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Crush Injury of Left Cruris Region with Vascular Injury: A Case Report

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Abstract: Crush injuries resulting from traffic accidents, cause severe damage to soft tissues, muscles, and nerves, leading to complications such as compartment syndrome and vascular injury. Vascular injuries may require timely diagnosis and intervention to prevent limb loss or death. Through-knee amputation (TKA) with anterior flap is an effective technique for preserving limb function while minimizing amputation extent. The procedure is less complex, reduces infection risks, and promotes better healing compared to more extensive amputation methods. We reported a 46-year-old male who suffered from a severe traffic accident resulting in intense pain and significant bleeding in the left lower leg (*cruris sinistra*). Upon physical examination and vital signs, no abnormal findings were noted. The local examination revealed an open fracture with surrounding tissue avulsion in the left lower leg, with a MESS of 8. X-ray and Doppler ultrasound confirmed tibia and fibula fractures with associated vascular damage. The patient underwent a through-knee amputation (TKA) with an anterior flap, aimed at preserving limb function while addressing severe vascular and soft tissue damage. Comprehensive follow-up care, including adequate antibiotics, post-surgical transfusion, analgesics, rehabilitation, and psychological support, was provided to promote recovery. In conclusion, through-knee amputation is a viable option for patients aiming to preserve as much limb function as possible, providing significant long-term benefits, followed by post-operation ambulatory and rehabilitation. This case highlights the successful outcome of TKA, with complete wound closure after one week of care, and emphasizes the importance of comprehensive post-operative rehabilitation, including physical therapy, occupational therapy, and psychiatric support, to enhance the patient's quality of life and functional recovery.
Keywords: crush injury; vascular injury; through-knee amputation

INTRODUCTION

Crush injury occurs when physical trauma causes prolonged compression of the body, leading to damage in tissues, muscles, and nerves, either from the direct impact or from ischemia due to compression.[1] This type of injury is prevalent in traffic accidents, which are the leading cause of death worldwide, particularly among children and young adults, with approximately 1.35 million fatalities annually. In Indonesia, the death toll reached 103,645 in 2021, with adolescents aged 15-20 accounting for 79.2% of injuries, primarily from motorcycle accidents.[2,3] Crush injuries can result in significant swelling, muscle necrosis, and neurological impairment, further exacerbated by secondary complications like compartment syndrome and vascular injury. Up to 80% of patients with crush injuries die from severe head trauma or asphyxiation, while 10% recover without complications and the remaining 10% develop crush syndrome, a serious condition requiring medical intervention.[3,4]

Traumatic vascular injuries in the limbs can result from direct puncture wounds, lacerations, sharp bone fragments, or, more frequently, from indirect forces like stretching and shear, which cause tearing of the vessel's inner lining and obstruction. Prompt diagnosis and vascular intervention are crucial, as failing to save a numb or non-functional limb can lead to severe complications like sepsis or even death.[5] Various scoring systems have been developed to assess prognosis and determine which limbs may require amputation. The Mangled Extremity Severity Score (MESS), introduced 25 years ago, uses factors such as the extent of skeletal and soft tissue damage, limb ischemia, shock, and age to help predict whether amputation will be necessary following an extremity injury.[6]

Vascular injury evaluation is generally divided into soft signs and hard signs. Major limb amputation is the loss in the transverse anatomical plane at or proximal to the ankle joint, indicated in cases of prolonged ischemia with dead muscles, significant neuronal damage leading to paralysis, and in extensive crush injuries where the likelihood of limb survival is minimal.[7] Losing a limb due to accidental trauma or disease has a profound impact on a person's body, emotions, relationships, vocation, and way of life. Follow-up therapies such as physical medicine and rehabilitation, consultation with a prosthetist or orthotic expert, occupational therapy, psychiatry, and continued medication are necessary to improve the function of the remaining body parts and enhance the patient's quality of life, both physically and psychologically.[8] We presented the case of a 46-year-old man who underwent disarticulation of left knee with anterior flap, caused by open fracture of the tibia and fibula in the proximal third and vascular damage.

CASE REPORT

A 46-year-old male presented with severe pain and immobility in his left lower leg after a motorcycle accident, with a large open wound and significant bleeding. Physical examination revealed exposed bone, multiple avulsions, deformities including rotation and angulation, and severe tenderness with limited range of motion (Fig. 1A, 1B, 1C). Vascular assessment showed normal femoral and popliteal pulsations but absent posterior tibial and dorsalis pedis pulsations, with the extremity feeling cold, pale, and delayed capillary refill. Additionally, there was sensory motor impairment, and oxygen saturation in the toes was undetectable, indicating compromised circulation.

