Background Pelvic Trauma

Pelvic fractures result from high velocity mechanisms such as motor vehicle crashes, pedestrians hit by motor vehicles, motor bike crashes, falls, crush injuries, and sport or recreational accidents.  

These are amongst the most devastating musculoskeletal injuries and are associated with a high incidence of mortality (19%) due to acute blood loss or exsanguination.

Survival rates have increased over recent years and death is usually as a result of multiple injuries and concomitant injuries such as chest or head injury rather than isolated pelvic fractures.

Pelvis Anatomy

Pelvic fractures, especially with pelvic ring disruption allow an increased volume of blood to accumulate in the pelvic cavity before tamponading. In 80% of pelvic ring fractures cases, bleeding is usually venous from the pelvic veins and pre-sacral venous plexus, or the marrow of the broken pelvic bones. Arterial bleeding is a direct result of damage to the vessel close to a bony injury. Injured vessels are typically branches of the internal iliac artery. Other organs that can be affected in pelvic ring injuries include those in the genitourinary and gastrointestinal systems and the lumbar and sacral plexuses.

Classification of Pelvic Ring Injuries

The pelvis is relatively immobile due to the sacral iliac (SI) joints; hence disruption of the pelvic ring requires a break in two places and disruption of the posterior ligaments, causing it to become unstable.

Young and Burgess describe three forces involved in pelvic ring injuries:

- **Lateral Compression (LC)**
  
  This is the most common force and usually occurs in association with abdominal thoracic and cervical spine injuries. LC results from side impact and causes inward rotation of the hemi-pelvis and rotational instability e.g. pedestrian struck by motor vehicle, motor vehicle crashes with side impact. If the force is not strong enough to open the pelvis, there can be organ damage from bony fragments. Caution should be exercised with pelvic compressive devices in LC fractures; use should be confirmed with orthopaedic team.

- **Anterior Posterior Compression (APC)**
  
  This compression force is directed either from anterior to posterior, or posterior to anterior e.g. motor vehicle or motorbike crashes. Injuries are mostly ligamentous with possible pubic rami fractures i.e. open book pelvis. AP injuries are often associated with severe arterial damage involving the internal iliac artery, and adjacent vein and lumbosacral plexus injuries. These injuries have the potential to lead to haemodynamic instability.

- **Vertical Sheer (VS)**
  
  VS injuries transmit energy through the femurs and produce varying injury patterns e.g. someone jumping from a great height and landing on an extended lower limb causing ipsilateral disruption of all ligaments restraining the hemi-pelvis. This mechanism does not usually involve major arterial injuries.
Treatment

Key points in treating pelvic fractures are: 1, 5, 8, 9, 13, 14

- Resuscitation (refer to TRM06.01 Haemodynamically Unstable Pelvic Fracture Guideline)
- Skeletal stabilisation (see below)
- Haemorrhage control (refer to TRM06.01 Haemodynamically Unstable Pelvic Fracture Guideline)

Pelvic Stabilisation can be achieved by:

- Circumferential compression via wrapping with a sheet or via Pelvic Circumferential Compression Devices (PCCDs), such as the RMH Pelvic Binder or Sam Sling © (used by Ambulance Victoria) C/Clamp, external fixation and/or open reduction internal fixation (ORIF) are invasive, require theatre time and can delay angiography.

Early reduction and stabilisation of pelvic fractures can be lifesaving; application of PCCDs, which are quick, safe, and easy. They can assist in stabilising the disrupted pelvic ring, reducing the volume and assisting with tamponade and clot formation, decrease mobility and can have an effect on bleeding and pain. 2, 5-11, 15, 16

Pelvic Circumferential Compressive Devices (PCCDs)

PCCDs are most commonly used in pelvic fractures where there has been separation of the pelvic ring, particularly the symphysis pubis. 16 These can be used for cases where operative intervention is unsuitable or patient’s haemodynamic status is labile. The PCCDs are easy to apply, provide controlled pressure delivery and do not hinder ongoing resuscitation efforts. 6, 8, 9, 16, 17

The most effective application site is the greater trochanters and symphysis pubis regions (see Figure 1). 2, 5 The PCCD should be tightened to 180 Newtons which is equivalent to lifting an eighteen kilo weight. 9, 17

PCCDs are not without complications which include pressure areas and skin abrasions from friction on tightening. 2, 8-10, 16 The risk of these complications increases after 48 hrs of continuous use, so they should be removed as soon as the patient is haemodynamically stable or definitive management of the pelvis has occurred. 2

Figure 1: Greater trochanters and symphysis pubis region
At the scene, if a pelvic fracture is suspected, Ambulance Victoria paramedics may fit a Sam Sling ©. This should remain in situ until further assessment and management of the pelvis is decided on, and the patient is haemodynamically stable.

A RMH Pelvic Binder may be applied if requested by the Orthopaedics team, they are available in the Emergency Department.

The Royal Melbourne Hospital RMH Pelvic Binder Guideline

The Royal Melbourne Hospital TRM06.01Haemodynamically Unstable Pelvic Fracture Guideline dictates that the following patients are fitted with a RMH Pelvic Binder as early as possible if the patient has not had a PCCD already applied at the scene.

Those patients with: 18

- haemodynamic instability
- suspected pelvic fracture

The Royal Melbourne Hospital Pelvic Binder Application

The RMH Pelvic Binder consists of 3 adjustable straps (Figure 2: Three-Strap RMH Pelvic Binder Closed) that are attached with velcro and can be detached for application and removal of the binder. The 3 straps are adjustable to assist with pressure area care and longevity of the binder (Figure 3: Velcro straps removed).

