

The objective diagnosis of early tennis elbow by magnetic resonance imaging

David Mackay¹, Amar Rangan¹, G. Hide¹, Tracey Hughes² and Joanne Latimer²

Objective	To identify the salient magnetic resonance imaging (MRI) features of tennis elbow. An objective diagnosis is important when managing work-related incapacity due to ill-defined lateral arm pain.
Method	Twenty-three symptomatic and 17 asymptomatic elbows in 20 patients with tennis elbow, no evidence of other pathology and no previous treatment were imaged using established MRI sequences.
Results	In the symptomatic elbows, the common extensor origin (CEO) showed signs of oedema in 23, thickening in 19, peri-tendon oedema in 3 and tears in 13 cases. More extensive abnormalities were demonstrated in only two elbows. Six out of 17 asymptomatic elbows also showed oedema in the CEO.
Conclusions	The CEO is confirmed as the primary site of MRI changes in tennis elbow. Oedema was commonly found in asymptomatic elbows, necessitating the presence of thickening or tears in the CEO tendon to objectively diagnose tennis elbow on MRI.
Key words	Diagnostic criteria; MRI; tennis elbow.
Received	25 June 2002
Revised	3 December 2002
Accepted	7 January 2003

Introduction

Tennis elbow is a common condition that is generally diagnosed on clinical grounds [1]. As such, it can become a term of convenience used to label any case of poorly defined lateral arm pain. The condition is linked with chronic overuse injuries and not uncommonly leads to prolonged sick leave or work-related incapacity claims [1,2]. In the management of such cases, establishing a robust, objective diagnosis is of great importance. Several magnetic resonance imaging (MRI) studies have attempted to provide such criteria [3–7]. They all confirm oedema, thickening or partial tears in the common extensor origin (CEO). However, more widespread pathology has been reported. This includes oedema in the radial collateral ligament [5], anconeus muscle [3,4] and radial bursa [3]. Calcification in the CEO [6] and

periostitis in the lateral epicondyle [5] have been identified.

Most of these series included patients with chronic tennis elbow who had undergone several treatments, including repeated steroid injections. It is difficult to determine which of these findings represent true primary pathology and which are artefacts of treatment [4,8]. Steroid injection is known to produce soft tissue signal change, which can mimic pathology [8].

The present study investigated both the symptomatic and asymptomatic elbows in cases of early tennis elbow, prior to any form of treatment, to establish the fundamental MRI appearances.

Patients and methods

During a 6 month period, all patients referred to us with a first episode of tennis elbow prior to any form of treatment (except simple analgesia) were included in the study. The diagnosis was made using the criteria suggested by Davis [9], namely: pain localized to the CEO, exacerbated by activity; tenderness localized to the CEO; and pain on passive stretching or resisted active contrac-

¹Middlesbrough General Hospital, Ayresome Green Lane, Middlesbrough TS5 5AZ, UK.

²MRI Centre, North Tees General Hospital, Stockton on Tees TS19 8PE, UK.

Correspondence to: Mr D. Mackay, 21 Lindale Avenue, Whickham, Newcastle upon Tyne NE16 5QT, UK. Tel: +44 191 496 0586; fax: +44 191 565 3973; e-mail: dmackay@supanet.com

tion of the CEO muscles. Atypical cases and patients with evidence of other pathology, either clinically or on X-ray, were excluded. Patients with a previous history of elbow problems, including tennis elbow, were also excluded.

The asymptomatic elbows were also studied to investigate the extent of any MRI changes in the clinically normal elbows of these patients.

MRI scans were obtained using a 1.5 T GE Sigma Horizon LX magnet with a 5 inch general purpose surface coil around the elbow. Patients were positioned supine with their arms by their side and the forearm supinated. Coronal and axial T₁, T₂ and STIR and sagittal T₁ sequences were obtained for each elbow. Each scan was read independently by three consultant radiologists, blinded to the clinical findings, with consensus agreement.

Ethical approval for the study was obtained from the local ethics committee.

Patient demographics

The study group consisted of 20 patients (nine male and 11 female), with a mean age of 41 years (range = 19–56 years). Six patients were employed in heavy manual jobs, 10 had light sedentary work (six of which involved regular use of keyboards) and four were housewives.

Seventeen patients had unilateral symptoms, 15 in the dominant arm and two in the non-dominant arm. Three patients had bilateral symptoms. The duration ranged from 6 weeks to 1 year, with a mean of 5 months.

Seven patients suffered symptoms only during activities involving heavy lifting or straining, 10 showed symptoms during all activities involving the elbow and three patients reported symptoms even at rest. Symptoms were described as mild in five cases, moderate in 14 and severe in one case. Four patients complained of limitations of heavy lifting only. A further four patients described difficulties with sporting activities and four with driving. Eight patients' symptoms were severe enough to limit their work.

Results

The findings are summarized in Table 1. Figure 1 shows the MRI appearance of a normal elbow.

Symptomatic elbow

Changes in the CEO indicative of tennis elbow were identified in all 23 elbows. Oedema was also present in all cases. The tendon showed significant thickening in 19 cases (Figure 2). A complete tear of the CEO was found in two cases (Figure 3) and a partial tear in 11 cases (Figure 4). Both pathologies were present in nine cases. These changes affected the whole mass of the CEO. In no

Table 1. MRI findings in the symptomatic and asymptomatic elbow of patients with tennis elbow

	Symptomatic	Asymptomatic
Oedema CEO	23	6
Thickening CEO	19	1
Partial tear CEO	11	0
Complete tear CEO	2	0
Oedema lateral epicondyle	1	0
Pseudomeniscus radiohumeral joint	1	0
Total number	23	17



Figure 1. Coronal STIR image showing a normal common extensor origin. The tendon appears homogeneously black.

case was the pathology localized to extensor carpi radialis brevis or any other tendon.