According to the Mangled Extremity Severity Score (MESS) assessment there are four scores, as follows:[9] high-velocity trauma with gross contamination (score 4); distal vascular, sensory, and motor impairment (score 3); age between 30 and 50 years (score 1); and blood pressure >90 mmHg (score 0). The total MESS score of this patient was 8.

The X-ray of the left femur and knee is normal (Fig. 2), while the X-ray of the left lower leg reveals malalignment of the tibia and fibula (Fig. 3), discontinuity in the proximal and mid portions of the tibia, and displaced bone fragments in the distal fibula, accompanied by swelling in the surrounding soft tissue. A Doppler ultrasound showed normal flow in the common femoral

and popliteal arteries (Fig. 4A, 4B), but no pulsation is detected in the dorsalis pedis or posterior tibial arteries, suggesting vascular injury (Fig. 4C, 4D). The working diagnosis was a crush injury of the left lower leg (MESS 8) with vascular injury, and an open fracture of the tibia and fibula in the proximal third, classified as grade III C according to Gustilo-Anderson. Given the severe vascular damage, the decision was made to proceed with disarticulation using an anterior flap technique at the left knee, with the patella preserved to maintain quadriceps contraction, protect the quadriceps tendon, and prevent rotation of the femoral condyles, thereby improving the patient's long-term quality of life.

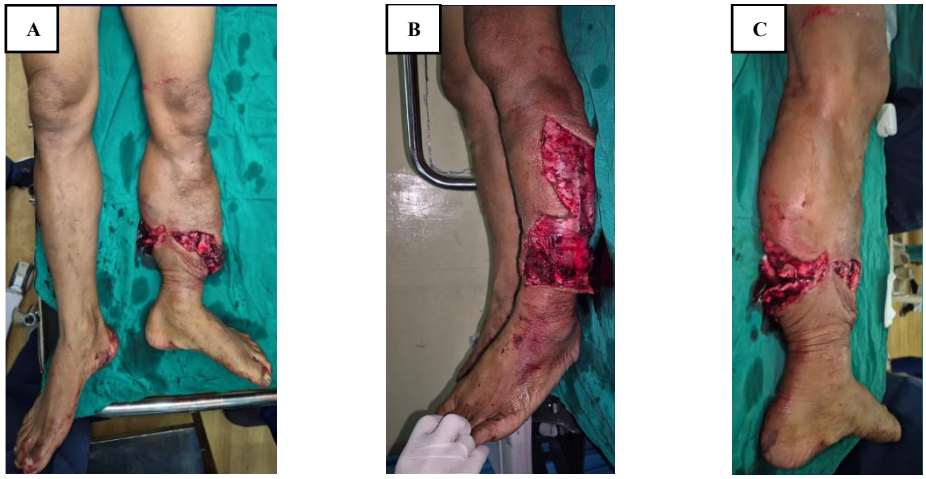

Figure 1. Clinical appearance. A, Deformity in the left cruris area following a traffic accident with tissue avulsion (top view); B, Tissue avulsion with the underlying supporting muscle of the cruris, irregular tissue edges, without active bleeding (lateral view); C, Tissue avulsion with deformity, showing a protrusion of the fractured fibula (medial view)

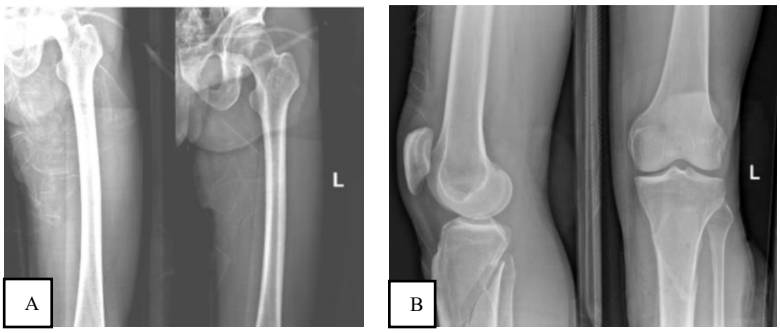

Figure 2 A, B. Femur and knee X-Ray AP-lateral position. Normal interpretation: no fractures or bone destruction observed.

