Surgical correction of congenital radioulnar synostosis: a protocol of treatment

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Purpose
The aim of this study is to establish a protocol of treatment with clear indications of surgical intervention in congenital radioulnar synostosis (CRUS) and to assess the results of this protocol by performing the osteotomy through the synostosis mass.
Patients and methods
A total of 20 forearms with CRUS in 15 patients underwent surgical correction through an osteotomy of the synostosis mass according to our protocol. The mean age of the patients at surgery was 6.5 years. The synostosis mass was divided, and the osteotomy was fixed using an intramedullary wire. The average duration of follow-up was 4.2 years (3–6 years).
Results
The desired correction was achieved intraoperatively in all patients. The mean preoperative fixed pronation was 80.7° in the dominant limb, with a mean improvement of 40.7°, and 29.1° in the nondominant limb, with a mean improvement of 49.1°. All patients were extremely satisfied with the result of surgery regarding the cosmetic improvement as well as performing activities of daily living comfortably.
Conclusion
Correction of CRUS by osteotomy through the synostosis mass is a safe, easy, and efficient technique that markedly improves the child's function. The clear guidelines set in this study on when to intervene, which forearm to correct, and how much derotation to perform help clarify confusion in literature. Because of loss of correction observed in all forearms, we recommend overcorrection by 10° than initially planned according to the protocol.

Keywords:
congenital radioulnar synostosis, forearm deformity, forearm osteotomy

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Introduction

Congenital radioulnar synostosis (CRUS) is a rare anomaly that can be very disabling. It is more commonly bilateral than unilateral, and the forearm is fixed in variable degrees of pronation [1]. The interosseous membrane and fascial tissues are short, the supinator muscles are abnormal/absent, and the head radius may be dislocated. Review of literature revealed that there are many controversial and debatable issues regarding CRUS. Initially various surgical options are available: (a) techniques that aim at restoring a range of pronation/supination (excising/separating the mass; splitting interosseous membrane; inserting free vascularized/nonvascularized fascio-fat graft interposition) and (b) techniques that aim at placing the forearm in a new fixed but more functional position (rotational osteotomy of radius and/or ulna, rotational osteotomy through the synostosis mass). Another debatable issue is whether to interfere or not in unilateral cases, correct one/both hands in bilateral cases, at which age to interfere, and in which position to fix the forearm [2,3]. Results of techniques that attempt to restore a ROM are controversial [3–5]. Results of osteotomy at the level of synostosis and more distal osteotomies of the radius and ulna are again controversial with some authors advocating either technique and reporting less complications with the technique they adopt [6,7]. In general, the decision to operate should be carefully planned regarding the affected side, hand dominance (child dexterity), and position/degree of fixed deformity, with the aim of allowing the child to eat and perform self-hygiene with the nondominant limb and write and perform keyboard activities and button/unbutton clothes with the dominant limb [8–10]. Accordingly we decided to set the following protocol for management of CRUS: intervention should be attempted in children more than or equal to 4 years, osteotomy is to be done through the

synostosis mass, the nondominant hand should be corrected to 30° supination, and in the dominant hand if fixed in less than or equal to 45° pronation, then no intervention is indicated, and if fixed in more than 45° pronation, it is corrected to 30° pronation. The aim of this study is to (a) establish a protocol of treatment with clear indications of surgical intervention in CRUS and (b) to assess the results of this protocol by performing the osteotomy through the synostosis mass.

