

Management of Polytrauma in Limited Resources: A Case Report and Literature Review

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ABSTRACT

Background: Polytrauma is widely known with high mortality and morbidity, especially in developing countries. Effective management requires a multidisciplinary to improve patient outcomes. The case report highlights the importance of live-saving interventions and adherence to trauma management principles, even in rural areas with limited resources.

Case Report: A 27-year-old woman sustained with multiple injuries including moderate trauma brain injury and fractures of the left middle-third proximal humeral, right middle-third distal radius, bilateral middle third distal femur, left neck femur, inferior pubic symphysis and right first posterior rib. Emergency surgery was performed and she was admitted to Intensive Care Unit (ICU). She made a good recovery despite complication such as brachial plexus injury in right hand and peroneal nerve injury on the right foot. She was discharged two weeks later.

Discussion: Managing of polytrauma is particularly challenging due to the absence of a universally accepted treatment protocol. This patient had an Abbreviated Injury Scale (AIS) ≥ 3 in multiple organs (head, thorax, extremities), systolic blood pressure (SBP) ≤ 90 mm Hg, and Injury Severity Score (ISS) of 45, categorizing her as

unstable (grade III). The application of Damage Control Orthopedics (DCO) principles led to favorable outcomes.

Conclusion: In resource-limited rural settings, timely emergency response, accurate clinical decision-making, access to essential medical resources, and trained personnel are critical to reducing morbidity and mortality polytrauma cases. This case underscores the effectiveness of DCO in managing complex trauma.

Keywords: Polytrauma, Multiple fractures, Damage Control Orthopedics

INTRODUCTION

Polytrauma remains a significant public health issue globally. The World Health Organization (WHO) identifies it as a critical challenge requiring prioritized healthcare strategies. According to WHO in 2023 approximately 1.19 million people die each year due to road traffic collisions. These incidents are now the primary cause of death among individuals aged 5-29 years, with 92% of fatalities occurring in low- and middle- nations. Speeding remains a key contributor, with each 1% increase in mean speed raising the risk of fatal crashes by 4% and serious crashes by 3%.¹ According to the Indonesia Police reported, there were 148.575 road traffic accidents in 2023,

resulting in 22,172 fatalities – an average of 60 deaths per day.²

Pelvic fractures in polytrauma are often accompanied by visceral, vascular and/or neurological injuries due to high-energy trauma required to disrupt the pelvic ring.³ Many of these deaths are preventable but are often exacerbated by delays in definitive care caused by poor infrastructure, lack of prehospital trauma services, and long transport times that exceed the critical “golden hour”.^{4,5}

Polytrauma management is inherently complex and lacks a universally endorsed treatment pathway.⁴ A multidisciplinary approach incorporating principles of Damage Control Orthopaedics (DCO) or Early Total Care (ETC) is essential to achieving positive outcomes.⁶ This case illustrates the importance of timely intervention and trauma care in low-resource, rural environment.

CASE REPORT

A 27-year-old woman arrived at the emergency department approximately one hour motor vehicle collision. She was in semi-conscious and hypovolemic shock, presenting with a Glasgow Coma Scale (GCS) 13/15, blood pressure of 87/54 mmHg, pulse rate of 126 bpm, respiratory rate 28 breaths/min, and oxygen saturations of 91%.

