Provincial Health Services Authority

Trauma Services BC
Specialist Trauma Advisory Network

Complex Orthopedic Trauma
Specialist Advisory Group

Clinical Practice Guideline

for the management of

PELVIC RING INJURY

in adults with hemodynamic instability

Version 1.2
May 2019

Update Version 2.0
January 2024

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Summary of update (2023)

The following new guidance statements have been added:

I. RESUSCITATION AND STABILIZATION

H. In patients with a pelvic ring injury presenting with hypovolemic shock to centers with REBOA capabilities, early femoral arterial access with an 18 gauge or larger should be achieved to allow for a "step up" approach, allowing rapid introduction of REBOA. Most commonly, this can be achieved with a femoral arterial line.

II. TEMPORARY PELVIC RING INJURY IMMOBILIZATION

K. In patients requiring ongoing resuscitative efforts with a posterior pelvic ring injury that is inadequately reduced resulting in enlarged internal pelvic volume, an antishock iliosacral screw can be considered as a resuscitation adjunct to aid in temporizing reduction and stabilization of the pelvic ring. This type of screw fixation should be carried out by an experienced orthopedic surgeon; it may not be definitive and could result in injury to surrounding anatomical structures.

V. OPEN PELVIC RING INJURIES AND ASSOCIATED GASTROINTESTINAL / GENITOURINARY INJURIES

K. Patients with a pelvic ring injury who have undergone surgical repair of a bladder injury should receive urethral catheter drainage without suprapubic (SP) cystostomy unless SP drainage is specifically indicated. [Adopted from AUA guidelines 2020 amendment] Extensive efforts at primary realignment of the acutely injured urethra are discouraged, and SP catheter is recommended in this situation.

- Specialist Advisory Group member list has been updated.
- Algorithm has been updated.

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Purpose

The prompt diagnosis of a major pelvic ring injury and rapid and effective control of massive pelvic hemorrhage, as part of a general hemostatic resuscitation effort, is a key clinical priority in the successful management of the blunt trauma patient with a mechanically unstable pelvic ring injuries.

The purpose of this clinical practice guideline (CPG) is to review best evidence and generate expert consensus on recommendations for the management of hemodynamically unstable adult patients (age >16) with pelvic ring injuries in B.C.

Key management questions

I. RESUSCITATION AND STABILIZATION

1. What are key considerations in the initial assessment and management of patients with mechanically unstable pelvic ring injuries?
2. When and how should REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta) be used in the acute management of major pelvic ring injuries?

II. TEMPORARY PELVIC RING INJURY IMMOBILIZATION

3. How should the mechanically unstable fractured pelvis be immobilized initially?
4. What considerations guide the duration of use of pelvic binders?
5. What is the role of emergency department C-clamp application in the initial management of pelvic ring injuries?

III. HEMORRHAGE CONTROL — ANGIOEMBOLIZATION

6. When should angioembolization be used in the acute management of major pelvic ring injuries?
7. When should selective versus non-selective angioembolization be used in acute management of blunt pelvic ring injury?

IV. HEMORRHAGE CONTROL — PELVIC PACKING

8. When should peritoneal pelvic packing be employed for major pelvic ring injuries?
9. How and by whom should pre-peritoneal pelvic packing be performed?
10. Should pre-peritoneal pelvic packing be performed in a rural/remote or community setting?

V. OPEN PELVIC RING INJURIES

11. How should patients be assessed for the presence of open pelvic ring injury?
12. What are the indications for fecal diversion in the management of open pelvic ring injuries?

VI. DIAGNOSTIC IMAGING

13. How should patients presenting with proven or suspected major pelvic ring injuries be diagnostically imaged?
14. When and how should patients with pelvic ring fracture undergo evaluation of the urethra and the bladder?

VII. TRANSFER TO HIGHER LEVEL OF CARE

15. What are the indications and timing for higher level of care (HLOC) transfer of a trauma patient with major pelvic trauma to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries?

16. What is the preferred process for inter-facility transfer of major pelvic ring injuries?

17. Which patients with pelvic ring fractures can be managed in a centre with general orthopedic surgery?

18. Which mechanically unstable pelvic ring injuries can be managed in a centre without orthopedic surgery?

19. How should the orthopedic surgeon on-call in a community hospital be involved in the early management of the patients with pelvic ring injury?

VIII. HOSPITAL CARE

20. What are the care requirements for acceptable management of the stabilized admitted patient with a major pelvic ring injury?

IX. DEFINITIVE SURGICAL CARE

21. What is the preferred timeframe for definitive surgical fixation of major pelvic ring injury?

22. How should bladder rupture (intraperitoneal and extraperitoneal) associated with major pelvic injuries be managed?

X. TRANSFER TO LOWER LEVEL OF CARE (REPATRIATION)

23. What are the indications and timing for repatriation back to a sending facility (or equivalent) of patients with major pelvic ring injury transferred to a regional centre with expertise for advanced orthopedic care?

XI. REHABILITATION

24. What is the preferred rehabilitation strategy for patients treated for major pelvic ring injury?

25. When and how should patients who have undergone definitive surgical fixation of major pelvic ring injury be mobilized?

