Fig 2 Three dimensional reconstruction reveals a transverse fracture just below the attachment of the first ribs to the manubrium.

from the lying position, when the fracture happened. He had been performing body building exercises every second day for six months. He had trained the pectoralis muscle group each time, using four different sessions inclusive of bench press. He started body building, because he was in very poor condition. The causal mechanism in this case must be found in the muscle attachments and the direction of their forces on the manubrium and sternum. The attachment of the manubrium to the spine through the first and second ribs and

the attachment to the shoulders through the clavicles are also part of the mechanism. The sternal head of the sternocleidomastoid and part of the pectoralis major are attached anteriorly to the manubrium and sternum. The sternohyoid and sternothyroid muscles are attached posteriorly to the manubrium, whereas the tranverse thoracis is attached to the posterior surface of the sternum. The very strong rectus abdominis is attached to the distal part of sternum. During sit up exercises hyperflexion of the spine presses the upper part of the manubrium anteriorly, and the contraction of the abdominal and thoracic muscles at the same time add to the fracture angulation.

Computerised tomography scanning with three dimensional reconstruction revealed a transverse fracture just below the attachment of the first ribs to the manubrium (fig 2).

Presumably, the repetitive strenuous training sessions in this formerly untrained patient led to a stress fracture in the manubrium, because the strength of the muscles build up faster than the strength of the bones. Fracture-dislocation of the manubriosternal joint has been described as a complication of seizures,³ and the mechanism in our case may be somewhat similar.

- 1 Harley DP, Mena I. Cardiac and vascular sequelae of sternal fractures. *J Trauma* 1986;26:553-5.
- 2 Jones HK, McBride GG, Mumby RC. Sternal fractures associated with spinal injury. *J Trauma* 1989;29:360-4.
- 3 Dastgeer GM, Mikolich DJ. Fracture-dislocation of manubriosternal joint: an unusual complication of seizures. *J Trauma* 1987;27:91-3.
- 4 Kurzweg FT, Danna SJ, Lolley RT. Open reduction and fixation of a comminuted fracture of the sternum. *J Thorac Cardiovasc Surg* 1972;63:424.
- 5 Henley MB, Peter RE, Stephen K. External fixation of the sternum for thoracic trauma. *J Orthop Trauma* 1991; 5:493.

Simultaneous rupture of the quadriceps tendon with contralateral rupture of the patellar tendon in an otherwise healthy athlete

N I Munshi, Chima E Mbubaegbu

Abstract

A case of a healthy athlete with simultaneous rupture of quadriceps tendon and rupture of the contralateral patella tendon is reported. Both tendons rupturing in the same patient is rare and this is the first reported case in a previously healthy person. Different mechanisms are implicated in the different ruptures. The rarity is because the simultaneous presence of contributory factors for either injury in the same person is uncommon.

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Key terms: quadriceps tendon; patella tendon; simultaneous rupture; weight lifter.

Bilateral simultaneous rupture of either the infrapatellar tendon or the quadriceps tendon is rare. There are demographic differences in the occurrence of quadriceps and patellar tendon ruptures.¹ Quadriceps tendon rupture, commoner over the age of 40, is usually the result of age related changes in the tendon, often associated with degenerative changes in the knee. Patella tendon rupture, on the other hand, occurs in young athletes and is usually attributed to repeated microtrauma. Local or systemic steroids may increase the risk of rupture.²

The simultaneous rupture of the quadriceps tendon and contralateral patella tendon in a healthy athlete has as yet not been reported.

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Case report

A 47 year old man, a champion power lifter weighing 97 kg, suddenly collapsed in pain while doing a power lift. The injury (recorded on video) occurred while he was squatting with the weight across his shoulders but before he started to push upwards. He was in pain and unable to extend either knee.

Examination showed palpable gap in the suprapatellar tendon of the left knee a similar palpable gap was felt on the right knee in the infrapatellar region.

Past history included several steroid injections in his shoulders but he never had systemic steroids or injection locally into or around his knees. There was no systemic disease that could account for the injuries. His serum urate, cholesterol, urea and electrolytes, and erythrocyte sedimentation rate were all within normal limits.

