CASE REPORT

Non-operative management of an isolated lateral collateral ligament injury in an adolescent patient and review of the literature

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SUMMARY

We present a rare case of isolated traumatic pure ligamentous rupture of the lateral collateral ligament of the knee in an adolescent high-level footballer managed non-operatively with a good functional outcome and return to sport in 4 months.

BACKGROUND

We recommend a high index of suspicion of soft tissue injury of the knee in young patients presenting with ongoing pain, prolonged effusion and difficulty in weight bearing following traumatic injury. Plain radiographs may not be diagnostic and often the patient will not tolerate varus and valgus stress radiographs; therefore, MRI is recommended if clinically suspected. There is a limited evidence on outcomes of non-operative versus operative management of these injuries in the adolescent population and although we have described previous case series in both children and adults with lateral collateral ligament (LCL) injuries, there remains a lack of consensus on appropriate management specifically in adolescent patients and the expected time of return to sport.

CASE PRESENTATION

A 16-year-old male patient presented to our fracture clinic 10 days following a varus injury to his right knee. The injury was sustained during a football game and he was reviewed in accident and emergency. While there were clinical symptoms and signs of pain, tenderness and effusion radiographs failed to indicate a diagnosis and he was discharged with a provisional diagnosis of a soft tissue injury.

On presentation to our fracture clinic, he was unable to bear weight. There was a gross effusion of the knee which he held at 5° of flexion. Examination showed tenderness over the lateral aspect of the distal femur and a range of movement actively and passively of 5°–45°. The patient demonstrated an intact extensor mechanism. There was no posterior sag, and ligamentous stress testing indicated an intact Anterior Cruciate Ligament (ACL), Posterior Cruciate Ligament (PCL) and Medial Collateral Ligament (MCL); however, there was laxity to varus stress. Medial joint space opening was estimated to be 10 mm at 30° of flexion with a firm end point. The Dial test and McMurray's meniscal test

were difficult due to residual tenderness but yielded no grossly positive signs. Neurological examination showed an intact common peroneal nerve. Beighton Hypermobility Index was normal.

INVESTIGATIONS

Plain radiographs in orthogonal views showed a joint effusion only and no evidence of relevant differential diagnoses for this case presentation including osteochondral defect or avulsion fracture of the lateral distal femur. We had a high suspicion of soft tissue injury to the knee based on the above findings; however, the patient's pain precluded us from obtaining varus and valgus stress radiographs to assess for collateral ligament instability, therefore proceeded to MRI scan which demonstrated an isolated rupture of the LCL at its distal insertion on the fibula. We re-reviewed the images with our expert musculoskeletal radiologist and importantly identified an intact popliteus tendon, popliteofibular ligament, lateral meniscus and lateral capsular structures. There was no sign of a bony avulsion fracture at the origin or insertion of the LCL (figure 1).

TREATMENT

We opted for non-operative management which included analgesia, non-weight bearing in a locked hinged knee brace for 2 weeks with progressive active range of movement increasing the flexion–extension arc incrementally over 8 weeks. Initial clinical progress was slow with the joint pain and swelling only settling at 6 weeks. By 8 weeks, the pain had resolved and the range of movement had improved to 0°–90°. The hinged knee brace was removed and physiotherapy started initially with unidirectional activity and passive and active mobilisation in the sagittal plane progressing on to achieve multidirectional activity at 4 months post injury. Further clinical assessment demonstrated stability to varus stress at 30° of flexion at the knee.

OUTCOME AND FOLLOW-UP

This patient returned to competitive football at 4 months and reported the Knee Injury and Osteoarthritis Outcome Score for Children (KOOS-Child) was normal (100) for symptoms, activity of daily living, sport/play and quality of life while the KOOS-Child Pain score was 94.5.

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Figure 1 Coronal plane T2-weighted MRI image indicating the ligaments avulsion of the lateral collateral ligament from the proximal fibula in isolation.

DISCUSSION

The LCL, in contrast to the MCL, is tubular in shape and originates from the lateral aspect of the distal femur adjacent to the popliteus tendon. It inserts as the most anterior structure on the anterolateral fibula head. The LCL is the primary restraint to varus stress at 30° flexion and contributes to stability in extension along with the ACL and PCL and resists external rotation in extension.¹

Isolated LCL injury of the knee is a rare diagnosis in patients of all ages. In the adult population, LCL rupture is more commonly associated with the posterolateral corner injury which accounts for an estimated 7%–17% of adult traumatic soft tissue knee injuries.² The mechanism is typically high energy such as sports or road traffic accidents where the primary force is varus and external rotation of a hyperextended knee.

