INTRA-ARTERIAL CHEMOTHERAPY FOR RETINOBLASTOMA

Surgical Specialty:	Interventional Radiology
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Background:

- **General Considerations:**
  - Direct injection of chemotherapy into the ophthalmic artery via microcatheters circumvents the need for systemic administration of chemotherapeutic agents and allows for the delivery of higher treatment doses to retinoblastoma tumors. A typical protocol is 3 treatments at one-month intervals.
  - Brief but significant episodes of pronounced cardiorespiratory instability can be seen during the administration of intra-arterial (IA) chemotherapy and are thought to be due to autonomic reflexes stimulated by mechanical cannulation of the ophthalmic artery. Cardiorespiratory instability is typically seen within 2 minutes after catheter insertion into the ophthalmic artery.[1]
  - **Sudden, profound decreases in lung compliance with and without hypotension and bradycardia have been reported.** This cardiorespiratory instability occurs with differing degrees of severity in the same patient across repeated treatments. Symptoms usually improve with **catheter removal** and **epinephrine** administration.
  - Intraoperative cardiorespiratory instability occurs in an estimated 20% of cases, most of which manifest as isolated decreases in lung compliance.[1]
- **Patient Considerations**
  - Review prior anesthetic records for previous episodes of cardiorespiratory instability with cannulation of the ophthalmic artery.

Anesthetic Planning:

- Pre-Anesthetic Evaluation
  - Discussions to have with surgeons/family
    - Discuss the possibility of intraoperative cardiopulmonary instability with the parents.
    - At some institutions, arterial lines are routinely placed for initial IA treatments, discuss needs with IR proceduralist and family.
    - Discuss the need for post-procedure stillness due to groin puncture, typically for 4-6 hrs.

- Specific or Unique Room Set-Up Requirements
  - **Drugs/Infusions:**

        - **Have epinephrine ready:** doses of 0.5-1 mcg/kg/dose are most commonly reported, with up to 10mcg/kg/dose in severe cases.[2,3]
        - **Atropine**: some institutions pretreat with 10 mcg/kg.
        - **Administer topical vasoconstrictor to nares:** Administration of nasal vasoconstrictors will reduce the bypass of chemotherapy drugs away from the tumor and works by constricting the ophthalmic artery --> external carotid artery bypass pathway. Typically done with oxymetazoline prior to chemotherapy administration. Vasoconstrictor is given **ipsilaterally or bilaterally to the tumor,** depending on institution.[2]
        - **Heparin:** discuss dose with IR proceduralist.
        - **Dexamethasone:** antiemetic dose also helps to decrease periorbital edema.
    - **Monitors:**
        - Standard American Society of Anesthesiologists monitors
        - +/- Arterial line
    - **PICU Bed Availability:**
        - May be needed in rare instances of severe cardiopulmonary instability that does not resolve with intraoperative treatment.

Intraoperative Considerations:

- Induction
    - Induction per routine, consider laryngeal tracheal atomization for deep extubation.
    - Muscle relaxation + intubation
- Positioning: Supine
- Maintenance: Volatile
- Surgical Considerations:
    - Administer heparin with femoral artery cannulation.
    - Spray bilateral nares with oxymetazoline prior to chemotherapy administration.
    - A microcatheter is introduced into the internal carotid artery to gain access to the ophthalmic artery. Once the catheter is in the ophthalmic artery, chemotherapy (eg. Melphalan) is injected directly into the artery, typically in a pulsatile fashion over 30 minutes.
- Emergence/Disposition: Consider extubating deep to minimize coughing. Patient usually must also lay flat for 4-6 hours for groin care. Some institutions routinely admit patients for observation post-operatively. Other institutions discharge to home after a 6-hour PACU stay.

Case Specific Complications/Pitfalls

- **Intraoperative cardiopulmonary instability:**
    - Communicate with IR proceduralist when the catheter is approaching the cavernous sinus of the internal carotid artery. Prepare for possible cardiorespiratory instability.
        - Switch to 100% O_2
        - Change BP to 1 min cycling if NIBP, 2 second averaging SpO_2
        - Consider pre-treatment with albuterol.
    - Common scenario:
        - Sudden decrease in lung compliance (up to 40%)[4] with concomitant decreases in SpO_2. Wheezing is rarely heard Consider hand-ventilating the patient as the IR proceduralist approaches the target treatment area. Early treatment with **epinephrine 0.5-1mcg/kg/dose is the drug of choice.**[2]

- Hemodynamic instability (hypotension and bradycardia) often occurs after the onset of respiratory changes. Hypotension can be severe (up to 40mmHg decrease in SBP) and last more than 30 min.[5] Chest fluoroscopy (with IR equipment), if performed at the time of the reaction, typically shows global cardiac hypokinesia.[6] Give fluid and additional epinephrine as needed. Consider atropine.
- Cardiorespiratory instability tends to normalize once the microcatheter is removed. **Communicate with IR proceduralist if you need them to withdraw the catheter.**

- **Postoperative Issues:**
  - **Groin puncture care:** Due to groin puncture, 4-6 hours of limited patient movement is typically required in the PACU. Consider postoperative sedation as allowed at your institution.
  - **Postoperative stroke:** Evaluate the patient postoperatively for strokes.

References

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