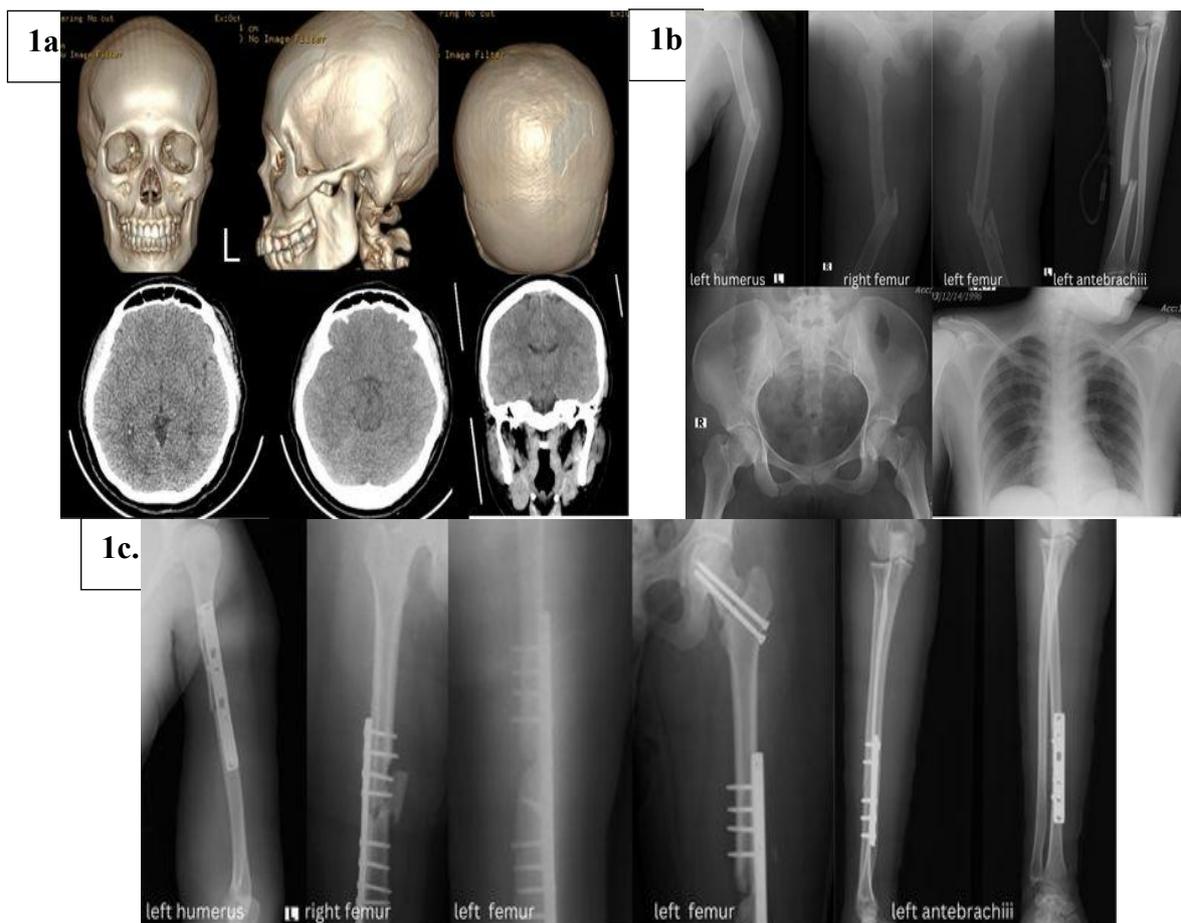
Primary survey revealed multiple injuries, including a large scalp laceration (10x5 cm) from the left forehead to the orbit bruising on the right posterior thorax, and deformities in both upper and lower limbs. There was no evidence of nasal or ear bleeding, and pupillary responses were intact. Significant deformities with tenderness and crepitus were noted in the right distal radius, left proximal humerus, bilateral distal femur, and left lower leg which also showed two open wounds (8x4cm and 3.5x2 cm) with active bleeding.

Initial management included cervical immobilization, compression bandaging limb splinting, IV fluid resuscitation with two liters of crystalloid and urinary catheterization (600mL clear urine output). After stabilization, the patient regained full consciousness (GCS 15), with improved vital sign: BP 110/64 mmHg, pulse 105 bpm, RR 22bpm. Radiographs and CT imaging confirmed the following injuries. Head CT showed right frontal lobe hemorrhagic contusion, subdural hematoma along the falx cerebri and right tentorium cerebelli, subarachnoid hemorrhage in bilateral frontal regions, cerebral edema, subgalea hematoma, and soft tissue defect from the left frontal scalp to orbit. Xray showed 112.1 (humerus), 2RA2 (radius), 21B3 (pelvis), 32A1b and 32B3b (bilateral femur) according to AO classification.

The patients underwent emergency surgery 12 hours post-admission, involving a joint procedure by

orthopedic and neurosurgical teams. Surgical interventions included craniotomy with debridement, and open reduction and internal fixation (ORIF) of the right distal radius, ulna, left humerus and bilateral femur. Postoperatively, she was admitted to intensive care unit (ICU), received four units of blood, and was extubated after two days. On day seven, she was undergoing a second surgery of ORIF left femoral humerus, followed by another short ICU stay. Recovery was largely uneventful, though she developed a brachial plexus injury affecting her right hand and peroneal nerve palsy leading to foot drop on the right side.