Correct application of the RMH Pelvic Binder should ensure that the flat square portion is under the patient’s buttocks (see Figure 4) and that the middle strap is overlapping the patient’s greater trochanteric and symphysis pubis region (see Figures 1 and 5).

Application by log rolling:

Step 1: Ensure the patient is lying supine

Step 2: Prepare the RMH Pelvic Binder for application: undo the clips and remove the velcro straps to enable the long straps to be rolled small enough to pass under the patient (see Figure 6)
Step 3: Line the RMH Pelvic Binder up so that the middle strap will pass under the patient’s great trochanteric and pubic region (see Figure 6).

Step 4: Log roll the patient as part of secondary survey. Insert the RMH Pelvic Binder by pushing the rolled straps through as far as possible (see Figure 7).

Step 5: Log roll the patient back and ensure that the flat square portion is under the patient’s buttocks. Pull the straps through (see Figure 8).

NOTE: To avoid log rolling, RMH Pelvic Binder can be put on the Emergency Department trolley ready for application when it is anticipated a patient will require one.

Step 6: Reattach the velcro tabs and apply the straps:

The most important strap is the middle strap, or the one positioned between the symphysis pubis and the greater trochanteric region, the other straps are fastened above and below this area for example:

- **Strap 1**: positioned between the anterior superior iliac spine and iliac crests (placed above strap 2)
- **Strap 2**: positioned over the symphysis pubis and the greater trochanteric region and fastened first
- **Strap 3**: positioned strap at the level of the symphysis pubis and ischial tuberosity (placed below strap 2)

In a time critical situation if the middle strap does not align with the greater trochanteric pubic region fasten the straps closest to this region; the RMH Pelvic Binder can be readjusted at a later stage.
Figure 9: Fasten the straps beginning with the middle strap if RMH Pelvic Binder is placed as directed.

Figure 10: 3 straps fastened.

Figure 11: Strap 1 left unfastened as it is above the iliac crests.

At no time should any strap be applied above the iliac crests. If the RMH Pelvic Binder is fitted with a strap in this position it should be left undone (see Figure 11) to prevent increasing abdominal pressure. Fastening this strap will have no effect on pelvic stabilisation.

Ensure that the velcro section is attached and it is tightened to approximately 180 newtons which is equivalent to lifting an 18 kilogram weight with manual tension (tight).

If a procedure needs to be attended i.e. femoral vascular access, eFAST scan or a catheterisation, the appropriate strap can be loosened and refastened on completion of the procedure.

Application by Sliding the RMH Pelvic Binder Under the Patient’s Buttocks

The RMH Pelvic Binder can be applied in emergency situations (i.e. pre-hospital, patient who cannot log roll), by sliding it under the patient’s legs and then buttocks. In this case there will be no need to remove the buckles; it can be opened by pulling apart the velcro.

Nursing Care of a Patient in a RMH Pelvic Binder

The RMH Pelvic Binder is used in the haemodynamically unstable trauma patient with a pelvic fracture. These injuries are treated with PCCDs angiography +/- external or internal fixation. In the acute phase of care the PCCDs should not be released or re-tensioned until the patient is physiologically stable as evidenced by:

- normothermia
- correction of acidosis
- normal coagulation
- no evidence of ongoing haemorrhage
- adequate resuscitation

Pressure Area Care

Nursing care of the patient with a RMH Pelvic Binder requires close monitoring of the patient’s haemodynamic status and skin integrity.

Rotation of Straps

Rotating the straps may assist in prevention of potential skin break down. Straps can be released 1-2 hourly in ICU and up to 4 hourly on the wards, on a rotational basis (as long as the binder is placed correctly). Only two straps are required to be tensioned at a time to maintain pelvic stability, i.e. one strap of the three can be released at any one time.

When undoing the straps ensures that skin is checked for any early signs of skin breakdown (see Figure 11).

If the patient demonstrates any signs of haemodynamic compromise when undoing straps they should be refastened as soon as possible and the patient reassessed.
Replacement of the RMH Pelvic Binder

Replacement of the RMH Pelvic Binder should only be considered in the haemodynamically stable patient as outlined above, or when markedly soiled, wet or offensive (i.e. blood soaked).

If it is anticipated that the binder will become soiled (i.e. ongoing bleeding or incontinence), insert a plastic-backed (blue) sheet inside the Binder to provide some protection. Before removal ensure there is clear documentation regarding pelvic stability and position restrictions. RMH Pelvic Binder replacement is similar to application (see Figure 13).

Using the Bedpan

Patient can be log rolled and a slipper pan used (see Figure 14). For this procedure the bottom strap should be loosened. Ensure that a Plastic-backed (blue) sheet is placed under the bedpan to prevent soiling of the linen and the RMH Pelvic Binder.

Monitoring

Patients should be monitored throughout all of the above procedures. If at any time there are signs of haemodynamic compromise the patient should be immediately returned to the supine position and the RMH Pelvic Binder re-tensioned.

Neurovascular Observations

Neurovascular observations to the lower limbs should be attended after PCCD application, re-tensioning or replacement.

Cleaning and Maintenance of the RMH Pelvic Binders

The RMH Pelvic Sling can be reused; it is not disposable unless deemed unfit for reuse. Once the RMH Pelvic Binder use is complete it should be placed in the red linen skip and will be processed by Princess Linen. Once washed, the RMH Pelvic Binder will be returned to emergency department, here it will be checked for quality and returned to storage for reuse. RMH Pelvic Binders that do not pass inspection or are damaged in any way are disposed of. If the RMH Pelvic Binder passes inspection, it is bagged, tagged and signed, and then returned to circulation.

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References