26. What are the indications for in-patient rehabilitation of a patient treated for major pelvic ring injury?

XII. FOLLOW-UP

27. What is the recommended follow-up for a discharged patient with unstable pelvic ring injury?

Guidelines referenced

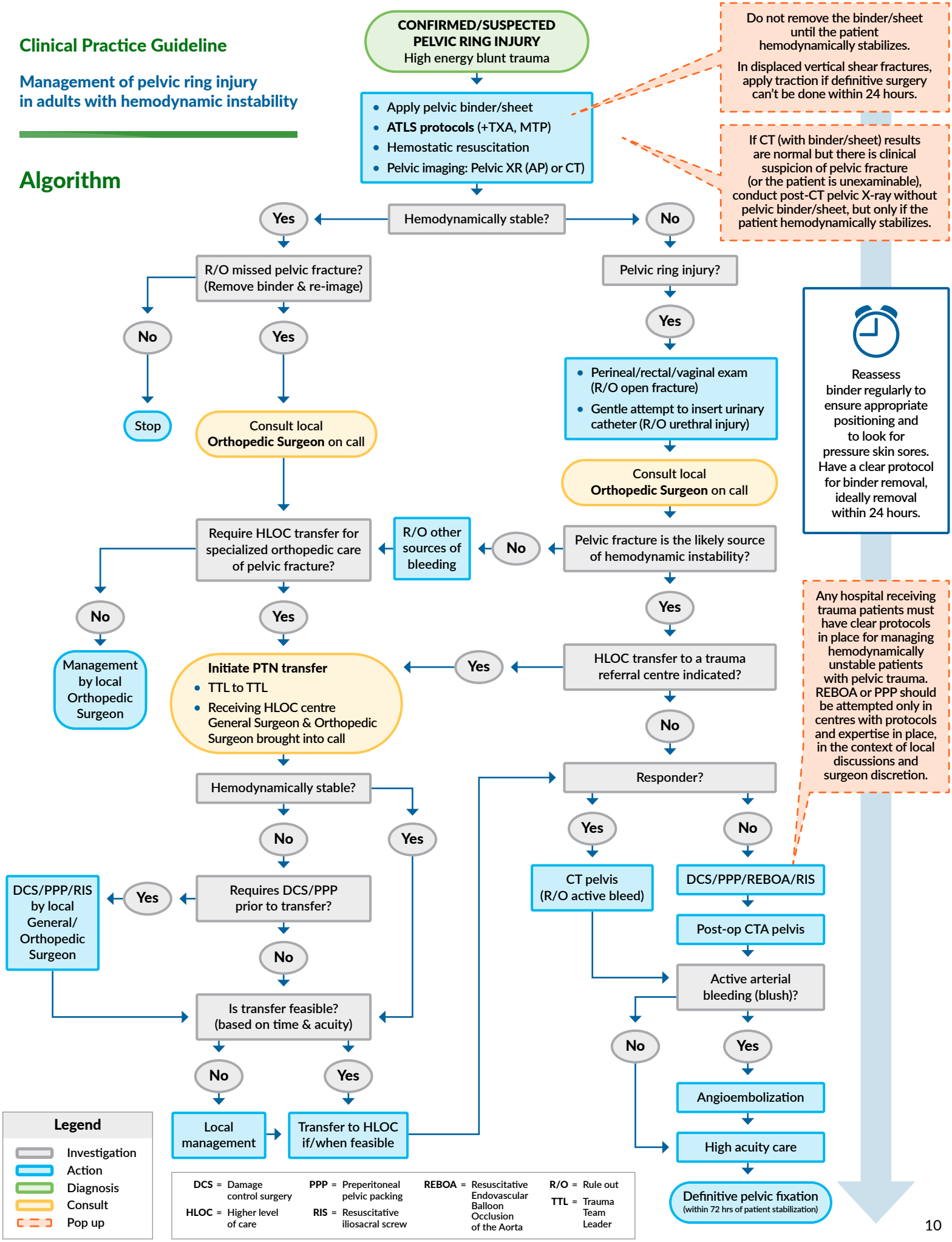
ORGANIZATION	TITLE, YEAR	CITATION	GRADING SYSTEM
British Orthopedic Association	The Management of Patients with Pelvic Fractures, 2018 [1]	BOA	None
Eastern Association for the Surgery of Trauma	Eastern Association for the Surgery of Trauma practice management guidelines for hemorrhage in pelvic fracture — update and systematic review, 2011 [2]	EAST	**Level 1:** Convincingly justifiable based on available scientific information alone. Supported by prospective randomized studies or prospective, noncomparative studies or retrospective series with controls. **Level 2:** Reasonably justifiable by available scientific evidence and strongly supported by expert opinion. Supported by prospective, noncomparative studies or retrospective series with controls or a preponderance of retrospective analyses. **Level 3:** Supported by available data but lacking adequate evidence. Supported by retrospective analyses.
World Society for Emergency Surgery	Pelvic trauma: WSES classification and guidelines, 2017 [3]	WSES	**1A:** Strong recommendation, high-quality evidence **1B:** Strong recommendation, moderate-quality evidence **1C:** Strong recommendation, low-quality or very low-quality evidence **2A:** Weak recommendation, high-quality evidence **2B:** Weak recommendation, moderate-quality evidence **2C:** Weak recommendation, low-quality or very low-quality evidence

ORGANIZATION	TITLE, YEAR	CITATION	GRADING SYSTEM
Eastern Association for the Surgery of Trauma	Management of blunt force bladder injuries: A practice management guideline from the Eastern Association for the Surgery of Trauma, 2019 [4]	EAST 2019	Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology
British Orthopedic Association	The Management of Urological Trauma Associated with Pelvic Fractures, 2016 [5]	BOA 2016	None
American Urologic Association	Urotrauma Guideline, 2014 [6]	AUA	Evidence reviewed via systematic review. Strength of evidence rating of A (high), B (moderate), or C (low). Where there lacked sufficient evidence, statements were qualified as Clinical Principles or Expert Opinions.

Clinical Practice Guideline

Management of pelvic ring injury in adults with hemodynamic instability

Algorithm



Summary of recommendations

Recommendations are newly drafted by the Complex Orthopedic SAG, unless indicated otherwise.

I. RESUSCITATION AND STABILIZATION

A. When there is suspected active bleeding from a pelvic ring injury, apply a pelvic binder in the correct position. This should be applied pre-hospital. [Adopted from BOA]

B. Patients with suspected pelvic ring injuries with signs of hemodynamic instability should be transported directly to a regional centre with orthopedic expertise in the surgical management of complex pelvic ring injuries. If the patient is received into a hospital with general orthopedic capabilities, then resuscitation should be commenced followed by immediate transfer to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries for definitive treatment of active bleeding when advisable and feasible. [Adopted from BOA with modification]

C. All patients require IV Tranexamic Acid as soon as possible and ideally within an hour of injury. In the presence of hemodynamic instability, patients should be urgently resuscitated using blood products according to Massive Transfusion Protocols. [Adopted from BOA]

D. Patients with suspected pelvic ring injuries from high-energy trauma should have a CT scan with IV contrast of the pelvis on admission. Given the energy required to cause pelvic ring injury, other injuries should be expected, and investigations should also include CT of the head and C-spine without contrast and CT of the chest and abdomen with contrast. [Adopted from BOA with modification]

E. All patients with blunt polytrauma undergoing damage control laparotomy should have imaging of the pelvis before surgery (X-ray or CT). All patients should have a pelvic binder in-situ during surgery, and this should not be removed for a post binder pelvic X-ray until the patient is hemodynamically stable. [Adopted from BOA]

F. Active bleeding from the pelvis in patients who do not respond to resuscitation can be managed by surgical packing of the pelvis or interventional radiology with selective embolization of active arterial bleeding vessels. Any hospital receiving trauma patients must have, based on its resources and facilities, clear protocols in place for managing patients with pelvic ring injury and hemodynamic instability. [Adopted from BOA with modification]

G. In a patient in extremis, where resuscitation is failing, Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) can be a first measure to temporarily control hemorrhage in conjunction with pelvic packing as a bridge to definitive care. REBOA should only be attempted in institutions with protocols and expertise in place and in the context of local discussions and surgeon discretion. This novel technology requires further assessment regarding efficacy and safety in the setting of pelvic ring injury with hemodynamic instability.

H. In patients with a pelvic ring injury presenting with hypovolemic shock to centers with REBOA capabilities, early femoral arterial access with an 18 gauge or larger should be achieved to allow for a “step up” approach, allowing rapid introduction of REBOA. Most commonly, this can be achieved with a femoral arterial line.

II. TEMPORARY PELVIC RING INJURY IMMOBILIZATION

A. To immobilize the mechanically unstable fractured pelvis, apply a pelvic binder in the correct position as initial means of immobilization. This should be applied pre-hospital. If the patient becomes clinically stable, proceed to early definitive surgery. [Adopted from BOA with modification]

B. If early definitive surgery cannot be performed, conduct external fixation in the early provisional care:

- **a.** if the patient is brought to the operating room (OR) for pelvic packing, or
- **b.** if the patient is brought to the OR for another procedure and time and patient condition allow. A binder could also be kept in place.

[Adapted from BOA with modification]

C. In displaced vertical shear fractures, traction should be considered along with a binder when early definitive surgery cannot be performed. [Adopted from BOA with modification]

D. Pelvic binders should be positioned cautiously in pregnant and elderly patients. [Adopted from WSES]

E. Reassess regularly (i.e. twice daily and as needed if patient is moved) to ensure binder position is appropriate and reapply binder if pressure skin sores develop or binder had not been applied properly.

