Chronic Exertional Compartment Syndrome and Prolotherapy

John Lyftogt, Christchurch, New Zealand

Abstract

Background. Chronic exertional compartment syndrome (CECS) is not uncommon. It affects mainly young, active people, is debilitating and intensely painful. Conservative treatment is not effective; however surgery through fasciotomy offers hope.

The author has found that prolotherapy is effective in relieving pain and reducing intramuscular pressures in CECS. A one-year prospective pilot study was undertaken as a preliminary to a more systematic review.

Objective. To explore:

1. the effectiveness of prolotherapy as a conservative treatment modality for chronic exertional compartment syndrome.

2. recovergrams for conveying meaningful clinical information on prolotherapy in a one-year prospective pilot study with six months' follow up.

Patients and methods. Twenty-seven patients were entered into the study. The only entry criterion was that the diagnosis was made by an experienced sports medicine physician.

The patients were treated weekly with a standard prolotherapy solution of glucose 20% and lignocaine 0.1% solution.

The individual results were monitored with a recovergram and compiled into a study recovergram.

Results. Two patients did not respond after five sessions and were found to have compartment pressures of up to 60 mm Hg. They were referred for surgery. One patient withdrew from treatment after two sessions. Twenty-four patients completed the treatment and 21 were satisfied with the treatment at six months' follow up.

Conclusions. This pilot study suggests that it is reasonable to offer patients with CECS a trial of prolotherapy. Recovergrams are an effective tool for monitoring effects of treatment and study recovergrams demonstrate the combined results readily in graphic format.

Background

Chronic exertional compartment syndrome (CECS) of the lower leg is a debilitating and exceedingly painful condition affecting mainly young, active people. Its incidence is not known and in the early stages it is often diagnosed as (chronic) muscle strain, shinsplints, medial tibial border syndrome, chronic anterior tibial pain, recurrent compartment syndrome, or idiopathic compartment syndrome. It can herald the end of a promising sporting career or simply mean giving up on physical activity with dire consequences for overall fitness, health, and enjoyment of life.

The cause of the activity-related intense pain is poorly understood. Most authors believe that the symptoms and dysfunction elicited by the syndrome are due to ischemia whereas others believe they are not.[1, 2] Many and varied conservative treatments have been tried without success.[2-5] In one systematic study, nonoperative treatment for up to one year was found to be unsuccessful.[6] However, fasciotomy has been shown to offer a cure. Fasciotomy does not treat the cause of the syndrome, but is effective in eliminating the pathological increase in compartment pressures.[2]

The success rate for surgery has been quoted as 60-100%[2] depending on which compartment is affected. Generally the anterior compartment of the lower leg has a higher success rate then the deep posterior compartment which has a 35% failure rate.[2] Complication rates of 5-15% have been reported[2] including nerve entrapment and deep venous thrombosis (DVT). Rehabilitation can take up to six months or even longer.[7] Permanent scars are of major consideration, particularly for young women.

There is a clinical impression that CECS with higher pressures do better with surgery than those with mild to moderately elevated pressures (20-40 mm Hg).

Prolotherapy has been used for a wide range of musculoskeletal conditions[8-10] but to the author's knowledge never for CECS.

Patients and methods

All 27 patients (16 male and 11 female) presenting over a one-year period with CECS were entered. All patients had a prior diagnosis of CECS made by an experienced sports medicine physician. Seven patients had confirmed elevated compartment pressure studies of which four had undergone surgery without relief of pain (respectively one, one, three, and 14 years before treatment).

This heterogeneous group had very high VAS scores, reported mainly with running distance but less so with "stop-start" sports like rugby or netball. All described "tight" muscles. Two patients (cyclists) with anterior thigh pain ("quad lock") experienced pain and "dead" legs with cycling. Three patients described the sensation along the tibial border as "glass shattering". One patient, a stoic physical education teacher, fell off the treadmill in severe pain during a compartment pressure test. All had tried a large number of treatments including physiotherapy, podiatry, acupuncture, and deep friction massage. Deep friction massage was reported mostly to aggravate the condition. Two had pain with walking and many experienced frequent night cramps. More than half knew of other members of the family with similar problems. There was one father and son combination. At least five reported a sudden onset of symptoms. One patient who had surgery reported a sudden very severe recurrence of her pain while watching television, necessitating a visit to the local accident and emergency department.

Most initially thought their pain was a "normal" part of exercise, that is, "no pain no gain" and the correct diagno-

sis was often made after seeing a wide variety of health professionals, receiving many unsuccessful treatments and often being told to "toughen up" or it is "all psychological".

The mean age was 25 (range 13-45 years) and the mean duration of symptoms was 4.8 years (range 1-20 years).

Diagnosis of involved compartments was made on clinical grounds for the purpose of identifying areas of treatment (anterior compartment 17, medial 26, lateral 10, anterior thigh 2).