She was discharged in stable condition two weeks after admission, using a wheelchair. At a two-week follow-up, her left hand and leg had returned to normal function, while the right-hand exhibited muscle atrophy and the right leg continued to show signs of foot drop.



Figures 1 A) CT-scan and Plain X-ray film of head. B) Plain X-ray of left humerus, right femur, left femur, left radius and ulna, pelvis and thorax before surgery. C) ORIF on left humerus, right femur, left femur, and left radius ulna.

DISCUSSION

Managing polytrauma presents significant challenges due to the absence of a universally accepted treatment protocol.⁴ The initial approach typically follows the Advanced Trauma Life Support (ATLS) protocol, which prioritizes the ABCDE method – Airway, Breathing, Circulation, Disability, and Exposure to evaluate the severity of injuries and determine treatment direction.⁶ Mortality in polytrauma can occur in three distinct phases:⁸

1. Immediately deaths within minutes of injury, usually due to massive haemorrhage or severe traumatic brain injury.
2. Early deaths within the first four hours, commonly from uncontrolled internal bleeding in thoracic, abdominal, or pelvic cavities.

3. Late death occurring days to weeks later, typically due to sepsis or multi-organ failure.

The definition of polytrauma have progressed. Earlier criteria used an Abbreviated Injury Scale (AIS) >2 across two or more anatomical regions. The updated New Berlin now incorporated patients with AIS ≥ 3 in at two or more body, plus at least one of five physiologic risk markers: systolic blood pressure (SBP) ≤ 90 mmHg, Glasgow Coma Scale (GCS) ≤ 8 , base excess ≤ -6.0 , Coagulopathy (PTT ≥ 40 seconds or INR ≥ 1.4), and age ≥ 70 years.^{9,10}

Effective management begins at the trauma scene and must continue seamlessly through the prehospital phase, emergency department, and operating room, emphasizing coordinated and timely care within the “golden hour”.^{11,12} Advances in

our understanding of trauma pathophysiology and immune response have shifted treatments paradigms over time.¹³

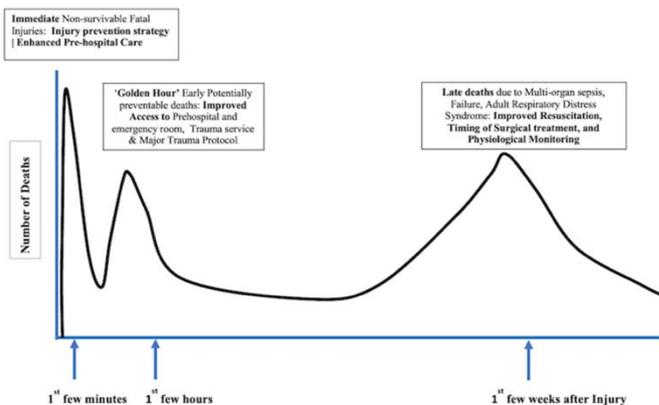


Figure 2. Timeline Following Polytrauma.⁷

This has resulted in a transition from traditional Early Total Care (ETC) to newer strategies such as:^{7,14,15}

Management Strategy	Core Principle	Potential Limitations
Early total care (ETC)	Carries out complete fixation of major fractures within 48-72 hours.	May trigger systematic complications or the “second hit” phenomenon in hemodynamically unstable patients, increasing morbidity and mortality in those with high ISS.
Damage control orthopedics (DOC)	Focuses on early temporary stabilization. Followed by definitive surgical repair one the patient’s contrition improves	Prolonged hospital risk; risk of complications; need for secondary procedures; requires resource availability.
Early appropriate care (EAC)	Bases timing of surgery on physiological stability (e.g. lactate, pH, CRP, and inflammatory markers).	Resource-demanding; necessitates real-time lab monitoring and individualized surgical timing.
Safe definitive surgery (SDS)	Tailors the surgical plan to patient stability – offering definitive care for stable cases and DCO for unstable patients.	Minimized reoperations in selected patients; like DCO but with individualized timing.
Prompt individualized safe management (PRISM)	Customized care based on patient condition, comorbidities, and local resource availability.	Effectiveness relies heavily on expert clinical judgement and availability of multidisciplinary support.

