BILATERAL CHRONIC COMPARTMENT SYNDROME IN THE FOREARM AND THE HAND

THOR A. SÖDERBERG

From Rogaland Central County Hospital, Stavanger, Norway

We report two cases of bilateral chronic exertional compartment syndrome (CCS) in the forearm and hand. Measurement of the intramuscular pressure was useful for diagnosis. These two cases illustrate that bilateral CCS should be suspected in patients complaining of bilateral exercise-induced pain in the anconeus muscle, the forearms, the thenar and hypothenar regions and in the first dorsal interosseous muscle. Fasciotomy relieved the pain in both cases.

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Compartment syndromes are defined as conditions in which increased pressure within a limited space compromises the circulation and function of the tissues within that space (Matsen 1975). They may be acute or chronic. Acute syndromes are the most common and may be caused by a variety of injuries, but particularly fractures. Chronic compartment syndromes (CCS) produce effort-related pain, swelling, and impaired function of the muscle (Reneman 1975). They usually occur in the leg and are rare in the arm. The clinical diagnosis should be supported by measurement of tissue pressure at rest and during exercise (Whitesides et al 1975; Mubarak et al 1976; Matsen, Winquist and Krugmire 1980; McDermott et al 1982; Rorabeck et al 1986; Styf and Körner 1986). Simple fasciotomy or fascectomy usually leads to relief of symptoms.

CCS in the forearm has been observed after injury (Kutz, Singer and Lindsay 1985; Pedowitz and Toutounghi 1988) and in a professional racing motorcyclist (Allen and Barnes 1989). Recently, Wasilewski and Asdourian (1991) described symptoms in both flexor compartments of the forearm and later in the legs. Effort-related dorsal forearm pain of unknown cause was reported in six patients, in four of

whom it was relieved by fasciotomy (Rydholm, Werner and Ohlin 1983), and Andersson (1988) described a heavy manual labourer whose bilateral forearm pain was also cured by this procedure.

We describe two patients with CCS, one with widespread symptoms in both arms and hands, and the other with pain in both hands.

CASE REPORTS

Case 1. A 32-year-old male, right-handed carpenter described pain in the volar and dorsal aspects of both forearms, associated with weakness in his hands after repetitive grasping at work. The right side was worse than the left. Symptoms increased with continued activity and he sometimes experienced numbness and tingling in the radial aspects of the hand and forearm. He had undergone extensive investigation without diagnosis and was unable to work. Physical examination showed only tenderness to palpation over the anconeus muscle during resisted extension and pronation.

The intracompartmental pressure was measured by wick catheters (Mubarak et al 1976) placed in the right anterior forearm compartment and in the right anconeus muscle. At rest the pressures were 29 mmHg and 27 mmHg, respectively. The patient exercised with the elbow in extension and with wrist and finger flexion-extension to the point of intense pain which was reached after approximately five minutes; the pressures increased to a maximum of 108 mmHg and 236 mmHg, respectively. After exercise there was firmness and aching in the anterior and posterior compartments of the forearm and in the anconeus.

Under local anaesthesia we exposed the anconeus and introduced a wick catheter into the muscle. The pressure at rest was 24 mmHg but after exercise with extension of the elbow and pronation of the forearm it reached 464 mmHg. An incision 5 cm long was made in the fascia and the pressure fell immediately to 8 mmHg at rest, increasing to 272 mmHg during exercise, with a slow recovery. Excision of a strip of fascia 2 cm wide allowed the resting pressure to fall to 0 mmHg rising to 104 mmHg after exercise, with a rapid recovery. The muscle appeared normal on biopsy. Subsequently, the patient was free from pain at the elbow, but that in the forearm persisted and he underwent superficial volar and dorsal forearm compartment fasciotomy, with total relief of pain within four weeks. Three months

T. A. Söderberg, MD, PhD, Senior Consultant
Department of Plastic Surgery, Rogaland Central County Hospital, PB 8100, N-4003 Stavanger, Norway.

Correspondence should be sent to Dr T. A. Söderberg at Bölevägen 38, S-90431, Umeå, Sweden.

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later similar operations were carried out on the left side. His symptoms resolved and he returned to work as a farmer with heavy manual labour.

