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Volume 2 • Issue 5 • 2018

Scientia Ricerca

Editorial

Orthopaedic Surgery and Traumatology

ISSN: 2573-4962

Damage Control Orthopaedics: Current Concepts and Trends

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Received: October 10, 2018; **Published:** November 05, 2018

Volume 2 Issue 5 November 2018

Surgeons use damage control orthopedics (DCO) to treat patients with critical injuries by temporarily stabilizing the fractures so that the patient's general condition can improve. The purpose is to avoid worsening the patient's condition by the "second stroke" of a major orthopedic procedure. The surgeon's strategy focuses on controlling bleeding, controlling the soft tissue injury and the stability of the fracture, avoiding additional trauma for the patient. When a person is injured, particularly a patient with polytrauma in which multiple bones are broken and internal organs are damaged, the body responds by releasing inflammatory mediators (fluids, including blood and cells intended to heal and protect).

As a result of the injury, the traumatized patient also experiences damaging physiological changes, such as a large blood loss that leads to decreased oxygenation of the tissues (blood cells carry oxygen) and large amounts of blood replacement that can cause abnormalities in the coagulation. The patient may also be affected by acute respiratory distress syndrome (ARDS), a condition caused by fluids that seep into the lungs and reduce oxygen. In addition, the patient becomes susceptible to infection and can become septic (an infection in the bloodstream). Finally, these factors often affect the traumatized patient in a short period of time, and this serious combination can lead to multiple organ failure and death.

Surgery itself is a type of trauma that can exacerbate the release of inflammatory mediators, increase blood loss and cause damage to the lungs. Consequently, surgeons want to minimize what is known as a "second stroke" of extensive surgery in the initial period after a traumatic injury. Therefore, the surgeon can temporarily stabilize the fracture to limit blood loss, tissue damage and the release of inflammatory mediators.

DCO is an evolving field. Its benefits were demonstrated during the First World War with the use of the Thomas splint for fractures of the femur. The mortality rate was 80% for these wounds before the splint was used for temporary stabilization. The rate fell to 20% after doctors began to apply the splint in ambulances. By the end of the century, the trend shifted toward surgical treatments for stabilization, usually with an internal fixator, such as a nail to keep the fractured femur bone in place.

However, additional studies appeared to demonstrate that a surgery that stabilizes the femur with a nail may have created a "second stroke" that led to increased release of inflammatory mediators and pulmonary complications (lungs). Therefore, the trend then shifted towards less invasive treatments, such as the use of an external fixator, such as pins inserted through the skin and into the bone to

temporarily stabilize the fracture. Furthermore, larger studies showed that the definitive early fixation of femur fractures actually had a lower overall mortality, especially if both femurs were broken.

The "second stroke", once attributed to the spiking of the femur, is now thought to be related to the use of crystalloids (fluids) in large quantities during resuscitation (administration of emergency procedures to maintain life) of the patient. A change in the use of blood products, instead of crystalloids, and other treatments that improve the oxygenation of the tissues, as well as a change towards the early fixation of the femur with nails, has helped to improve survival after polytrauma.

Currently, we seek to identify and refine which patients have the highest risk of surgery. Currently we use a marker inside the blood that reflects the level of tissue recovery and oxygenation. Lactic acid is formed when the body breaks down carbohydrates to use as energy when oxygen levels are low. When a patient has decreased the oxygenation of tissues, lactic acid accumulates; therefore, we can measure the level of serum lactate to determine the best course of treatment. It has been found that this is the most sensitive perfusion marker (passage of fluids through the body).

Surgeons seek to have the lactate level below a certain level, which demonstrates adequate oxygenation and perfusion of the tissues, before surgery. Conversely, high lactate levels confer an increased risk for surgery and the need for additional recovery before an operation. When a patient arrives at a traumatology center with life-threatening injuries and fractures, rushing to surgery to stabilize the fracture is not always a good treatment plan. The fracture should stabilize to help control the body's responses, but sometimes a temporary solution may be a better option. Starting the DCO and waiting until the patient is stable and in optimal conditions for surgery is usually the best treatment plan.