Table 1. Characteristics and Risks of Different Polytrauma Management Strategies.^{7,14,15}

In the present case, the patient arrived with clear airways and stable respirations but exhibited sign of hemorrhagic shock. Immediate resuscitation with 2000 mL of crystalloid was initiated, along with the cervical immobilization and splinting of all four limbs. Once stabilized, radiographic and CT Assessment were performed X-ray and head CT scan are performed.

Polytrauma is defines by the presence of multiple life-threatening injuries. Patients ofen show sign as hemorrhagic shock, coagulopathy, hypothermia, and soft tissue injuries may occur. An ISS >16 is associated with a mortality risk exceeding 10%. In this case, the patient had AIS ≥ 3 in multiple body organs (head, thorax and extremities), hypotension (SBP ≤ 90 mm

Hg) and an ISS of 45, classifying her as grade III unstable. Based on these findings, Damage Control Orthopedics (DCO) was chosen, with staged surgical interventions. This approach

minimized further physiological stress while addressing life-threatening injuries first. Ultimately, the patient achieved a good outcome despite neurological complications.

Indicator	Mildly Affected (Grade I)	Borderline State (Grade II)	Unstable State (Grade III)	Critical State (Grade IV)
Systolic BP (mmHg)	≥100	80-100	60-90	<60
Blood transfusion (first 2 hour)	0-2 units	Up to 8 units	Up to 15 units	>15 units
Approx. Lactate Level	Normal	Slightly increased	Moderate high (<2.5)	Severe acidosis
Base deficit (mmol/L)	Normal	-	-	>6 to 18
ATLS classification	I	II-III	III-IV	IV
Urine output (per hour)	>150 mL	50-50 mL	<100 mL	<50 mL
Platelet count (x10 ³ /μL)	>110	90 - 110	70 - 90	<70
Coagulation Factor II and V (%)	90-100	70-80	50-70	<50
Fibrinogen (g/dl)	>1	Approx. 1	<1	DIC
D-dimer	Normal	Elevated	Abnormal	DIC
Core Temperature (°C)	>34	33-35	30-32	<30

Table 2. Physiological and Laboratory Markers in Polytrauma.¹⁰

Trauma Components	Mild	Moderate	Severe	Extensive/ Life-Threatening
Lung oxygenation; PaO ₂ /FiO ₂	>350	~ 300	200-300	<200
Chest injury score (AIS)	I or II	II or higher	II - III	≥ III
Thoracic trauma; TTS	0	I-II	II-III	IV
Abdominal trauma (Moore)	≤ Grade II	≤ Grade III	Grade III	Grade ≥ III
Pelvic ring injury (AO classification)	A	B or partially C	Full disruption (C)	AO-C with vascular compromise
Limb involvement (AIS)	I-II	II-III	III-IV	Crush, rollover mangled limb.
Recommend Surgical Plan	ETC or DCO	DCO or staged ETC	DCO	Emergency DCO

Table 3. Injury Pattern and Recommended Surgical Strategy in Polytrauma.¹⁰

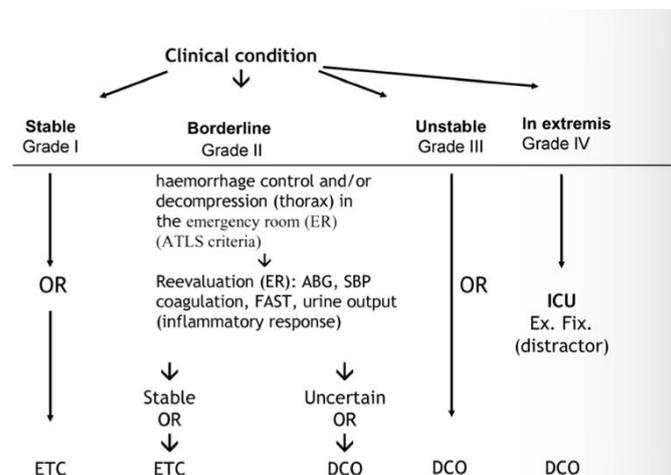


Figure 3. Treatment Protocol based in Clinical Conditions in Polytrauma.¹⁰

CONCLUSION

In rural environments with limited healthcare infrastructure, rapid emergency response, timely decision-making, adequate medical resources, and trained healthcare providers are essential for managing polytrauma effectively. The implications of Damage Control Orthopedic can significantly improve outcomes in patients with polytrauma, even under resource-constrained conditions.