Two years later he was free from pain in the elbows and forearms but began to develop pain induced by exercise over the thenar region and later over the first web space in both hands. This was followed by a cramping sensation which forced him to rest. He had also noted swelling of the muscles. Pressure measurements in the right first dorsal interosseous muscles recorded 8 mmHg at rest, 90 mmHg after 3 minutes of similar activity with a key grip and 180 mmHg after 1.5 minutes of dynamic work with a pinch grip. He experienced muscle pain followed by fatigue at these latter levels, and the pressures remained elevated for five minutes after exercise had stopped. In the abductor pollicis brevis the pressures were 12 mmHg at rest, 90 mmHg with the key grip, and 150 mmHg with the pinch grip. We performed fasciotomy of the first dorsal interosseous muscle, the short flexor and abductor muscles of the thumb, and of the opponens pollicis. One year later similar procedures were carried out on the opposite hand. He returned to work four weeks after operation and one year later had no discomfort in his hands.

Case 2. A 20-year-old male right-handed motor mechanic had experienced exercise-induced pain and swelling of the thenar, hypothenar, and first dorsal interosseous muscles in both hands at work for six months. The symptoms resolved on stopping the activity, but recurred with resumption of work or writing. He had no complaints during the night. One year before he had had a reconstruction of his right radio-ulnar ligament. Physical examination revealed negative Phalen and Tinel signs at the wrist and elbow, symmetrical two-point discrimination of 4 mm, and symmetrically functioning muscles in the hands and forearms. Nerve-conduction studies and EMGs of the ulnar and medial nerves were normal. The intramuscular pressure was measured in the right short abductor muscle of the thumb. At rest it was 14 mmHg but was elevated on exercise to 32 mmHg. The maximum pressure at pinch grip was 460 mmHg. During these procedures pain and swelling occurred in the thenar, hypothenar and first dorsal interosseous muscles and a diagnosis of CCS was made.

Fasciotomy of the right abductor digiti minimi, abductor and flexor pollicis brevis and the opponens muscle relieved pain in the thenar and hypothenar regions. A later fasciotomy of the first dorsal interosseous muscle relieved the symptoms in his hand. Because of the good results in the right hand we later performed fasciotomy on the other side with the same result. One year later he had no pain or swelling in the hands during exercise.

DISCUSSION

The diagnosis of CCS is difficult to establish on clinical signs alone. Pressure measurements are needed but care must be taken since it has been shown that the technique

used, the location of the catheter, the position of the limb, muscle contraction and technical experience may affect the result. Measurements of resting pressures should be taken before and after exercise (Reneman 1975; Pedowitz et al 1990), muscle contraction (McDermott et al 1982) and during muscle relaxation (Styf and Körner 1986; Styf, Forssblad and Lundborg 1987). The wick catheter technique allows measurement of fluid pressure before, during, and after a muscle contraction without the introduction of positional artefacts (Hargens et al 1977).

The pressure in the superficial flexor compartment at rest in a normal patient ranges from 4 mmHg to 14.5 mmHg (Mubarak et al 1976; Kutz et al 1985; Pedowitz and Toutoungi 1988) and in the CCS syndrome pressures between 6 mmHg and 31 mmHg have been quoted (Kutz et al 1985; Pedowitz and Toutoungi 1988; Allen and Barnes 1989; Wasilewski and Asdourian 1991). Elevated pressures during or after exercise in patients with CCS range between 32 mmHg and 58 mmHg (Kutz et al 1985; Pedowitz and Toutoungi 1988; Allen and Barnes 1989; Wasilewski and Asdourian 1991). In our patients they ranged between 29 mmHg and 108 mmHg.

Exercise-induced compartmental syndrome in the first dorsal interosseous muscle has been described in four patients (Styf et al 1987). The mean intramuscular pressure at rest was 9.0 mmHg rising to 82 mmHg after exercise. These findings are similar to our results and those of Phillips et al (1986).

Abrahamsson et al (1987) described a patient with CCS involving the anconeus with pressure measurements similar to those of our patients and with a comparable improvement after decompression. We have not been able to find any account in the literature of pressure measurements in the thenar muscles.

Bilateral CCS in the forearms has been described before but only in the flexor muscles (Allen and Barnes 1989; Wasilewski and Asdourian 1991) and open fasciotomy cured the condition. We have not encountered descriptions of CCS affecting the anconeus muscle, hypothenar, or thenar muscles on both sides, but the condition has been recorded in both first dorsal interosseous muscles (Dellon and Fine 1990).

Our two cases illustrate that CCS should be suspected in patients complaining of bilateral exercise-induced pain in the forearm or the hand.

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