have a condition in which the forearm is fixed in pronation. This may cause severely disabling functional impairment such as inability to scoop up

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Table I Assessment of activities of daily living*

ADL items: 26		
Hygiene and self-care items: 11	Feeding-related items: 8	Environmental interaction: 7
Face washing	Using a spoon	Holding a phone receiver
Shampooing	Using chopsticks	Turning over book pages
Body washing	Using a fork	Writing a letter
Tooth brushing	Using a knife	Using a keyboard
Nail clipping	Drinking liquid with a cup	Turning a doorknob
Cleaning after defecation	Pouring liquid into a cup	Turning a door lever
Tying shoelaces	Holding a rice bowl	Standing up from a chair using a hand
Fastening shirt buttons	Holding a dish	
Putting on a shirt		
Putting on pants		
Pulling a pants zipper		

* Assessment: 5 points, normal; 4 points, clumsy; 3 points, requiring time; 2 points, needing assistance; 1 point, impossible

water in the hands, to use a fork or chopsticks, or to drink water from a glass. In older children, the chief complaints are often difficulty in sports. The indications for surgery in Asian and Western countries depend on the severity of the deformity, amount of disability, and lifestyle.

Rotational osteotomy of the forearm bones or a surgical procedure to mobilize the fused joint is recommended to achieve a more functional position. Osteotomy is usually done through the fusion mass, but the operative procedure for adequate correction is relatively complicated.[4,5,12,16] To prevent these complications, Ogino and Hikino[14] have reported shortening rotation osteotomy of the fused bone. However, shortening osteotomy is difficult to perform when the fused mass is short. In 1994, Kashiwa et al[10] developed a simple method for correction of the forearm position in which osteotomy was performed only across the shaft of the radius, which they reported in 2000. Horii et al[6] reported good results of single osteotomy at the radial diaphysis using temporary fixation with Kirshner wire. Although these procedures were relatively simple, the long-term outcomes were not described. Here we report the long-term (≥10 years) results of simple rotational osteotomy for CRUS without use of an implant.

Materials and methods

Between 1998 and 2006, 12 forearms in 9 Asian patients (6 boys and 3 girls; average age, 6.4 years; range, 4-10 years) underwent simple rotational osteotomy for CRUS performed by a single surgeon and were monitored for an average of 13.6 years (range, 10-19 years). In 3 of the patients, both forearms were involved. The average preoperative degree of fixed forearm pronation was 51.3° (range, 30°-90°). The postoperative (true) forearm position, the palm pronation and supination angles at 90° of elbow flexion, and complications were measured. The true position of the forearm in ankylosis was measured by a line through the styloid processes of the radius and the ulna.

Eight patients were asked to subjectively evaluate the degree of improvement in their activities of daily living (ADL) with a mean follow-up of 5.2 years (range, 1-10 years) after surgery. We evaluated 26 ADL items, including 11 that related to hygiene and self-care, 8 that related to feeding, and 7 that assessed environmental interaction (Table I). A questionnaire was sent to the parent of each patient, and all the items were evaluated by the parent on a 5-point scale (1-5, with 5 as the highest score). At the final follow-up point, the 11-item version of the Disability of the Arm, Shoulder and Hand (*Quick*DASH) score was recorded for all patients. Measurements and final evaluations were performed by the first author, (H.S.) and only midterm evaluations were performed by the coauthors.

Surgical methods

A longitudinal 4-cm incision was made over the radial flexor side of the mid forearm. The insertion of the pronator teres to the radius was explored between the flexor carpi radialis and the brachioradialis. The pronator teres tendinous insertion and the periosteum beneath it were longitudinally incised to expose the shaft of the radius subperiosteally (Fig. 1). Several fine holes were created with a Kirschner wire at the osteotomy site, and the osteotomy was undertaken using a fine chisel. The radius was cut transversely, and the pronation position was gradually rotated manually until the palm achieved 90° of supination with compensatory rotation around the wrist (Fig. 2). No image intensifier guidance was used.

The cut ends of the tendinous portion of the pronator teres and the periosteum were repaired with 3-0 braided nylon to ensure stability of the osteotomy site (Fig. 1). This method did not require soft tissue release around the osteotomy site to achieve sufficient correction. Internal fixation was also not necessary.

The skin incision was closed. A long arm cast was applied with the palm in 90° of supination with compensatory rotation around the wrist (Fig. 2).

Postoperative care

Radiographs were examined every 1 to 2 weeks. The cast was not replaced until callus formation. The cast was removed between 7 and 12 weeks after surgery when sufficient callus formation had become evident radiographically. No rehabilitation program was