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Application of Tactical Combat Casualty Care in the Management of a Proximal Left Leg Gunshot Wound: From Battlefield to Surgical Amputation - A Case Report

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Abstract

Gunshot wounds to the lower extremities can cause life-threatening haemorrhage and vascular injury, requiring rapid intervention according to Tactical Combat Casualty Care (TCCC) principles. This case describes a 24-year-old soldier with a proximal left cruris gunshot wound managed initially under fire with a tourniquet, hemostatic agents, analgesia, and tranexamic acid. After delayed evacuation due to battlefield conditions, further stabilization and surgical management revealed open fractures and popliteal artery injury. Despite vascular repair, prolonged ischemia exceeding the golden period resulted in irreversible tissue damage, necessitating amputation. This case highlights that while TCCC effectively improves survival, timely evacuation and early definitive vascular treatment are critical for limb salvage in combat settings.

Keyword: Gunshot Wound, TCCC, Vascular Injury, Delayed Revascularization, Amputation

Introduction

Gunshot wounds to the lower extremities represent a leading cause of mortality and disability in combat and armed conflict settings. These injuries frequently involve extensive soft tissue injuries, massive hemorrhage, and vascular trauma, which can threaten life and limbs.[1] The cruris region is particularly vulnerable due to the presence of major vascular structures, including the popliteal, anterior tibial, posterior tibial, and peroneal arteries. Penetrating trauma in this area often results in vascular injury and subsequent distal ischemia.[2]

In the past two decades, Tactical Combat Casualty Care (TCCC) has been proven reduced preventable combat fatalities, primarily through rapid intervention for severe hemorrhage using tourniquets, bleeding control, and initial stabilization. Multiple studies indicate that pre-hospital tourniquet application decreases mortality without significantly increasing morbidity, making it a critical component of life-saving measures in extremity trauma. The TCCC principle of "Stop the Bleeding First" prioritizes stabilization to ensure survival until definitive care is available. Timely field intervention is essential to prevent death from hemorrhage or shock. On the battlefield, medical personnel such as combat medics are crucial for providing first aid, controlling bleeding, and stabilizing patients prior to evacuation. [3-4]

However, saving lives is not always synonymous with saving limbs. Despite being hemodynamically stable, the patient experienced prolonged limb ischemia due to delayed revascularisation, and the presence of an open fracture put him at risk of amputation. This case is reported to illustrate the importance of early management of gunshot wounds in conflict areas, which may subsequently require amputation as a definitive life-saving measure.

CASE REPORT

During a gunfight between the Mobile Task Force security team and the OPM group, a 24-year-old male soldier sustained a gunshot wound to the anterior proximal left cruris from a distance of approximately 30 meters. The patient presented with active bleeding and severe pain. Field assessment revealed an entry wound approximately 1.5 cm in diameter in the anterior proximal left cruris, extensive soft tissue damage, and ongoing hemorrhage. Initial vital signs were Compos Mentis (E4V5M6) and a VAS score of 9. Further examination was limited due to the ongoing firefight. The enlisted medic army (Takes) team initiated tactical combat casualty care at the scene as follows:

1) Application of a proximal tourniquet to the right femur to control bleeding.
2) Administration of Celox Hemostat and Combat Gauze with wound dressing using an Elastic Bandage at the wound site.
3) Administration of metamizole 1000 mg IM injection and tranexamic acid 1000 mg IM injection for analgesia.
4) Continuous administration of oral rehydration solution (IV infusion was challenging to perform due to safety considerations).

After 4 hours, the patient was evacuated by the team and received temporary treatment at the Task Force Command Post by the task force physician (battalion doctor). Physical examination showed Compos Mentis (E4V5M6), blood pressure 100/50 mmHg, pulse 150 beats per minute, respiratory rate 20 breaths per minute, temperature 35.2°C, SpO2 98%, and VAS score 9.

Figure 1. When the patient can be evacuated (left) and temporary management at the task force command post (right)

General status: The patient appeared weak. Head: bilateral anemic conjunctivae palpebrae. Thoracic and abdominal examinations were within normal limits. Local status: gunshot wound in the anterior proximal left cruris, approximately 1.5 cm in diameter, with active bleeding seeping through the elastic bandage. The following interventions were then performed:

1) Administration of oxygen at 4 lpm via nasal cannula
2) IV infusion set up with 2 lines (IVFD NS 2000 cc)
3) Removal of the tourniquet and elastic bandage to evaluate the wound and reapplication of Celox Hemostat and Combat Gauze with wound dressing using an elastic bandage at the wound site.

4) Administration of Ketorolac 30 mg IV injection, Tranexamic Acid 1000 mg IV injection, and Ceftriaxone 1 g IV injection.

