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Intravenous regional administration of corticosteroids in juvenile chronic arthritis

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Background **Treatment of juvenile chronic arthritis patients with longstanding multiple joint or tendon involvement that is resistant to medication remains a challenge. For 20 years, we have been treating these severely ill patients with intravenous regional glucocorticoids (a modified Bier's block).**

Patients and methods **Since 1996, all juvenile chronic arthritis patients have been followed prospectively by an occupational therapist who has registered the grip strength and range of motion at an average of 6 months after treatment.**

Results **In 22/40 wrists and hands, increased grip strength was recorded. The mean grip strength increased for the whole group from 47 to 59 N and the flexion lag decreased.**

Interpretation **The effect of intravenous regional steroid treatment may be limited from a long-term perspective, but in our series, half of the patients showed a considerable improvement after 6 months. Surgical synovectomy can be postponed and perhaps even be omitted.**

Sometimes tenosynovitis or arthrosynovitis in juvenile chronic arthritis persists despite systemic medication and local corticosteroid injections. Since the 1980s, we have been using intravenous regional corticosteroids in this situation for treatment of both upper and lower extremities. Here we describe this treatment for the hands in juvenile patients and evaluate the mid-term effect in terms of grip strength and range of motion.

Patients and methods

Between 1996 and 1999, we treated 40 hands in 21 patients (16 girls) according to a standard protocol (Figure 1). The indications were longstanding mul-

Figure 1. A. An intravenous cannula is inserted into a vein under general anesthesia and the arm is exsanguinated. A single pneumatic tourniquet is applied and inflated to 100 mm Hg above the systolic blood pressure.

B. 150 mg hydrocortisone is diluted in 20–40 mL saline and injected. Most often, both arms are treated simultaneously. The tourniquet is released after 20 min.

Results given as mean values (SD) per patient before and after treatment

	Preoperative mean (SD)	Follow-up mean (SD)	P-value
Grip strength, N	47 (40)	59 (48)	0.01
Flexion lag, mm	10 (8)	6 (7)	0.04
Extension lag, mm	5 (8)	6 (10)	0.46

tiple joint swellings and/or tenosynovitis that had not responded to alterations in systemic medication and/or locally administered corticosteroids. The mean age was 10 (6–18) years. All patients had a juvenile chronic arthritis. 12 children had seropositive polyarticular, 7 had seronegative polyarticular, 1 oligoarticular and 1 mixed connective tissue disease (MCTD). The mean C-reactive protein value at the time of treatment was 60 (SD 53) mg/L and at follow-up 34 (SD 29) mg/L, the mean hemoglobin value was 111 (SD 15) g/L and 116 (SD 12) g/L, and the thrombocyte concentration 474 (SD145) 10^9/L and 423 (SD 134) 10^9/L, respectively. The follow-up examinations were made at a mean of 6 (4–12) months after treatment.

If the patients had further surgical treatment in the same hand or arm, the examination before this procedure was chosen as the follow-up examination, regardless of time point. The patients were examined by an occupational therapist preoperatively and at the follow-up. Grip strength was measured using the Grippit meter (Nordenskjöld and Grimby 1993), and extension and flexion deficits were measured. Mean grip strength was chosen as the main outcome parameter. For statistical analysis, the mean value was calculated for each patient in bilateral cases and each hand in unilateral cases. Paired t-test was used for statistical analysis.

Results

No adverse effects were noted. In 22/40 hands, increased grip strength was recorded. The mean grip strength increased for the whole group from 47 to 59 N ($p = 0.01$, paired t-test; Table). The flexion lag decreased from 10 to 6 mm ($p = 0.04$), whereas the extension lag was unchanged.

Within the first year, 7 patients had repeated surgical treatment. In 4 patients, the intravenous regional steroid treatment was repeated and in 5 patients an open or transarthroscopic teno- and/or arthrosynovectomy was performed. 1 patient has since been operated with a wrist artrodesis and another with bilateral elbow prostheses. In total, another 25 operations (0–4) have been done in the upper extremities in these 21 patients to date.

Figure 2. The hand of a 16-year-old juvenile chronic arthritis patient with multiple joint and tendon involvement.

Discussion

In the early stages of joint or soft tissue swelling in juvenile chronic arthritis, medication and sometimes splints are the treatment of choice and the synovitis can often remit. Apart from oral administration, corticosteroids can be administered locally as injections into tendon-sheets or into joints. Intraarticular injections are efficient into a limited amount of joints and lead to full remission after 6 months in 80% of patients, so that oral medication may be discontinued (Padeh and Passwell 1998). When multiple joints and tendons are involved (Figure 2), the total dose becomes high. Systemic side effects may also appear after local treatment and correct deposition into multiple tendon sheets can be difficult to achieve. High-dose pulsed intravenous treatment has also been used in children (Adebajo and Hall 1998). Gastrointestinal hemorrhage, arrhythmias and avascular necrosis of the hip have, however, been reported in adults treated by this method. Surgical arthro- and tenosynovectomy reduces pain effectively, but is often followed by decreased mobility (Hanff et al. 1990) and requires the young patient to be able to cope

with an often intense postoperative training. The preventive effect in the long term is unclear.

As an alternative approach, when everything else has been tried, corticosteroids can be administered as intravenous regional treatment analagous to a Biers block, whereby corticosteroids are injected instead of local anestheticum. The method has been described in adult rheumatoid patients and good short-term effects have been reported (Jelinek et al. 1991, McCarthy et al. 1993, Bengtsson et al. 1998). In the latter study, local anesthetic was used as placebo control and was as rewarding as cortisone for up to 6 weeks.

Our hospital is the national centre for juvenile chronic arthritis in Sweden, and patients come from all over the country for medical treatment and surgery. The children travel back home before full effect has been achieved, which makes a complete and standardized short-term follow-up and outcome analysis difficult. Interpretation of our mid-term results in the juvenile patients is difficult. Half of the patients showed no increase in, or even a reduction in grip strength at follow-up and we do not know how these patients would have been without treatment. The other half of the patients showed a substantial improvement. Also, in this group we do not know whether this reflects a spontaneous remission of the disease or an actual effect of the treatment. For this reason, the results can only be roughly compared to historical data from synovectomy series, the operation that would have been performed on these patients 20 years ago (Hanff et al. 1990).

The mode of action of the cortisone can only be hypothesized. The local anesthetic in a Bier block binds to the tissue and only small amounts are released into the blood stream after the block is released. No detectable plasma concentration of cortisone can be traced 24 hours after intravenous regional treatment (Jelinek et al. 1991). However, suppression of endogenous cortisol production was found 24 hours after intravenous and regional administration of methylprednisolone in adults. This indicates that the cortisone is distributed to the body after release, perhaps as a wash-out after re-establishing the vascular flow. Thus, a systemic effect cannot be excluded.

It remains uncertain how best to treat this subgroup of juvenile rheumatic patients, the ones who do not respond to systemic medical treatment. These patients have severe disease, as reflected by the high numbers of operations performed in the following year. The response to treatment can be used to validate and adjust the medical treatment. An increased mobility would imply that the joint capsule is still elastic and paraffin treatment or a remission-inductive drug can be tried. Intravenous and regional administration of corticosteroids is a safe method of treating synovitis in these patients, and is easy for the patient, thus ensuring high compliance. The effect from a long-term perspective may be limited, but in our series, surgical synovectomy could be postponed and in some cases could even be omitted. When it proves to be effective, intravenous regional cortisone treatment can be repeated several times.

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