Figure 3. Cruris X-Ray AP-lateral position

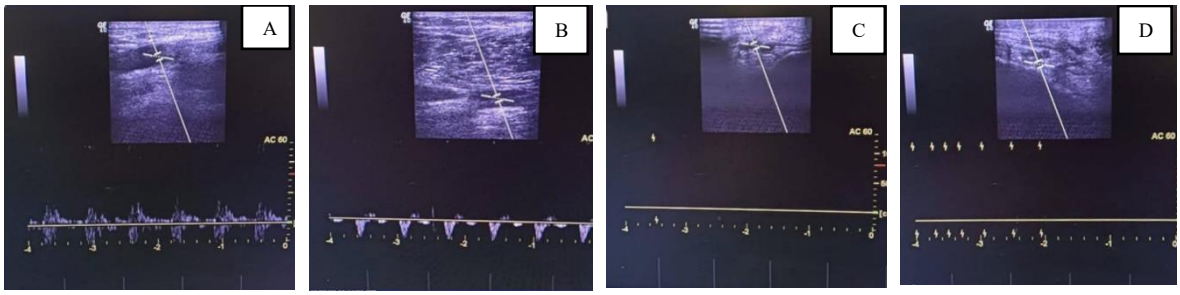

Figure 4. USG Doppler. A, Normal pulse on left common femoral artery with triphasic flow; B, Normal pulse on left popliteal artery with triphasic flow. C, No pulse on left dorsalis pedis artery with triphasic flow; D, No pulse on posterior tibial artery with triphasic flow

Initial management included strong analgesics and broad-spectrum antibiotics to prevent secondary infections postoperatively. Pre-opreative assessment was performed (Figure 5 A, B, C). In intra-operative assessment, a circumferential incision was made around the knee joint, with a general anterior skin flap created to provide coverage over the stump. The patella was retained during the amputation procedure. Post-operative evaluation of the anterior flap disarticulation showed a well-closed wound, but hemoglobin level was low at 4.5 g/dL. Therefore, a packed red cells (PRC) transfusion was given until hemoglobin reached >10 g/dL. Maintenance analgesics and antibiotics were administered adequately during the outpatient management. Follow-up one week after discharge showed complete wound closure with a good outcome and no secondary infections (Fig. 6). Ongoing medical rehabilitation and nutritional support were provided to aid in the healing process.

Figure 5. Pre-operative assessment. A, Top view; B) Lateral view; C) Medial view

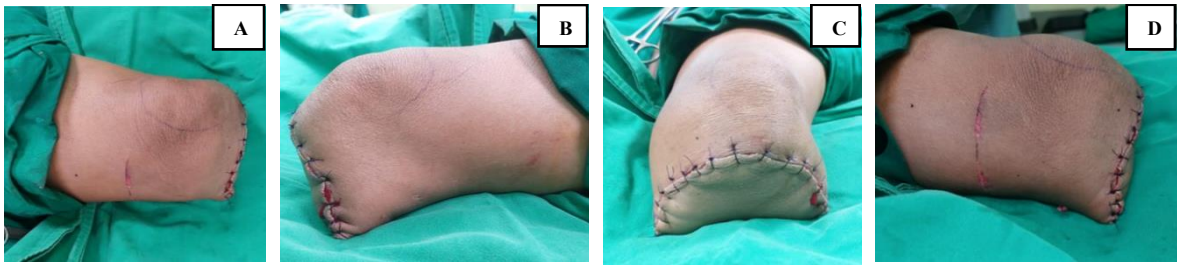

Figure 6. Post-operative assessment. Full stump coverage without excessive bleeding, swelling, or signs of secondary infection. (A) Top view, (B) Lateral view, (C) Bottom view, (D) Medial view

DISCUSSION

Severe limb injuries from traffic accidents often result in irregular wounds that damage soft tissues, muscles, and nerves, frequently contaminated by debris or microbes, requiring rapid decisions about amputation or limb salvage.[3] The MESS system, which evaluates factors like trauma severity, shock, age, and ischemia, is used to guide these decisions; a score above 8 generally indicates amputation. In this case, the MESS score was 8, with points given for high-velocity trauma, vascular, sensory, and motor impairment, and the patient's age, while blood pressure measurements indicated no shock. [4,9] Vascular injury confirmed by the presence of absent pulses and ischemic tissue in the distal limb, and a Gustilo-Anderson Grade III C fracture, further complicate the situation, suggesting that restoring vascular function and tissue viability is unlikely.[10] Given the extent of damage, including contamination and ischemia, the decision was made to perform a through-knee amputation (TKA) to preserve as much of the limb as possible and maximize functional recovery.[9,10]