Oedema around the CEO tendons was present in three cases and oedema in the lateral epicondylar bone in one case. A pseudomeniscus was seen in the radio-humeral joint in one case. No changes were found in anconeus, the radial collateral ligament or any other structure.

Asymptomatic elbow

Oedema in the CEO was demonstrated in six out of 17 elbows which had never been symptomatic. One of these elbows also showed evidence of thickening of the CEO. The remaining elbows showed no additional pathology.

Discussion

We report the MRI findings in a series of patients suffering from tennis elbow, of mainly short duration,



Figure 2. Coronal STIR image showing oedema and thickening in the common extensor origin. There is a surrounding white band of oedema and grey areas within the tendon.



Figure 3. Coronal STIR image showing a complete tear of the common extensor origin. There is a white gap where the tendon substance is disrupted.

prior to any form of treatment. In particular, those patients with a history of steroid injections or physiotherapy involving ultrasound or diathermy, which could



Figure 4. Coronal STIR image showing a partial tear of the common extensor origin. Areas of grey, oedematous tendon still bridge the CEO insertion.

produce soft tissue reactions [8], were excluded. This differs from previous series [3,5,6,7] in which such patients with chronic tennis elbow, presenting late in treatment, were included. Martin and Schweitzer [4] have reported a series of relatively early tennis elbow, but did not exclude previous treatment. Our study is therefore free of the confounding factors of chronicity and treatment artefact that confuse the findings of these previous series.

At this early stage, we found oedema plus thickening or tearing of the CEO to be the only consistent MRI changes. Only a few cases had peri-tendon oedema or changes in the lateral epicondyle. We found no evidence of the changes in anconeus, the radial bursa or the radial collateral ligament described previously [1,3,5,6]. The finding of more widespread pathology in later cases may represent either a widening of the disease process or an artefact of treatment. Steroid injections are certainly known to produce signal changes on MRI [8]. Martin and Schweitzer [4] also found a lack of these more widespread changes in early cases of tennis elbow. Since their patients had been subjected to previous treatment, it would appear that the duration of symptoms is the factor determining the extent of MRI changes.

In our series, MRI signal changes involved the whole mass of the CEO. In no case was it possible to localize involvement to a single tendon. Previous series [5,6] describe changes localized to the extensor carpi radialis brevis tendon. They do, however, admit that the three

tendons of the CEO are closely apposed, making differentiation in the presence of pathology difficult [5].

We observed CEO oedema in six out of the 17 asymptomatic contralateral elbows of patients with tennis elbow. This high proportion of clinically normal elbows showing MRI changes was reported previously by Steinborn *et al.* [7], but is not generally appreciated. Steinborn *et al.* found signal changes in six out of 11 asymptomatic contralateral elbows. The significance of this is uncertain, but may reflect a pre-symptomatic stage of tennis elbow in patients who are predisposed to the condition. No study has followed these cases up to ascertain what proportion subsequently develop clinically apparent tennis elbow. This is an area which warrants further investigation. Alternatively, subtle oedema in the CEO tendons may be an occasional phenomenon in asymptomatic individuals, simply reflecting the sensitivity of MRI. In Martin and Schweitzer's study [4], three out of 19 entirely normal volunteers with no past history of elbow pathology or risk factors for tennis elbow showed such MRI changes. Consequently further changes, including thickening or partial tearing of the tendon, are required to safely establish the diagnosis of tennis elbow on MRI scan.

Our results clarify the salient MRI features required to diagnose tennis elbow. The majority of patients can and should be diagnosed and treated on clinical grounds alone. However, our results are of great importance when the modality is used to investigate patients with an atypical clinical presentation or recalcitrant symptoms. In disputed cases of prolonged sick leave or work-

related incapacity claims, the ability to provide precise evidence to confirm or refute the diagnosis can be of great help.

References

1. Gabel G, Morrey B. Tennis elbow. *AAOS Instructional Course Lectures* 1998;**47**:165–172.
2. Kraushaar B, Nirschl R. Current concepts review: tendinosis of the elbow (tennis elbow). *J Bone Joint Surg* 1999;**81A**:259–278.
3. Coel M, Yamada C, Ko J. MR imaging of patients with lateral epicondylitis of the elbow (tennis elbow): importance of increased signal in anconeus. *Am J Roentgenol* 1993;**161**:1019–1021.
4. Martin C, Schweitzer M. MR imaging of epicondylitis. *Skeletal Radiol* 1998;**27**:133–138.
5. Potter H, Hannafin J, Morwessel R, DiCarlo E, O'Brien S, Altchek D. Lateral epicondylitis: correlation of MR imaging, surgical and histological findings. *Radiology* 1995;**196**:43–46.
6. Schenk M, Dalinka M. Imaging of the elbow: an update. *Orthop Clin North Am* 1997;**28**:517–535.
7. Steinborn M, Heuck A, Jessel C, Bonel H, Reiser M. Magnetic resonance imaging of lateral epicondylitis of the elbow using a 0.2T dedicated system. *Eur Radiol* 1999;**9**:1376–1380.
8. Resendes M, Helms C, Fritz R. MR appearance of intramuscular injections. *Am J Roentgenol* 1992;**158**:1293–1294.
9. Davis T. Diagnostic criteria for upper limb disorders in epidemiological studies. *J Hand Surg* 1998;**23B**:567–569.