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Outline the potential causes of recurrent hamstring problems in a veteran (over 35) runner. Briefly outline the treatment you would undertake for this runner.

Introduction

Hamstring injuries have been consistently identified as the commonest injuries sustained in running and sprinting athletes (Drezner, 2003). Reoccurring hamstring injuries are frequently reported in comparison to other musculo-skeletal injuries (Woods et al., 2004), this would suggest that misdiagnosis and or poor management/rehabilitation could be a major factor upon initial presentation, thus the alarmingly high reoccurrence rate.

Many studies have examined alleged predisposing factors to hamstring injury, such as insufficient warm up, poor flexibility, fatigue, muscular imbalances and poor muscular strength with conflicting results (Foreman et al., 2006). Originally, poor flexibility of the hamstrings was thought to be the major cause of injury, however studies by Bennel et al. (1999), Rolls and George (2004), report no significant relationship between hamstring length and injury.

Anatomically the hamstring muscles cross two joints, which through resulting increased tensile forces are inherently more susceptible to injury. The hamstring muscles are innervated by the sciatic nerve which emerges from the lumbar spine at L5-S3 and travels posteriorly down the thigh where it splits above the knee. The nerve can become irritated, tethered or inflamed at any point along its pathway with the potential to refer symptoms

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distally. For this reason, clinicians should integrate neurological testing into the assessment and treatment of hamstring injuries.

Differential Diagnosis

This assignment will discuss the commonest causes of recurrent hamstring problems that are likely to be presented, but the clinician must consider and exclude a number of other causes such as neoplasms, avulsion fractures, DVT'S, bursitis, and muscular apophysitis.

Hamstring strain: It is unlikely that this is a hamstring strain, as the runner is a distance athlete who tends to gradually change running speed, and the nature of his activity is that he is not required to change speed rapidly or explosively. The runner does not report an acute episode of injury and he reports a gradual onset of discomfort whilst out running. There is no palpable tenderness at the musculo-tendinous junction. There has been no sign of bruising, resisted hamstring tests display slight weakness but are pain-free. Positive straight leg raise (SLR) was displayed but as resisted tests were pain free, this condition was excluded.

Hamstring syndrome: No traumatic incident reported by the runner which fits this condition, however no gluteal symptoms were reported and there was no palpable tenderness around the ischial tuberosity or the sciatic nerve. The runner displayed a positive SLR with ankle dorsi-flexion (ADF) which was aggravated with internal rotation. However, the slump test can display normal with this condition as nerve tethering occurs below the pelvis.

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Posterior compartment syndrome: Although reported to be very uncommon, chronic forms have been associated with distance runners (Read, 2000). This condition gradually becomes more painful with exercise but pain subsides quickly when provoking activity stops. This is not the case with our runner, our runners' SLR was positive and markedly reduced (SLR should be negative with posterior compartment syndrome) and a slight weakness was displayed on resisted tests although they were pain-free. Immediate rest does not relieve our runners' symptoms and SLR and muscular weakness exclude this condition.

Piriformis syndrome: Pain felt in the buttock where the piriformis muscle is inflamed/in spasm where the sciatic nerve passes through the muscle. Therefore, this condition can give referred pain. This is tender to palpitation. The runner had no symptoms in the buttock and resisted external hip rotation was normal and pain-free, therefore this condition was excluded. This condition although documented extensively in the literature may be commonly misdiagnosed; out of 640 cadaver limbs examined, only in 12% of the limbs did the sciatic nerve pass through the piriformis muscle (Agur & Lee, 1999).

Adverse neural tension/Lumbar spine pathology: The runner complained of gradual onset of pain whilst out running which had a frequently increasing amount of episodes. More recently, he described that he felt a constant ache in his posterior thigh. The runner also complained that his back became stiff and sore when he sat down at work for prolonged periods, which he was able to relieve when he stood up. Active lumbar flexion at end of range was painful, side flexion to the right was restricted and extension generally stiff and

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sore. Observation of posture revealed a sway to the left away from the pain. Resisted hamstring and hip extension were slightly weak (4/5), but generally pain-free. SLR with ankle dorsi-flexion was painful and aggravating; but when ankle dorsi-flexion was released, the patient was able to achieve a greater range of SLR until pain and resistance was encountered. Slump test was painful with a significant reduction in knee extension. The subjective/objective assessment indicated that the runners' symptoms had a neurogenic origin from the lumbar spine. The runner was diagnosed with a Lumbar disc herniation (LDH) of L5/S1 with a possible spinal stenosis. This was thought to be a postero-lateral herniation due to the restriction of side flexion and the symptoms being in one leg only.

Brief treatment outline for the runner

Patient instructed to avoid prolonged seated and repetitive spinal flexion positions. Whilst in the irritable phase the patient was instructed to modify physical activity avoid hill running etc, use cross-trainer and strengthen core muscles TA and multifidus, specific flexion control exercises given with posture education. The patient was given one and two ended neural sliders in the form of a self slump to be carried out little and often at home.

Once the runners' symptoms had settled the hypo-mobile lumbar spine segments were mobilized into resistance and the patient was instructed to perform self SLR and McKenzie extension exercises and to continue neural sliders. Glute and hamstring strengthening exercises were given within inner to mid range and slow jogging was gradually introduced; frequency, load and intensity were progressively increased. When

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satisfactory pelvic control was achieved, outer range hamstring strengthening was introduced.

If conservative treatment fails and symptoms worsen to the point of an acute adverse effect on the runners' lifestyle, surgical intervention may be warranted.