The clinical diagnosis was based on palpation of swollen, tender and tight bands in the involved muscles variously known as "taut" bands, "myotendinosis", or "aponeurosis" (quads).

These were treated weekly with prolotherapy (glucose 20% and lignocaine 0.1% solution) deposits of 0.5-1 ml each, approximately 1.5 cm apart along the whole length of the "myotendinosis", carefully avoiding penetration of the epimysium.

Results

See Figure 1 for Prolotherapy Recovergram.

See Figure 2 for Visual Analog Scale.

Every patient was monitored prospectively with a recovergram. A VAS was recorded at the beginning of each treatment session.

Patient SH was easily the worst affected and had one of the longest histories of 11 years. She received a large number of injections at each session which she tolerated remarkably well due to virtual numbness of both lower legs. As she improved, the swelling in both ankles disappeared and normal sensation returned, making later sessions considerably more painful. She interrupted her treatment after the first three sessions for a holiday and pain relapsed somewhat. After the initial course over four months she chose to have further monthly treatments for four months. She has now fully recovered and is able to dance, rock climb, tramp, and run on the treadmill.

See Figure 3 for CECS Study Recovergram.

A VAS regression line was constructed for each patient by connecting the initial VAS with the last recorded VAS over the length of treatment in weeks.

The study recovergram shows that the response to treatment varied enormously, with some patients responding within two treatments and others taking many months. The length of treatment did not seem to be correlated to the length of symptoms or the initial VAS score. Three patients who had had prior surgery responded very quickly and were VAS=0 at follow up. However, one patient with prior surgery did initially respond well but relapsed and refused further prolotherapy treatment, citing pain from the injections as prohibitive.

Two patients with very high compartment pressure studies of over 60 mm Hg opted for surgery. Of the 24 patients finishing the treatment, 21 were satisfied with the results at follow up.

Two patients have returned after the six-months' follow up period and one (soccer player) requires a "top-up"session at the beginning of each new training season which lasts him for the length of the competition. The other was not so lucky and had to abandon his plans to do a triathlon.

A sister and brother combination had further complications with subclinical hypothyroidism. Both responded to treatment only after initiation of thyroid replacement therapy.

Discussion

The results of this one-year prospective pilot study with six months' follow up are unexpected and confus-

Fig. 1. Prolotherapy Recovergram (after Dr Philip Watson,* Australas Mus Med *Nov 2000)

Name: SH	Date of onset: age 16
Address:	Chronic "shinsplints" since age 16. S/b numerous health professionals. Eventually diagnosed with CECS by sports medicine specialist.No effective treatments. Advised to have surgery or stop sport.O/e markedly swollen, tense, numb bilateral lower legs, self-described as "cankles" or "chuncles". C/o pain with walking and pain adversely affecting her effectiveness as a performing arts teacherVery tender prominent "myotendinosis" in bilateral tibialis anterior, gastrocnemius, peroneus, and medial soleus.
Phone:	
Age: 27 Sex: female	
Occupation: Performing arts teacher	

Fig. 2. VAS: visual analogue scale (0=no pain 10=worst imaginable pain)

Year: 2005	Month:	02		03				04				05					06		
	Day:	17	24	3				4	12	19	30	5	12		24		8		21
X=R	10																		
O=L	9	X																	
	8	O																	
	7		XO																
	6							XO											
	5			XO					XO										
	4									X									
	3									O	X								
	2										O	X	X		X				
	1											O	O		O		XO		X
	0																		O

ing. The author offers the following explanation.

Chronic Exertional Compartment Syndrome (CECS) is a classical myofascial pain syndrome (MPS) as described by Travell and Simons.[11] In CECS the MPS is associated with the most severe form of dystrophic changes, known as "taut bands"[11] or "myotendinosis" as described by Fassbender.[12] It is postulated that in CECS the specific location of the taut bands or myotendinosis causes an increase in venous and total intramuscular pressure resulting in cessation of muscle capillary blood flow. In one study increased thickness of the fascia over the anterior compartment was reported in 25 out of 36 samples.[13]

Animal and human studies on the influence of increased intramuscular pressure at rest on muscle blood flow (MBF) have demonstrated a significant decrease or even cessation of flow when tissue pressure exceeds 30-60 mm Hg.[2]

Palpation of the taut bands or myotendinosis easily identifies painful trigger points (TrPs) as described by Travell and Simons.[11] The pain from TrPs is known to be aggravated by activity.

Alfredson et al. have demonstrated that pain arising from tendons is caused by neovessel and neuron complexes.[14] Elimination of neovascularization with sclerosing polidocanol injections eliminates pain[14] and allows remodelling of tendons to occur.

Neovessels can be imaged only with ultrasound/colour doppler.

