

PELVIC RING FRACTURES

By Ronald R Romanelli, M.D.



"With our advanced treatment and internal fixation and anatomical restoration of the pelvic ring, we significantly helped trauma patients with pelvic ring disruptions."

Despite a relatively mild winter, most people in central and southern Illinois will look forward to the upcoming warm weather. Unfortunately, the coming of spring brings increased incidence of injury from motorcycle and motor vehicle crashes, falls and construction mishaps.

There are two types of injuries that are commonly being referred to the Trauma Center – fracture of the pelvic ring and fracture of the acetabulum.

The pelvic ring is made up of paired innominate, pubic and ischial bones and the sacrum. It is joined posteriorly by the sacroiliac joints and ligaments and anteriorly by the pubic symphysis. On the lateral surface of the innominate bone is the acetabulum to which the ilium, ischium and pubis all contribute. The cavity enclosed by the bony pelvis is divided into two subcategories. The true (or lesser)

pelvis below the brim houses the pelvic viscera and the false greater pelvis above the brim forms part of the abdominal cavity. The pelvis allows transfer of weight from the vertebral column to the acetabulum when standing or to the ischial tuberosity when sitting.

Pelvic fractures are divided into two major types based on the amount of energy involved – low-energy fractures, generally resulting in isolated fractures of individual bones, and high-energy fractures, producing pelvic ring disruption. Accurate assessment of the injury depends not only on the medical history, physical exam, diagnostic X-rays and CT scans, but also on the knowledge gained from description of the accident. Details including the type, direction and magnitude of force involved and whether or not the injury occurred during a motor vehicle crash, motorcycle crash, or a fall are helpful in understanding the biomechanics of the injury. These details are obtained from various sources, including the patient, pre-hospital personnel, witnesses, and deductive analysis of the clinical picture. In impact injuries, it is important to know the direction of the force involved (frontal, oblique and lateral), or whether a motorcyclist was thrown over the handlebars and experienced sudden de-acceleration forces, or whether the victim landed in a vertical or lateral position.

Crush injury is another mechanism that can occur when the victim is trapped between the injurious force in an unyielding environment, such as the ground or pavement. The magnitude, velocity and duration of the crushing forces are valuable information to the orthopaedic surgeon and the trauma team. These are important factors directly affecting the prognosis.

Low-energy fractures usually affect individual bones. High-energy incidents result in more severe injury to the pelvic ring and associated soft tissues. A common distribution of mechanism of injury include:

Motor vehicle	60%
Pedestrian	18%
Motorcycle	9%
Falls from height	9%
Crush	4%

Classification of pelvis injuries includes lateral compression, anterior/posterior compression, vertical shear and a combination of lateral compression and vertical shear. Most patients having pelvic fractures are victims of high-energy accidents and should have diagnostic workups as suggested by guidelines from the American College of Surgeons. After immobilization in the field, the patient undergoes evaluation in an

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Emergency Department with attention to the ABC's of trauma care. Simultaneously, baseline vital signs and neurologic status are noted. General status of the pelvis should be assessed by palpation, inspection and detailed neurological and vascular examinations. At our hospitals in Springfield, preliminary radiographic assessment is performed with an AP pelvis X-ray. Inlet and outlet views are usually performed at our hospitals to assess the pelvic ring as well as anterior and posterior displacement, degree of rotational displacement and to assess the sacroiliac joint. Obturator and iliac oblique views further delineate fractures of the acetabulum. Computer tomography is extremely important to help delineate injuries to the posterior ring as well as imaging of acetabular pathology. Associated pathological conditions of pelvic injuries include hemorrhage, genitourinary injury, gastrointestinal injury and open pelvic fractures.

The first therapeutic approach to a patient with hypotension secondary to a pelvic fracture is to identify its etiology. Hypotension in an injured patient is most likely due to hypovolemia, caused by hemorrhage. Four potential sites of bleeding include the chest, peritoneal cavity, long bones and the extra peritoneal space of the pelvis. Hemorrhage is the most perilous complication associated with pelvic fractures. It may result from bleeding of the fracture, venous or arterial tears or disruption of a major vessel. There are many methods of treating hemorrhage associated with pelvic fractures. A simple safe temporary technique includes a bed sheet wrapped around the pelvis and twisted to apply compression, thereby preserving life due to the pelvic ring bleeding. External fixation, internal

fixation, embolic angiography and laparotomy also can be considered.

The objectives for treating pelvic ring injuries include restoring bony anatomy, preventing deformity, minimizing discomfort and returning to mobility and function. After a careful analysis of the patient's history, physical exam, X-rays and CT scan, we will decide between non-operative and/or operative treatment. For stable or minimally displaced fractures, patients are treated with gentle mobilization and protected weight bearing on the side of the ring injury. We do not allow prolonged bed rest, pelvis suspension, slings or spica casts in the present therapeutic algorithm. Traction is used only temporarily for fracture reduction until we are able to stabilize the patient and prepare for surgery.

Operative treatment consists of open reduction and internal fixation of the pelvic ring under direct or indirect fracture reduction techniques and rigid internal fixation. Over the last several years, I have used percutaneous fixation techniques for disruption of the sacroiliac joint and many sacral fractures that require stabilization. External fixation also is used as a method of hemorrhage management or temporary stabilization of an "open book" type injury, but my recommendation for treatment is to perform an open reduction and internal fixation with plates over the fracture lines secured by screws. Some "open book" type pelvis injuries can be treated with anterior plating alone, or in combination with posterior percutaneous or open techniques.

Vertical shear injuries require an anterior approach combined with a posterior surgery. Iliac fractures are usually treated with plating or long percutaneous screws.

Post-operatively, patients are usually treated with non-weight bearing on the injured side for approximately eight to twelve weeks, depending on the injury, but are mobilized from bed to chair on the first post-operative day. Early mobilization helps prevent deep vein thrombosis, pressure sores and atelectasis and helps re-orient the patient to their surroundings. Prognosis for complications, such as long-term pain or disability, is usually related to the degree of residual deformity after pelvic ring injury. In patients who had no residual deformity and less than one cm of displacement, 88 percent usually have no substantial pain and 82 percent have normal function. In patients with residual deformity, 70 percent have persistent pain and 30 percent have no substantial pain. However, only 30 percent have normal function. Complications can include thromboembolism, infection, malunion or nonunion.

In conclusion, diagnosis and management of pelvic fractures have progressed and improved markedly over the past two decades. With our advanced treatment by using early open reduction, internal fixation and anatomical restoration of the pelvic ring, we have significantly helped trauma patients with pelvic ring disruptions.

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