The TKA is an older and more anatomical technique that avoids cutting through bone or muscle bellies, offering a shorter operative duration and better functional outcomes.[11] A 2024 study by Zink showed that 100% of patients experienced improvement, with no skin necrosis or infections, and an average follow-up of 4.6 years.[12] This TKA provides advantages such as good weight distribution and retention of the abductor prosthetic, but it results in a non-cosmetic socket due to the need for an external joint mechanism.[12,13] This procedure is particularly beneficial for patients who cannot use a prosthesis or for growing children to preserve femoral length, as it reduces the risk of gangrene or post-surgical infection and improves tissue healing, making it an appropriate choice for this patient.[14] Patients who undergo TKA typically have already received extensive medical and surgical interventions aimed at saving the limb, including imaging, pain management, antibiotics, and multiple surgeries.[15] Despite its limitations, TKA is chosen to minimize the extent of amputation while preserving movement function, with patella fix method improving functionality by: 1) maintaining quadriceps contraction; 2) protecting the quadriceps tendon; and 3) preventing socket rotation around the femoral condyles.[16,17] This approach offers improved cosmesis, function, and recovery, making it a promising option for enhancing patient outcomes.[18]

The anterior flap technique involves creating a surgical flap from the anterior of the limb to aid in wound closure, reduce soft tissue tension, and improve functional outcomes. This technique supports leg function, especially for prosthetic fitting and ambulation.[19] The TKA is often considered in cases of severe trauma, complex fractures, vascular compromise, or infections where limb preservation is prioritized, as well as in cases of gangrene or extensive soft tissue damage that would compromise function with more extensive amputations.[18,19] The anterior flap technique requires minimal bone cutting, ensures full soft tissue coverage, and improves the potential for prosthetic rehabilitation.[20,21]

In this case, the patient experienced a favorable outcome with complete wound closure within one week of outpatient care, which included PRC transfusion, antibiotics, and pain management, demonstrating effective surgical technique and post-operative care.[22] Physical therapy was initiated to restore strength, mobility, and flexibility, focusing on the knee joint and preparing for prosthesis use, while occupational therapy aimed at improving independence in daily tasks. Psychiatric support, including counseling and therapy, was essential to help the patient cope with the emotional and psychological impacts of the amputation, addressing issues like grief, anxiety, and PTSD. Overall, the quality of life (QoL) outcomes after surgical are typically better than other amputation methods.[23]

CONCLUSION

The case of through-knee amputation (TKA) with an anterior flap that involved patella preservation showed successful outcome one week after outpatient follow-up. One of the advantages of TKA is its ability to preserve the quadriceps and patella, which helps maintain movement function and facilitates prosthetic use. Follow-up care, including appropriate medication management and rehabilitation, significantly improves the patient's quality of life and helped restore his condition to as close to his previous state as possible.

Conflict of Interest

The authors affirm no conflict of interest in this study.

REFERENCES

1. Arango M, Cruz D, Salcedo A, Marin G. Amputation in crush syndrome: a case report. Int J Surg Case Rep. 2020;72(8):346-50. Doi: 10.1016/j.ijscr.2020.05.087
2. Kusumastutie N, Patria B, Hastjarjo T, Kusrohmaniah S. A review of accident data for traffic safety studies in Indonesia. IOP Conference Series Earth and Environmental Science. 2024;1294(1):0120123. Doi:10.1088/1755-1315/1294/1/012012

