

# **ANESTHETIZING DISEASED PATIENTS: URINARY; NEUROLOGICAL; TRAUMATIZED**

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## **Patients with Urinary Tract Diseases**

### **General considerations**

- Three main factors to consider in anesthetizing urinary tract diseased patient
  - Fluid, electrolyte and acid/base balance
  - The effect of drug on renal function
  - The effect of renal disease on drug metabolism
- Urinary tract rupture is present commonly in patients with car accidents
- Leakage of urine to the abdomen produces hyperkalemia, hyponatremia, hypochloremia and uremia.
- Hyperkalemia produces bradycardia, ventricular dysrhythmia, poor myocardial contractility and generalized weakness
- Excessive hyperkalemia predispose to severe cardiac dysrhythmia potentially leading to ventricular fibrillation, and therefore anesthesia should be postponed until normal restoration of serum potassium level
- Uremia produces CNS depression, alteration of thiopental sodium pharmacokinetic profile inducing overdose effect. In uremia, the percentage of unbound barbiturates doubles (from around 28 % to 56 %)

### **Anesthetic plan**

- Check electrolytes and pH, and restore to the normal range
- Check PCV, TP, and hydration status, and restore to the normal range
- Catheterizing the urinary tract or peritoneum would help drain the urine and relieve some undesirable clinical signs
- Choose premedicants with minimal cardiovascular depression (e.g., neuroleptanagesic combination comprised of benzodiazepine and opioid)
- Low dose of induction agent, face mask induction, and inhalational anesthesia for maintenance
- Keep warm and good analgesia
- Monitor electrolytes (with particular emphasis on  $K^+$ ) and acid base status at least once intraoperatively as prognostic indicator regarding the surgery.
- Avoid NSAIDs
- Polyionic crystalloids at 10 ml/kg/hr is adequate for intraoperative fluid therapy, however if severely hypovolemic (especially if the problem is traumatic in origin) colloids are better alternative to restore circulatory fluid balance
- After correction, hypokalemia may develop, so serial check should be extended during the recovery period

- Monitoring of urine production should be continued at recovery and diuretics may be considered if oliguric or anuric

## Case example: ruptured bladder in foals

Problem	Significance or Potential Complication	Plan
CNS depression	Overdose, hypoventilation	Use less than the usual calculated dose rates, use controlled ventilation
Hypovolemia with hyponatremia, hypochloremia and hyperkalemia	Hypotension, dysrhythmia (second degree AV block or premature ventricular complexes)	Give normal saline before anesthesia
Metabolic acidosis	Decreased anesthetic requirement, decreased CV function	Treat moderate to severe acidosis with bicarbonate
Abdominal distension	Decreased cardiac output, hypoventilation	Decompress slowly, support CV function
Sepsis	Decreased anesthetic requirement	Use less than the usual calculated dose rates

## Patients with Neurological Diseases

### Patient with seizure disorders

- Medical management of epilepsy consists of a variety of drugs, most commonly phenobarbital
- Represent low risk for anesthesia, uncommon to see problems with seizure disorders during the perianesthetic period
- However, a few points to remember:
  - Maintain antiepileptic medications throughout the perianesthetic period
  - Avoid anesthetic agents that may exacerbate seizure disorders
    - Phenothiazines
    - Dissociatives

### Patient with cranial mass; head trauma; CNS dysfunction

- Potentially difficult cases to manage
- Preoperative evaluation of CNS function important - may be presented in a semiconscious or unconscious state
- Intracranial space is fixed in volume and comprised of cranial mass, CSF, and blood
- As volume of one component increase, the volume of the other components decreases, or the intracranial pressure (ICP) rises (Monroe-Kelly doctrine)

