The Effectiveness of Physiotherapy After Operative Treatment of Supracondylar Humeral Fractures in Children

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Abstract: The indications for physiotherapy after supracondylar humeral fractures in children are not clear in the literature, even in the presence of an active or passive limitation of elbow joint motion. The authors therefore performed a prospective randomized study to assess the effectiveness of physiotherapy in improving the elbow range of motion after such fractures. The authors studied two groups of 21 and 22 children with supracondylar humeral fractures Felsenreich types II and III, all without associated neurovascular deficits. All children were treated by open reduction and internal fixation with Kirschner wires inserted from the radial side of the humerus. Postoperative follow-up at 12 and 18 weeks showed a significantly better elbow range of motion in the group with weekly physiotherapy, but there was no difference in elbow motion after 1 year. In each group, one child had an extension deficit of 15 or 20 degrees. The authors conclude that postoperative physiotherapy is unnecessary in children with supracondylar humeral fractures without associated neurovascular injuries.

Key Words: physiotherapy, supracondylar humeral fractures, range of motion, elbow stiffness

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Operative treatment of supracondylar humeral fractures in children may result in limitation of active movement of the elbow joint.[1] By persistent flexion or extension deficit, an important medicolegal question rises: would the treatment outcome have been changed if an early physiotherapy program was prescribed? The literature is controversial in recommending physiotherapeutic measures after childhood supracondylar fractures. Several authors recommend physical therapy (PT) for elbow stiffness, whereas others reject it totally.[2,3] Data from a multicenter study performed in the pediatric trauma centers affiliated with the German Trauma Association found that one third of all centers prescribe PT after supracondylar humeral fractures (personal communications).

The advances in health care in the direction of evidence-based medicine have influenced not only doctors but also physiotherapists, with evidence for the effectiveness of PT shifting more to the foreground. We conducted this study to assess whether PT is appropriate in improving the postoperative elbow range of motion (ROM) after supracondylar humeral fractures in children as it does in adults.

PATIENTS AND METHODS

In a prospective randomized study between January 1994 and December 1998, the active range of elbow flexion and extension in 51 children with supracondylar humeral fractures was determined using the neutral-zero method. The inclusion criteria for joining the study were age between 5 and 12 years, an isolated supracondylar humeral fracture Felsenreich type II or III, open reduction of the fracture and fixation using radially inserted criss-cross Kirschner wires, as well as consent to join the study[4,5] (Figs. 1, 2). The exclusion criteria were closed reduction and percutaneous pinning of the fracture, multiple injuries, postoperative neurologic deficit, fractures with associated vascular or neurologic injury, and failure to keep to the study protocol.

After being accepted into the study, randomization was done using a Software Excel Version 3.0 (Microsoft)-generated randomization plan. After 4 to 5 weeks of casting, the Kirschner wires were removed, and the children were followed in weeks 6 to 7, 12 to 13, and 18 to 19 after surgery as well as after 1 year by different examiners so that the examiner did not know to which randomization group the child belonged.

Thirty-minute PT sessions were prescribed two or three times a week. Passive joint and soft tissue stretching techniques as well as active exercises after the Sherrington principles were applied by physiotherapists.[6] All exercises were modified so that the playing component predominates. Because most patients visited a local therapist, the regularity of the exercise program was determined and the patient's compliance was checked at every follow-up visit.

The first group (without PT) consisted of 24 children. Because of a late prescription of PT by a family doctor, three children were excluded from the study. The second group (with PT) consisted of 27 children; of them, 5 were not considered for evaluation because of noncompliance with the study protocol. The age and sex distribution as well as the fracture types was

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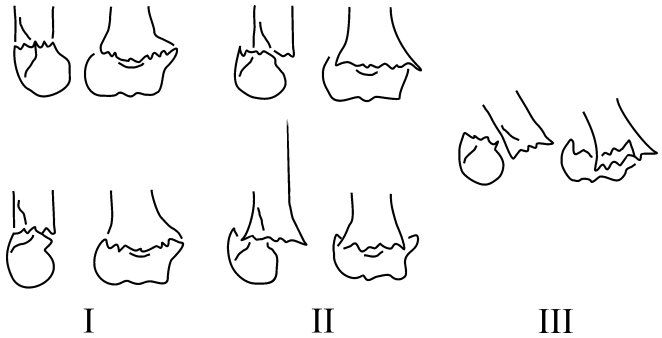

