

## Short Communication

# Vascular Assessment of Traumatic Knee Injuries - A Wessex Orthopaedic Learning Forum Collaborative Audit

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- Assessment

**Abstract**

Tibiofemoral dislocations are an uncommon but significant and often devastating injury with a high risk of vascular insult. Tibial plateau injuries are more common, though high energy Schatzker IV-VI injuries in younger patients are less common. Recommended assessment of all injuries is by pulse palpation and recording the ankle-brachial pressure index. Duplex ultrasound is vital in those deemed high risk of vascular injury. If a vascular injury is suspected from clinical assessment patients should undertake an urgent CT Angiography.

Data was collected over a 2-year period from 2016-2017 from the 7 Hospitals in Hampshire and Dorset. All patients who sustained a Schatzker IV-VI tibial plateau fractures or tibio-femoral dislocation were identified. Patients with low energy osteoporotic fractures were excluded. Records were reviewed to identify the nature of the vascular assessment performed and whether they had subsequent CT angiography.

A total of 72 patients were identified from 7 Hospitals. The pulse was documented in 51 patients. ABPIs were documented in 9 patients. 26 patients had a CT angiogram. There were 6 vascular injuries identified in this series.

There is poor adherence to suggested guidelines for vascular assessment of patients with this injury across the region. Although all those clinically assessed to be at risk of injury were further assessed by angiography, the rate of CT angiogram is more closely linked to the availability of the service than the vascular assessment. There needs to be more consistency in the assessment of these patients.

**ABBREVIATIONS**

CTA: Computed Tomography Angiogram; ABPI: Ankle: Brachial Pulse Index; ATLS: Advanced Trauma Life Support; MTC: Major Trauma Centre; TU: Trauma Unit; NICE: National Institute for Health and Care Excellence

**INTRODUCTION**

Knee dislocation is one of the most severe but also rare orthopaedic injuries, representing less than 0.2% of presentations [1]. However, this is likely an underestimate due to the proportion of knee dislocations that spontaneously reduce prior to hospital attendance diagnosis [2]. This could cause clinicians to overlook vital neurovascular signs and subsequently lead to a high morbidity associated with neurological or vascular insult. Approximately 20% of knee dislocations have been reportedly associated with a vascular injury [3].

Suspected knee dislocation and tibial plateau fractures (Schatzker IV-VI) in younger patients are typically associated with

a high-energy mechanism and should be initially assessed using the ATLS protocol. During assessment it is paramount to compare both limbs and record any discrepancy. Specific documentation includes, assessment of the posterior tibial and dorsalis pedis pulses, sensory and motor nerve function, distal capillary refill, skin colour and temperature. However, clinicians must be aware that popliteal artery injuries can be present with palpable collateral distal pulses and a warm limb; therefore, many experts advise angiography. The routine use of angiography in a clinically well perfused limb, however, is controversial thus careful clinical monitoring can be considered optimal management. Clinical monitoring can then be supplemented with selective angiography when an ankle-brachial pulse index (ABPI) is recorded <0.9 [4]. Clinical monitoring with serial ABPI readings can be difficult to achieve in a busy hospital environment on a patient who is likely to have a painful injury that has been splinted or placed into plaster with potential associated injuries.

A number of classifications have been created to help direct understanding of traumatic knee injuries. Examples include the

Schatzker classification which describes the pattern of injury to the tibial plateau. The Schatzker classification is widely understood, recorded by orthopaedic trainees in the Wessex region and is shown to have moderate to substantial inter-user agreement [5]. None of these classifications guide specific management but higher grades of Schatzker injury have been associated with greater neurovascular morbidity and so was used to retrospectively identify injuries at high risk of neurovascular compromise. The motivation for this project came after The Wessex Trauma Group raised concerns about the methods of vascular assessment across the region in response to two cases of missed injuries leading to consequent loss of limb. UpToDate is a subscription-based service providing summary reviews of literature and its use has been shown to improve outcomes [6]. To date there are no BOAST guidelines for the management of these injuries with respect to vascular assessment. We have therefore used the suggested guidelines from UpToDate as a basis upon which to audit regional practice in the management of suspected tibio-femoral dislocations.

**MATERIALS AND METHODS**

This was a multicenter retrospective audit by the Wessex Orthopaedic Learning Forum trainee collaborative of medical records documenting assessment of patients presenting with tibio-femoral dislocation or high-grade tibial plateau fractures to the emergency department. The UpToDate management algorithm was used as a standard against which practice was audited. The study was performed at 6 hospitals across Dorset and Hampshire, forming the Wessex Trauma Network. This included 1 Major Trauma Centre (MTC) and 5 Trauma Units (TU). The trainee network was utilised to facilitate collection of data across the region using existing communication channels. Patients were identified between January 2016 and December 2017. In each unit, the lead orthopaedic trainee registered the audit with their audit department. Medical records and imaging were interrogated to identify clinical and radiological assessment and clinical outcomes were reviewed prior to discharge.

Data collected included age, sex, date of injury, type of injury, whether this was open or closed, documentation of pulse, ABPI, frequency of ABPI, whether a CT angiogram was performed and then whether a vascular injury was identified and then orthopaedic and vascular treatments delivered.

