Specialised chronic compartment measurement clinic in a district general hospital: is it worthwhile?

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ABSTRACT

INTRODUCTION Chronic compartment syndrome is one of the conditions that cause exertional pain in the young. In this condition, a careful history taking is usually the key for making the correct diagnosis, but intracompartmental pressure measurement that has high sensitivity and specificity rates can add invaluable confirmation, especially when surgical decompression is indicated. In a district general hospital there is usually a logistical problem in performing compartmental pressure measurement. In this study, we describe our experience in dealing with such a problem by setting up a quarterly specialised clinic for intracompartmental pressure measurement that, according to our knowledge, is unique in the UK.

PATIENTS AND METHODS We retrospectively reviewed the medical records of 42 patients referred to our specialised clinic and documented the referral patterns, clinical picture, additional investigations, pressure measurement results, final diagnosis and outcome of treatment. The intracompartmental measurement was recorded pre- and post-exercise on the treadmill for 1 min or 5 min and results were interpreted according to published criteria.

RESULTS The mean age of the referred 42 patients was 33.1 years (range, 15–78 years). There were 16 positive results (38%) confirming the diagnosis of chronic compartment syndrome and four clinically characteristic cases of this condition with negative results. There were 22 negative results (53%), one borderline, and three patients were not tested for different reasons. All of the 10 patients who were treated surgically had positive pre-operative test results.

CONCLUSIONS An inappropriate referral rate of approximately 52% was encountered that had a significant impact on the waiting time for the proposed test (5.7 months), which is far longer than the 18-week target for treatment in the NHS. We found that a positive test is a strong predictor of a successful outcome of surgical treatment. Such a specialised clinic, therefore, should only receive carefully assessed patients.

KEYWORDS

Compartment syndrome – Exertional – Intracompartmental pressure – Chronic leg pain

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Chronic leg pain can be a challenging diagnostic problem, especially in the young or in active patients. Chronic exertional compartment syndrome is an exercise-induced condition characterised by a relative inadequacy of musculo-fascial compartment size producing chronic exercise induced leg pain with a resultant disability.¹ It is generally accepted that it affects the young and active with a tendency to be symmetrical in both lower limbs; however, it can be unilateral, especially in older patients with previous soft tissue injury.²

Differential diagnosis includes referred pain from the spine, hip or knee and also neurogenic/vascular claudication. More localised differentials include stress fractures, medial tibial stress syndrome (shin splints), tendonopathies, peripheral nerve entrapment and rare causes

such as popliteal artery entrapment syndrome caused by anomalous insertion of the medial head of gastrocnemius.

The true incidence of chronic compartment syndrome in the lower limb is not well defined in the literature. The reported incidence suggests an increasing trend with 60 cases of tentative diagnosis of chronic compartment syndrome out of 12,000 patients (0.5%) evaluated for lower extremity symptoms in a sports medicine clinic.²

On working towards a diagnosis of chronic compartment syndrome, a careful history from the patient can often be highly indicative of the underlying diagnosis. Exercise-induced anterior compartment muscle pain in association with paraesthesia and numbness involving the first web space are indicative of deep peroneal nerve involvement requiring compartment pressure studies of the anterior

compartment. Peroneal compartment exercise induced muscle pain in association with symptoms of paraesthesia and numbness affecting the lateral aspect of the dorsum of the foot are indicative of superficial peroneal nerve involvement and require intracompartmental pressure monitoring studies of the peroneal compartment. Posterior compartment exercise induced muscle pain in association with symptoms of paraesthesia or numbness involving the sole of the foot are indicative of posterior tibial nerve involvement and require intracompartmental pressure monitoring studies of the deep posterior compartment. This needs to be differentiated from exercise-induced muscle pain involving superficial posterior compartment which is unlikely to have any neurological associated symptoms.

Within our department, we have noticed a random referral of patients suspected of having chronic compartment syndrome across all consultants, thereby diluting experience. The number of patients being referred skewed in a positive direction due to the presence of the Royal Marines, Hamworthy in Poole. Individual consultants were experiencing difficulty finding the appropriate environment to perform compartment pressure monitoring. Due to the senior author's previous experience, a decision was made for the senior author with an experienced extended scope physiotherapist to develop a dedicated service for intracompartmental pressure monitoring. The detailed service review represents our experience.

Patients and Methods

A quarterly out-patient clinic held in the hospital physiotherapy gymnasium was deemed appropriate to meet local needs. Patients were seen in order of referral. Patients were asked to attend wearing tracksuit and training shoes. The clinic was performed by the senior author along with an experienced extended scope physiotherapist. A careful clinical history was taken from the patient in order to identify which compartments required monitoring. The procedure of compartment pressure monitoring along with the associated risks were detailed to the patient and signed consent obtained. The entry point of the compartment pressure needle was marked and a subdermal/subcutaneous injection performed with 2 ml of 0.5% Marcain, which successfully rendered the procedure painless for the patient. Pre-exercise intracompartmental pressure measurements were performed and patients then exercised on a treadmill under the guidance of the extended scope physiotherapist. The period of exercise was patient-dependent but every attempt to induce symptoms was made. As per the published criteria,⁵ the post-exercise compartment pressures were measured either 1 min or 5 min after exercise. The selection of which compartments to monitor was dictated largely by the patient's history.

As part of the consenting process, it was ensured that no patients had any contra-indication to compartment pressure study, such as needle phobia or the use of anti-coagulant medication.

At the end of the procedure, the results were explained to the patient and those referred from within the department were returned to the original team with the results detailed in the medical notes.

