

# How Can a Thoracic Epidural Catheter Be Safely Discontinued in the Post-operative Setting of Coagulopathy, Thrombocytopenia, and Mechanical Ventilation?

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## **Objectives:**

1. Discuss indications for and patient selection criteria for the use of thoracic epidurals for post-operative analgesia
2. Discuss indications for and timing of epidural discontinuation in the post-operative period
3. Review safety of the use of epidurals and discontinuation of epidurals in the setting of anticoagulants, thrombocytopenia, or abnormal coagulation studies
4. Identify risk factors for epidural hematoma and epidural abscess formation; discuss clinical signs and symptoms that lead to these diagnoses and their management
5. Discuss how to best monitor for clinical signs of epidural hematoma or epidural abscess in a mechanically ventilated, deeply sedated patient

## **Case History:**

A 6-year old female (weight 18kg) with a history of mid-abdominal aortic syndrome complicated by superior mesenteric artery stenosis, renal artery stenosis, and renovascular hypertension is scheduled for a complex renal artery and mesenteric revascularization. She has had ongoing difficulties with hypertension, which has been refractory to multiple medications. All of her preoperative laboratory tests were within normal limits, including chemistries, blood counts (platelets 239), and coagulation studies (PTT 23.3, INR 1.0).

## **Questions:**

What is mid-abdominal aortic syndrome? What are the implications of SMA stenosis and renal artery stenosis? What are the main anesthetic concerns? Would this patient benefit from an epidural? How would you place it (awake/under GA, positioning)?

### **Case History, cont.**

The procedure was complicated by a long cross-clamp time (>1hr total) and at the end of the case, the patient's abdomen was left open and she required postoperative mechanical ventilation. During the procedure, she received 1 unit of PRBC's, 2.8L of crystalloid, and 0.5L 5% albumin and had an EBL of 300mL. As is typical for these cases, the patient received IV heparin (total 6500 units, given in 6 divided doses) and an aspirin tablet (325mg) during the procedure and will be on aspirin (150mg daily) in the post-operative period. A thoracic epidural catheter had been placed after induction of anesthesia (pre-incision) for post-operative analgesia.

### **Questions:**

How does heparin work? How is it different from lovenox? How are the therapeutic effects of these drugs monitored? Is there any contraindication to an epidural in this setting of open abdomen, patient requiring postoperative mechanical ventilation? Beyond the obvious analgesic benefit, does the epidural provide any other benefit in this patient?

### **Case History, cont.**

Post-operatively, she developed severe thrombocytopenia (platelets 20,000) and a coagulopathy with an INR 2.7. The coagulopathy was believed likely due to hepatic injury from her underlying disease and long cross-clamp time. Thrombocytopenia and coagulopathy persisted despite multiple transfusions of platelets and plasma. On post-operative day 6, the patient remained intubated with the epidural catheter still in place and she developed a fever to 39°C.

### **Questions:**

What are the safety concerns regarding discontinuation of an epidural catheter? Is there a threshold for platelet count or INR beyond which you feel discontinuation of an epidural catheter is unsafe? What do the ASRA guidelines say? Are there medications that should be discontinued prior to pulling an epidural catheter? Which medications that have effects on the coagulation cascade are safe to continue? At what doses? What are the signs and symptoms

of an epidural abscess? What are the signs and symptoms of an epidural hematoma? Should we monitor for these two complications in this patient? How? Would an MRI scan be helpful? Would it be practical? What time window exists for reversing spinal cord ischemia?

## **Discussion**

Mid-abdominal aortic syndrome is an uncommon condition which results in progressive narrowing of the aorta and its major abdominal branches. It usually presents with hypertension and claudication, progressing to renal failure if untreated. It may be congenital in origin or associated with neurofibromatosis type 1 (von Recklinghausen's disease). Treatment is generally surgical, with re-vascularization procedures the mainstay of therapy.