Patients were included if they were identified to have sustained a tibio-femoral dislocation or presumed potential dislocation (Schatzker IV-VI tibial plateau fracture). Patients were excluded if they had sustained an osteoporotic insufficiency fracture, or Schatzker I-III tibial plateau fracture.

**RESULTS AND DISCUSSION**

72 patients were identified during the 2-year study period with a median age of 44.4 years (interquartile range IQR 23.0 years), 54.2% were male, 5.5% injuries were open, and 84.7% were managed operatively. The distribution of their grade of injuries is summarized in Table 1.

Over this period 6 patients (8.3%) with suspected knee dislocations or high-grade tibial plateau fractures sustained vascular injuries identified on angiography. 1 patient required

popliteal bypass grafting, fasciotomy and external fixation. 5 patients were managed with a combination of fasciotomies, external fixation and conservative vascular input using extended antiplatelet agent prophylaxis (Table 2).

51 patients (70.8%), had assessment of their pulses clearly documented, 9 patients (12.5%), had thorough documentation of ABPI assessment, 26 patients (36.1%), underwent CT angiography. None of the patients assessed with ABPI underwent serial monitoring.

The majority of patients presented to TUs, 52 (72.2%), compared to 20 at MTCs. There was a significant difference in the proportion of patients undergoing CT angiography investigations between the MTC and the TUs with 85.0% of patients receiving a scan at the MTC, and 19.2% at the TUs (Figure 1).

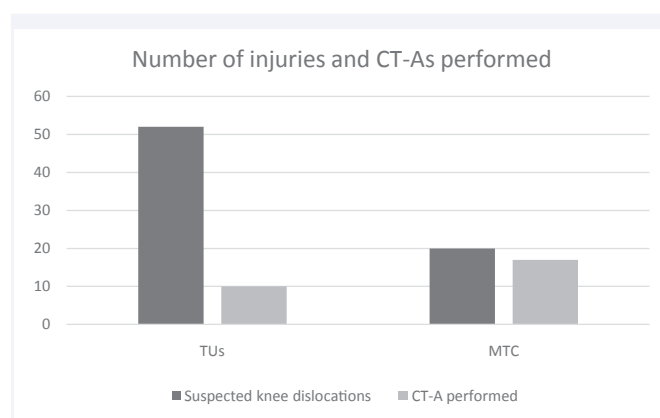
NICE guidance provides UK hospitals with contemporary and evidence-based recommendations. The commonly taught

**Table 1:** Proportion of injuries by Schatzker Classification or documented as dislocation and whether those injuries were associated with open injury.

| Schatzker Classification | Number of patients | Number open injuries |
|--------------------------|--------------------|----------------------|
| IV                       | 11                 | 0                    |
| V                        | 29                 | 2                    |
| VI                       | 22                 | 1                    |
| (Dislocation)            | 10                 | 1                    |

**Table 2:** Proportion of injuries by Schatzker Classification or documented as dislocated and whether they had vascular injury or required operative intervention.

| Schatzker Classification | Operative fixation | Vascular injury (operative / conservative) |
|--------------------------|--------------------|--|
| IV                       | 7                  | 0 / 0                                      |
| V                        | 26                 | 0 / 1                                      |
| VI                       | 19                 | 0 / 3                                      |
| (Dislocation)            | 8                  | 1 / 1                                      |



**Figure 1** The number of injuries received at Trauma Units (TU) and Major Trauma Centers (MTC) with comparison to number of CT-Angiograms performed to review potential vascular injury.

assessment of tibio-femoral dislocation and presumed dislocation is controversial and based on small studies, and thus no formal NICE guidance is published. Within the Wessex region senior opinion is divided as to the best mechanism, but the UpToDate guidance demonstrates that at present either pulse index or angiographic assessment is acceptable provided it is applied to the appropriate clinical scenario and performed thoroughly.

One of the greatest concerns from this study is the poor level of documentation of a basic neurovascular assessment. It is possible that many of these patients did indeed have their neurovascular status assessed, but without documentation there is no evidence to this effect. This is important not just for the communication of patient care, but also critical in a medico-legal context.

The evidence suggests that either ABPI or a CT angiogram should be used to assess vascular injury as patients with an intimal tear may still have a palpable pulse on their initial neurovascular assessment. The ABPI is a readily available, quick and non-invasive bedside test that can provide reassurance about the presence of good arterial blood supply in the non-diabetic patient. However, this can be painful and impractical to achieve when a patient is immobilized in a backslab. The UpToDate guidelines suggest that all patients should have an ABPI performed, with selective use of CTA. This is likely due to the fact that CTA is not always available out of hours and incurs an additional cost to the health service. However, the cost of losing one limb is considerably higher in a young patient than 72 CTAs over two years [7,8].

It is interesting to note that the units in our study who had access to 24 hour CTA, for example our MTC, showed a much higher rate of CTA performance.

## CONCLUSION

Major Trauma Networks have provided invaluable emergent

treatment to the majority who need it however those patients who present to trauma units or with isolated injuries must be treated with the same emergent care in order to reduce morbidity and prevent injuries from being missed. Resources may vary between centers, but it is vital that we continue to provide consistency at all of our units by conducting simple bedside tests, recording clinical signs and performing a CTA when appropriate to ensure the correct treatment is provided to each patient.

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