F. Each trauma centre must have a clear protocol for binder removal. Ideally, it should be removed within 24 hours of injury. [Adopted from BOA with modification]

G. In a patient with pelvic binder, an early transfer from the spine board whenever possible significantly reduces skin pressure lesion. [Adopted from WSES]

H. All polytraumatised patients require a post-binder X-ray after resuscitation, even in the presence of a negative CT scan because a well-applied pelvic binder can mask a catastrophic pelvic ring injury. [Adopted from BOA]

I. With the ready access to commercially available binders and sheeting techniques, there is little need for C-clamps and similar devices.

J. In patients requiring ongoing resuscitative efforts with a posterior pelvic ring injury that is inadequately reduced resulting in enlarged internal pelvic volume, an antishock iliosacral screw can be considered as a resuscitation adjunct to aid in temporizing reduction and stabilization of the pelvic ring.

III. HEMORRHAGE CONTROL — ANGIOEMBOLIZATION

A. After pelvic stabilization, initiation of Massive Transfusion Protocol, exclusion of non-pelvic sources of blood loss, and pelvic packing, patients with pelvic ring injuries and ongoing hemodynamic instability or signs of ongoing bleeding should be considered for pelvic angiography/embolization. [Adopted from EAST and WSES with modification]

B. Patients with "blush" on CT and hemodynamic stability should be monitored closely and considered for angioembolization depending on their condition. [Adopted from WSES with modification]

C. If resources, protocols and skill set are in place, REBOA and/or pelvic packing should precede angiography/embolization in the hemodynamically unstable patient.

D. Trauma centres with interventional radiology (IR) need to have a clear protocol in place for angiography/embolization in patients with pelvic ring injury and hemodynamic instability. [Adopted from BOA with modification]

E. Trauma centres without IR should have a clear local protocol in place for managing hemodynamically unstable pelvic ring injuries, which may involve pelvic packing on site (if skillset is available) and/or transfer for angiography/embolization.

F. Irrespective of type of resources available, every trauma centre must have a protocol in place for managing hemodynamically unstable patients with pelvic ring injuries. [Adopted from BOA with modification]

G. If angiography is performed, selective angioembolization is preferred in acute management of blunt pelvic ring injury to minimize the risk of soft tissue/organ necrosis following mass embolization.

H. Non-selective angioembolization is not desired in acute management of blunt pelvic ring injury. If selective angioembolization is not possible, preferred options include pre-peritoneal pelvic packing or REBOA in conjunction with packing (if protocols are in place and surgeon has experience in REBOA or packing).

IV. HEMORRHAGE CONTROL — PELVIC PACKING

A. Active bleeding from the pelvis in patients who do not respond to resuscitation can be managed by surgical packing of the pelvis or interventional radiology with selective embolization of active arterial bleeding vessels. Trauma centres with orthopedic surgery (general or expertise in the surgical management of complex pelvic ring injuries) must have a clear protocol in place for managing hemodynamically unstable patients with pelvic ring injuries. [Adopted from BOA with modification]

B. If resources, protocols and skill set are in place, REBOA and/or pelvic packing should precede angiography/embolization in patients with hemodynamic instability.

C. Trauma centres without interventional radiology (IR) should have a clear local protocol in place for transfer for angiography/embolization in patients with pelvic ring injuries and hemodynamic instability. In such centres, pelvic packing (if skillset is unavailable on site) should be considered.

D. Pelvic packing should be performed in conjunction with pelvic stabilization (binder or external pelvic fixation) to maximize the effectiveness of bleeding control. [Adopted from WSES]

E. Indications for pre-peritoneal pelvic packing include:

- Pelvic ring injury-related hemodynamic instability (after pelvic stabilization), or
- Pelvic ring injury-related hemodynamic instability with persistent bleeding after angiography. [Adapted from WSES]

F. Hospitals with expertise should develop local protocols for pelvic packing in unstable pelvic ring injuries.

G. If indications are appropriate and local team has updated skillset and is willing, rural/remote/community hospitals should perform pre-peritoneal pelvic packing.

V. OPEN PELVIC RING INJURIES AND ASSOCIATED GASTROINTESTINAL OR GENITOURINARY INJURIES

A. Patients with pelvic ring injury require physical examination to rule out open pelvic ring injury and urological injury. This includes vaginal speculum exam and rectal exam. Temporarily remove the binder if needed to conduct examinations. [Adapted from WSES]

B. In the setting of gastrointestinal/genitourinary (GI/GU) injury, general surgery and/or urology consultation is recommended. [Adapted from BOA] See **GI/GU injuries** below.

C. If general surgery/urology procedure is considered, the position of the stoma/incision/drains should be determined, whenever possible, in conjunction with the orthopedic surgical team. It should usually be sited in the upper abdomen, to ensure that it is sufficiently remote from the site of potential definitive pelvic surgical fixation. [Adopted from BOA with modification]

BLADDER INJURIES

A. Patients with pelvic ring injury and hematuria should receive CT cystogram for potential bladder injury. [Adopted from EAST 2019 with modification]

B. In patients sustaining pelvic ring injury with intraperitoneal bladder rupture, we recommend operative management over non-operative management to decrease complications from the bladder injury. [Adopted from EAST 2019]

C. Patients with pelvic ring injury and simple extraperitoneal bladder injury can be managed non-operatively, with conservative management and drainage, if no fracture repair is planned. See recommendation below. [Adopted from EAST 2019 with modification]

D. Patients with pelvic ring injury and a urine leak from either the bladder or urethra should receive operative repair of the bladder/urethra and simultaneous pelvic fixation. The pelvic fracture should be treated like an open long-bone fracture with appropriate antibiotics for 72 hours and early fracture fixation if the patient's physiology allows. [Adopted from EAST 2019 and BOA 2016]

E. Patients with a pelvic ring injury who have undergone surgical repair of a bladder injury should receive urethral catheter drainage without suprapubic (SP) cystostomy unless SP drainage is specifically indicated. [Adopted from AUA guidelines 2020 amendment]

F. All patients with a positive cystogram or at risk of bladder rupture should receive follow-up cystography. [Adopted from EAST 2019 with modification]

URETHRAL INJURIES

A. Clinicians should perform retrograde urethrography in patients with blood at the urethral meatus after pelvic trauma. [Adopted from AUA]

B. A single, gentle attempt at catheterization, by an experienced doctor, is permissible, even if the clinical or CT findings suggest urethral injury. A 16F soft, silicone catheter should be used. The procedure and the presence of clear or blood stained urine must be recorded in the medical records. [Adopted from BOA 2016]

C. If the catheter will not pass or passes and drains only blood, do **not** inflate balloon. Withdraw catheter and perform a retrograde urethrogram. [Adopted from BOA 2016]

D. Clinicians may perform primary realignment in hemodynamically stable patients with pelvic fracture associated urethral injury. Clinicians should not perform prolonged attempts at endoscopic realignment in patients with pelvic fracture associated urethral injury. [Adopted from AUA]

E. In hemodynamically unstable patients:

- Clinicians should establish prompt urinary drainage in patients with pelvic fracture associated urethral injury. [Adopted from AUA]
- Surgeons may place suprapubic tubes (SPTs) in patients undergoing open reduction internal fixation (ORIF) for pelvic fracture. [Adopted from AUA]
- The placement of a suprapubic catheter may alter the timing of pelvic fracture surgery and so the pelvic fracture service should be involved at an early stage. [Adopted from BOA 2016]

VI. DIAGNOSTIC IMAGING

A. Patients with proven or suspected major pelvic fractures should be diagnostically imaged via an initial plain X-ray in the trauma bay. They should then undergo an intravenous contrast enhanced CT scan of the abdomen and pelvis when stable. X-ray views which reflect intraoperative imaging (inlet/outlet and judet views) may be done at the discretion of the surgeon when the patient is stable and surgery is planned.

