

**Trauma Center Practice Management Guideline**  
*Iowa Methodist Medical Center — Des Moines*

<b><i>Damage Control Orthopedic Surgery</i></b>	
<b>ADULT – Orthopedic Practice Management Guideline</b>	Effective: 5/2017
<b>Contact: Trauma Center Medical Director</b>	Last Reviewed: 4/2024

**PURPOSE:**

Orthopedic damage control strategy is to perform only those interventions needed to preserve life or limb until the patient is resuscitated.

**STATEMENT OF THE PROBLEM:**

Damage control surgery is utilized for critically ill or injured patients as an early initial step to definitive surgical management. The underlying principle of damage control strategy is to perform only those interventions needed to preserve life or limb until the patient is resuscitated. This approach implies that early procedures are often truncated, with a view toward staged definitive interventions over the ensuing days. **Damage control surgery that prioritizes resuscitation and correction of metabolic derangements, coagulopathy, hypothermia, and/or resolution of soft tissue injuries over early definitive surgical repair.**

In orthopedic surgery, the focus of damage control surgery is often to control hemorrhage, decrease contamination through debridement, and provide bone and soft tissue stabilization to patients unable to undergo definitive repair. External fixation is often used in damage control orthopedic surgery, particularly in femur fractures, to minimize ongoing soft tissue damage, decrease risks of fat embolism, control hemorrhage and contamination, alleviate pain due to fracture motion, and facilitate patient mobilization. Additionally, external fixation is used to regain and/or maintain gross length, rotation, and alignment of extremities with unstable fractures and soft tissue injuries that preclude early internal fixation.

After a period of resuscitation, patients are taken back to the operating room for definitive management of their injuries. In general, patients who could benefit from damage control surgery are those undergoing emergent control of life-threatening injuries by other disciplines (for example, trauma surgery, neurosurgery, and so on) or who are reaching the limits of their physiologic reserve as determined by the presence of hypothermia, coagulopathy, and/or acidosis, or who have severe closed or open soft tissue injuries.

Severe compromise of this soft-tissue envelope presents another indication for damage control surgery. Examples of this issue include heavily contaminated open fractures or closed injuries that historically have been shown to do poorly with acute open reduction and internal fixation (ORIF), such as pilon fractures and bicondylar tibial plateau fractures (unicondylar plateau fractures are typically amenable to immediate ORIF). Soft tissue injuries evolve over the hours or days following injury. In this context, temporary approaches to skeletal fixation allow the full extent of the soft tissue injury to declare itself before committing to a definitive internal fixation.

### **Timing of Definitive Repair following Damage Control Surgery**

There is considerable variability in the duration and severity of physiologic derangements that occur after trauma. In many cases, these derangements may be short lived and early definitive fracture management may be pursued. In others, definitive management may be significantly delayed. The optimal timing and physiologic targets that indicate it is safe to proceed to definitive management are controversial. Normalization of heart rate and blood pressure are important, but measures of adequate resuscitation, including an improving base deficit or lactate, might be more accurate to inform decision making. A retrospective review of traditionally resuscitated patients with an injury severity score (ISS) of >18 and a femur fracture stabilized within 24 hours of admission found that patients with a lactate of >2.5 had a higher pulmonary and infectious complication rate when compared with those with a normal lactate. Additionally, patients with severe traumatic brain injury proceeding to definitive fixation are less likely to have dips in their cerebral perfusion pressure in the operating room if they have been adequately resuscitated. **Although there is no clearly identified end point for resuscitation, we will aim to have improved hemodynamics, bleeding control, improved base deficit and lactate as well as adequate peripheral oxygen delivery before considering definitive repair of orthopedic injuries.**

### **Long Bone Fractures**

Historically, long bone fractures were acutely managed with traction due to a perceived increased risk of fat embolization syndrome (FES) in the time immediately following injury. However, several decades of research have demonstrated the benefits of early stabilization of long bone fractures with no increased risk of FES or their sequelae.

**Based on current evidence, long bone fractures should be stabilized early in multiply injured patients.** The method for doing so depends on whether a damage control approach is required. If the patient presents with isolated injuries and there is no indication for damage control surgery (resuscitated patient, no severe traumatic brain injury (TBI), adequate soft tissue envelope), then early definitive stabilization is appropriate. For these patients, earlier stabilization simply leads to a decreased length of hospital stay and a lower risk of complications related to immobilization. However, for patients in extremis or those in whom resuscitation is incomplete, alternatives to definitive fixation need to be considered, most commonly external fixation.

### **Patients with Thoracic Injuries and a Femoral Shaft Fracture**

This injury pattern was the initial focus of damage control orthopedics, with the concern being significant worsening of pulmonary dysfunction due to FES. If the patient has been adequately resuscitated and meets no other indication to hold off on definitive fixation, there appears to be little risk to proceeding. The exception might be patients who at or shortly following presentation have evidence of **significant pulmonary dysfunction on high levels of ventilatory support** who could not tolerate any nonessential operative procedure. **Temporary external fixation might be reasonable in this scenario.**

### **Patients with Concurrent Severe Traumatic Brain Injury**

Special consideration should be given to patients with concomitant orthopedic and TBI. The management of fractures in patients with TBI represent a particular challenge in that early surgical fixation may complicate the acute management of TBI. The goals of acute TBI management are to maintain adequate cerebral perfusion, prevent hypotension, provide adequate oxygenation, avoid hypo- and hypercarbia, and maintain normothermia. Efforts should be made to adhere to each of these goals. Intraoperative monitoring of intracranial pressure (ICP) should be considered to support cerebral perfusion pressure. In the context of a stable ICP and mean arterial pressure (MAP), definitive fixation can be considered in the resuscitated patient, as these patients are less apt to experience transient episodes of hypotension in the operating room. **The under-resuscitated patient or those patients whose ICP and cerebral perfusion pressure (CPP) have not yet stabilized are best served with damage control procedures or traction.**

## **RECOMMENDATIONS:**

- Orthopedic damage control surgery should be considered as the first stage of intervention when early definitive surgical management is not possible, typically in patients who are critically injured or those with significant soft tissue injuries pending resuscitation and/or soft tissue injury resolution.
- Damage control surgery should be considered in patients who demonstrate:
  - Severe traumatic brain injury
  - Not adequately resuscitated
    - Ongoing fluid and blood requirements
    - High base deficit or lactate, which are not improving
    - Pulmonary dysfunction requiring significant ventilatory support
  - Open or closed compromised or suspected compromise of soft tissues (soft tissue loss, significant contamination, severe closed soft tissue injury)
- **The use of damage control orthopedic surgery will be monitored by the trauma performance improvement program (PIPS).**
- If a patient is in extremis, it is reasonable to place a skeletal traction pin to aid in bony stabilization and alignment. Similarly, patients with femur or pelvis fractures who are not stable enough to be anesthetized for placement of external fixation or are unable to tolerate the additional blood loss or physiologic insult may benefit from a period of skeletal traction.
- Once patients are in the operating room for management of concurrent injuries or able to physiologically tolerate operative intervention, formal stabilization with external or definitive fixation should be performed.

## **REFERENCES:**

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