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Technical Trick

Circumferential Pelvic Antishock Sheeting: A Temporary Resuscitation Aid

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Summary: Acute traumatic pelvic ring instability causes severe pain and associated hemorrhage. Circumferential pelvic sheeting provides patient comfort and noninvasive, rapid, and temporary pelvic ring stability. A bed sheet is readily available, inexpensive, easily applied around the pelvis, and disposable.

Key Words: Circumferential pelvic sheeting, Hemorrhagic shock, Pelvic ring instability.

Hemodynamic instability is frequently noted in patients with acute, unstable pelvic ring disruptions after high-energy traumatic events (19,20). Pelvic ring instability is diagnosed during the screening physical examination of the patient, either at the accident scene or in the emergency department. Gentle manual compression at the iliac crests on both sides shows hemipelvic mobility and associated tenderness. Traumatic separation of the symphysis pubis produces a palpable defect and local tenderness. The specific pelvic ring injury zones and associated deformities are noted on the initial anteroposterior plain pelvic radiograph (5,31). Pelvic ring reduction and stability diminish the potential pelvic volume, decrease ongoing pelvic hemorrhage, and provide comfort in patients with hemodynamic instability (9,13). Various techniques are advocated to stabilize unstable pelvic ring disruptions emergently (24,26,33). Skeletal traction, spica casting, military antishock trousers, and anterior and posterior pelvic external fixation devices are some of the techniques recommended to diminish clinically significant pelvic bleeding by providing emergent pelvic stabilization (3,6,7,10,16,17,21,27). This report describes the use of circumferential pelvic sheeting to stabilize an unstable pelvic ring disruption temporarily in a hemodynamically unstable patient.

CASE REPORT

A forty-year-old woman was injured in an automobile accident. She was hypotensive and tachycardic at the injury scene. Intravenous crystalloid solutions were administered through large bore catheters. Her initial hematocrit was 20 percent. Physical examination showed pelvic ring and left femoral shaft instabilities. A plain anteroposterior pelvic radiograph showed a wide symphysis pubis disruption, bilateral incomplete sacroiliac joint injuries, and a left hip dislocation (Fig. 1). The hip was treated with closed manipulative reduction. A longitudinally folded bed sheet was snugly applied circumferentially around the pelvis by two physicians and was secured by clamping the sheet anteriorly. The pelvic circumferential sheet was folded smoothly and positioned to allow abdominal and lower extremity assessments (Fig. 2). The subsequent plain pelvic radiograph showed reductions of the pelvic ring and left hip joint (Fig. 3). The left femoral shaft fracture and ipsilateral hip reduction were initially stabilized using distal femoral skeletal traction. After circumferential pelvic sheeting, femoral traction application, and volume resuscitation including blood transfusion, her vital signs stabilized and her clinical condition improved. Her hematocrit was 31 percent. The pelvic ring was then surgically stabilized using orthogonal symphyseal plates after open reduction. An antegrade, reamed, locked medullary nail stabilized her femur fracture. Her hip reduction was stable without residual joint debris and was treated without surgery. She was discharged eleven days after injury. Her pelvic ring injury healed uneventfully and without deformity.

DISCUSSION

Unstable pelvic ring injuries caused by high-energy traumatic events are difficult to treat effectively. Associated injuries and hemodynamic instability are two of the primary challenges during early management (18, 22,32). The unstable pelvic ring allows ongoing

FIG. 1. Anteroposterior plain pelvic radiograph showing the pelvic ring injuries and hip dislocation.

hemorrhage. Significant and sustained bleeding occurs as the unstable pelvic ring displaces. Pelvic ring instability also prevents stable clot formation caused by the uncontrolled fracture surfaces. Hemorrhagic shock results (2,22). Adequate volume replacement, patient thermoregulation, and pelvic ring stability are important components of a successful resuscitation. Sustained hemodynamic instability caused by pelvic arterial injury is controlled using selective angiographic embolization (1,2, 20).

Various techniques have been advocated to achieve rapid pelvic ring stability. External or noninvasive treatments include emergent spica casting or military antishock trousers. Cotler and Hansen (6) recommended emergent spica casting in patients with unstable pelvic fractures. They used a special fracture table to allow cast application in the operating room. Spica casting is difficult to accomplish during the resuscitation of these patients and may not be possible in the emergency room. Spica cast application in emergent situations demands excellent skills and trained assistants. These casts limit abdominal and lower extremity accesses and serial examinations and fit poorly in obese patients or patients with multiple injuries. Several authors have advocated military antishock trousers for these patients (3,4,8). Mattox et al. (14,15) reported complications with military antishock trousers in patients treated in an urban