B. Volume rendered 3D images of the bony pelvis based on CT acquisition data should be conducted at the original site where imaging is conducted prior to surgery, as these images provide additional information for surgical planning.

C. All polytraumatised patients require a post-binder removal X-ray after resuscitation, even in the presence of a negative CT scan because a well-applied pelvic binder can mask a catastrophic pelvic ring injury. [Adopted from BOA]

D. In the setting of gastrointestinal/genitourinary (GI/GU), general surgery and/or urology consultation is recommended. Refer to B.C. Imaging Guidelines for Major Trauma Trauma for recommendations regarding imaging of bladder/urethral injury.

VII. TRANSFER TO HIGHER LEVEL OF CARE

A. A hemodynamically unstable patient with major pelvic trauma should be transported to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries as early as possible. Trauma/general surgery at the referral centre should be the primary point of contact. Local orthopedic surgeon and referral centre orthopedic surgeon should be involved in the Patient Transfer Network (PTN) call where time permits. [Adopted from BOA with modification]

B. A stable patient major pelvic trauma should be transferred to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries within 24 hours with the goal to operate within 72 hours. Local orthopedic surgeon is the primary point of contact, with involvement of the referral centre orthopedic surgeon. [Adopted from BOA with modification]

C. When transferring patient to higher level of care, call PTN and involve general surgery, orthopedic surgery and any other specialties as required. Avoid direct calls to surgeons.

D. Patients who are too unstable to tolerate transfer should be resuscitated by the Emergency Physician and General Surgeon on site and assessed by the local orthopedic surgeon as soon as possible.

E. Patients with fractures which are minimally displaced and not requiring fixation, and non-operative cases can be managed in a centre with general orthopedic surgery but without orthopedic expertise in the surgical management of complex pelvic ring injuries. Such cases should be assessed by the local orthopedic surgeon in discussion with referral centre.

F. All hemodynamically stable patients with mechanically unstable pelvic ring injuries must be transferred to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries, with the exception of patients who cannot tolerate transfer.

G. A local orthopedic surgeon on-call at the site of initial presentation, who is certified in Orthopedic Surgery by the Royal College of Physicians and Surgeons of Canada, should assess the hemodynamically stable patient in person, inform PTN, and consult an orthopedic surgeon with expertise in the surgical management of complex pelvic ring injuries.

VIII. HOSPITAL CARE

A. Specialised units must have written local policies for thromboprophylaxis for patients with pelvic ring injuries, which should be followed and documented in the medical records. [Adopted from BOA]

B. Orthopedic surgeon must clarify weight-bearing orders, including timeline, and the need for follow-up imaging and timeline, as well as indicating any rehabilitation or transfer restrictions.

IX. DEFINITIVE SURGICAL CARE

A. Definitive fixation should be done within 72 hours of stabilization of the patient's physiological state. [Adopted from BOA with modification]

B. Any bladder rupture with associated contaminated pelvic ring injury and/or trauma to the urethra should involve urology.

C. In the setting of gastrointestinal/genitourinary (GI/GU) injury, general surgery and/or urology consultation is recommended.

X. TRANSFER TO LOWER LEVEL OF CARE (REPATRIATION)

A. Agreement for repatriation should clearly state weight-bearing orders (including timeline), the need and timing for follow-up imaging, as well as indicating any rehabilitation or transfer restrictions. The follow-up plan, including documentations must be provided by the higher level of care site. See Recommendation B for KMQ-21.

B. Medically stable patients not requiring complex orthopedic care for their pelvic ring injury should be transferred back to sending facility or a facility close to patients' residence.

XI. REHABILITATION

A. Patients with major extremity and/or pelvic ring injuries should have access to rehabilitation services to the same extent as patients with other conditions, such as stroke or spinal cord injury. This would include appropriate rehabilitation facilities where needed, including intense, focused rehabilitation therapy.

B. Mobilization should include a clarification of weight-bearing and the need for follow-up imaging. See Recommendation B for KMQ-21.

C. All patients with major pelvic injuries should receive in-patient rehabilitation.

XII. FOLLOW-UP

A. Patient follow-up should occur in a specialist pelvic trauma unit or rehabilitation clinic, to ensure full advice is available for the pain, physical, psychological, and urological disabilities, which are common adverse outcomes. Follow-up can be done in-person, remotely or via the family physician. [Adopted from the BOA with modification]

B. All patients who may be sexually active should receive written advice on sexual dysfunction in consultation with urology. [Adopted from BOA with modification]

Rationale

I. RESUSCITATION AND STABILIZATION

KMQ-1. What are key considerations in the initial assessment and management of patients with mechanically unstable pelvic ring fractures?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Pelvic binder • When there is a suspected active bleeding from a pelvic fracture, apply a pelvic binder in the correct position. This should be applied pre-hospital. [BOA] • The application of non-invasive external pelvic compression is recommended as an early strategy to stabilize the pelvic ring and decrease the amount of pelvic haemorrhage in the early resuscitation phase. [WSES: 1A] • Pelvic binders are superior to sheet wrapping in the effectiveness of pelvic haemorrhage control. [WSES: 1C]	Adopted BOA wording. Rejected WSES recommendation regarding the superiority of binders to sheet due to low quality of evidence supporting this statement.
Transport • Patients with suspected pelvic fractures with signs of haemodynamic instability should be transported directly to a Major Trauma Centre in accordance with network guidelines. If received into a trauma unit then resuscitation should be commenced followed by immediate transfer to the Major Trauma Centre for definitive treatment of active bleeding. [BOA]	Modified BOA statement to reflect the B.C. trauma system.
Blood products • All patients require IV Tranexamic Acid as soon as possible and ideally within an hour of injury. In the presence of haemodynamic instability, patients should be urgently resuscitated using blood products according to Massive Transfusion Protocols. [BOA] • Serum lactate and base deficit represent sensitive diagnostic markers to estimate the extent of traumatic-haemorrhagic shock, and to monitor response to resuscitation. [WSES: 1B] • The time between arrival in the Emergency Department and definitive bleeding control should be minimized to improve outcomes of patients with hemodynamically unstable pelvic fractures. [WSES: 2A]	Adopted BOA wording for its clarity and specificity.

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Diagnostic imaging • Patients with suspected pelvic fractures from high-energy trauma should have a CT scan with IV contrast including head, chest, abdomen and pelvis on admission. This should include a head to toe scanogram. [BOA] • All patients with blunt polytrauma undergoing damage control laparotomy should have imaging of the pelvis before surgery (X-ray or CT). All patients should have a pelvic binder in-situ during surgery and this should not be removed for a post binder pelvic X-ray until the patient is haemodynamically stable. [BOA]	Adopted BOA statements, modified to reflect provincial diagnostic imaging standard, i.e. Whole Body CT.
Hemorrhage control • Active bleeding from the pelvis in patients who do not respond to resuscitation can be managed by surgical packing of the pelvis or interventional radiology with selective embolization of active arterial bleeding vessels. Major Trauma Centres must have a clear protocol in place for managing this situation. [BOA]	Adopted BOA statement, modified to reflect the B.C. trauma system. See Additional Literature Support below for evidence regarding the benefits of implementing institutional protocols.

