



Essential Learning

Abdominal Aortic Aneurysm

- **What is the pathophysiology and risk factors for AAA?**
 - Weakness in the wall of the aorta causes dilation of the vessel, which causes increased pressure at the wall, increasing the rate of stretch until a leak or rupture occurs
 - This condition tends to progress slowly (over years) and the risk of rupture increases with the diameter of the vessel, with greatest risk > 5.0 cm.
 - Most AAAs are infrarenal (97%) and most ruptures are into the retroperitoneal space
 - Approximately 20% will rupture into the intraperitoneal space and result in a positive FAST exam
 - Risk factors for AAA include age > 60, male gender, family history of AAA, smoking, hyperlipidemia, HTN, atherosclerotic disease (CAD, PVD), or connective tissue disease
 - 100% mortality if no surgical intervention is performed
- **Clinical presentation of AAA**
 - Asymptomatic
 - Diagnosed incidentally on abdominal imaging, or screening (abnormal = 3 cm or greater)
 - One-time screening with abdominal ultrasound is recommended by the US Preventive Services Task Force for men aged 65-75 years who have smoked at any point in life
 - Complications of AAA
 - Thromboembolic phenomena
 - Due to embolism of atherosclerotic clot within the aneurysm to distal vasculature
 - Large emboli can cause acute limb ischemia
 - Small emboli can obstruct distal vessels causing digital ischemia and “blue toe syndrome”
 - Cholesterol microemboli can obstruct capillaries of the skin causing livedo reticularis
 - Rupture
 - Ruptured AAA can mimic other less severe disease processes and should be considered in any patient undergoing a workup for syncope, kidney stone, MSK back pain, diverticulitis, scrotal hematoma or mass.
 - Retroperitoneal rupture
 - Most common site of rupture
 - Presents with triad of: (all three present in 1/3 of patients)
 - Pain (flank, abdominal or back pain)

- Shock (hypotension)
 - Pulsatile mass in the abdomen
 - Other signs: abdominal bruit (auscultation), flank ecchymosis (Gray-Turner's sign) or periumbilical ecchymosis (Cullen's sign)
 - Hemorrhage is slowed temporarily by tamponade and may allow patient time to seek treatment
 - Free intraperitoneal bleed
 - Less common (10-30%)
 - No tamponade; hemorrhage is brisk and rapidly fatal
 - Gastrointestinal bleed
 - Symptoms include brisk hematochezia, shock
 - E.g., aorto-enteric fistula
- **Management of AAA rupture in the ED**
 - Once a ruptured AAA is suspected, all efforts should be concentrated on stabilizing the patient and transferring the patient to the OR with vascular surgery
 - Bedside ultrasound, including views of the aorta and FAST views to r/o intraperitoneal fluid, is a key component of diagnosis (see POCUS Pearls below)
 - ED Workup
 - High Suspicion + Unstable Patient + POCUS+ = Immediately to OR
 - If the patient is stable or the diagnosis is uncertain, consider CT
 - ED Management
 - IV, O2, monitor, airway and crash cart to the bedside
 - Permissive hypotension (SBP 70-90 mm Hg)
 - Vigorous transfusion may be harmful (may disrupt clot/tamponade)
 - Type and cross pRBCs, transfuse blood for profound shock
 - Consider balanced resuscitation with 1 pRBCs : 1 FFP
 - Avoid IV crystalloid unless blood products are not immediately available
 - May cause dilutional coagulopathy and iatrogenic acidosis
 - Reverse anticoagulation
 - Emergent vascular surgery consult
 - Dispo to OR ASAP
 - In an elderly patient or those with significant comorbid disease, a risk/benefit discussion for operative management and goals of care discussion should help guide decision making
- **Advanced Management of AAA rupture in the ED**
 - *What are the indications for chemical sedation?*
 - Any patient who is a potential threat to themselves or others, or lacks capacity to refuse care may require some form of physical restraint or chemical sedation
 - If a patient does not present an immediate threat (uncooperative, severely agitated, or violent), an attempt should always be made to calm them using verbal techniques and open communication

