



Can tibial plateau fractures be reduced and stabilised through an angiosome-sparing antero-lateral approach?



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ABSTRACT

Introduction and aim: Tibial plateau fractures (TPFs) are an independent, non-modifiable risk factor for surgical site infections (SSIs). Current antero-lateral approaches to the knee dissect through the anterior tibial angiosome (ATA), which may contribute to a higher rate of SSIs. The aim of this study was to develop an angiosome-sparing antero-lateral approach to allow reduction and fixation of lateral TPFs and to investigate its feasibility in a consecutive cohort.

Methods: Twenty cadaveric knees were dissected to define the position of the vessels supplying the ATA from the lateral tibial condyle to the skin perforators. Based on these results, an angiosome-sparing surgical approach to treat lateral TPFs was developed. Fifteen consecutive patients were subsequently treated through this approach. Clinical outcomes included assessment of SSI and Lysholm score. Fracture healing and stability were assessed using the Rasmussen score and radiostereometric analysis (RSA). **Results:** At the latest follow-up between 1 and 4 years, there was no report of SSI. Nine patients (60%) had good or excellent Lysholm scores. The mean Rasmussen score at final follow-up was 17 (median 18, range 14–18) with 10 patients (66%) graded as excellent. Fracture fragment migration measured using RSA was below 2 mm in all cases.

Discussion: This study has demonstrated that an angiosome-sparing antero-lateral approach to the lateral tibial plateau is feasible. Adequate stability of these fracture types was achieved by positioning a buttress plate away from the bone and superficial to the regional fascial layer as an 'internal-external fixator'.

Conclusion: The angiosome-sparing approach developed was able to be used in a prospective cohort and the clinical results to date are encouraging. Future clinical studies need to investigate the potential benefits of this surgical approach when compared with the previously described antero-lateral approaches.

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Tibial plateau fractures (TPFs) and tibial shaft fractures have been shown to have a higher rate of surgical site infection (SSI) compared to all other fracture types.¹ Historically, SSIs after TPFs have been reported to be as high as 40–50%.^{2,3} SSI prolongs treatment, negatively influences postoperative outcomes, reduces the patient's quality of life and can increase health-care costs by >300%.⁴ Therefore, clinical-practice changes that can reduce the rate and severity of SSIs are important for both the patient and the health-care systems.

Improved surgical techniques,⁵ intra-operative respect for soft tissues⁶ and delayed definitive fixation^{7,8} have all contributed to

reducing SSIs in TPFs. However, despite recent improvements, the rates of deep SSIs after TPFs, especially after complex TPFs, continue to be reported as being between 8%^{1,9} and 18%.¹⁰ In addition, TPFs have been recently identified as an independent, non-modifiable risk factor for SSIs.¹

An angiosome is a composite tissue block of bone, muscle, fascia and skin which are linked three dimensionally by anastomotic arteries from one source vessel.¹¹ Dissection through any angiosome is known to devascularise the angiosome in part or entirely.¹² Current antero-lateral approaches for the treatment of TPFs are performed through curvilinear incisions over the lateral aspect of the knee and elevation of the proximal origin of the tibialis anterior (TA) muscle^{13–15} and therefore through the anterior tibial angiosome (ATA).¹² An antero-lateral approach performed between the knee angiosomes without elevation of the TA muscle has the potential to decrease the rate of SSIs after TPFs.

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Table 1

Patient demographic data, injury information, fracture classification and management and weight bearing status.

Patient number	Age (years)	Sex	Mechanism of injury	AO fracture classification	Preoperative fracture depression on CT (mm)	Confounding factors, associated injuries, comorbidities	ISS	Time to surgery (days)	Surgical approaches	Fracture stabilisation	Postoperative weight bearing
1	57	M	Butted by sheep	B3	5	Nil	9	5	AL	ORIF with lateral buttress plate and raft of subchondral screws	PWB
2	47	M	Assault, hit with shovel	B3	No CT	Previous ipsilateral patellectomy and incipient knee osteoarthritis Workers' compensation case	9	4	AL	ORIF with lateral buttress plate and raft of subchondral screws	PWB
3	25	F	Fall from ladder	B3	16	Nil	9	4	AL, PM	ORIF with lateral buttress plate and raft of subchondral screws ORIF with posteromedial buttress plate	PWB
4	25	M	Motorbike accident	B3	8	Associated contralateral femoral and tibial and ipsilateral malleolar fractures, lung contusion Methadone programme Workers' compensation case	11	11	AL	Iliac crest bone autograft ORIF with lateral buttress plate and raft of subchondral screws	PWB
5	38	M	Motorbike accident	B3	13	Nil	9	1	AL	ORIF with lateral buttress plate and raft of subchondral screws Iliac crest bone autograft	PWB
6	28	M	Jumped across stream and landed awkwardly	C3	6	Nil	9	3	AL, PM	ORIF with lateral buttress plate and raft of subchondral screws ORIF with posteromedial buttress plate	PWB
7	25	F	Motorbike accident	B3	8	Nil	9	7	AL	ORIF with lateral buttress plate and raft of subchondral screws Iliac crest bone autograft	PWB
8	45	F	Motorbike accident	B3	16	Nil	9	5	AL	ORIF with lateral buttress plate and raft of subchondral screws Impaction bone allograft	FWB
9	54	F	Fall from ladder	B3	5	Nil	9	4	AL	ORIF with lateral buttress plate and raft of subchondral screws Impaction bone allograft	FWB
10	42	M	Motorbike accident	B3	19	Recurrent ipsilateral patellar dislocation and knee osteoarthritis Alcoholic liver disease Workers' compensation case	9	1	AL	ORIF with lateral buttress plate and raft of subchondral screws Iliac crest bone autograft	PWB
11	35	F	Fall from white water raft	B3	6	Depression	9	7	AL	ORIF with lateral buttress plate and raft of subchondral screws	PWB
12	64	F	Fall from standing height	B3	12	Ipsilateral CPN palsy Hypothyroid, asthma, pituitary adenoma	9	6	AL	ORIF with lateral buttress plate and raft of subchondral screws Impaction bone allograft	FWB
13	54	F	Fall from ladder	B3	6	Nil	9	3	AL, PM	ORIF with lateral and posterior buttress plate and raft of subchondral screws	PWB
14	54	M	Fall from standing height	C3	9	Workers' compensation case	9	3	AL, PM, AM	ORIF with lateral buttress plate and raft of subchondral screws ORIF with posteromedial and anteromedial buttress plates	FWB
15	53	M	Motorbike accident	B1	11	Associated ipsilateral ACL and PCL injuries, contralateral tibial plateau fracture and bilateral open ankle fractures Contralateral knee osteoarthritis Workers' compensation case	9	3	AL, PM	ORIF with anterolateral and posterolateral bridging plates and lag screws	FWB

M, male; F, female; AL, anterolateral; PM, posteromedial; AM, anteromedial; ORIF, open reduction and internal fixation; FWB, full weight bearing; PWB, partial weight bearing; CPN, common peroneal nerve; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament.

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