ADDITIONAL LITERATURE SUPPORT

Several studies show decrease in mortality with the introduction of a multidisciplinary institutional protocol for the management of pelvic trauma:

- A large retroactive analysis at a single trauma centre in Hong Kong (n=1,682) found significant decrease in adjusted pelvic ring injury mortality after implementation of protocol that includes early use of pelvic binder and rapid/appropriate use of pelvic angiography. Odds ratio for 3 years prior to protocol vs. first 4 years of protocol implementation: 2.05 (95% CI=1.26, 3.3). In the healthiest patients with unstable pelvic ring injuries, the mortality rate is now similar to that of patients with stable fracture patterns.[7]
- A registry analysis at the Denver Health Medical Center (n=216) found a significant decrease in mortality (from 31% to 15%, $p<0.05$) after revising its pelvic trauma pathway to include immediate ED presence of orthopedic surgeon, wrapping the pelvis with a sheet, and using C-clamps or early surgical fixation.[8]
- A retrospective study at a Level 1 trauma centre in Texas (n=199) found an over 30% decrease in 30-day mortality rate after the implementation of protocols for pelvic angiography and pelvic packing by over 30%. Implementation of protocol for pelvic embolization alone significantly reduced the 30-day mortality rate by more than 20% ($p=0.009$).[9]

- A small analysis of prospectively collected data in Australia (n=31) found decrease in 24-hour packed red blood cells transfusion (from 16±2U to 11±1U, $p<0.05$) and in mortality (from 35% to 7%, $p<0.05$) after implementing a multidisciplinary practice protocol that includes prehospital notification of pelvic trauma, pelvic binding, and pelvic angioembolization.[10]
- A case study demonstrated that, while Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is most associated with hemorrhage control, a "step up" approach to its application, which involves early arterial access and 7 French sheath placement, also enables continuous blood pressure monitoring and helps guide rapid endovascular treatments as required.[11]

KMQ-2. When and how should REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta) be used in the acute management of major pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
REBOA • REBOA technique may provide a valid innovative alternative to aortic cross-clamping. [WSES: 2B] • In hemodynamic unstable patients with suspected pelvic bleeding (systolic blood pressure <90 mmHg or non-responders to direct blood products transfusion), REBOA in zone III should be considered as a bridge to definitive treatment. [WSES: 2B] • In major trauma patients with suspected pelvic trauma, arterial vascular access via femoral artery (e.g. 5Fr) introducer might be considered as the first step for eventually REBOA placement. [WSES: 2C] • Partial-REBOA and/or intermittent-REBOA should be considered to decrease occlusion time and ischemic insult. [WSES: 2C]	Drafted a new recommendation based on provincial realities, including institutional protocols and local expertise. The SAG notes that the BOA does not make recommends regarding REBOA at this time. It is the expert opinion of this SAG that REBOA is a promising clinical option that requires further assessment regarding its efficacy and safety in the setting of pelvic ring injury with hemodynamic instability. (See Additional Literature Support below.)

ADDITIONAL LITERATURE SUPPORT

What is the effectiveness of REBOA in controlling hemorrhage in traumatic pelvic injuries?

The use of REBOA is increasing worldwide over the past 10 years and as long as 15 years in Japan. Currently, the quality of evidence supporting the use of this novel technology is low.

- **Effectiveness:** A recent prospective study (n=114) by the American Association for the Surgery of Trauma showed hemodynamic improvements of 67.4% of patients with REBOA and 47.8% of patients with REBOA achieved stability (systolic blood pressure consistently >90 mm Hg for >5 minutes) compared to 27.9% who received open aortic occlusion.[12] These differences are not statistically significant and the advantages of REBOA compared to resuscitative thoracotomy remain unconfirmed.
- **Complications:** Studies to date show rates of complications below 1%, which include distal ischemia or thromboembolic events, intracranial massive hemorrhage, pseudoaneurysm at the access site.[13] While the introducer sheath size has been suggested as a risk factor for complications, it is unclear whether a low-profile device offers significant advantages.
- **Mortality:** A high mortality rate of 65% has been demonstrated but has been suggested to be attributed to the severity of the injuries rather than failure of REBOA.[5]
- **Advantages:** Insertion of an arterial catheter allows for angiography in the OR without having to transfer the patient to an interventional radiology suite.[5]
- **Caveats:** The attending surgeon requires skillset and confidence. Trained surgeons have been shown to perform REBOA in 3 to 15 minutes in simulated settings.[5] WSES notes that REBOA is only a temporary solution, which must be followed by definitive care, noting that most trauma centres reserve REBOA only in patients in critical condition with multiple sites of bleeding.[3]

The SAG notes that REBOA is a promising clinical option, pending more high-quality evidence and stronger recommendation by other professional bodies.

II. TEMPORARY PELVIC RING INJURY IMMOBILIZATION

KMQ-3. How should the mechanically unstable fractured pelvis be immobilized initially?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Indication • When there is a suspected active bleeding from a pelvic fracture, apply a pelvic binder in the correct position. This should be applied pre-hospital. [BOA] • External fixation should be considered for temporary mechanical stabilisation when early definitive surgery cannot be performed. [BOA] • External pelvic fixation provides rigid temporary pelvic ring stability and serves as an adjunct to early haemorrhage control in hemodynamically unstable pelvic ring disruptions. [WSES: 1A] • TPBs effectively reduce unstable pelvic fractures as well as definitive stabilization and decrease pelvic volume. [EAST: Level 3] • TPBs may limit pelvic hemorrhage but do not seem to affect mortality. [EAST: Level 3]	Modified BOA statements for greater specificity: • Recommend applying pelvic binder to the mechanically unstable fracture pelvis rather than suspected active bleeding from a pelvic ring injury, and • Additional situations where external pelvic fixation should be considered. Ignored WSES and EAST statements; they are points of information rather than recommendations for clinical practice.
Type • Temporary pelvic binders (TPBs) work as well or better than emergent EPF (external pelvic fixation) in controlling hemorrhage. [EAST: Level 3]	Rejected EAST statement for low-quality evidence supporting this statement.
Other • In displaced vertical shear fractures, traction should be considered when early definitive surgery cannot be performed. [BOA] • Pelvic binders should be positioned cautiously in pregnant women and elderly patients. [WSES: 2A]	Adopted BOA statement regarding vertical shear fractures and added "along with a binder." Adopted WSES statement regarding pregnant and elderly patients.

KMQ-4. What considerations guide the duration of use of pelvic binders?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Each trauma network must have a clear protocol for binder removal but, ideally, it should be removed within 24-hours of injury. [BOA] • Non-invasive external pelvic compression devices should be removed as soon as physiologically justifiable, and replaced by external pelvic fixation, or definitive pelvic stabilization, if indicated. [WSES: 1B] • In a patient with pelvic binder whenever it's possible, an early transfer from the spine board reduces significantly the skin pressure lesions. [WSES: 1A] • All polytraumatised patients require a post-binder X-ray after resuscitation, even in the presence of a 'negative' CT scan because a well-applied pelvic binder can mask a catastrophic pelvic ring injury. [BOA]	While there is no evidence for optimal duration of pelvic binders, the SAG agreed that there should be a process where binders are reassessed regularly for skin pressure points. Adopted BOA recommendation for the need for clear institutional protocol, with 24-hour mark as a guide.