- *What route should the medications be given?*
 - Oral medications should be tried first if the patient is willing to cooperate with treatment
 - Oral formulations have similar action to IM/IV medications and are less invasive
 - Use IM or IV preparations if rapid control is needed or the patient is uncooperative
- *What medications can be used for chemical sedation?*
 - Benzodiazepines are preferred in patients with unknown cause of agitation, drug-related agitation, alcohol withdrawal, seizure disorder, or who are at risk for extrapyramidal effects or prolonged QT related to antipsychotic use
 - Lorazepam (Ativan): 1-4 mg PO/IM/IV, 3-5 min onset (IV), peak 30 min, duration 1-4 hr, ok with renal or hepatic dysfunction
 - Midazolam (Versed): 1-2 mg IV (5 mg IM) q2-3 min, 30 min duration, caution with liver dysfunction, ok for renal failure
 - Diazepam (Valium): 2-10 mg PO/IM/IV, onset 3-5 min (IV), duration 2-4 hr, caution with liver or renal failure
 - Patients should be monitored for respiratory depression
 - Antipsychotics are preferred for agitation related to underlying psychiatric conditions
 - Haloperidol (Haldol): 2-10 mg PO/IM/IV, onset 30-45 min (deaconate = long acting formulation, lactate = short acting formulation)
 - Olanzapine (Zyprexa): 10 mg PO/ODT/IM, onset 15-45 min
 - Ziprasidone (Geodon): 10-20 mg PO/IM, onset 45-60 min
 - Patients should be monitored for extrapyramidal effects and QT prolongation (avoid if known prolonged QTc), more common with typical than with atypical antipsychotics
 - Combination therapy with a benzodiazepine and antipsychotic can be reasonably considered to control violence and agitation in an acute setting
 - Ketamine: 1-2 mg/kg IV or 4-5 mg/kg IM, onset 1-2 min IV/4-5 min IM, duration 15-25 min
 - Potential side effects including laryngospasm, catecholamine surge (HTN, tachycardia, increased myocardial O₂ demand), emergence reactions, and vomiting
 - Apnea can be seen with rapid IV administration
- *What are the options for sedation in the elderly in the ED?*
 - In general, and especially for long-term treatment of agitation/dementia, it is important to use medications with the lowest side-effect profile and at the lowest therapeutic dose
 - Sedation in the ED emergency may require use of fast acting IM or IV preparations such as Haldol or Benzos- these should still be used at lower doses

- 1st generation/typical antipsychotics (e.g., haloperidol) are usually less effective in elderly patients and carry significant side effects including:
 - QTc prolongation
 - High risk of extrapyramidal symptoms (especially tardive dyskinesia)
 - Orthostatic hypotension
 - Excessive sedation
 - Worsened delirium
 - Anticholinergic effects
 - Not ideal for long-term use given modest clinical effect and higher likelihood of side effects
- Benzodiazepines may be used when necessary but short acting formulations (e.g., lorazepam, midazolam) and at the lowest possible dose is recommended
 - Chronic use should be avoided due to common side effects such as cognitive impairment, sedation, falls, and paradoxical behavioral disinhibition
- 2nd generation/atypical antipsychotics (risperidone, quetiapine, olanzapine) are well tolerated in the elderly population due to the reduced side effect profile and higher efficacy

- **POCUS Pearls**

- POCUS for AAA is a critical application of Emergency Ultrasound
 - POCUS that is technically adequate has close to 100% sensitivity for demonstrating an AAA.
 - However, EMPs adequately visualize in only 60-70% of cases.
- The abdominal aorta can be visualized using the low frequency abdominal probe in a transverse orientation starting at the subxiphoid space. The entirety of the aorta should be visualized from the celiac trunk to the bifurcation.
 - Cephalad to caudad: Celiac trunk is the first to emerge from the aorta, then SMA then renal arteries
 - The majority of AAA's are located inferior to the renal arteries
- Definitions vary, but it is generally agreed that a diameter > 3 cm is consistent with AAA
- FAST can be positive, however is usually negative as AAA's most commonly leak into the retroperitoneum and not the intraperitoneal space
 - Absence of free fluid on FAST does not mean the AAA is not leaking
 - AAA's of any diameter > 3cm are at risk for leak, however risk for leak significantly increases with increasing size
- Avoiding Pitfalls:
 - Overlying bowel gas can hinder the view of the aorta and limit the sensitivity of the scan. Gentle, constant downward pressure can displace bowel gas
 - Be sure to know what a mural thrombus looks like as large AAA's can sometimes appear to be of normal diameter if the mural thrombus is not identified
 - Be sure to correctly identify the aorta and not the IVC

- Aorta is on patient's left, is generally non-compressible, pulsatile, thick-walled, without respiratory variation and generally smaller than IVC (unless there is a AAA)

- **Attributions**

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