In the paediatric population, ligamentous injuries are far less commonly seen than bony avulsion injuries due to the differential strength of new bone compared with ligaments. As growth progresses from the childhood age group to the adolescent age group, there is a sudden relative increase in muscle strength relative to bone and this is a contributor to the higher proportion of bony avulsion injuries seen in adolescent patients.³ For this reason, more common sports injuries of the knee in this young cohort are tibial spine avulsion, tibial tuberosity avulsion, lateral distal femoral avulsion and osteochondral defects.⁴ Despite this ligamentous injury of the ACL, PCL, LCL and MCL can occur.⁵ In all of these scenarios the most sensitive and specific investigation is MRI scan. In many cases of paediatric knee injuries non-operative interventions are sufficient to obtain a good function outcome and return to sport; however, severe ligamentous laxity, displaced articular injuries and large osteochondral defects with symptoms of mechanical block should be treated operatively.

We have reviewed the literature which shows this injury to be rare in adolescents and there is a lack of consensus in management of these injuries.

There have been previous case reports of adult patients with isolated LCL ruptures during various sporting activities including rock climbing, ju-jitsu⁶ and yoga.⁷ Davis *et al* describe their experience of two fit adults sustaining avulsion injuries from the femoral attachment of LCL diagnosed clinically and on MRI.⁶ One case occurred during competitive ju-jitsu and the other during a particular rock climbing manoeuvre. Both patients were successfully managed non-operatively with either bracing (2 weeks locked in extension then 4 weeks unlocked, full range of movement) or non-weight bearing (2 weeks) before starting physiotherapy rehabilitation. The authors describe return to full activity at 6–7 months postinjury in both patients; however, no further information is provided as to the clinical symptoms, examination laxity at follow-up and the physio protocol used making comparison to our case limited.⁶ In addition, these cases describe avulsion from the distal femur compared with our case of LCL rupture at the proximal fibula. In contrast Patel and Parker report the same pattern of injury as our case in a 34-year-old male patient presenting with acute lateral sided knee pain following an extreme posture during yoga.⁷ This patient presented with grade II laxity to varus stress and isolated rupture of the LCL from the proximal fibula was diagnosed on MRI. Following non-operative management, the patient returned to yoga at 8 weeks postinjury; however, the authors report a residual asymptomatic grade II laxity to varus stress at 6-month and 12-month follow-up. Given the preceding activity and the minimal symptoms at presentation (including a pain-free range of movement from –15° to 145°), the authors suggest that the underlying pathology may be of chronic attritional rupture rather than acute rupture as in our case; therefore, comparison of the management and outcome is again limited.⁷

A review of the reported outcomes of management of LCL rupture in adults indicated that in grade I and II LCL ruptures immobilisation for 2 weeks followed by progression to a hinged knee brace with staged increase in range of movement is satisfactory.⁸ In cases of severe varus instability and grade III or greater widening on stress tests, the evidence supports open direct primary repair of midsubstance tears and bone anchor fixation of avulsion type injuries. In a retrospective review of National Football League players between 2004 and 2009, there were 32 cases of LCL injury identified (12 grade I, 10 grade II and 10 grade III). The distribution of injury pattern demonstrated that 11 were proximal fibula avulsions, 10 were midsubstance and 9 were distal femoral avulsions, interestingly the majority of injuries at the distal fibular avulsion site presented with grade I laxity (8/11) and none presented at grade III laxity.⁸ While the authors were unable to provide specific information as to the non-operative management protocol, a mean of 4 weeks bracing was used in 70% and 100% of patients with grade II and III injuries, respectively. No patient received operative intervention for their LCL injury although two players (one with grade II LCL and one with grade III LCL) were subsequently found to have meniscal tears requiring arthroscopic debridement. The authors describe a significant correlation between injury grade and return to competitive sport with a mean of 1.3 weeks, 3.5 weeks and 4.6 weeks in the LCL grade I, II and III injury patients, respectively.⁸ This study supports the non-operative management of LCL injury in adults regardless of grade; however, we would suggest caution in interpreting the relatively short rehabilitation intervals as these professionals not only have access to intensive physiotherapy and rehab resources but are also subject to external influences on their return to sport. In addition, it should be noted that Sikka *et al* described residual laxity to varus stress on examination at 12-month follow-up in all players.⁸