3. Rama E, Jayawant S, Zhang J, Krkovic M. Crush injuries to the lower limbs at a major UK trauma centre: a retrospective observational study. Eur J Orthop Surg Traumatol. 2024;35(1):44. Doi: 10.1007/s00590-024-04164-6
4. Rajagopalan S. Crush injuries and the crush syndrome. Med J Armed Forces India. 2010;66(4):317-20. Doi: 10.1016/S0377-1237(10)80007-3
5. Long B, Liang SY, Gottlieb M. Crush injury and syndrome: a review for emergency clinicians. Am J Emerg Med. 2023;69(46):180-7. Doi: 10.1016/j.ajem.2023.04.029
6. Loja M, Sammann A, DuBose J, Li CS, Liu Y, Savage S, et al. AAST PROOVIT Study Group. The mangled extremity score and amputation: time for a revision. J Trauma Acute Care Surg. 2017;82 (3):518-23. Doi: 10.1097/TA.0000000000001339
7. Malcolm J, Mahmooth Z, Rindler R, Allen J, Grossberg J, Pradilla G, et al. Autologous cranioplasty is associated with increased implant failure rate: a systematic review and meta-analysis. World Neurosurg. 2018;116(113):60–8. Doi: 10.1016/j.wneu.2018.05.009
8. Choo YJ, Kim DH, Chang MC. Amputation stump management: a narrative review. World J Clin Cases. 2022;10(13):3981-8. Doi: 10.12998/wjcc.v10.i13.3981
9. Yoneda H, Takeda S, Saeki M, Iwatsuki K, Yamamoto M, Tatebe M, et al. Utility of severity scoring systems for mangled upper limb salvage: a systematic review and meta-analysis. Injury. 2024;55(4):111447. Doi: 10.1016/j.injury.2024
10. Ntola V, Hardcastle T. Diagnostic approaches to vascular injury in polytrauma—a literature review. Diagnostics. 2023;13(6):1019.11. Doi: 10.3390/diagnostics13061019.
11. Panhelleux B, Shalhoub J, Silverman A, McGregor A. A review of through-knee amputation. Vascular. 2022;30(6):1149-59. Doi: 10.1177/17085381211045183
12. Zink TM, Gonzalez AG, Coden G, Smith E, Bono J. Outcomes of total knee arthroplasty following a Sham incision procedure in patients with previous knee incisions. J Bone Joint Surg Am. 2024;106 (21):1986-90. Doi: 10.2106/JBJS.24.00114
13. Lim S, Javorski MJ, Halandras PM, Aulivola B, Crisostomo PR. Through-knee amputation is a feasible alternative to above-knee amputation. J Vasc Surg. 2018;68(1):197-203. Doi: 10.1016/j.jvs.2017.11.094
14. Crane H, Boam G, Carradice D, Vanicek N, Twiddy M, Smith G. Through-knee versus above-knee amputation for vascular and non-vascular major lower limb amputations. Cochrane Database Syst Rev. 2021;12(12):CD013839. Doi: 10.1002/14651858.CD013839.pub2
15. Gordon H, Hebenton J, Dave S, Twiddy M, Smith G, Carradice D. Surgical and rehabilitation outcomes of patients undergoing through knee amputation compared with above knee amputation. Journal of Vascular Societies Great Britain & Ireland. 2023;2(4):208-14. Available from: http://doi.org/10.54522/jvsgbi.2023.081
16. Dewi M, Gwilym B, Coxon A, Carradice D, Bosanquet D. Surgical techniques for performing a through-knee amputation: a systematic review and development of an operative descriptive system. Annals of Vascular Surgery. 2023;93(3):428-36. Doi: 10.1016/j.avsg.2022.12.089
17. Albino FP, Seidel R, Brown BJ, Crone CG, Attinger CE. Through knee amputation: technique modifications and surgical outcomes. Arch Plast Surg. 2014; 41(5):562-70. Doi: 10.5999/aps.2014.41.5.562
18. Guo S, Hinchliffe RJ. Through knee amputation: a neglected technique that offers opportunities for future research. Eur J Vasc Endovasc Surg. 2023;66(5):607-8. Doi: 10.1016/j.ejvs.2023.09.001
19. Sharif A, Michael G. Vascular trauma. Surgery. 2012;30(12):399-404. Available from: https://doi.org/10.1016/j.surg.2012.11.007
20. Walthert L, Ris M, Moerenhout K, Déglise S, Di Summa P, Steinmetz S. Modified Gritti-Stokes amputation: tips and tricks. EFORT Open Rev. 2024;9(4):276-84. Doi: 10.1530/EOR-23-0118
21. Gordon H, Boam G, Carradice D, Smith G, Twiddy M. Exploring UK clinician perceptions of through-knee amputation compared to above-knee amputation: a mixed methods study. Disabil Rehabil. 2024;27(1):1-8. Doi: 10.1080/09638288.2024.2441423
22. Met R, Janssen LI, Wille J, Langezaal A, van de Mortel RWH, van de Pavoordt EDWM, et al. Functional results after through-knee and above-knee amputations: Does more length mean better outcome? Vasc Endovascular Surg. 2008; 42(5):456-61. Doi: 10.1177/1538574408316914
23. Jo SH, Kang SH, Seo WS, Koo BH, Kim HG, Yun SH. Psychiatric understanding and treatment of patients with amputations. Yeungnam Univ J Med. 2021;38(3):194-201. Doi: 10.12701/yujm.2021.00990