Surgical exploration confirmed tendon ruptures. On the right, the tendon was avulsed from its tibial insertion extending through the expansion to the medial and lateral collateral ligaments. The cruciate ligaments were normal. The left quadriceps tendon ruptured just above the insertion to the patella. Repairs were done primarily with absorbable sutures.

Postoperatively, the left knee was immobilised in plaster cylinder for 48 h and the right knee for two weeks. A continuous passive motion machine was used to mobilise each knee once out of plaster.

The range of movement at nine weeks was 0-85 degrees and 0-110 degrees on the right and left respectively. Full flexion had been achieved in both knees at twenty two weeks.

Discussion

Bilateral simultaneous rupture of either the infrapatellar tendon or the quadriceps tendon is rare. There are demographic differences in the occurrence of quadriceps and patellar tendon ruptures.¹ The exact mechanisms resulting in ruptures are different and results of treatment are more favourable with patella tendon ruptures. Though bilateral quadriceps tendon rupture or patella tendon rupture have been known to occur, there is no recorded incident of simultaneous rupture of patella tendon and contralateral quadriceps tendon in a healthy patient. There has been a reported case of a similar condition in a patient with renal insufficiency.³

Quadriceps tendon rupture, commoner over 40 years of age, is usually the result of age related diffuse tendon degeneration or degenerative changes in the knee.^{4 5} It is rare in athletes.

Patella tendon ruptures occur in athletes who are usually under 40 and are then due to massive flexion forces of knee extension in the presence of forced contraction of the quadriceps. They may also be due to local involvement of tendons in systemic diseases such as gout, hyperlipidaemia, systemic lupus erythematosus, or rheumatoid arthritis, or in patients given systemic or local steroid injections.^{2 6}

McMaster⁵ showed in 1933 that normal tendons do not rupture with stress, but detach at the osseotendinous or musculotendinous junction where the vascular supply is most at risk and the ability to repair injuries impaired. Scanpinelli,⁶ in discussing the vascular supply of the tendon, says that ruptures of the tendon substance are uncommon. Zernicke *et al*⁷ found that normal tendons could rupture at stresses greater than 17.5 times body weight. These kinds of repetitive stress occur in power sports like weight lifting.

The contralateral quadriceps tendon rupture was probably the result of age related weakening of the tendon. Our patient's age had exceeded the threshold for increasing incidence of degenerative ruptures. The stress of weight lifting may have tilted the balance in favour of earlier rupture.

As power sports and body building become more popular, and the age at which these sports are played is further stretched, the combined effect of stresses around various muscle groups and aging may result in unusual combinations of tendon ruptures and other injuries.

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- 1 Haaf SB, Callaway H. Disruptions of the extensor mechanism. *Orthop Clin North Am* 1992;23:687-95.
- 2 Burgess RC, Guise ER. Infrapatellar tendon ruptures. *Orthopaedics* 1985;8:362-64.
- 3 Blum J, Ahlers J, Runkel M. Simultaneous rupture of the patella tendon and the contralateral quadriceps tendon in chronic kidney insufficiency. *Unfallchirurgie* 1991;17:290-3.
- 4 Kelly DW, Carter VS, Jobe FW, Kerlan RK. Patella and quadriceps tendon ruptures - jumper's knee. *Am J Sports Med* 1984;12:375-9.
- 5 McMaster PE. Tendon and muscle ruptures. *J Bone Joint Surg* 1933;15:705-22.
- 6 Scanpinelli R. Studies on the vasculature of the human knee joint. *Acta Anat* 1968;70:305-31.
- 7 Zernicke RF, Garhammer J, Jobe FW. Human patellar tendon rupture, a kinetic analysis. *J Bone Joint Surg [Am]* 1977;59A:179-83.

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Unusual patellar tendon injury in an adolescent runner with generalised ligamentous laxity

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Abstract

A case is reported of an acute traction injury of the patellar tendon in a boy of 14

with joint hypermobility. Such injuries are unusual but early diagnosis and surgical repair lead to a good long term out-