In comparison to the success of non-operatively treated LCL injuries in adult patients, a retrospective study describing acute knee ligament injuries in 32 children with open physes (mean age 14.8 ± 2.4 years in 21 boys and 12 girls) demonstrated that for injuries with grade II collateral ligament laxity non-operative management resulted in an excellent functional outcome at a mean of 8.2 years follow-up while in cases a grade III collateral ligament laxity there was a poor functional outcome.⁵ Furthermore, a report of six cases of LCL avulsion fractures from the distal femoral origin in patients with a mean age of 13.3 years (12.6–13.7 years) followed up to a mean of 5.2 years with questionnaire, clinical examination, radiographic assessment and strength tests support operative management.⁹ Five of six patients had been treated operatively with fixation of the avulsion fragment in the acute phase while a single patient was managed non-operatively. Interestingly the outcomes in the case series demonstrate a satisfactory outcome following operative reconstruction with a Lysholm and KOOS knee scores of mean 98 and 80, respectively; however, the single case managed non-operatively required osteotomy for valgus deformity secondary to osseous bar formation at the physis and had a poor outcome (Lysholm score 80, KOOS score 25 and full flexion restricted by 10°).⁹

This evidence from von Heideken *et al*⁹ and Kannus⁵ would appear to suggest that non-operative measures, while acceptable in adult patients, may result in a poor outcome in younger patients with open physes. However, it is important to recognise that in one case series the LCL injury was described as involving the popliteus tendon, also known as the 'Peel-Off complex',¹⁰ while the other series included patients with ACL, PCL and MCL injuries in combination. These more complex and potentially unstable injuries are more likely to require operative intervention and have a poor outcome with non-operative management compared with isolated LCL injuries.¹⁰

A recently published retrospective case series from the USA assessing outcomes of 'cruciate-normal' collateral ligament injuries in children and adolescents (average age 13.8 years) over an 8-year period identified a total of 51 injuries, of which only six were isolated LCL injuries and only two involving a rupture of the distal ligament like our case.¹¹ Kramer *et al* reported a return to sport of median 2.2 months for all injury types (MCL, LCL, PLC and avulsions) with 95% of players returning to sport by 4 months but unfortunately no subgroup analysis to report the duration of rehab for LCL injuries specifically. All LCL injuries reported were treated with hinged knee bracing and physiotherapy.¹¹

In our case, non-operative management gave a good functional result at 8 weeks with return to sport at 4 months which is similar to another single case report of a 16-year-old male high school wrestler with an isolated grade III LCL tear from the proximal attachment to the distal femur described an excellent outcome and return to competitive sport with non-operative rehabilitation.¹² This case is clinically the most comparable to our patient and indeed the overall management and time to return to sport is similar.

It is our opinion, following observation of our case and review of the literature, that when dealing with an isolated LCL injury in an adolescent patient, it is important to recognise that there may be an absence of the classic avulsion fracture seen in younger patient with open physes and furthermore the potential for satisfactory rehabilitation via non-operative management appears to be similar to descriptions in adult case series. Return to multidirectional sport was achieved at 4 months which is

longer than the median recovery period described in the series by Kramer *et al* despite being within the observed range,¹¹ however, Kramer *et al* included MCL injuries in this outcome measure. Return to sport is governed by many factors including psychological factors including patient's motivation and does not necessarily correlate with injury grade which may explain the discrepancy in previous outcome reports. A limitation of our report is the restriction to an isolated case and therefore although we are confident that non-operative management is appropriate in these cases, the duration of rehabilitation should be interpreted with caution. We believe this case highlights this rare injury and the need for further research into adolescent-specific knee injury management.

Learning points

- If there is a suspicion of an acute soft tissue injury of the knee, MRI is indicated in preference to plain radiographs.
- Although avulsion injuries are more common in the paediatric and adolescent population, it is important to consider the differential of a pure ligamentous injury.
- There is a lack of evidence in the literature to guide the management of lateral collateral ligament injuries in the adolescent population.
- Our case demonstrates that non-operative management provided a good functional outcome and early return to sport.

Contributors All authors contributed to the article. DD, AA and MRE were involved in conception, design and acquisition of data. DD and MRE were involved in analysis and interpretation of data and literature search and discussion. DD and MRE were involved in the revision.

Competing interests None declared.

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