Declaration by Authors

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REFERENCES

1. World Health Organization. Road Traffic Injuries. [Internet] 2023 [updated 2023 December; cited 2024 Oct 14]. Available from: <https://www.who.int/news-room/factsheets/detail/road-traffic-injuries#:~:text=Approximately%201.19%20million%20people%20die,adults%20aged%205-29%20years.>
2. GoodStat. 2023 Capai Angka Tertinggi Kecelakaan Lalu Lintas 5 Tahun Terakhir. [Internet] 2023 [updated 2023 May; cited 2024 Oct 14]. Available from: [https://goodstats.id/article/2023-capai-angka-tertinggi-kecelakaan-lalu-lintas-5-tahun-terakhir-z67bk.](https://goodstats.id/article/2023-capai-angka-tertinggi-kecelakaan-lalu-lintas-5-tahun-terakhir-z67bk)
3. J. Samona, R. Colen, Orthopedic Considerations in the Pedestrian versus Motor Vehicle Accident Polytrauma Patient. *Case Reports in Orthopedics*. 2012 Jun 17; 201:149847. DOI: 10.1155/2012/149847
4. Massaga F, Washington LA, Ngayomela IH, et al. Management of a Road Traffic Accident Poly-Trauma Patient in a Limited Regional Resource Hospital Setting in Tanzania: Review of Literature and Case Report. *International Journal of Surgery Case Reports*. 2023 Sep: 110:1088764. DOI: 10.1016/j.ijscr.2023.108764
5. Premji EN, Kilindimo SS, Sawe HR, et al. Patterns and predictors of Timely Presentation and Outcomes of Polytrauma Patients Referred to the Emergency Department of a Tertiary Hospital in Tanzania. *Emerg. Med. Int*. 2022 Nov 4:2022:9611906. DOI: 10.1155/2022/9611602
6. Merchan CR, Juan CRS. *Complex Fractures of the Limbs: Diagnosis and Management*. New York: Springer. 2014 p. 137-146. DOI:10.1007/978-3-319-04441-5
7. Iyengar KP, Venkatesan AS, Jain VK, et al. Risks in the Managements of Polytrauma Patients: Clinical Insights. *Orthopedic Research and Review*. 2023;23:27-38. DOI: 10.2147/ORR.S340532
8. Keel M, Trentz O.. Pathophysiology of polytrauma injury. *Injury*. 2005 Jun;36(6):691-709. DOI: 10.1016/j.injury.2004.12.037
9. Rau CS, Wu RS, Kuo PJ, Chen YC, et al. Polytrauma Defined by the New Berlin Definition: A Validation Test Based on Propensity-Score Matching Approach. *International Journal of Environmental research and Public Health*. 2017 Sep 11;14(9):1045. DOI: 10.3390/ijerph14091045
10. Pape HC, Giannoudis PV, Krettek C, et al. Timing of Fixation of Major Fractures in Blunt Polytrauma. Role of Conventional Indicators in Clinical Decision Making. *Journal of Orthopaedic Trauma*. 2005 Sep;19(8):551-562. DOI: 10.1097/01.bot.0000161712.87129.80
11. Devendra A, Nishith PG, Dilip Chand Raja S, et al. Current updates in management of extremity injuries in polytrauma. *Journal of Clinical Orthopaedics and Trauma*. 2021;12(1):113-122. DOI: 10.1016/j.jcot.2020.09.031
12. Payal P, Sonu G, K GA, Prachi V. Management of Polytrauma Patients in Emergency Department: an Experience of a Tertiary Care Health Institution of Northern India. *World Journal of Emergency Medicine*. 2013;4(1):15-19. DOI: 10.5847/wjem.j.issn.1920-8642.2013.01.003
13. Moore TA, Simske NM, Vallier HA. Fracture fixation in the polytrauma patient: markers that matter. *Injury*. 2020 May;51(2):S10-S14. DOI: 10.1016/j.injury.2019.12.024
14. Upadhyaya GK, Iyengar KP, Jain VK, et al. Evolving concepts and strategies in the management of polytrauma patients. *J Clin Orthop Trauma*. 2021;12(1):58-65. DOI: 10.1016/j.jcot.2020.10.021

15. Pharon SK, Schoch S, Marchand L, et al. Orthopaedic Traumatology: Fundamental Principles and Current Controversies for the Acute Care Surgeon. Trauma Surgery Acute Care Open. 2018 Jan;3(1):e000117. DOI: 10.1136/tsaco-2017-000117

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