KMQ-5. What is the role of emergency department C-clamp application in the initial management of pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Pelvic C-clamp application is contraindicated in comminuted and transforaminal sacral fractures, iliac wing fractures, and LC-type pelvic ring disruptions. [WSES: 2B] • Anterior "resuscitation frames" through iliac crest or supra-acetabular route provide adequate temporary pelvic stability in APC-II/-III and LC-II/-III injury patterns. A posterior pelvic C-clamp can be indicated for hemorrhage control in "vertical shear" injuries with sacroiliac joint disruptions [WSES: 2A].	Rejected WSES statements indication C-clamp usage, based on expert opinion of the SAG regarding the relevance of this technology.

ADDITIONAL LITERATURE SUPPORT

Antishock iliosacral screws (ASISS) are an inexpensive device that offers mechanical stabilization of the posterior pelvic ring while also enabling patient transport, mobilization, and imaging; however, ASISS placement requires orthopedic expertise and preoperative planning to ensure accuracy and speed of the intervension.[14]

III. HEMORRHAGE CONTROL — ANGIOEMBOLIZATION

KMQ-6. When should angioembolization be used in the acute management of major pelvic ring injury?

RECOMMENDATIONS

A. After pelvic stabilization, initiation of Massive Transfusion Protocol, exclusion of non-pelvic sources of blood loss, and pelvic packing, patients with pelvic ring injuries and ongoing hemodynamic instability or signs of ongoing bleeding should be considered for pelvic angiography/embolization. [Adopted from EAST and WSES with modification]

B. Patients with "blush" on CT and hemodynamic stability should be monitored closely and considered for angioembolization depending on their condition. [Adopted from WSES with modification]

C. If resources, protocols and skill set are in place, REBOA and/or pelvic packing should precede angiography/embolization in the hemodynamically unstable patient.

D. Trauma centres with interventional radiology (IR) need to have a clear protocol in place for angiography/embolization in patients with pelvic ring injury and hemodynamic instability. [Adopted from BOA with modification]

E. Trauma centres without IR should have a clear local protocol in place for managing hemodynamically unstable pelvic ring injuries, which may involve pelvic packing on site (if skillset is available) and/or transfer for angiography/embolization.

F. Irrespective of type of resources available, every trauma centre must have a protocol in place for managing hemodynamically unstable patients with pelvic ring injuries. [Adopted from BOA with modification]

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Timing/sequence • After pelvic stabilization, initiation of aggressive hemostatic resuscitation and exclusion of extra-pelvic sources of blood loss, patients with pelvic fractures and hemodynamic instability or evidence of ongoing bleeding should be considered for pelvic angiography/angioembolization [WSES: 2A] • Patients with pelvic fractures and hemodynamic instability or signs of ongoing bleeding after nonpelvic sources of blood loss have been ruled out should be considered for pelvic angiography/embolization. [EAST: Level 1]	Adopted WSES wording with the following modification: Angiography/embolization should be considered after pelvic packing has been attempted.

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Indication: CT results • Patients with evidence of arterial intravenous contrast extravasation (ICE) in the pelvis by CT may require pelvic angiography and embolization regardless of hemodynamic status. [EAST: Level 1] • CT-scan demonstrating arterial contrast extravasation in the pelvis and the presence of pelvic hematoma are the most important signs predictive of the need for angioembolization. [WSES: 1C] • Patients with CT-scan demonstrating arterial contrast extravasation in the pelvis may benefit from pelvic angiography/ angioembolization regardless of hemodynamic status. [WSES: 2A]	Adopted EAST and WSES statements regarding CT-scan results as indication for angiography/angio-embolization. However, rejected the phrase "regardless of hemodynamic status," as angiography/ embolization should be done in setting of some degree of hemodynamic instability (e.g. in patients responding to resuscitation).
Management pathway • Active bleeding from the pelvis in patients who do not respond to resuscitation can be managed by surgical packing of the pelvis or interventional radiology with selective embolization of active arterial bleeding vessels. Major Trauma Centres must have a clear protocol in place for managing this situation. [BOA]	Modified BOA statement (created two new statements) to reflect the B.C. trauma system. (See Additional Literature Support for the benefits of implementing institutional protocols on page 19.)
Indication: Age • Elderly patients with pelvic fractures should be considered for pelvic angiography/angioembolization regardless of hemodynamic status. [WSES: 2C] • Patients older than 60 years with major pelvic fracture (open book, butterfly segment, or vertical shear) should be considered for pelvic angiography without regard for hemodynamic status. [EAST: Level 2]	Rejected due to concerns with risk in renal function in the setting of hemodynamic instability, as well as disagreement with blanket statement "regardless of hemodynamic status."
Repeat angiography/embolization • After extra-pelvic sources of blood loss have been ruled out, patients with pelvic ring injuries who have undergone pelvic angiography with or without angioembolization, with persisting signs of ongoing bleeding, should be considered for repeat pelvic angiography/angioembolization [WSES: 2B] • Patients with pelvic ring injuries who have undergone pelvic angiography with or without embolization, who have signs of ongoing bleeding after nonpelvic sources of blood loss have been ruled out, should be considered for repeat pelvic angiography and possible embolization. [EAST: Level 2].	Ignored: out of scope.

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Other details • Fracture pattern on pelvic X-ray does not single-handedly predict mortality, hemorrhage, or the need for angiography. [EAST: Level 2] • Presence/location of hematoma does not predict or exclude the need for angiography and possible embolization. [EAST: Level 2] • Absence of contrast extravasation on CT does not always exclude active hemorrhage. [EAST: Level 3] • Pelvic hematoma >500 cm3 in size has an increased incidence of arterial injury and need for angiography. [EAST: Level 3] • Although fracture pattern or type does not predict arterial injury or need for angiography, anterior fractures are more highly associated with anterior vascular injuries, whereas posterior fractures are more highly associated with posterior vascular injuries. [EAST: Level 3] • Angioembolization is an effective measure of haemorrhage control in patients with arterial sources of retroperitoneal pelvic bleeding. [WSES: 1A]	These statements are points of information rather than recommendations for clinical management, and as such were excluded. However, these statements provide supportive evidence to the SAG's recommendations.

ADDITIONAL LITERATURE SUPPORT

What is the effectiveness of CT scan in indicating pelvic angiography?

Arterial contrast extravasation on CT scan as an indication of pelvic angiography: sensitivity 60–84%; specificity 85–98%.[15]

KMQ-7. When should selective versus non-selective angioembolization be used in acute management of blunt pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Pelvic angiography with bilateral embolization seems to be safe with few major complications. Gluteal muscle ischemia/necrosis has been reported in patients with hemodynamic instability and prolonged immobilization or primary trauma to the gluteal region as the possible cause, rather than a direct complication of angioembolization. [EAST: Level 3] • Sexual function in males does not seem to be impaired after bilateral internal iliac arterial embolization. [EAST: Level 3]	These statements are points of information that support selective angioembolization as preferred method. New recommendation statements were created to guide clinical management.

ADDITIONAL LITERATURE SUPPORT

What is the risk of complications associated with non-selective angioembolization of the pelvis?

Potential complications of non-selective angioembolization are gluteal necrosis, wound complications, claudication, neuropathy, poor fracture healing and impotence. Risk of complications ranges from 3.3 to 66%.[16]

A multicentre retrospective cohort study (n=145) comparing selective and non-selective angioembolization in pelvic trauma patients found an increased rate of overall in-patient complications in the non-selective group, longer hospital and ICU stays, and higher rate of thromboembolic complications (12.1% vs. 0, p=0.010).