FIGURE 1. Felsenreich classification.[4] Type I, minimal or no dislocation in the frontal plane, posterior angulation up to 20 degrees in the lateral plane. Type II, partial dislocation (up to the shaft width) and/or torsional displacement. Type III, complete dislocation, no contact between the bony fragments.

not significantly different between the two groups (Table 1). The ROM in both limbs was compared using the Wilcoxon test. The chi-square test was used to compare movement limitation greater than 10 degrees. $P > 0.05$ was considered statistically significant.

RESULTS

At the time of Kirschner wire removal, all children had a considerable loss of active motion in the fractured elbow. There was no statistically significant difference between the two groups at that time. Twelve weeks after trauma, there was a significantly greater elbow ROM in the patients who received PT, and after 18 weeks the ROM in this group was still significantly better. This difference, however, was no longer evident 1 year after trauma (Table 2). There was no evidence referring to periarticular ossifications in the PT group. In both groups, there was one patient with persistent limitation of active elbow motion of 15 or 20 degrees. Five of the eight patients who were excluded from the study were likewise examined after 1 year. In two of them, the examination was carried out by the family doctor. None had a limitation of motion greater than 10 degrees (Fig. 3). The outcome of the remaining three patients could not be determined because their addresses were no longer available.

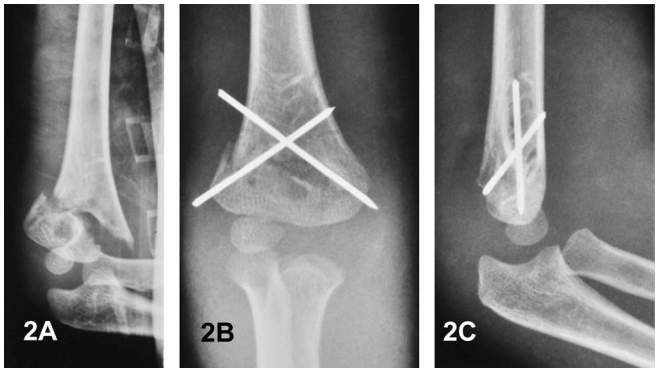

FIGURE 2. A, Five-year-old girl with a displaced supracondylar humerus fracture, Felsenreich type II. B, Open reduction and internal fixation with crossing radially inserted Kirschner wires. The postoperative AP view shows only a minimal valgus with no translation. C, The postoperative lateral view shows an anatomic reduction of the fracture.

TABLE 1. Patient Data

	With PT	Without PT
Patients	14 boys, 8 girls	16 boys, 5 girls
Age (median)	7 years (range 5–12)	7 years (range 5–11)
Cast	35 days (range 32–40)	36 days (range 34–41)
Felsenreich II	9	10
Felsenreich III	13	11
Drop-outs	5	3

DISCUSSION

For every articular or periarticular fracture, an age- and injury-dependent after-treatment is necessary. For children with posttraumatic elbow stiffness, PT is not unsuccessful or totally contraindicated. As the current study shows, children receiving PT achieved a more rapid return of a normal or near-normal elbow ROM. No adverse effect from PT could be shown. The end result, however, was not changed by PT; therefore, its effectiveness in children is questionable. With persistent elbow stiffness after supracondylar humeral fractures without associated neurovascular injury, the treating doctor cannot be accused of neglect or malpractice if he or she did not advise PT.

Joints need motion to keep their function. Because a part of the kinetic system may temporarily lose its function and because an operative treatment to recover full ROM is sometimes necessary, an optimal postoperative program is essential to achieve the best possible healing result.[7] In fractures about the elbow, the effectiveness of postoperative PT in adults in unquestioned.[8] Children's urge for motion is particularly evident between 5 and 10 years, so as a rule no joint mobilization measures are necessary in this age group.[9] Children automatically move their elbow joints until pain ensues.

