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Brief Communication

A novel forward-deployed damage control orthopedics: Battlefield Monitoring and Stabilization (BMS)

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Abstract: Delayed evacuation creates a critical gap between point-of-injury care and definitive surgical management in battlefield trauma. Although Damage Control Orthopedics (DCO) is an established strategy for physiologically unstable trauma patients, it is usually implemented after evacuation and depends on higher-level medical support. We propose Battlefield Monitoring and Stabilization (BMS) as a forward-deployed conceptual framework for earlier battlefield care. BMS emphasizes temporary stabilization, hemorrhage-oriented intervention, basic physiological support, and portable monitoring before evacuation and definitive treatment. Proposed applications include point-of-injury stabilization, prolonged field care, and en-route casualty management. Several enabling components, including a rapidly assembled pelvic stabilization device, are under development. Relevant evaluation domains include fixation speed, hemostatic performance, monitoring accuracy, portability, and environmental adaptability. Further validation is warranted.

Keywords: Damage control orthopedics, battlefield trauma, hemorrhage control, fracture stabilization, physiological support, frontline care

Delayed evacuation in battlefield creates a critical gap between point-of-injury care and definitive surgical management [1-4]. Although Damage Control Orthopedics (DCO) is an effective strategy for physiologically unstable trauma patients, it is usually performed after evacuation and depends on higher-level medical support [5-7]. In casualties with limb or pelvic fractures, ongoing hemorrhage, mechanical instability, and limited monitoring capability may lead to preventable deterioration due to this interval [8-10].

To address this gap, we propose Battlefield Monitoring and Stabilization (BMS), a forward-deployed framework intended to extend selected damage-control principles to earlier phases of battlefield care. Rather than representing a single device or a replacement for conventional DCO, BMS is conceived as a transitional care concept that emphasizes early temporary stabilization, hemorrhage-oriented intervention, basic physiological support, and portable monitoring before evacuation and definitive treatment (**Table 1**). The proposed application scenarios of BMS include point-of-injury stabilization, prolonged field care under delayed evacuation, and en-route casualty management. Its workflow involves rapid casualty assessment, immediate bleeding control, recognition of suspected pelvic or limb instability, deployment of the stabilization module, initiation of portable monitoring, and serial reassessment during transport. BMS is intended to be tiered, with basic functions performed by trained combat medics and more advanced procedures undertaken by physicians or other appropriately trained personnel.

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Table 1. Comparison between Conventional Damage Control Orthopedics (DCO) and Battlefield Monitoring and Stabilization (BMS)

Item	DCO	BMS
Nature	Established staged trauma strategy	Forward-deployed conceptual framework
Timing	After evacuation	Before or during evacuation
Setting	Higher-level medical support	Austere battlefield setting
Main purpose	Temporary stabilization before definitive fixation	Transitional stabilization and monitoring before definitive care
Target phase	Post-evacuation unstable trauma care	Point-of-injury, delayed evacuation, and en-route care
Monitoring	Facility-based	Portable/field-based
Orthopedic focus	Temporary fracture stabilization	Early temporary limb/pelvic stabilization
Personnel	Surgeons and hospital trauma teams	Tiered personnel, including combat medics and physicians

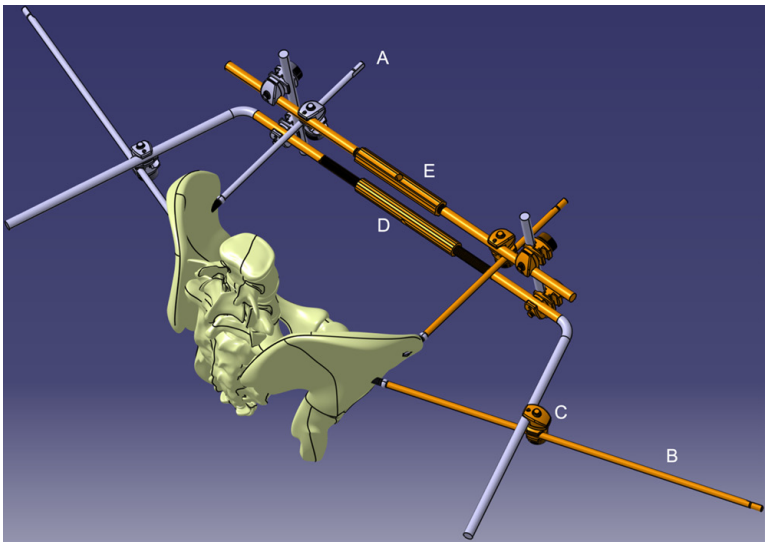

Figure 1. A rapidly assembled pelvic stabilization device. A, B. Novel external fixation pins for anterior and posterior pelvic ring. C. Rapidly assembled joint. D, E. Adjustable stabilization frames for anterior and posterior pelvic ring.

As BMS is currently presented as a conceptual proposal, objective evaluations should focus on the feasibility and performance of its enabling components and implementation processes. Several enabling components, including the rapidly assembled pelvic stabilization device (**Figure 1**), are under development to facilitate practical implementation of the BMS concept in austere battlefield settings. Relevant metrics may include assembly time, fixation success rate, simulated hemostatic performance, agreement of monitoring outputs with reference devices, total system weight, packed dimensions, and operational performance under adverse environmental conditions. Further bench, simulation, and field-oriented validation studies are warranted.

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Disclosure of conflict of interest

None.

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