IV. HEMORRHAGE CONTROL — PELVIC PACKING

KMQ-8. When should peritoneal pelvic packing be employed for major pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
Management pathway • Active bleeding from the pelvis in patients who do not respond to resuscitation can be managed by surgical packing of the pelvis or interventional radiology with selective embolization of active arterial bleeding vessels. Major Trauma Centres must have a clear protocol in place for managing this situation. [BOA] • Patients with pelvic fracture-related hemodynamic instability should always be considered for pre-peritoneal pelvic packing, especially in hospitals with no angiography service. [WSES: 1C] • Pelvic packing should be performed in conjunction with pelvic stabilization to maximize the effectiveness of bleeding control. [WSES: 2A] • External pelvic fixation is a required adjunct to preperitoneal pelvic packing to provide a stable counterpressure for effective packing. [WSES: 2A]	Adopted BOA statement, with modification to reflect the B.C. trauma system. (See Additional Literature Support for the benefits of implementing institutional protocols on page 19.) Created a new recommendation regarding pelvic packing in hospitals without IR, adapted from WSES statement to reflect the B.C. trauma system. Adopted WSES statements regarding the need for pelvic stabilization and specified options: binder or external fixation.
Indication • Direct preperitoneal pelvic packing represents an effective surgical measure of early haemorrhage control in hypotensive patients with bleeding pelvic ring disruptions. [WSES: 1B] • Patients with pelvic fracture-related hemodynamic instability with persistent bleeding after angiography should always be considered for pre-peritoneal pelvic packing. [WSES: 2A] • Retroperitoneal pelvic packing is effective in controlling hemorrhage when used as a salvage technique after angiographic embolization. [EAST: Level 3]	Created a new recommendation for the indications of pelvic packing, adapted from WSES and EAST, i.e.: • hemodynamic instability and • persistent bleeding after angiography.
C-clamp • Retroperitoneal pelvic packing is effective in controlling hemorrhage when used as part of a multidisciplinary clinical pathway including a POD/C-clamp. [EAST: Level 3] • Pre-peritoneal pelvic packing is an effective technique in controlling hemorrhage in patients with pelvic fracture-related hemodynamic instability who have undergone prior anterior/C-clamp fixation. [WSES: 2A]	Rejected EAST and WSES statements regarding C-clamp, as binders and sheets are recommended in hemodynamically unstable patients with pelvic ring injury (see Recommendation I for KMQ-5).

ADDITIONAL LITERATURE SUPPORT

What evidence supports the use of pelvic packing to control pelvic hemorrhage after trauma?

80–90% of bleeding in patients with hemodynamically unstable pelvic ring injuries is attributed to venous bleeding, providing rationale for pelvic packing as acute surgical method of hemorrhage control.[3]

Inconclusive findings regarding superiority of pelvic packing to pelvic angioembolization.

Small studies have shown shorter times for pelvic packing than pelvic angioembolization.[1, 2] However, these findings are dependent on local institutional protocols.

KMQ-9. How and by whom should pre-peritoneal pelvic packing be performed?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None available	Created new recommendation based on evidence indicating the benefits of having an institutional protocol for pelvic trauma. (See Additional Literature Support for the benefits of implementing institutional protocols on page 19.)

KMQ-10. Should pre-peritoneal pelvic packing be performed in a rural/remote or community setting?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None available	Created new recommendation based on the B.C. trauma system, particularly where the benefits of timely and appropriate local management are preferred over long transfer times to higher level of care.

V. OPEN PELVIC RING INJURIES AND ASSOCIATED GASTROINTESTINAL/GENITOURINARY INJURIES

KMQ-11. How should patients be assessed for the presence of open pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Perineal and a rectal digital examination are mandatory in case of high suspicious of rectal injuries. [WSES: 1B] • In case of a positive rectal examination, proctoscopy is recommended. [WSES: 1C] • Potential injury to the bladder or urethra should be suspected, diagnosed and managed according to The Management of Urological Trauma Associated with Pelvic Fractures BOAST. [BOA]	Created a new SAG recommendation, adapting the wording of the WSES statement regarding perineal and rectal examinations and adding recommendation to remove the pelvic binder if necessary. Statement based on expert opinion of the SAG.

KMQ-12. What are the indications for fecal diversion in the management of open pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Open pelvic ring injuries associated with wounds to the lower abdomen, groin, buttocks, perineum, anus (including sphincters) and rectum require urgent assessment by a consultant general or colorectal surgeon and wound debridement as per the Open Fractures BOAST. Clinically and/or radiologically proven or suspected injuries to the anus and/or rectum may initially require construction of a defunctioning stoma. Nursing care of wounds to the perineum or buttocks may also require a defunctioning stoma, although this is unlikely to be necessary for open pelvic ring injuries associated with wounds to the groin or lower abdomen alone. [BOA] • The position of the stoma should be determined, whenever possible, in conjunction with the orthopaedic surgical team. It should usually be sited in the upper abdomen, to ensure that it is sufficiently remote from the site of potential definitive pelvic surgical fixation. [BOA, originally from the Association of Coloproctology of Great Britain and Ireland and the Association of Surgeons of Great Britain and Ireland]	Created new recommendations, emphasizing interdisciplinary interaction between orthopedics and general surgery/urology.

VI. DIAGNOSTIC IMAGING

KMQ-13. How should patients presenting with proven or suspected major pelvic ring injuries be diagnostically imaged?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
X-ray and E-FAST • The use of Pelvic X-ray and E-FAST in the Emergency Department is recommended in hemodynamic and mechanic unstable patients with pelvic trauma and allows to identify the injuries that require an early pelvic stabilization, an early angiography, and a rapid reductive maneuver, as well as laparotomy. [WSES: 1B] • Focused Assessment with Sonography for Trauma (FAST) is not sensitive enough to exclude intraperitoneal bleeding in the presence of pelvic fracture. [EAST: Level 1] • FAST has adequate specificity in patients with unstable vital signs and pelvis fracture to recommend laparotomy to control hemorrhage. [EAST: Level 1]	Created a new recommendation statements emphasizing the use of plain X-ray in stable patients, based on the expert opinion of the SAG. Developed in consultation with the Diagnostic Imaging Specialist Advisory Group.
CT • In the hemodynamically stable patient with a pelvic fracture, CT of the abdomen and pelvis with intravenous contrast is recommended to evaluate for intra-abdominal bleeding regardless of FAST results. [EAST: Level 2] • CT of the pelvis is an excellent screening tool to exclude pelvic hemorrhage. [EAST: Level 2] • Patients with pelvic trauma associated to hemodynamic normality or stability should undergo further diagnostic workup with multi phasic CT-scan with intravenous contrast to exclude pelvic hemorrhage. [WSES: 1B] • CT-scan with 3-Dimensional bones reconstructions reduces the tissue damage during invasive procedures, the risk of neurological disorders after surgical fixation, operative time, and irradiation and the required expertise. [WSES: 1B]	Created a new recommendation specifying CT views and rendering required, based on the expert opinion of the SAG and the B.C. trauma imaging system. Developed in consultation with the Diagnostic Imaging Specialist Advisory Group.
• All polytraumatised patients require a post-binder X-ray after resuscitation, even in the presence of a 'negative' CT scan because a well-applied pelvic binder can mask a catastrophic pelvic ring injury. [BOA] • Diagnostic peritoneal tap (DP)/Diagnostic peritoneal lavage (DPL) is the best test to exclude intra-abdominal bleeding in the hemodynamically unstable patient. [EAST: Level 2]	Adopted BOA statement regarding post-binder removal X-ray, modified for clarity, i.e. added "removal." Ignored EAST statement regarding DP/DPL.