While epidurals are placed in adult patients while they are awake, it is common practice to place the epidural after the induction of general anesthesia for young children. Aside from the obvious benefit of post-operative analgesia, this patient in particular may benefit from an epidural due to the side effect of some degree of sympathetic blockade. Hypertension often remains a problem in these children in the post-operative period and a working epidural has the additional benefit of assistance with blood pressure control.

Heparin's anticoagulant effect is due to binding to antithrombin (AT) with high affinity, resulting in its ability to inactivate thrombin (factor IIa), factor Xa, and factor IXa. The anticoagulant effect of unfractionated heparin (UFH) depends on both the number of heparin molecules and the size of the molecules; larger molecular weight heparins inhibit both factor IIa and Xa; smaller molecular weight heparins inhibit only factor Xa. When heparin is given subcutaneously, therapeutic effect is not realized for 1-2 hours; when given IV, the effect is immediate. Heparin's anticoagulant effect is usually monitored with the aPTT; the ACT (activated clotting time) is usually selected when higher doses of heparin are given (e.g. for cardiopulmonary bypass). Adequate therapeutic effect coincides with an aPTT between 1.5 to 2.5 times the patient's baseline value. The half-life of heparin, when given intravenously is 60-90 minutes. ASRA guidelines state that for twice daily dosing of subcutaneous UFH, there are no contraindications to epidural catheters; however when administered IV in the perioperative period such as during vascular cases, they recommend not administering UFH for 1 hour after catheter placement and not removing catheter until 4 hours have elapsed since the last dose of UFH.

LMWH (lovenox) typically does not necessitate monitoring of the anticoagulant response. Its half-life is 3-4 times that of unfractionated heparin, resulting in significant anti-Xa activity even 12 hours after a subcutaneous injection. As LMWH is mostly excreted via the

kidneys, the half-life is prolonged in patients with renal insufficiency. Protamine does not easily bind to LMWH, thus it does not reliably reverse the anti-Xa activity. Heparin administration has been associated with increased risk of epidural hematoma when there is a less than 60 minute time interval between the administration of heparin and lumbar puncture, a traumatic needle placement, and concomitant use of other anticoagulants, including aspirin. Epidural catheter placement or removal is contraindicated for 24 hours when patients are receiving therapeutic doses of LMWH; it is contraindicated for 12 hours when patients are receiving thromboprophylactic doses of LMWH. ASRA guidelines also suggest not maintaining an epidural catheter in patients receiving therapeutic or twice daily doses of LMWH. Regarding use of other drugs, aspirin is not contraindicated in the presence of an epidural, provided no other antiplatelet/thrombolytics/anticoagulation medications are given. When other medications that have an effect on the coagulation cascade are given concurrently with aspirin, then ASRA guidelines suggest that an epidural catheter is contraindicated.

ASRA guidelines suggest an INR <1.5 for safe removal of an epidural catheter. However, these guidelines are specifically referring to patients who are on Coumadin; the guidelines do not address other reasons for elevated INR. This value was derived from studies correlating hemostasis with clotting factor activity levels greater than 40%. The guidelines also suggest that neurologic assessment be continued for at least 24 hrs after catheter removal for these patients.

An epidural hematoma typically presents with increasing sensorimotor blockade; the second most common complaint is loss of bowel/bladder function. Radicular back pain is actually not consistently reported and may be a later finding. Studies that have evaluated spinal cord ischemia resulting from epidural hematoma note that many patients achieved at least a partial return of function if a laminectomy was performed within 8 hours of symptom onset. Epidural abscess presentation has similar symptoms to an epidural hematoma. Fever is present in up to 1/3 of patients and leukocytosis is present in 2/3 of patients who have an epidural abscess; otherwise, neurologic findings include localized back pain progressing to radicular symptoms and finally to sensorimotor deficits. Diagnosis is confirmed with MRI scan and treatment is surgical decompression. Similar to an epidural hematoma, outcomes are typically correlated with time until surgical decompression.

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