



# Chronic exertional compartment syndrome testing: a minimalist approach

Matthew Hislop,<sup>1</sup> Mark E Batt<sup>2</sup>

<sup>1</sup>BSEMS, Brisbane, Australia

<sup>2</sup>Centre for Sports Medicine, Queens Medical Centre, Nottingham, UK

## Correspondence to

Matthew Hislop, BSEMS, Brisbane, Australia; info@bsems.com.au

Accepted 18 April 2011

Published Online First 23 May 2011

## INTRODUCTION

Intracompartmental pressure testing is considered the 'gold standard' for investigating chronic exertional compartment syndrome (CECS) and is the primary investigation used to decide on whether to proceed with surgical intervention. It involves getting patients to reproduce their symptoms of exercise-related pain,<sup>1</sup> and then inserting a pressure manometer into the symptomatic compartment and recording the intracompartmental pressure. To date, a universal protocol has not been adopted for compartment pressure testing and much debate exists as to the 'right way to do it'.

## METHODOLOGICAL ISSUES

The physiology of compartment pressure measurements is complex and spurious compartment pressure measurements are likely to result unless the water manometer or pressure transducer is inserted in parallel to muscle fibres and away from the musculotendinous junction.<sup>2</sup> Thus, the anterior compartment alone lends itself easily to measurement. Normative values for resting and exercise pressures for each of the four lower leg muscle compartments are not clearly established. Our approach is to compare pressure readings against a matrix of abnormal results as defined by Styf, Pedowitz *et al* and Reid.<sup>3–5</sup> In our experience, it is the anterior compartment that causes symptoms, and thus it is this compartment that is routinely measured.

## WHY SHOULD WE AVOID UNNECESSARY NEEDLE INSERTION?

Although compartment pressure testing performed by experienced hands is generally considered to be safe, it is an invasive investigation and complications can occur. These complications can be significant, and potentially limb threatening, and include infection, haemorrhage, damage to neurovascular structures and the development of an acute compartment syndrome necessitating emergency fasciotomy. It follows that with an increased number of needles inserted, there is an increased risk of potential complication.

In addition, multiple needle insertions increase patient discomfort and add to the time required to perform the test, when much of the 'critical' information is gathered in the first 5 min after cessation of exercise.

As such, any protocol that limits or removes unnecessary needle insertion should be promoted.

## DO BOTH LEGS NEED TO BE MEASURED?

In confirmed cases of CECS, symptoms are bilateral in 75–90% of the time, and clinicians should maintain a high index of suspicion in patients presenting with unilateral symptoms for other diagnoses such as vascular insufficiency.<sup>6</sup> If symptoms are unilateral, then clearly only the symptomatic leg requires testing.

We suggest (in cases of bilateral symptoms) that it is possible to investigate one limb only and to be able to safely conclude that a positive result indicates that CECS is present in the contralateral symptomatic compartment(s). The more symptomatic leg is tested, thus reducing the number of needle insertions.

## DO ALL COMPARTMENTS NEED TO BE MEASURED ROUTINELY?

We do not recommend routine investigation of all four compartments and in our experience, patients will typically present with symptoms in one or perhaps two compartments. Rarely will the 'entire leg' (ie, all four compartments) display symptoms suggestive of CECS. A thorough work up of patients before the test will help to eliminate other potential coexisting causes of exertional leg pain that may confound symptoms<sup>7</sup> (like medial tibial stress syndrome coexisting with anterolateral CECS).

Testing asymptomatic compartments increases the number of needle insertions and as such the risk of complications. We concede that it is possible for a patient to develop symptoms in previously unaffected compartments post-fasciotomy, but we are not aware of any studies that record the likelihood of this occurring. Likewise, it would be difficult to justify invasive surgery on a compartment with positive pressure results, but which is asymptomatic during exercise.

## DO RESTING PRESSURES NEED TO BE MEASURED?

The normal resting compartment pressure is between 0 and 8 mm Hg.<sup>8</sup> Exercise results in an increase in muscle volume of the magnitude of 8–20%,<sup>9, 10</sup> which results in increased pressure. The pathophysiology of CECS suggests that pain present at rest is not in keeping with CECS, which is, by definition, an exercise-related, reversible, myofascial intracompartmental pressure increase.<sup>6</sup> Thus, the pain that is positional or present at rest is suggestive of another cause of leg pain.

One difficulty of measuring a 'resting' pressure is defining what is truly at rest – for how long does the patient need to abstain from exercise

before the test, and could even walking before the appointment affect pressure results?

Regarding the measurement of resting pressures, there is a 'doubling' in the number of needle insertions and an increased risk of complications. Thus, we suggest that measuring resting pressures is not necessary in the investigation of CECS.

**Competing interests** None.

**Provenance and peer review** Commissioned; internally peer reviewed.

## REFERENCES

1. **Edwards P**, Myerson MS. Exertional compartment syndrome of the leg: steps for expedient return to activity. *Phys Sportsmed* 1996;**24**:31–46.
2. **Nakhostine M**, Styf JR, van Leuven S, *et al*. Intramuscular pressure varies with depth. The tibialis anterior muscle studied in 12 volunteers. *Acta Orthop Scand* 1993;**64**:377–81.
3. **Styf JA**. Intramuscular pressure measurements during exercise. *Oper Tech Sports Med* 1995;**3**:243–9.
4. **Pedowitz RA**, Hargens AR, Mubarak SJ, *et al*. Modified criteria for the objective diagnosis of chronic compartment syndrome of the leg. *Am J Sports Med* 1990;**18**:35–40.
5. **Reid DC**. *Sports Injury Assessment and Rehabilitation*. New York: Churchill Livingstone 1992. ISBN 0-443-08662-1.
6. **Best TM**. Soft-tissue injuries and muscle tears. *Clin Sports Med* 1997;**16**:419–34.
7. **Cebesoy O**, Kose K. Is the diagnosis as simple as the treatment? Diagnostic pitfalls in chronic exertional compartment syndrome? *Knee Surg Sports Traumatol Arthrosc* 2007;**15**:109.
8. **Lee BY**, Brancato RF, Park IH, *et al*. Management of compartmental syndrome. Diagnostic and surgical considerations. *Am J Surg* 1984;**148**:383–8.
9. **Puranen J**, Alavaikko A. Intracompartmental pressure increase on exertion in patients with chronic compartment syndrome in the leg. *J Bone Joint Surg Am* 1981;**63**:1304–9.
10. **Raether PM**, Lutter LD. Recurrent compartment syndrome in the posterior thigh. Report of a case. *Am J Sports Med* 1982;**10**:40–3.