KMQ-14. When and how should patients with pelvic ring fracture undergo evaluation of the urethra and the bladder?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Potential injury to the bladder or urethra should be suspected, diagnosed and managed according to The Management of Urological Trauma Associated with Pelvic Fractures BOAST. [BOA] • Retrograde urethrogram or/and urethrocystogram with contrast CT-scan is recommended in presence of local perineal clinical hematoma and pelvic disruption at Pelvic X-ray. [WSES: 1B]	Created new recommendation emphasizing interdisciplinary interaction.

VII. TRANSFER TO HIGHER LEVEL OF CARE

KMQ-15. What are the indications and timing for higher level of care (HLOC) transfer of a trauma patient with major pelvic trauma to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Patients with suspected pelvic ring injuries with signs of haemodynamic instability should be transported directly to a Major Trauma Centre in accordance with network guidelines. If received into a trauma unit then resuscitation should be commenced followed by immediate transfer to the Major Trauma Centre for definitive treatment of active bleeding. [BOA] • Patients who are admitted to Trauma Units and require surgical stabilisation should be referred and safely transferred to a specialist centre within 24 hours. [BOA]	Adopted BOA statements, modified to reflect the B.C. trauma system.

KMQ-16. What is the preferred process for inter-facility transfer of major pelvic ring injuries?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	Created a new recommendation to reflect the B.C. trauma system.

KMQ-17. Which patients with pelvic ring fractures can be managed in a centre with general orthopedic surgery?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	Created a new recommendation to reflect the B.C. trauma system.

KMQ-18. Which pelvic mechanically unstable ring fractures can be managed in a centre without orthopedic surgery?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	Created a new recommendation to reflect the B.C. trauma system.

KMQ-19. How should the orthopedic surgeon on-call in a community hospital be involved in the early management of the patients with pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	Created a new recommendation to reflect the B.C. trauma system.

VIII. HOSPITAL CARE

KMQ-20. What are the care requirements for acceptable management of the stabilized admitted patient with a major pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Specialised units should have written local policies for thromboprophylaxis for patients with pelvic fractures, which should be followed and documented in the medical records. [BOA]	Adopted BOA statement. Created a new recommendation to reflect the BC trauma system.

IX. DEFINITIVE SURGICAL CARE

KMQ-21. What is the preferred timeframe for definitive surgical fixation of major pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Reconstruction of the pelvic ring should occur within 72 hours of the stabilisation of the patient's physiological state if associated injuries allow. [BOA] • Hemodynamically stable patients and "borderline" patients can be safely managed by early definitive pelvic fracture fixation within 24 h post injury. [WSES: 2A] • Definitive pelvic fracture fixation should be postponed until after day 4 post injury in physiologically deranged polytrauma patients. [WSES: 2A]	Adopted BOA statement to reflect resources available in trauma centres across the province.

KMQ-22. How should bladder rupture (intraperitoneal and extraperitoneal) associated with major pelvic injuries be managed?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Potential injury to the bladder or urethra should be suspected, diagnosed and managed according to The Management of Urological Trauma Associated with Pelvic Fractures BOAST. [BOA]	Created a new recommendation emphasizing interdisciplinary interaction.

X. TRANSFER TO LOWER LEVEL OF CARE (REPATRIATION)

KMQ-23. What are the indications and timing for repatriation back to a sending facility (or equivalent) of patients with major pelvic ring injury transferred to a regional centre expertise for advanced orthopedic care?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	New recommendations created based on provincial realities and the expert opinion of the SAG.

XI. REHABILITATION

KMQ-24. What is the preferred rehabilitation strategy for patients treated for major pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	New recommendation created based on the expert opinion of the SAG.

KMQ-25. When and how should patients who have undergone definitive surgical fixation of major pelvic ring injury be mobilized?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	New recommendation created based on the expert opinion of the SAG.

KMQ-26. What are the indications for in-patient rehabilitation of a patient treated for major pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• None	New recommendation created based on the expert opinion of the SAG.

XII. FOLLOW-UP

KMQ-27. What is the recommended follow-up for a discharged patient with unstable pelvic ring injury?

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
• Patient follow-up should occur in a specialist pelvic trauma unit or rehabilitation clinic, to ensure full advice is available for the pain, physical, psychological, and urological disabilities, which are common adverse outcomes. [BOA] • All patients who may be sexually active should receive written advice on sexual dysfunction in accordance to the guidelines from the British Association of Urological Surgeons. [BOA 2018] • Each network should submit appropriate data (to the TARN), monitor performance against national standards and audit their outcomes. [BOA]	Adopted BOA statement regarding general follow-up, modified to emphasize patient-centered care. Adopted BOA statement regarding sexual function, modified to emphasize interdisciplinary interaction. Ignored BOA statement regarding performance monitoring as out of scope.

Appendix

KEY PERFORMANCE INDICATORS

Purpose: To measure improvements in the system, including CPG compliance.

INDICATOR	RATIONALE
1. Number of patients with pelvic fracture	Benchmark data
2. Number of hemodynamically unstable patients with pelvic fracture	Benchmark data
3. Number of hemodynamically unstable patients that did not receive pelvic packing (partial data available)	Benchmark data
4. Number of hemodynamically unstable patients who received REBOA	Benchmark data
5. Number of patients who received REBOA with/without pelvic packing	CPG compliance
6. Number of hemodynamically unstable pelvic fracture patients who receive pelvic binding (partial data available)	CPG compliance
7. Time to definitive pelvic fixation (MSP codes: 55702, 55705, 55707, 55706, 55736)	Destination compliance/ Benchmark data
8. Number of patients transferred for non-operative management (metric development in progress)	CPG compliance/ Destination compliance
9. Number of patients transferred to rehab	Benchmark data

DESTINATION CRITERIA

Purpose: To identify key criteria for the transfer of patients, including timing and requirements for resource capabilities in receiving centres.

CRITERIA
1. Apply a pelvic binder prior to transport.
2. A hemodynamically unstable patient with major pelvic trauma should be transported to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries as early as possible.
3. Trauma/general surgery at the referral centre should be the primary point of contact.
4. Local orthopedic surgeon and referral centre orthopedic surgeon should be involved in the Patient Transfer Network (PTN) call where time permits.
5. Referral centre orthopedic surgeon should be informed of any transfers.
6. A stable patient major pelvic trauma should be transferred to a centre with orthopedic expertise in the surgical management of complex pelvic ring injuries within 24 hours with the goal to operate within 72 hours. Local orthopedic surgeon is the primary point of contact, with involvement of the referral centre orthopedic surgeon.

KEY STAKEHOLDERS

Purpose: To identify key stakeholder groups to either a) consult for direct input on the CPG content during its development, or b) to inform for review and final approval when the CPG content is complete.

TO CONSULT FOR DIRECT INPUT	TO INFORM FOR FINAL REVIEW
Urology (Dr. Alex Kavanagh)	Operational Trauma Directors at regional sites, Director of Surgery
Diagnostic Imaging (Drs Jason Blaichman & Ken Wong)	
BCHS: PTN, ambulance services, EPOS	
EPs, General Surgery, TTLs, Medical Directors of regional trauma centres	
Rehabilitation (KPIs) (Dr. Rhonda Willms)	

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