The duration of external immobilization after open reduction and Kirschner wire stabilization of supracondylar humeral fractures is an important variable that affects joint mobility. In children the usual 5- to 6-week postoperative immobilization period can be reduced to 3 to 4 weeks; thus, restoring free elbow ROM can be rapidly achieved.[2] In the current study, however, there was no age-dependent difference in the period of immobilization to standardize the treatment and to avoid systematic mistakes.

The spectrum of physiotherapeutic measures in 5- and 12-year-old children cannot be directly compared. Nevertheless, the age distribution in both groups was so similar that this difference did not influence the end result. The compliance of young children during PT is key: if the therapist fails to motivate the child, the treatment is useless. For this reason, the PT program was discontinued in every fifth patient. The discontinuation rate in the whole study was about 16%, so

TABLE 2. Limitation of Active ROM Compared to the Healthy Side

	Limitation of ROM			
	6–7 Weeks	12–13 Weeks	18–19 Weeks	56–60 Weeks
Group 1 (without PT)	72 ± 21° (SD)	35 ± 13° (SD)	20 ± 7° (SD)	5 ± 5° (SD)
Group 2 (with PT)	73 ± 25° (SD)	20 ± 19° (SD)	9 ± 5° (SD)	3 ± 5° (SD)
Wilcoxon test	$P = 0.21$	$P = 0.009$	$P = 0.02$	$P = 0.26$
Chi-square test	$P = 0.12$	$P = 0.007$	$P = 0.03$	$P = 0.41$

the validity of the study and its results were not adversely affected.[10]

The PT regimen could not be as standardized as the operative technique because patients mostly chose a local therapist. Specific and nonspecific components of PT (eg, motion therapy and the therapist's behavior) were therefore fused. Bias in this regard cannot be excluded in our study, but due to the large number of physiotherapists, this seems unlikely.

The assessment of the operative result was done exclusively by measuring the active ROM of the elbow. Flexion and extension deficits were equally weighed, although the resulting disability varies greatly. With a persistent limitation of maximally 20 degrees, the distinction between both types using functional criteria is however irrelevant.

PT includes many treatment techniques and a wide zone of applications. The effectiveness of PT in general has not been sufficiently studied.[11] During the past few years, studies reporting the effectiveness of PT have led to much thought. Several studies, like the current one, verified either no benefit or only a poor long-term benefit from PT.[12,13] Nevertheless, such effectiveness studies are important for therapists because negative results are sometimes readily ignored; only by looking at the outcomes can knowledge gaps be closed and PT measures for patients systematically improved.

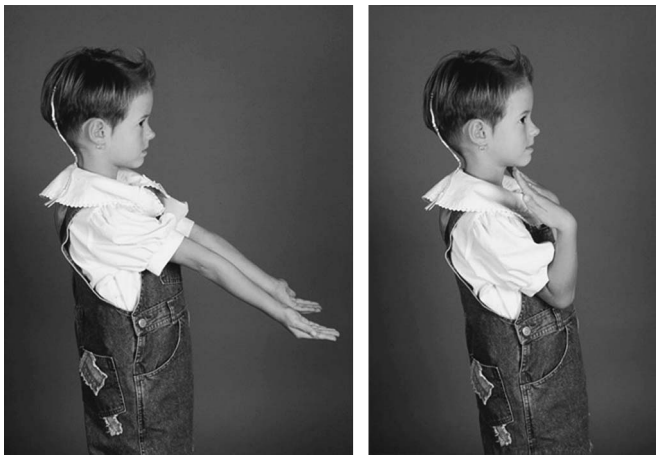

FIGURE 3. The same child shown in Figure 2 with full active ROM of the right elbow 1 year after the trauma without PT.

After uncomplicated operative stabilization of supracondylar humeral fractures without associated neurovascular compromise, PT is not indicated, even in the presence of early considerable limitation of motion. The late function of the elbow joint depends primarily on the quality of operative fracture reduction.[3] Parents should therefore be carefully informed about the prognosis by the treating surgeon.

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