Discussion

Magnetic Resonance Imagery (MRI) is being increasingly used to diagnose lumbar pain and sciatica. In a study by Boden et al. (1990), of sixty-seven male and female asymptomatic volunteers aged from 20-80 years old, a third of all volunteers were deemed to have substantial abnormalities as agreed by three independent radiologists who were blinded to the study. The L5/S1 level was by far the commonest site of pathology, which has also been found to be true in athletes (Ong et al., 2003). Orchard et al. (2004), postulated a strong correlation of age related soft tissue injury of structures innervated by L5/S1 nerve supply. Thirty-five percent of the younger subjects (20-39yrs) had degeneration or a LDH of the spine, with increasing pathology shown up to the 60-80 year olds. This study illustrates that spinal stenosis, degeneration and LDH of the spine increases with age and is to be normally expected in ageing subjects.

Therapists use manual tests to objectively assess patients; the two commonly used tests to assess neural integrity of the lower limb are the straight leg-raise (SLR) and the slump

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test. The aim of these tests is to induce the patients' symptoms by increasing neural tension. Inflamed or injured neural tissues are usually highly sensitized/ irritable and therefore it is relatively easy to mechanically evoke physiological symptoms, such as altered conduction properties and reduced intraneural blood flow. Shacklock (1995), defines the combined effect of mechanical and physiological neural tissue interaction as 'neurodynamics'. Dilley et al. (2005), cited in Coppieters et al. (2006), demonstrated that 3% elongation of human neural tissue been shown to provoke symptoms in subjects with inflamed neural tissues. Animal studies suggest that more severe conduction losses occur at around 6% (Kwan et al., 1992 cited in Hall & Elvey, 1999).

Studies examining slump test reliability have reported high incidences of positive results in 'normal' subjects Lew & Puenteadura (1985), Phillip et al. (1989), cited in Kuilart et al. (2005). These findings back up studies that neural tissues are highly sensitive to stretch even in normal individuals, and indicate that neural tension is fairly easy to achieve in asymptomatic subjects, therefore care must be taken when interpreting a 'positive result'. The Therapist must clearly communicate with the patient and be sure it is reproducing the same pain that the patient complains of.

Depending upon the symptoms displayed by the patient the therapist must decide whether to use just one test, or use the SLR and slump test in combination to assess neural involvement. Hall et al. (1998), matched 20 control subjects with 20 chronically painful lumbar spine subjects displaying referred symptoms. They found that the onset of resistance (R1), a common marker reliably used by therapists in SLR tests was not significantly reduced in range on the painful subjects. EMG data however did display

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increased earlier muscular activity in the range of the painful subjects, but when adding sensitizing neural elements such as ankle dorsi-flexion (ADF) and cervical flexion (CF), muscular activity was not significantly increased.

Presumably, earlier muscular activity displayed in painful subjects was a protective mechanism; protective postures are well documented in neuropathic pain (Hall & Elvey, 1999). According to the authors, earliest muscular activity correlated with the first increase in moment of the stretched tissue. The authors however say this cannot be reliably found by therapists, but it would have seemed likely that this earlier instance of muscular activity would have initiated an earlier R1 in painful subjects. Limitations of this study are that no pain scores were taken from subjects so even though ADF, CF, did not increase muscular activity, we do not know if it affected pain levels, therefore we cannot attribute these maneuvers to increase neural activity.

The slump test was evolved from the SLR, and is more reportedly used in assessing subjects with combined spinal and lower limb symptoms (Lew & Briggs, 1997). Lew & Briggs (1997) found that by when adding the CF component during the Slump test it significantly increased perceived pain by 39% in the normal subjects. Importantly the EMG data of the hamstring muscles did not change significantly so this would indicate that the increased pain in the hamstrings was coming from a neural structure. This study used a fixation device to keep the subject in a fixed slump position, the idea of the device was good as it stopped any movement at the pelvis or knee, but the subjects' knee was fixed in extension and hip flexion prior to spinal and CF being added. The study does not state how long the subjects were in this position before they attained the full slump but inevitable compensatory relaxation of the limb must have occurred therefore maybe resulting in less EMG activity when CF was added.

Conclusion

Any disturbance/ impingement of the dura mater or its nerve roots, results in a marked interference of neural gliding and significantly reduced intraradicular blood flow (Kobayashi et al., 2003). The reduced intraradicular blood flow often results in impaired conduction properties of the nerve level affected, and referred pain being displayed in the individual. Referred pain can potentially masquerade itself as a musculoskeletal condition and as such is sometimes misdiagnosed. Incorrect diagnosis or mis-management of the original injury at the outset by clinicians can lead to a continuum of muscle injury in the athlete.

Clinicians base their diagnosis on the patients' history and their objective findings, which they use to build an overall picture of the patients' condition. Despite the technology available in medicine today, the literature demonstrates that presently not one single test can conclusively diagnose a patient's condition such as our runners. Therefore, due to the multi-factorial aetiology of hamstring injuries, it is of the upmost importance that the clinician considers the possibility of all structures that may be the cause of, or that are contributing to the injury. Reports of the reliability of tests such as the SLR and Slump test used to assess neural tension are conflicting, it could be deduced that the tests are only as good as the tester performing them and that they must be carried out consistently in the same manner each time to be of value.

Further research needs to address consistency and reliability of neural tension testing as performed by clinicians, as often in the studies it appears to be taken for granted that they are reliable. Sequential elements of tests are often not documented precisely in the

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methodology therefore casting a possible doubt on validity (Shacklock, 2005). Larger studies are needed to examine the effect of neurodynamic treatments used by clinicians, as presently only a few very small case studies appear to exist. Presently clinicians base their treatment on their own beliefs, often with little direct evidence to support it. In the future researchers may have to be more prepared to work together to contribute to their profession, and medical ethics may need to be addressed to allow operative investigations to be carried out, and reported to further our understanding of neural dysfunction and pathology.

Total word count 2153

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