The clinic commenced in 2002 and a record was kept of all patients passing through the clinic, which included a record of referral patterns, additional investigations and final diagnosis along with the outcome of any treatment received by each patient.

Results

There were 21 referrals made from consultants within the department, 13 referrals from a member of a consultant team, seven direct general practitioner referrals and one referral from a physiotherapist.

There were 42 patients referred to the clinic, 30 male, 10 female; one patient, who had a needle phobia, could not proceed with compartmental pressure studies and there was one failure to attend. Mean age was 33.1 years (range, 15–78 years). The average wait from date of referral to pressure monitoring clinic was 5.7 months. The range was from 3 weeks to 19.5 months (patient choice).

There were 35 patients referred with lower limb symptoms, three patients with forearm compartment symptoms, one patient with thigh symptoms and one patient with hand symptoms. Of the 35 patients with lower limb symptoms, nine had bilateral symptoms; in this group, results of intracompartmental pressure studies were similar and counted as one measurement. In the group of patients with forearm symptoms, two had bilateral presentation.

A positive result for chronic compartment syndrome was identified in 16 patients (38%) including three patients with chronic compartment syndrome of the forearm. There were 22 negative results (53%) and this included patients presenting with thigh and hand symptoms. There was one borderline result with respect to the lower limb and one patient mutually agreed not to proceed with intracompartmental pressure monitoring when it was identified from the history the presentation was not consistent with chronic compartment syndrome (Fig. 1).

Six patients went on to have magnetic resonance imaging (MRI), one patient underwent an isotope bone scan and one patient had lymphoscintigraphy. All these investigations were performed after compartmental pressure monitoring gave a negative result.

In the group of patients with negative intracompartmental pressure studies, the final diagnosis varied from local to distant causes (Fig. 2). Six patients were discharged with no

diagnosis but acknowledging that they had received good symptomatic improvement after activity modification. Six patients showed a characteristic clinical picture of chronic compartment syndrome, but had negative result and the diagnosis in those was considered as a true chronic compartment syndrome and treated as such.

Accepting that one patient failed to attend, the referral pattern was indicative that approximately 50% of referrals were found to be true chronic compartment syndrome.

Of the 20 patients with chronic compartment syndrome, 10 were treated non-surgically and 10 treated surgically with fasciotomy. All patients who underwent surgery had positive intracompartmental pressure studies. In the group of patients treated surgically, all achieved complete resolution of symptoms and a return back to a full level of activity.

Discussion

The first case of chronic compartment syndrome was published in 1956 by Mavor,⁴ who termed the condition anterior tibial syndrome. Mavor's description is an exercise-induced ischaemia of the anterior compartment of the leg, which was treated successfully in one patient with a fasciotomy and fascia lata graft. This enabled the patient to return to professional football for a further 4 years. Since then, exertional compartment syndrome has been recognised in the differential diagnosis of painful leg condition.

Some authors regard chronic compartment syndrome as a type of over-use injury. In these injuries, repetitive micro-trauma can lead to local tissue damage in the form of cellular and extracellular degeneration. This is most likely to occur when an athlete changes the mode, intensity or duration of training.⁵ Muscle hypertrophy, altered fascial compliance, changes in thickness and elasticity lead to micro-fascial scarring, venous hypertension and post-traumatic soft tissue inflammation.

The differential diagnosis of exertional compartment syndrome includes a wide variety of conditions. Proximal causes include referred pain from the hip and knee, along with radiculopathy in the lumbar spine. Vascular and neurological claudication can also produce symptoms that can be confused with chronic compartment syndrome. Local causes can be classified as being related to bony, periosteal, tendonous, muscular and neurovascular structures. Therefore, conditions such as bone infection, neoplasm, stress fractures, medial tibial stress syndrome, tendonitis/tendonopathy, popliteal artery entrapment syndrome and peripheral nerve entrapment are all considered part of the differential diagnosis in patients who are assessed with leg pain.⁶

Intracompartmental pressure measurement remains the gold standard in investigation with 77% sensitivity and 83% specificity with the cut-off point at 35 mmHg. MRI can show increased signal in T2-weighted image in legs affected by chronic compartment syndrome. While the sensitivity is comparable to that of intracompartmental pressure measurement, the associated specificity with MRI reduces its benefit as a diagnostic tool. Near-infrared spectroscopy, which measures the haemoglobin oxygen saturation non-invasively, has a similar sensitivity and specificity but is not widely available.⁷

There are sporadic reports of chronic compartment syndrome involving the forearm^{8,9} and through our clinic survey we identified three such cases.

Decompressive fasciotomy for chronic compartment syndrome enjoys a high success rate reported in the literature (81–100%) for the anterior compartment.¹⁰ We identified that a positive intracompartmental pressure measurement would be a very strong predictor of a successful surgical fasciotomy.

Our experience from this service review is that allowing open access to the service generates an approximately 52%

inappropriate referral rate. We are considering a change in practice whereby the patient is reviewed and assessed in the clinic setting by the specialist who performs the intracompartmental pressure studies, in order that patients can be correctly selected for this invasive investigation when it is indicated. This will allow for a significant reduction in the waiting time for clinic service occurring at a 3-monthly interval, but will also significantly reduce unnecessary invasive investigation.

Conclusions

It has been our experience that, in the vast majority of cases, an experienced history taking and examination can be highly indicative of the underlying diagnosis of exertional compartment syndrome. We recommend that, if such a setting is contemplated in other hospitals, this will be better accompanied by re-education or refreshment for all the professionals involved to minimise the number of inappropriate referrals.

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