

Chapter 22

REGIONAL ANESTHESIA AND COAGULOPATHY OF TRAUMA SHOCK

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INTRODUCTION

DETERMINING WHEN TO USE REGIONAL ANESTHESIA

THE CAMP BASTION PROTOCOL

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INTRODUCTION

Acute coagulopathy of trauma shock (COTS) is an ill-defined entity that is induced by tissue trauma, shock, acidemia, hypothermia, and hemodilution. It is often exacerbated by large volume autologous blood transfusion, with further dilution and consumption of coagulation factors. COTS has a very different pathophysiology

compared to other forms of coagulopathy such as drug-induced (eg, heparin, low molecular weight heparin [LMWH]), preeclampsia, and bleeding disorders. Aggressive trauma resuscitation in accordance with current best practice is the best defense against undesirable consequences of markedly disturbed coagulation.

DETERMINING WHEN TO USE REGIONAL ANESTHESIA

The trauma patient, particularly following blast or ballistic trauma, with complex injuries requiring multiple dressing changes and operations may benefit from regional anesthesia (Exhibit 22-1). Guidelines have been published by national societies on the management of regional anesthesia in coagulopathy,^{1,2} but there is no published evidence specifically on COTS and regional anesthesia.

Therefore, the decision-making process for regional anesthesia in the presence of COTS should focus on two principles: (1) Coagulopathy is dynamic; no fixed numbers show “safe” or “unsafe” conditions. (2) Risks of regional anesthesia need to be weighed against the potential benefit for each patient (Figure 22-1). This decision should include other trauma team members and the patient (when possible).

THE CAMP BASTION PROTOCOL

An acceptable approach has been used at the joint UK/US Role 3 hospital in Camp Bastion, Afghanistan. Anesthesiologists there are encouraged to assess and document coagulation as well as discuss potential risks and advantages of the planned regional anesthetic technique with the patient’s trauma team. When available, thromboelastometry offers significant advantages for functional assessment of coagulation alongside traditional laboratory tests. Manufacturers of throm-

boelastomeric machines provide standard figures to assist with interpretation of results. The standard figures, as is the case with other laboratory standards, are developed from evidence and expert opinion on non-COTS coagulopathy. These figures should be used as supplemental information concerning a patient’s coagulation state and no more. However, the addition of thromboelastomeric data has supplemented clinical decisions in COTS patients at the Camp Bastion

EXHIBIT 22-1

POTENTIAL BENEFITS OF REGIONAL ANESTHESIA

- Decreased morphine (or other opioid) requirement, which means less initial pain, fewer side effects of morphine, less time in recovery, and less opioid-associated immune suppression. Also, regional anesthesia is easier to manage on ward.¹
- Humanitarian; foreign nationals are less likely to communicate their own pain experience.²
- During critical care, patient will awaken early, have a shorter stay in intensive care, and have improved respiratory dynamics.³
- Better early pain management potentially decreases the severity and incidence of both acute traumatic brain injury and chronic pain.⁴

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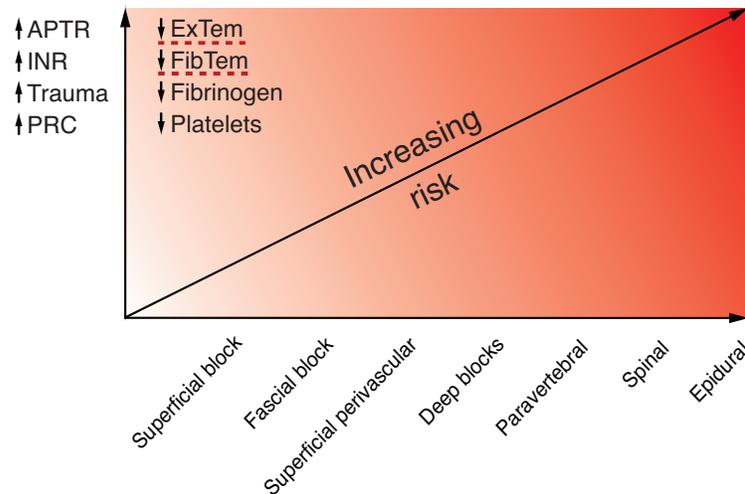


Figure 22-1. The continuum of regional anesthesia risk.

