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CENTRAL LINE PLACEMENT/REMOVAL

Surgical Specialty:	Pediatric Surgery
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Background:

- General Considerations
  - Central line placement is a common procedure to provide central venous access.
    - Placement may be by untunnelled or tunneled catheter, or implantable port.
    - Insertion may be percutaneous or by cutdown.
    - The most common points of insertion are the internal jugular and subclavian vein.[1]
    - Other sites such as femoral or retrohepatic inferior vena cava can be used in case of thrombosis of the classic vessels.
  - Central line removal typically occurs because the condition necessitating the line no longer exists or the line has become infected or malfunctioned.
- Patient Considerations
  - Almost always occurs in the setting of a significant disease state.
- Associated Comorbidities/Syndromes
  - Hematological malignancy and other cancers requiring treatment such as chemotherapy, bone marrow transplant
  - Mediastinal Mass
  - Metabolic Diseases requiring frequent or continuous infusions.
  - Short gut necessitating long-term parenteral nutrition (TPN).
  - End-stage renal disease requiring dialysis.
  - Other significant comorbid conditions requiring frequent needle sticks for procedures, lab draws, infusions, or blood transfusions: e.g., cystic fibrosis.

Anesthetic Planning:

- Pre-Anesthetic Evaluation
  - Standard thorough pre-operative evaluation with identification and evaluation of comorbidities including the reason for line placement or removal.
  - Additional labs/tests indicated during work-up
    - Consider complete blood count for cancer patients.
    - Coagulation profile in the setting of coagulopathy and hematologic malignancy.
    - Blood chemistry panel for patients with end-stage renal disease.
- Specific or Unique Room Set-up Requirements

- Airway
  - Endotracheal tube versus laryngeal mask airway (LMA) for placement, with consideration to head-turning and movement during the procedure which may favor endotracheal tube placement.
  - A laryngeal mask airway is generally adequate for line removal.
- Drugs/Infusions
  - Avoid steroids (e.g., prophylactic dexamethasone) in cancer patients who have not yet started chemotherapy due to the risk of tumor lysis.
  - PONV prophylaxis with ondansetron (0.1-0.15 mg/kg) – max 4mg.
  - Antibiotic prophylaxis for insertion, based on institutional protocol (typically cefazolin 30mg/kg).
- Monitors
  - Standard ASA monitors
- Blood Availability (if indicated)
  - Typically not required but consider in patients with anemia or coagulopathy due to comorbid conditions.
- Other Indicated Resources
  - For central line removal, ensure another venous access is in place prior to line removal.

Intraoperative Considerations:

- General
  - Must consider the reason for the line placement and associated anesthetic risks of that condition: e.g., the presence of a mediastinal or cervical mass, low platelet count, etc.
    - In patients with mediastinal mass, refer to the SPA case guide on "Mediastinal Mass". Consider IV sedation as a preferred anesthetic versus general endotracheal anesthesia to balance risks of mediastinal mass.
    - Short gut syndrome is typically associated with prematurity at birth. Consider associated conditions such as bronchopulmonary dysplasia, cerebral palsy, and developmental delay.
- Induction
  - Mask or IV induction as appropriate.
- Positioning
  - Supine with head turned away from the side of insertion. Trendelenburg to facilitate venous engorgement.
- Maintenance
  - General anesthesia with inhalational agent is typical, but institutional practice may vary.
- Hemodynamic/Physiologic goals
  - Standard practice
  - Consider aing ventilation if the patient is in a semi-Fowler's/sitting position to minimize risk of venous air embolism, and provide PEEP to prevent air embolism.
- Surgical Considerations
  - Proceduralists typically require ultrasound to check for vessel patency and for ultrasound-guided percutaneous access, and fluoroscopy via c-arm for position confirmation.
  - Tunneling (if performed) can be quite stimulating. Ensure adequate depth of anesthesia but avoid long-acting agents as the stimulation will cease after the

    tunneling is complete. Preemptive infiltration of the path with a local anesthetic is useful.
  - The catheter tip should be positioned at the junction of the superior vena cava and the right atrium, as positions within the heart can be associated with vessel or myocardial perforation or dysrhythmias.[2]
  - Easy aspiration of venous blood through the catheter should be verified.
  - Removal of lines that have been in place for a significant period of time, typically years, can be complicated by scarring of the line in the vessel with the risk of line fracture or tearing of the vessel, in rare cases.
  - Proceduralists typically place local anesthetic at the puncture and port site.
- Emergence/Disposition
  - No special considerations for the procedure but consider patient co-morbidities.
  - A compressive dressing over the puncture site may be useful in case of bleeding.
- Post-op Care
  - Non-opioid agents such as acetaminophen or ibuprofen are typically adequate for pain

Case-Specific Complications/Pitfalls

- Identify pertinent complications and pitfalls and discuss their management
  - Risk of pneumothorax during needle insertion.[1,2]
    - Lung ultrasound is more sensitive than chest X-ray to diagnose.
    - If clinically significant, proceduralist can needle decompress and/or place a chest tube
  - Risk of arterial puncture.[1,2]
    - Typically insignificant unless the vessel the arteriotomy site is dilated, in which case may require intervention by vascular surgery.
    - This may render subsequent access to the targeted vein more difficult
    - Significant hematoma may cause airway compression.
  - Risk of malpositioning such as in the pleural space, or in a thoracic vein or
  - in the pericardium resulting in cardiac tamponade.[2]
  - Arrhythmia with wire placement[2]
    - Typically a confirmatory sign of correct positioning, usually terminates with retraction of the wire. Rarely sustained but if clinically significant, refer to PALS/ACLS management of arrhythmias
  - Air emboli[2,3]
    - Risk can be reduced with avoidance of spontaneous breathing
    - Consider in the setting of unexplained hypotension or decrease $ETCO_2$.
    - Management is supportive and includes stopping the air entrainment (occlude the vessel or flood the field), 100% FiO2, and hemodynamic support.[3]
  - Malposition[1,2]
    - Confirmed by fluoroscopy
  - Line fracture (rare) during removal may require further intervention such as retrieval with interventional radiology
  - Vessel tearing during removal (very rare) may require repair by vascular surgery

References

1. Shilati F, Raval M, Lautz T. Technical factors and outcomes in pediatric central venous port placement. *J Pediatr Surg*. 2022;57(3):450-453. doi:10.1016/j.jpedsurg.2021.02.055 PubMed Link

2. Coté CJ, Lerman J, Anderson B. *A Practice Of Anesthesia For Infants And Children*. Philadelphia: Elsevier; 2018:1129-1145.

3. Mirski M, Lele A, Fitzsimmons L, Toung T, Warltier D. Diagnosis and Treatment of Vascular Air Embolism. *Anesthesiology*. 2007;106(1):164-177. doi:10.1097/00000542-200701000-00026 PubMed Link

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