Anterior interosseous nerve compression after supracondylar fracture of the humerus: a metaanalysis

ALEXANDER J OIST, M.D., UWE JOOSTEN, M.D., DIRK WETTERKAMP, M.D., MICHAEL NEUBER, M.D., AXEL PROBST, M.D., AND HORST RIEGER, M.D.

Department of Trauma and Hand Surgery, Westphalian Wilhelms-University, Muenster, Germany

Object. The authors conducted a metaanalysis of reports of anterior interosseous nerve syndrome, a rare nerve compression neuropathy that affects only the motor branch of the median nerve. This syndrome is characterized by paralysis of the flexor pollicis longus, the flexor digitorum profundus to the index finger, and the pronator quadratus, with weakness on flexion of the interphalangeal joint of the thumb and the distal interphalangeal joint of the index finger without sensory loss.

Methods. The authors reviewed reports of 34 cases of anterior interosseous nerve syndrome combined with supracondylar fractures of the humerus in children. They have added a new case identified in a 7-year-old boy in whom a diagnosis was made from the clinical findings and whose treatment and outcome are analyzed. The ages of patients reported in the literature ranged from 4 to 10 years. Ten patients (29%) were treated with closed reduction and application of a cast, whereas 25 patients (71%) were treated with open reduction and fixation of the fracture.

Conclusions. All patients regained full flexion and strength after 4 to 17 weeks. The fractures that were surgically treated showed no entrapment of the anterior interosseous nerve.

KEY WORDS • anterior interosseous nerve syndrome • metaanalysis • supracondylar humerus fracture • nerve compression syndrome • children

Clinical Material and Methods

We conducted a review of the articles published since the first description of the syndrome to evaluate the treatment and final outcome of anterior interosseous nerve compression after supracondylar fracture of the humerus in children. We found 11 reports comprising 34 cases, and we analyzed the age and gender of the patients as well as the treatment methods and the time needed for nerve recovery.

Over a period of 24 years only one case has been recorded at our institution, that of a 7-year-old boy with anterior interosseous nerve syndrome resulting from a dislocated supracondylar fracture of the left humerus. Three days after initial treatment with a cast he was referred to our emergency unit because of a massively swollen elbow. On plain x-ray films, we confirmed the diagnosis of a displaced extension type fracture. The patient was treated using open reduction and crossed pinning fixation with Kirschner wires. On admission the boy had been unable to bend the tips of his thumb and index finger, but demonstrated no sensory loss. Fourteen days postsurgery a neurophysiological examination revealed a lesion of the anterior interosseous nerve. Six weeks postoperatively the boy was starting to regain finger function, and after 10 weeks he could bend the interphalangeal joint of the thumb and the distal interphalangeal joint of the index finger with full strength.
Results

All 34 cases of anterior interosseous nerve palsy reported in the literature have been evaluated, together with the new case. The patients' ages ranged from 4 to 10 years. In seven cases the time needed for recovery was not noted, whereas in the remaining 28 patients complete recovery from the anterior interosseous nerve palsy was observed after 4 to 17 weeks (Table 1).

Discussion

Supracondylar fracture of the humerus is the most common injury of the elbow in children. The incidence of neurological complications varies from 9.5 to 16%7,9,10,26,33,34 but anterior interosseous nerve syndrome is a rare complication. In several larger series of supracondylar fracture there are no reports of anterior interosseous nerve syndrome.7,9,10,14,16 It may be difficult to diagnose this problem, especially in children. Children are often so distressed by their pain that they avoid any movement of the hand and fingers, so that the subtle motor loss is not recognized.

The surgeon may be most concerned with the vascular state and other lesions and may not specifically test the flexion of the distal interphalangeal joint of the index finger and interphalangeal joint of the thumb.

The very small number of reports of anterior interosseous nerve syndrome indicates that there may actually be more cases of this palsy after fractures.

Anterior interosseous nerve syndrome was first described as a complication of supracondylar fractures by Lipscomb and Burleson25 and later by Spinner and Schreiber,42 who suggested that the mechanism producing the paralysis is traction on the nerve caused by the relatively fixed position of the anterior interosseous nerve in the proximal forearm and the posterior displacement of the distal fragment of the humerus.

Another explanation for the origin of this palsy is injury of the median nerve proximal to the anterior interosseous nerve. The fibers are located in the posterior portion of the median nerve and might be damaged directly at the fracture site. This is called a pseudoanterior interosseous nerve syndrome.11 Because there is no sensory loss, this hypothesis seems implausible. A cross-sectional map of the median nerve shows that the anterior interosseous

---

TABLE 1
Review of the literature on anterior interosseous nerve syndrome*

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Age (yrs), Sex</th>
<th>Side</th>
<th>Surgery (wks)</th>
<th>Recovery (wks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipscomb &amp; Burleson, 1955</td>
<td>— NS</td>
<td>yes</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Spinner &amp; Schreiber, 1969</td>
<td>4, M lt</td>
<td>yes</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Maeda, et al., 1977</td>
<td>6, M lt</td>
<td>no</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Galbraith &amp; McCullough, 1979</td>
<td>8, F lt</td>
<td>yes</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Hovelius &amp; Tuverson, 1980</td>
<td>8, F lt</td>
<td>yes</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>McGraw, et al., 1986</td>
<td>4, F lt</td>
<td>yes</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Moehring, 1986</td>
<td>7, F rt</td>
<td>yes</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Pirone, et al., 1988</td>
<td>— NS</td>
<td>yes</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Barnard &amp; Stanley, 1989</td>
<td>6, M rt</td>
<td>yes</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Dormans, et al., 1995</td>
<td>7, M rt</td>
<td>yes</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Dormans, et al., 1995</td>
<td>9, M rt</td>
<td>yes</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Geitjens, 1995</td>
<td>7, F rt</td>
<td>no</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>present study</td>
<td>7, M lt</td>
<td>yes</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

* NS = not stated; — = not specified (child).
Anterior interosseous nerve compression after humerus fracture

nerve fibers are located immediately adjacent to the medi-an sensory fibers in the supracondylar area, so that selective damage to the motor fibers by traction with sparing of the sensory fibers is very unlikely. If there is motor loss accompanied by inability to flex the terminal joints of the thumb and index finger, together with sensory loss, the nerve injury must be located proximal to the anterior interosseous nerve branch.

In a third hypothesis transient ischemia is suggested as a possible cause of anterior interosseous nerve syndrome. Geutjens reported three cases of this palsy following supracondylar fractures of the humerus in children in whom the onset of anterior interosseous nerve paralysis was delayed and occurred only after surgery. During manip-ulation of the fracture the children suffered a transient epi-sode of ischemia, so that the added insult to the nerve may have precipitated the palsy.

In all cases full recovery from the paralysis took place within 4 to 17 weeks. A second operation to treat the ante-rior interosseous nerve palsy was not necessary. The ana-tomical location of the anterior interosseous nerve is dis-tal to the supracondylar fracture. Complete division of this nerve is therefore very unlikely and has never been de-scribed.

Conclusions

Conservative treatment for a period of 4 months is recom-mended. If after this time there has been no recovery of anterior interosseous nerve function, neurophysiologi-cal examination should be performed. In the event of total failure of reinnervation, exploration of the nerve is suggested. In nontraumatic cases of anterior interosseous nerve syndrome this procedure has been reported to be successful.

References


A. Joist, et al.

Manuscript received August 3, 1998.
Accepted in final form January 28, 1999.
Address reprint requests to: Alexander Joist, M.D., Department of Trauma and Hand Surgery, Westphalian Wilhelms-University, Waldeyerstrasse 1, D-48149 Muenster, Germany.