APTR: activated partial thromboplastin time ratio

INR: international normalized ratio

PRC: packed red blood cells

ExTem: platelet- and fibrin-dependent clotting test on thromboelastogram

FibTem: fibrin-dependent clotting test on thromboelastogram

hospital, and since its introduction in May 2010, no bleeding-related complications of regional anesthesia have been reported.

Suggested guidelines for regional anesthesia in the COTS patient (the Bastion protocol) are as follows:

Epidural catheter insertion (also applies to single injection spinal and epidural techniques)

1. Discuss and document the clinical requirement (risk vs benefit) for regional anesthesia (done by two senior clinicians; when possible, the requirement should also be discussed with the patient).
2. After large transfusions associated with use of fresh frozen plasma, epidural insertion should only be performed by a specialist; aim for least traumatic insertion.³
3. Insert epidural only when:
 - international normalized ratio (INR) ≤ 1.5 (INR = prothrombin time [test]/prothrombin time [normal]);
 - the activated partial thromboplastin time ratio (APTR) $\leq 1.5^2$ (APTR = test/normal);
 - and platelets $> 80 \times 10^9/L^4$
4. If the above measures are acceptable and thromboelastometry is available, the epidural insertion should still be deferred if:
 - clotting time (CT) > 100 s,
 - and maximum clot firmness (MCF) (Ex) < 40 mm or MCF (Fib) < 8 mm. (Expert opinion only; patient must be normothermic.)

5. If the patient is already on a prophylactic LMWH dose, then the epidural catheter should not be placed until more than 12 hours after the last dose. The following dose should be delayed at least 4 hours after insertion.²

Epidural catheter removal

1. Remove only when:
 - INR ≤ 1.4 ,
 - APTR $\leq 1.4^2$,
 - and platelets $> 80 \times 10^9/L^4$
2. If thromboelastometry is available, then MCF should be in normal range before removal (no research evidence presently exists to support this recommendation).
3. Catheter must be removed more than 12 hours after LMWH dose.²
4. Subsequent dose of LMWH should be at least 4 hours after catheter removal.²

Deep peripheral nerve block (single, continuous)

1. Follow epidural catheter insertion and removal guidelines above.^{2,5}
2. Be aware of the risk of retroperitoneal hematoma in the lumbar plexus, requiring surgical evacuation.
3. The paravertebral space, which is relatively avascular but incompressible, can be used as an alternative to the neuraxial approach if the benefit outweighs the risk (per expert opinion).

Superficial peripheral nerve block (single, continuous)

Notes

1. Bleeding or hematoma related to superficial nerve block placement is not associated with long-term damage,² and large case series demonstrate safe removal of continuous peripheral nerve block (CPNB) catheters in patients treated with warfarin, LMWH, and heparin.^{5,6}
2. CPNB catheters have been placed in patients receiving therapeutic (high dose) LMWH.⁷
3. Ultrasound use may reduce the risk of accidental vascular puncture.⁸
4. Higher values of INR and APTR as well as lower platelet count can be accepted for placement of CPNBs. There is insufficient evidence to make absolute numerical recommendations; therefore, the decision should be made per a risk/benefit analysis for each patient. Thromboelastometry can be of help in this process.
5. CPNB catheters must be removed more than 12 hours after an LMWH dose.²
6. Subsequent dose of LMWH should be at least 4 hours after catheter removal.²

- MCF (Ex), or MCF (ExTem) is a platelet- and fibrin-dependent clotting test on thromboelastogram. An abnormal MCF (Ex) in the presence of a normal MCF (Fib) reflects reduced platelet function. MCF (Fib) or MCF (FibTem) measures fibrin clot only. Low MCF (Fib) denotes fibrinogen or F XIII deficiency.
- Coagulation is dynamic; results should be less than 2 hours old or stable.
- Patient must be normothermic.
- There is no evidence to suggest which thromboelastometry values are safe for epidural insertion. An epidural or deep catheter should NOT be inserted if CT > 100 s, MCF (Ex) < 40 mm, or MCF (Fib) < 8 mm. If parameters are better than these values, clinical discretion must still be applied.
- Increased vigilance, including simple neurological observation and pain team review in accordance with standard procedures, is required after insertion of any epidural or CPNB catheter.
- Clear documentation of discussion and values should be appropriately recorded.

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