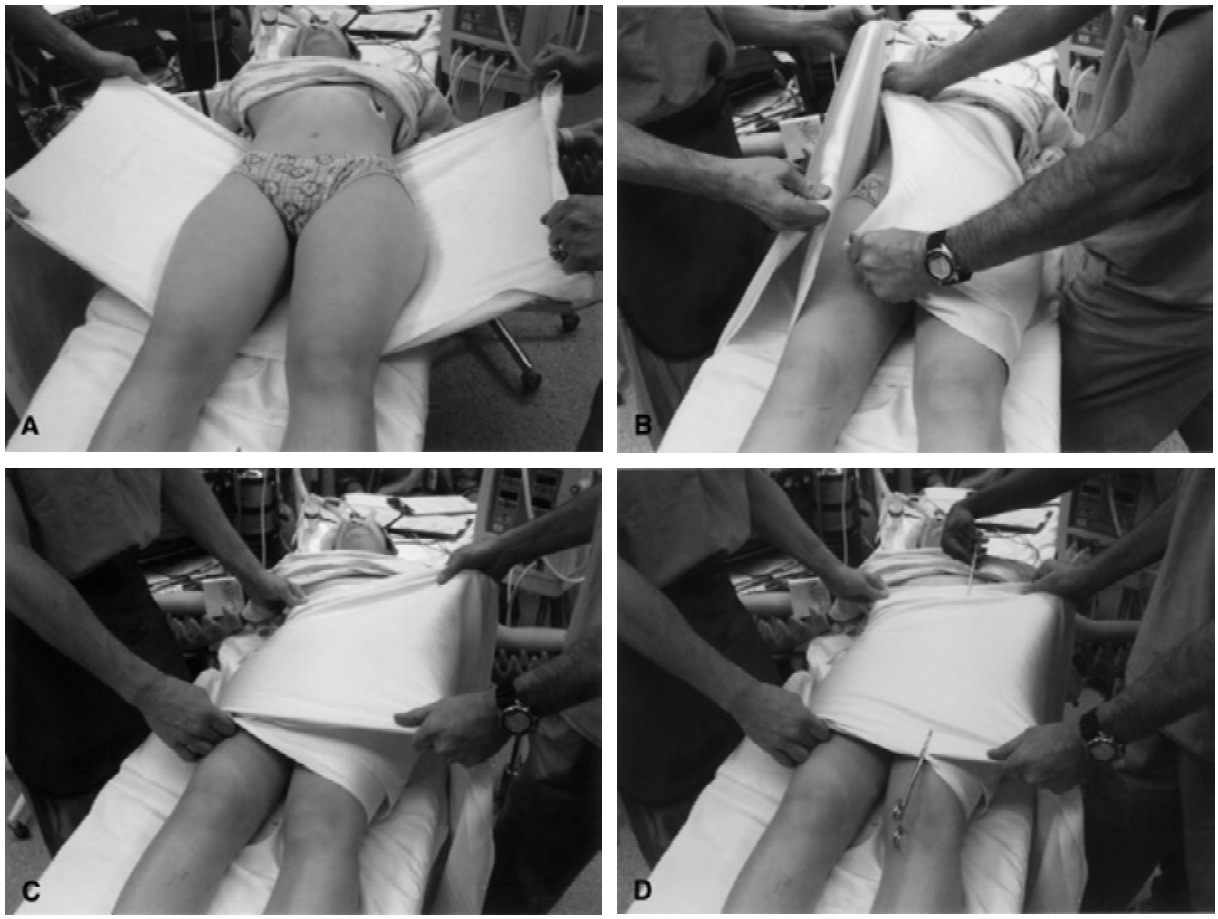

FIG. 2. A: Circumferential pelvic antishock sheeting is applied in this example patient. The patient's clothing should be removed before application. The sheet is positioned beneath the patient's pelvis smoothly. The ends of the sheet are crossed in an overlapping manner anteriorly **(B)** and are pulled taut **(C)**. Clamps secure the smooth and snug sheet **(D)**.

FIG. 3. Radiograph taken after closed reduction of the hip and application of a circumferential pelvic sheet.

environment, where rapid access to a trauma center was possible. Pneumatic antishock garments are expensive and not always readily available. Similar to spica casts, military antishock trousers deny lower extremity and inguinal accesses.

Anterior pelvic external fixation is advocated for patients with unstable pelvic ring disruptions and associated hemodynamic instability (11,16,17,28,29). This technique requires bilateral iliac crest pins to be inserted and then attached to connecting rods in an attempt to stabilize the unstable pelvic ring. Accurate iliac pin insertions are especially difficult in obese patients or in cases of a displaced hemipelvis. Anterior pelvic external fixation stabilizes the anterior pelvis yet may actually increase the posterior pelvic deformity in some patients (12,30). Posterior antishock pelvic clamps are advocated by Ganz et al. (7) to stabilize displaced posterior pelvic injuries. Posterior pelvic clamps are expensive and difficult to apply accurately, especially in patients with posterior pelvic deformities. Open surgical procedures for pelvic ring reduction and internal fixation improve stability but may decompress the organizing pelvic hematoma, which may cause additional pelvic bleeding (31). Satisfactory percutaneous fixation techniques depend on various factors, including accurate closed manipulative reductions and excellent intraoperative fluoroscopic imaging (23,25).

Circumferential pelvic antishock sheeting (CPAS) has numerous advantages. The bed sheet is small, transportable, and readily available in emergency medical vehicles and hospital emergency departments. Sheets are inexpensive and can be discarded if heavily soiled. CPAS is easily and rapidly applied by one or, more preferably, two individuals. Special training and imaging modalities are not required for accurate application. CPAS maintains pelvic stability and allows direct lower extremity and abdominal accesses throughout the ongoing evaluation and resuscitation of the patient. CPAS can be used temporarily during the examination and early treatment of the patient. No incisions, which might complicate later operative stabilization, are needed for CPAS. Skeletal traction can be used in association with CPAS, as was used in our patient. The sheet can also be positioned to maintain the pelvic closed reduction while other, more definitive forms of pelvic fixation are applied or inserted.

Circumferential pelvic antishock sheeting has potential disadvantages. Skin pressure problems may result from sustained or wrinkled applications, especially in thin patients. In patients with lateral compression pelvic ring injuries and sacral neuroforaminal fractures, forceful or aggressive CPAS application could produce pelvic visceral injury or worsen sacral nerve root injury.

The technique of CPAS is noninvasive, simple to apply, readily available, inexpensive, and a disposable temporary pelvic stabilizer that should be considered during the examination and resuscitation of hemodynamically unstable patients with unstable pelvic ring injuries.

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