The patient can be referred to a healthcare facility the following day using a Caravan aircraft. Actions at the referral healthcare facility (Timika Army Hospital Grade.IV): Re-evaluation of wound condition. Vital signs: blood pressure 96/57 mmHg, pulse 120 beats/minute, respiratory rate 19 breaths/minute, SpO2 99%. Laboratory tests: haemoglobin 9.3 g/dL, leukocytes 16,500/mm3, platelets 250,000/mm3, CT 3.5 seconds, BT 6.3 seconds, and GDS 120 mg/dL. An open wound on the left knee, an open fracture of the left distal intercondylar femur, an open fracture of the left tibial plateau, and left knee hematrosis were found. The procedures performed were debridement, repair of the left popliteal artery, repair of the wound, and application of a backslab. After 48 hours of surgery, the patient was treated in the ICU of Timika Army Hospital grade IV and referred to Gatot Subroto Army Hospital Jakarta.

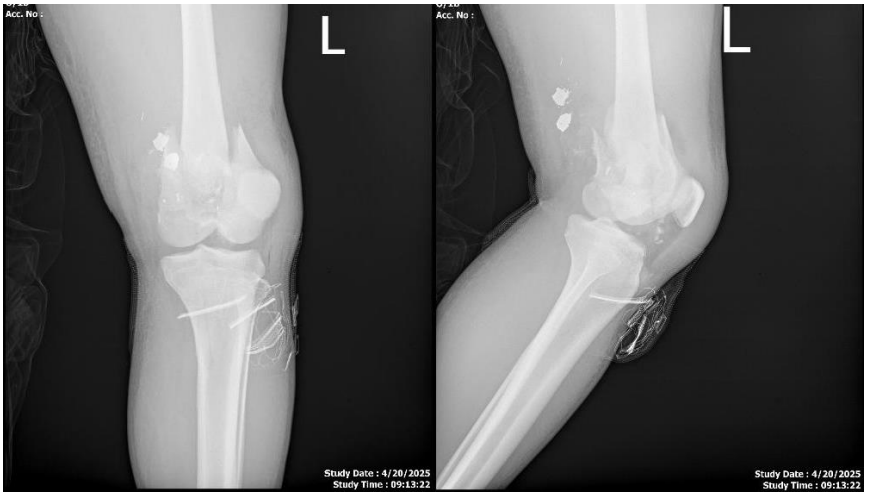

Figure 2. X-ray of the left genu during the patient's first referral.

Upon arrival at Gatot Subroto Army Hospital Jakarta, the patient's vital signs were as follows: blood pressure 125/80 mmHg, pulse 88 beats per /minute, respiratory rate 18 breaths per minute, and SpO2 99%. The patient underwent three surgical procedures: The patient underwent three surgeries. The first surgery involved debridement, extraction of a foreign body (projectile), and fasciotomy;. The second surgery involved vascular repair using a graft from the great saphenous vein. The third surgery involved amputation of the left leg.

Final outcome: the patient survived, the surgical wound healed appropriately, and post-amputation physical rehabilitation was initiated.