The author has been able to image neovessels corresponding with palpable TrPs in myotendinosis in two patients with CECS.

The clinical experience in this study suggests that treatment with hypertonic glucose scleroses TrPs and initiates remodelling of myotendinosis, resulting in elimination of pain.

The above hypothesis could explain the variable response to surgery. Fasciotomy effectively reduces the elevated intramuscular pressure, but surgery does not always eliminate pain.

It seems that surgical trauma doesn't always result in the robust healing response required to eliminate TrPs and initiation of remodelling of "myotendinosis."

In the future, sclerosing of neovessels may well become the first logical step towards elimination of tendon and CECS/MPS related pain. There is a growing body of research to support this view. Promising results from sclerosing treatments warrant further research.

This study also suggests that the etiology of CECS includes hereditary and endocrinological factors.

References

1. Amendola A, Rorabeck C H, Vellett D, et al. The use of magnetic resonance imaging in exertional compartment syndromes. *Am J Sp Med* 1990; 18 (1):29-34.

2. Styf J. Compartment syndromes: Diagnosis, treatment and complications. *http://www.ebooks.com/ebooks/book_display.asp?IID=214632#buy* CRC Press. 2003; 11: 151.

3. Blackman PG, Simmons LR, Crossley KM. Treatment of chronic exertional compartment syndrome with massage: a pilot study. *Clin J Sp Med* 1998; 8(1) 14-17.

4. Black KP, Taylor DE. Current concepts in the treatment of common compartment syndromes in athletes. *Sports Med* 1993; 15(6): 408-18.

5. Martens MA, Backaert M, Vermaut G, Mulier JC. Chronic leg pain in athletes due to a recurrent compartment syndrome. *Am J Sports Med* 1984; 12(2):148-51.

6. Reneman RS. The anterior and lateral compartment syndrome of the leg due to intensive use of muscles. *Clin Orthop Rel Res* 1975; 113:69-80.

7. Wallenstein R. Results of fasciotomy in patients with medial tibial syndrome or chronic anterior-compartment syndrome. *J Bone Joint Surg* 1983; 65(9):1252-55.

8. Hackett GS. *Ligament and tendon relaxation treated by prolotherapy*. 3rd ed. Springfield; Charles C Thomas, 1958.

9. Dorman T. *Diagnosis and injection techniques in othopedic medicine*. Hagerstown, Maryland; Williams & Wilkins, 1991.

10. Rabago D, Best T, Beamsley M, Patterson J. A systematic review of prolotherapy for chronic musculoskeletal pain. *Clin J Sports Med* 2005; 15(5): 376-80.

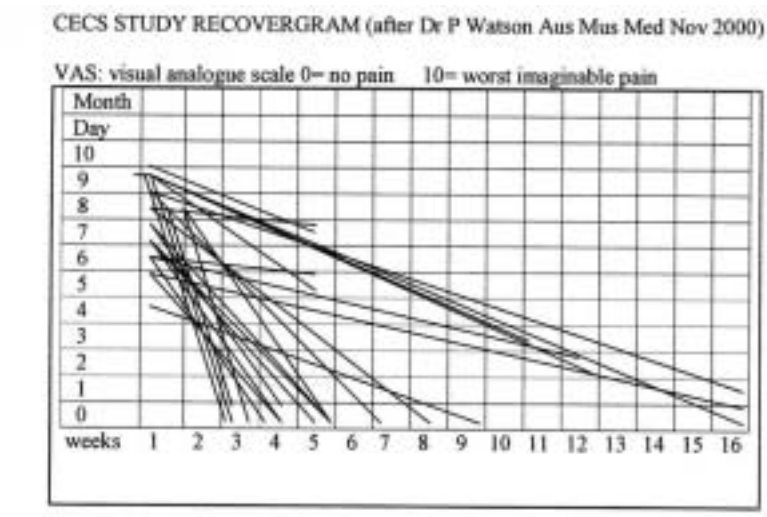
11. Travell JG, Simons DG. *Myofascial pain and dysfunction: The Trigger Point Manual*. Vol. 1. Upper Half of Body. Vol. 2. The Lower Extremities. Baltimore; William and Wilkins, 1983 and 1992.

12. Fassbender HG. *Pathology of Rheumatic Diseases*. New York; Springer-Verlag, 1975.

13. Detmer DE, Sharpe K, Sufir RL, Girdly FM, Chronic compartment syndrome: diagnosis, management and outcomes. *Am J Sp Med* 1985; 13 (3): 162-70.

14. Alfredson H. Chronic tendon pain - implications for treatment: an update. *Curr Drug Targets* 2004; 5(5): 407-10.

Fig. 3. CECS Study Recovergram (after Dr Philip Watson,* Australas Mus Med *Nov 2000)



VAS: visual analogue scale 0 = no pain, 10 = worst imaginable pain