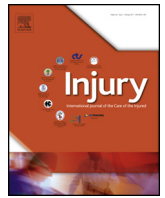




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## A prospective randomised non-blinded comparison of conventional and Dorgan's crossed pins for paediatric supracondylar humeral fractures

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### ABSTRACT

**Background:** Closed reduction and percutaneous pinning are the preferred treatment of displaced supracondylar humeral fractures in children. The purpose of this study is to evaluate the non-standard Dorgan's method and compare its results with those of the standard percutaneous cross pinning method in treatment of unstable or irreducible Gartland type II and III supracondylar humeral fractures in children.

**Patients and methods:** This was a prospective evaluation of 138 consecutive patients with Gartland type II or III extension supracondylar humeral fractures referred to University Children's Hospital during a four-year period. The patients were randomized into two groups: the first group, comprised of 71 patients, was treated with standard pin configuration and the second group, comprised of 67 patients, underwent Dorgan's method. The study included 88 boys and 50 girls aged 1.5–11.4 years (mean  $6.5 \pm 2$ ). At initial presentation 8.7% (n=12) fractures were classified as Gartland type IIa, 25.4% (n=35) as Gartland type IIb and 65.9% (n=91) as Gartland type III.

**Results:** Flynn's criteria were used to evaluate the results. An excellent clinical outcome was reported in about 90% of patients (n=90) treated with standard pin configuration and 89.5% (n=60) of patients treated with Dorgan's method. There were no statistically significant differences in outcomes between the groups in terms of their gender, age, fracture types, function and cosmetics. Neurological lesions were observed in 9.9% of patients (n=7) who were treated using the standard configuration Kirschner pins, while in those treated by Dorgan's method neurological complications were not observed. However, the procedure time was longer (mean  $36.54 \pm 5.65$  min) and radiation exposure significantly higher (mean  $10.19 \pm 2.70$  exposures) in the group that was treated using Dorgan's method, compared to the conventional method (mean  $28.66 \pm 3.76$  min and  $7.54 \pm 1.63$  exposures).

**Conclusion:** Two laterally inserted crossed pins provide adequate stability with good functional and cosmetic outcome for most unstable paediatric supracondylar humeral fractures with no risk of iatrogenic ulnar nerve injury.

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### Introduction

Closed reduction with percutaneous fixation is the method of choice in the treatment of displaced supracondylar fractures in children. There are different methods of pinning. Many authors,

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such as Swenson and Flynn, report using two pins, inserted medially and laterally through the medial and lateral epicondyles [1,2]. Supporters of this technique argue that its advantage is that it offers better biomechanical stability for the reduction of fractures, although there is a possibility of injury to the ulnar nerve in 2–8% of cases during the medial placement of the pin. Arino et al. recommended inserting the two pins through the lateral epicondyles to avoid ulnar nerve injury [3]. Biomechanically, fixation provided by two parallel lateral pins is less secure. Dorgan's method, insertion of two lateral crossed pins, provides a biomechanically stable fixation while avoiding the risk of ulnar nerve injury [4]. This method was named after Dr. John Dorgan, consultant orthopaedic surgeon, Alder Hey Children's Hospital, Liverpool, who came up with this lateral cross pinning technique.

The aim of the present study is to evaluate and compare the results of standard percutaneous cross pinning and lateral cross pinning method in treatment of unstable or irreducible type II and III supracondylar humeral fractures in children.

### Patients and methods

Between February 2010 and April 2014, we prospectively identified 138 consecutive patients aged 1.5–11.4 years (mean  $6.5 \pm 2$ ), admitted to the emergency department of the University Children's Hospital with extension-type displaced supracondylar humeral fractures. Skilled senior paediatric orthopaedic surgeons treated all the admitted patients. They were randomized by random number generator using R software environment where odd numbers were assigned to Dorgan's method of fixation while even numbers were assigned to conventional cross pinning technique.

Demographic information, clinical data and radiological findings were recorded upon admission. Information regarding the type of treatment, the time between the presentation and the referral to the definitive treatment, and procedure were recorded immediately after surgery. Treatment outcome was evaluated after the removal of the cast and wires and during the follow-up period. Antibiotic prophylaxis was given in case of all patients 30–60 min before surgery. Patients with Gartland type I fracture (non-displaced), patients with open fractures, patients that required open reduction and cases with serious neurovascular complications demanding other specific operative management were excluded.

There were 71 patients treated with standard percutaneous pinning (Group A, n=71) and 67 patients treated with Dorgan's method (Group B, n=67). Closed reduction and percutaneous pinning were done under general anaesthetic. In the first group of patients (Group A), after satisfactory reduction was obtained and confirmed by a C-arm, Kirschner pins were placed with elbow hyperflexion and forearm pronation to maintain good fragment position. First Kirchner pin was inserted into the bone using a cordless drill, always through the lateral part of ossified capitulum, passed through growth zones, then the fracture site and the medial pillar, to engage the opposite cortex. Insertion of the medial Kirschner pin was done after lateral pin placement. Kirchner pin was placed through the medial epicondyle, more horizontally than laterally, passed transversely through the medial pillar humeral fracture site and the lateral pillar, while ensuring that it engaged the opposite cortex (Fig. 1).

In the second group of patients (Group B), the first Kirchner pin was introduced through the lateral condyle across the fracture and into the medial cortex. The second pin was introduced through the lateral cortex, proximal to the fracture line, and was then driven across the fracture and into the medial condyle (Fig. 2). The pins had to cross above the fracture line.



Fig. 1. Kirschner wires configuration using conventional percutaneous pinning.



Fig. 2. Kirschner wires configuration using Dorgan's method of fixation.

After placing Kirschner pins under image intensifier control, to check if the reduction was successful and confirm the achieved fracture stabilization, the pins were bent at a 90° angle and then intersected. Plaster splint was placed with the elbow in 60–90-degree flexion.

Radiographic evaluation was performed four weeks after the procedure when the plaster cast and K-wires were removed, including antero-posterior and lateral views of the entire upper extremity, in order to estimate the reduction outcome.

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