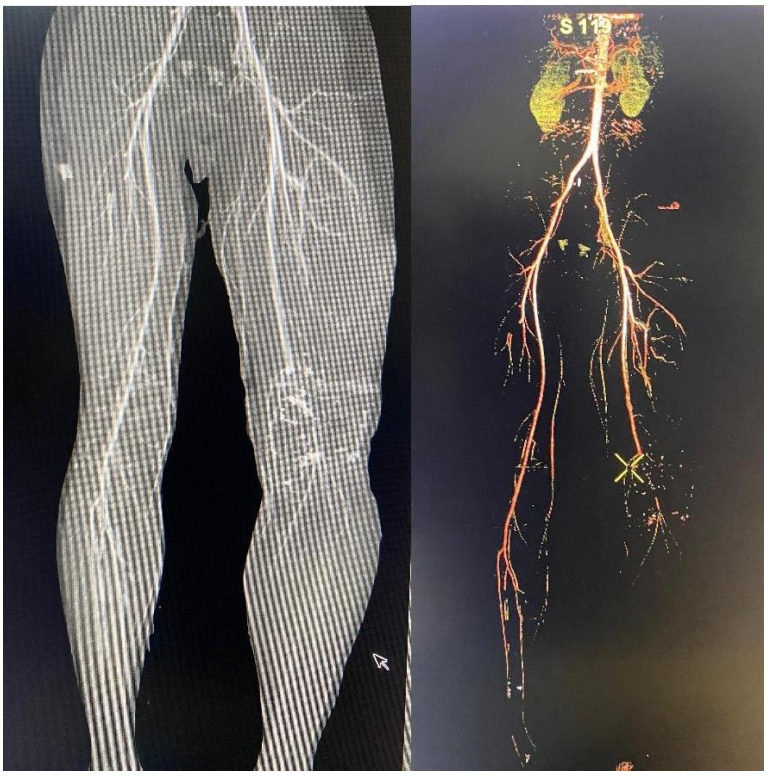

Figure 3. MRI of the patient when referred to Gatot Subroto Army Hospital

Figure 4. Projectile successfully extracted at Gatot Subroto Army Hospital

Figure 5. Post-amputation patient above the left knee region

Discussion

This case describes penetrating trauma to the lower extremities due to a projectile gunshot wound, with a wound in the anterior cruris proximal sinistra region. Initial management in the field followed the principles of Tactical Combat Casualty Care (TCCC), the gold standard for treating combat casualties, especially in active, high-risk field conditions.[1] Mortality in patients with extremity bleeding treated with a tourniquet (TCCC application) is 13%. When the tourniquet is applied before the onset of shock, survival is very high at 90% compared to 10% if applied after shock,[1] which is an application of the TCCC protocol.

In the early stages, patients show signs of active bleeding and severe pain, with Compos Mentis consciousness (E4V5M6). However, a comprehensive examination was not feasible due to ongoing gunfire. The team implemented Care Under Fire and Tactical Field Care in accordance with TCCC protocol.[3-4]

1) Primary bleeding control:
   - Application of a proximal tourniquet to control massive bleeding, as recommended by the Committee on Tactical Combat Casualty Care (CoTCCC), which emphasizes the use of tourniquets for life-threatening bleeding in the extremities.
   - Use of Celox hemostatics and Combat Gauze, which are effective for bleeding from gunshot wounds with extensive soft tissue damage.
   - Bandaging with an elastic bandage provides additional pressure and minimizes further blood loss.
2) Initial stabilization:
   - Analgesia with metamizole IM and administration of antifibrinolytic (Tranexamic acid 1000 mg IM), supporting pain control and preventing further bleeding.
   - Oral rehydration to address the risk of dehydration due to trauma and bleeding.

These interventions are life-saving and sustained the patient until safe evacuation was possible, aligning with the core principles of TCCC: control life-threatening hemorrhage, maintain airway, and prevent shock.[3-4]

The primary objectives of initial treatment gunshot wounds in conflict zones are to stop bleeding, prevent shock, and stabilize the patient for evacuation. The principles of Tactical Combat Casualty Care (TCCC) are applied, including: Care Under Fire: controlling bleeding with

a tourniquet as quickly as possible, Tactical Field Care: administering fluids, analgesics, and antibiotics, and Tactical Evacuation Care: coordinated medical evacuation to higher command and referral hospitals. This case confirms that tactical medical training for Task Force Health personnel has a significant impact on the safety of gunshot victims before they reach the hospital. [3-4]

At Timika Army Hospital g.IV, evaluation revealed a complex open fracture of the distal femur and left tibial plateau, hemarthrosis, and probable injury to the left popliteal artery. Initial surgical management included debridement and popliteal artery repair; however, the patient ultimately required amputation of the left leg at Gatot Subroto Army Hospital.

Vascular injuries of the extremities are a severe complication of combat trauma, often causing extensive tissue damage including blood vessels, soft tissue, nerves, and bones. Delayed or inadequate management of these injuries increasing the risk of limb loss or mortality.[5-6]

The necessity for amputation in this case is attributable to the missed 'golden period' of reperfusion, which refers to the critical time window to reperfusion is necessary before irreversible tissue damage occurs. Vascular injuries to the extremities require reperfusion within 6 hours of injury to reduce the risk of permanent ischemia. If this period is exceeded, the risk of amputation rises significantly, and amputation may become the only viable life- saving intervention to eliminate the source of toxins, prevent sepsis and prevent multiple organ failure. Amputation ultimately results in permanent disability. In this case, evacuation and definitive treatment occurred more than six hours after injury due to hazardous battlefield conditions, resulting in tissue necrosis and ischemic complications despite successful popliteal artery reconstruction. Studies indicate that delayed limb reperfusion, in complex injuries with open fractures, significantly increases the risk of amputation even when vascular repair is achieved.[7-9]

Additional factors contributing to the high risk of amputation in this case include open distal femur and open tibial plateau fractures with associated vascular injury and gunshot wound contamination. According to the Gustilo-Anderson classification, these injuries are categorized as Open Fracture Class IIIC, which carries an amputation rate of 78% even following vascular repair.[2]

Although the patient ultimately underwent amputation and significant permanent disability, the principles of TCCC successfully saved the patient's life and enabled post- operative rehabilitation. This case emphasizes the need for rapid evacuation integrated with bleeding control and hemodynamic stabilization to maximize the chances of limb salvage in combat casualties.

Conclusion

TCCC has demonstrated its effectiveness in improving survival in gunshot wounds, particularlyin cases extremity gunshot wounds. Missing the golden period for evacuation and organ revascularization can result in life-saving amputations, leading to disability, and a reduced quality of life.

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