Patients and methods

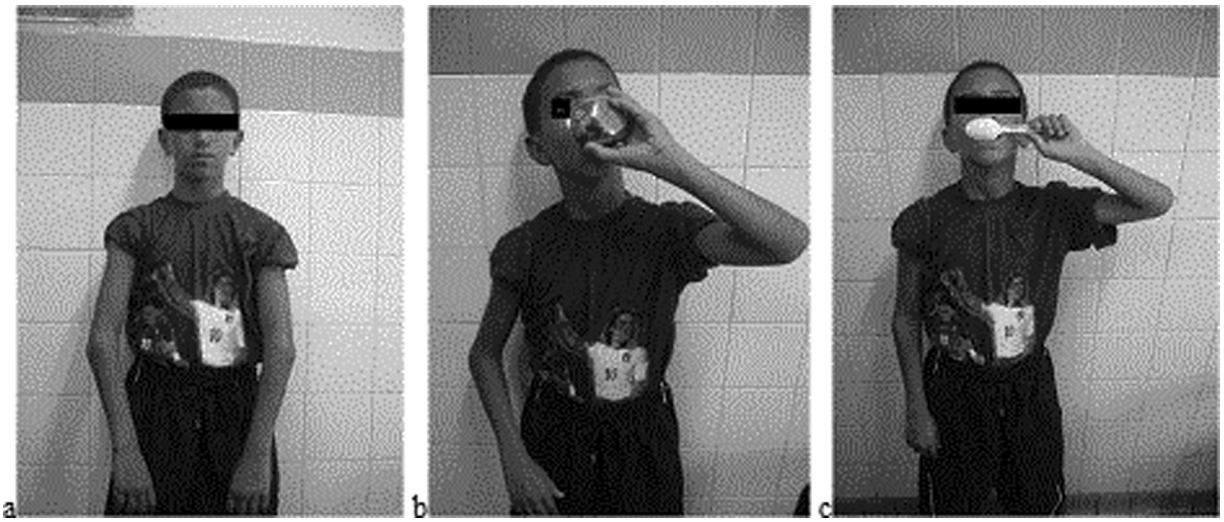
Over a period of 3 years (from March 2010 to March 2013), 20 forearms with CRUS in 15 patients (five bilateral and 10 unilateral) underwent surgical correction through an osteotomy of the synostosis mass according to our protocol. All operations were done in Ain Shams University Hospital. The mean age at surgery was 6.5 years (4–8 years). We operated on six nondominant forearms and 14 dominant ones. Through a Boyd approach, the synostosis mass was divided with an oscillating saw. A 2–3 mm K-wire was introduced proximally into the olecranon and proximal ulna, the forerearm was derotated into the desired position, and then the K-wire was pushed distally into the radial shaft. A well-moulded cast in the corrected position was applied. After 2 weeks, the cast was changed under anesthesia, and 4 weeks later, the cast and wire were removed. The average duration of follow-up was 4.2 years (3–6 years).

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Results

The desired correction was achieved intraoperatively in all patients, but there was a 10° loss of correction in the cast in all forearms noted immediately after removal of the cast that did not increase over the years. The mean preoperative fixed pronation was 80.7° in the dominant limb, with a mean improvement of 40.7°, and 29.1° in the nondominant limb, with a mean improvement of 49.1°. There were two cases of posterior interosseous nerve palsy that resolved completely at 6 weeks. All patients were extremely satisfied with the result of surgery regarding the cosmetic improvement as well as performing activities of daily living comfortably, including writing and keyboard activities as well as buttoning/unbuttoning shirts when surgery was performed on the dominant hand and eating, face washing, and perineal hygiene when performed on the nondominant hand (Figs 1 and 2). Satisfaction was measured by asking the parent(s) to grade their child's condition at the final follow-up on a scale of 0–5, with '0' meaning totally unsatisfied and '5' meaning extremely satisfied. Because CRUS is a rare condition, the number of patients included in this study was too small to apply any tests for statistical significance. However, it can be concluded that CRUS can be treated successfully with an osteotomy

Figure 1



(a) A 7-year-old boy, right hand dominant, had bilateral CRUS. He had difficulty in (b) drinking and (c) eating as fluids and food spilled out of cup/spoon. CRUS, congenital radioulnar synostosis.

Figure 2

The patient underwent rotational osteotomy through the synostosis mass on the left nondominant side which corrected his forearm into 30° supination with marked improvement in (a) hand-to-mouth position, (b) eating without spilling of food, and (c) hand over head position.

through the synostosis mass. The protocol of treatment set in this study is clear and reproducible.

Discussion

CRUS is a rare anomaly that can be very disabling [1]. Results of techniques that attempt to restore a ROM at the level of the synostosis and more distal osteotomies of the radius and ulna are controversial [4–7]. In general, the decision to operate should be carefully planned regarding the child's dexterity and position/degree of the fixed deformity, with the aim of allowing the child to eat, wash his/her face, and perform self-hygiene with the nondominant limb and write and perform keyboard activities and button/unbutton clothes with the dominant limb [8–10]. Correction of CRUS by an osteotomy through the synostosis mass is a safe, easy, and efficient technique that markedly improves the child's function and ability to perform activities of daily living (ADL). The clear guidelines set in this study on when to intervene, which forearm to correct, and how much derotation to perform help clarify confusion in the literature. Because of loss of correction observed in all forearms, we recommend overcorrection by 10° than initially planned according to the protocol.

Conclusion

Correction of CRUS by an osteotomy through the synostosis mass is a safe, easy, and efficient technique that markedly improves the child's function. The clear guidelines set in this study on when to intervene, which forearm to correct, and how much derotation to perform help clarify confusion in the literature. Because of loss of correction observed in all forearms, we recommend overcorrection by 10° than initially planned according to the protocol.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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