

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
<p>Pelvic binder</p> <ul style="list-style-type: none"> 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] 	<p>Adopted BOA wording.</p> <p>Rejected WSES recommendation regarding the superiority of binders to sheet due to low quality of evidence supporting this statement.</p>
<p>Transport</p> <ul style="list-style-type: none"> 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] 	<p>Modified BOA statement to reflect the B.C. trauma system.</p>
<p>Blood products</p> <ul style="list-style-type: none"> 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] 	<p>Adopted BOA wording for its clarity and specificity.</p>

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<p>Diagnostic imaging</p> <ul style="list-style-type: none"> 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] 	<p>Adopted BOA statements, modified to reflect provincial diagnostic imaging standard, i.e. Whole Body CT.</p>
<p>Hemorrhage control</p> <ul style="list-style-type: none"> 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] 	<p>Adopted BOA statement, modified to reflect the B.C. trauma system.</p> <p>See Additional Literature Support below for evidence regarding the benefits of implementing institutional protocols.</p>

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
<p>REBOA</p> <ul style="list-style-type: none"> • 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] 	<p>Drafted a new recommendation based on provincial realities, including institutional protocols and local expertise.</p> <p>The SAG notes that the BOA does not make recommends regarding REBOA at this time.</p> <p>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.)</p>

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
<p>Indication</p> <ul style="list-style-type: none"> 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] 	<p>Modified BOA statements for greater specificity:</p> <ul style="list-style-type: none"> 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. <p>Ignored WSES and EAST statements; they are points of information rather than recommendations for clinical practice.</p>
<p>Type</p> <ul style="list-style-type: none"> Temporary pelvic binders (TPBs) work as well or better than emergent EPF (external pelvic fixation) in controlling hemorrhage. [EAST: Level 3] 	<p>Rejected EAST statement for low-quality evidence supporting this statement.</p>
<p>Other</p> <ul style="list-style-type: none"> 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] 	<p>Adopted BOA statement regarding vertical shear fractures and added "along with a binder."</p> <p>Adopted WSES statement regarding pregnant and elderly patients.</p>

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

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<ul style="list-style-type: none"> • 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] 	<p>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.</p> <p>Adopted BOA recommendation for the need for clear institutional protocol, with 24-hour mark as a guide.</p>

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
<ul style="list-style-type: none"> • 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]. 	<p>Rejected WSES statements indication C-clamp usage, based on expert opinion of the SAG regarding the relevance of this technology.</p>

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 intervention.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
<p>Timing/sequence</p> <ul style="list-style-type: none"> • 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] 	<p>Adopted WSES wording with the following modification: Angiography/embolization should be considered after pelvic packing has been attempted.</p>

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<p>Indication: CT results</p> <ul style="list-style-type: none"> • 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] 	<p>Adopted EAST and WSES statements regarding CT-scan results as indication for angiography/angio-embolization.</p> <p>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).</p>
<p>Management pathway</p> <ul style="list-style-type: none"> • 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] 	<p>Modified BOA statement (created two new statements) to reflect the B.C. trauma system.</p> <p>(See Additional Literature Support for the benefits of implementing institutional protocols on page 19.)</p>
<p>Indication: Age</p> <ul style="list-style-type: none"> • 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] 	<p>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.”</p>
<p>Repeat angiography/embolization</p> <ul style="list-style-type: none"> • 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]. 	<p>Ignored: out of scope.</p>

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<p>Other details</p> <ul style="list-style-type: none"> • 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] 	<p>These statements are points of information rather than recommendations for clinical management, and as such were excluded.</p> <p>However, these statements provide supportive evidence to the SAG's recommendations.</p>

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
<ul style="list-style-type: none"> • 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] 	<p>These statements are points of information that support selective angioembolization as preferred method. New recommendation statements were created to guide clinical management.</p>

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
<p>Management pathway</p> <ul style="list-style-type: none"> 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] 	<p>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.)</p> <p>Created a new recommendation regarding pelvic packing in hospitals without IR, adapted from WSES statement to reflect the B.C. trauma system.</p> <p>Adopted WSES statements regarding the need for pelvic stabilization and specified options: binder or external fixation.</p>
<p>Indication</p> <ul style="list-style-type: none"> 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] 	<p>Created a new recommendation for the indications of pelvic packing, adapted from WSES and EAST, i.e.:</p> <ul style="list-style-type: none"> hemodynamic instability and persistent bleeding after angiography.
<p>C-clamp</p> <ul style="list-style-type: none"> 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] 	<p>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).</p>

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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> • 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] 	<p>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.</p>

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

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<ul style="list-style-type: none"> • 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] 	<p>Created new recommendations, emphasizing interdisciplinary interaction between orthopedics and general surgery/urology.</p>

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
<p>X-ray and E-FAST</p> <ul style="list-style-type: none"> 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] 	<p>Created a new recommendation statements emphasizing the use of plain X-ray in stable patients, based on the expert opinion of the SAG.</p> <p>Developed in consultation with the Diagnostic Imaging Specialist Advisory Group.</p>
<p>CT</p> <ul style="list-style-type: none"> 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] 	<p>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.</p> <p>Developed in consultation with the Diagnostic Imaging Specialist Advisory Group.</p>
<ul style="list-style-type: none"> All polytraumatized 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] 	<p>Adopted BOA statement regarding post-binder removal X-ray, modified for clarity, i.e. added "removal."</p> <p>Ignored EAST statement regarding DP/DPL.</p>

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
<ul style="list-style-type: none"> 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 urethrocytogram 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> 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] 	<p>Adopted BOA statement. Created a new recommendation to reflect the BC trauma system.</p>

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
<ul style="list-style-type: none"> 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] 	<p>Adopted BOA statement to reflect resources available in trauma centres across the province.</p>

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

KNOWLEDGE SYNTHESIS

EXTERNAL RECOMMENDATIONS	SAG'S DECISION
<ul style="list-style-type: none"> 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] 	<p>Created a new recommendation emphasizing interdisciplinary interaction.</p>

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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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.