- Minimizing increases in ICP is an important goal of anesthetic management
  - Autoregulation of cerebral blood flow
  - ICP is influenced by changes in cerebral blood flow (CBF). As CBF increases, so does ICP
  - Careful monitoring of fluid balance
  - $CPP = MAP - ICP$
  - Medical therapy - mannitol, furosemide, corticosteroids
  - Hyperventilation is desirable
    - ICP increases linearly with  $P_aCO_2$
    - Cerebral blood flow increases by approximately 2 ml/min/100 g of brain tissue for every 1 mmHg increase in  $P_aCO_2$  from 20 - 80 mmHg
    - Maintain  $P_aCO_2$  around 30-40 mmHg (i.e. end tidal around 25-35)
  - Inhalants induce increase in cerebral blood flow potentially increasing ICP, but decrease  $CMRO_2$ . This effect is clinically modest, provided  $PaCO_2$  is kept within the above recommended range and anesthetics not overdosed, and therefore inhalants can be safely used for neuro-anesthesia
- The blood brain barrier (BBB) is formed by cerebral capillary endothelium, the basement membrane and astrocyte foot processes, and tightly controls movement of substances between brain and capillary and serves as a neuro-protective layer against potential neuro-toxin.
- The tight BBB gets disrupted in inflammation, trauma and acute hypertension
- Anesthetic management
  - Preanesthetize with opioid +/- benzodiazepine if needed
  - If anticholinergics are indicated, glycopyrrolate is preferred over atropine because of it minimally crosses BBB
  - Preanesthetic diuretics can be beneficial to reduce cerebral edema and ICP
    - Mannitol: 0.25 - 1 g/kg IV over 20 mins
    - Furosemide: 1 - 4 mg/kg IV bolus 15 min after mannitol
    - Reduce crystalloids to 1 – 2 ml/kg/hr as soon as possible since it may exacerbate cerebral edema
  - Avoid emetic drugs (e.g., xylazine) as they induce transient increase in ICP
  - Rapid induction with propofol, thiopental or etomidate (with diazepam)
  - Avoid ketamine as it increases ICP and  $CMRO_2$
  - Maintenance with isoflurane or sevoflurane in oxygen
  - Initiate IPPV immediately, and maintain throughout the anesthetic period
  - Moderate fluid therapy
  - Invasive blood pressure monitoring is preferred
  - Keep warm and provide adequate analgesia

### Patient with spinal cord disease

- Another most common emergency cases
- Usually middle aged, healthy otherwise
- Animals with intervertebral disc disease present with rapid onset of severe pain, paralysis and increased sympathetic discharge, which may predispose to the development of arrhythmias and difficulty in anesthetic stabilization. Multi-modal analgesic approach including opioids, NSAIDs, local anesthetics, physical therapy such as acupuncture should all help alleviate the undesirable stress responses.

- Anesthetic management usually not difficult, however must consider that a myelography is usually part of the diagnostic workup
  - Myelography potentially causes seizures during the recovery period
  - Avoid anesthetic agents that may potentiate seizure disorders
  - Be prepared to treat seizures during recovery
    - Post-myelographic seizures usually present initially with twitching around the eyes and lips, then spread throughout the body
    - Rapid administration of 0.5 – 2 mg/kg diazepam IV at the onset of a seizure as first line of defense
    - If seizures persist, then pentobarbital or phenobarbital is the next in line...
- Movement of the patient during anesthesia must be done carefully!
  - While awake, the patient uses muscle rigidity to 'splint' the affected area of the spine, and limit further damage
  - Under anesthesia, the muscle relaxation we produce removes this mode of self protection
  - Critical to move the patients carefully, with minimal twisting or flexing of the spine
  - Potential exists to exacerbate the condition, produce more cord trauma
- Bradycardia is not uncommon due to increased vagal reflexes during the surgical manipulation, and usually responds well to the anticholinergic therapy

### Patient requiring EEG analysis

- Need a short period of general anesthesia to minimize movement artifacts from the EEG
- All anesthetics produce changes in the EEG
- Standardize anesthetic management to limit variability between patients
- Standard anesthetic protocol is a light level of thiobarbiturate anesthesia
- Propofol has also been advocated as a useful drug for EEG analysis

### Traumatized patients

- Mostly from road accidents, but gun shot wounds also occasionally seen
- Patients arrive in unstable condition needs immediate stabilization prior to presenting for anesthesia unless life threatening in which case the stabilization efforts go along with anesthesia
- Assess the level of consciousness
- Assess the adequacy of airway, breathing and circulation and work on the deficit
- Damage to CNS or major vessel constitutes the most serious challenge for stabilization
- Increased level of catecholamines predisposes to the dysrhythmia, so choose isoflurane or sevoflurane over halothane
- In patient with increased respiratory effort, pre-oxygenation is highly recommended prior to anesthetic induction
- Trauma to the chest wall requires immediate surgical intervention: flail chest, puncture, intrathoracic hemorrhage
- Anesthesia in these patients should be rapid sequence to avoid prolongation of further respiratory depression
- Ventilation must be supported
- Prescribing an opioid may dramatically improve breathing in chest pain related respiratory complication