Quiz 51
Spine surgery and co-existing disease

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This quiz is being published on behalf of the Education Committee of the SNACC.
1. A 5 M/O MALE PATIENT WITHACHONDROPLASIA IS SCHEDULED FOR POSTERIOR FOSSA DECOMPRESSION. WHICH OF THE FOLLOWING IS FALSE REGARDING THIS PATIENT:

A. Achondroplasia is a disease of skeletal dysplasia.
B. Infants may have sudden death.
C. Patients have normal airway.
D. This patient is prone to sleep apnea.
A. ACHONDROPLASIA IS A DISEASE OF SKELETAL DYSPLASIA.

This is True.

Achondroplasia is the most common skeletal dysplasia, with an incidence of 0.5–1.5 per 10,000 live births. It is caused by mutations in fibroblast growth factor 3 (FGFR3), which normally codes for constitutively active growth factor receptor. As a result of this mutation, faulty endochondral ossification results, which produces the characteristic phenotype of short stature and short proximal limb segments.

Shiang R, Thompson LM, Zhu YZ. Mutations in the transmembrane domain of FGFR3 cause the most common genetic form of dwarfism, achondroplasia. Cell 1994;78:334–42. 10.1016/0092-8674(94)90302-6
B. INFANTS MAY HAVE SUDDEN DEATH.

This is true. Craniocervical compression in some achondroplastic infants may lead to respiratory compromise secondary to central hypopneic episodes and oxygen desaturation leading to sudden death. This may be alleviated by early diagnosis and decompressive surgery.

C. PATIENTS HAVE NORMAL AIRWAY.

This is False. In achondroplastic dwarfs (ADs), abnormal bone growth leads to a disproportionate body and head structure. There are a number of anatomical abnormalities in the achondroplasia patient that could result in upper airway problems—reduced vital capacity, adenotonsillar hypertrophy, midface hypoplasia and kyphoscoliosis, oromotor hypotonia, unusually collapsible larynx, trachea and/or bronchi. ADs often have a relatively small airway. It would be reasonable to anticipate a difficult airway.

D. THIS PATIENT IS PRONE TO SLEEP APNEA.

This is true. Foramen magnum stenosis in these patients can lead to central sleep apnea from spinal cord compression at the cervico-medullary junction and may contribute to the increased risk of sudden death during infancy. Midfacial hypoplasia, adenotonsillar hypertrophy and hypotonia of upper airway muscles predispose these patients to development of obstructive apnea as well.

2. 65 Y/O MORBIDLY OBESE MALE WITH H/O CAD S/P 2 VESSEL BYPASS (LAD, RCA), HYPERTENSION, SCHEDULED FOR POSTERIOR CERVICAL DECOMPRESSION. POSSIBLE CAUSES OF HYPOTENSION IN PRONE POSITIONING ARE ALL EXCEPT:

A. Air embolism.
B. Abdominal freedom.
C. Coronary event.
D. Antihypertensives.
A. AIR EMBOLISM.

This is true. Air embolism can occur with atmospheric air entrainment. Most common in cranial/high spinal surgeries. The possible explanations could be negative pressure in the vascular space. In the prone position where the abdomen is free, intrathoracic and intra-abdominal pressures are reduced; vena caval pressures may be as low as −2 cm H\textsubscript{2}O. This negative pressure could then move gas along the gradient of 10–15 cm H\textsubscript{2}O from the operative site to the right atrium.

Risks are minimized by maintaining intravascular volume and pressure and (where possible) positioning the surgical site dependent relative to the heart.

B. ABDOMINAL FREEDOM.

This is not true. Abdominal compression results in compression of IVC and splanchnic vessels leading to reduced preload and hypotension. If positioning allows for abdominal freedom, it actually improves hemodynamics.

This is true. Patients who have had a CABG with an aorto-coronary or Internal Mammary Artery graft, have the possibility of getting it compressed during prone positioning leading to ischemia and hypotension. Treatment would be to rearrange the chest bolsters.

This is true. Antihypertensives, in particular the diuretics and ACE/ARBs/CCBs are known to exaggerate hypotension under anesthesia and have increased requirements for vasopressors.

3. A 30 Y/O 32 WEEK PREGNANT PATIENT IS SCHEDULED FOR URGENT DISCECTOMY. **TRUE** STATEMENT REGARDING SURGERY AT THIS STAGE OF PREGNANCY IS:

A. **Prone position is contraindicated.**
B. **Lateral position helps with hemodynamic stability.**
C. **Fetal transfer of Dexmedetomidine.**
D. **Surgery should be the first choice for treatment.**
This is not true. Prone position may not be an ideal position for a spine surgery in the 3rd trimester, but Ardaillon et al. acknowledge that surgery for lumbar herniation can be safely performed when managed closely with every healthcare provider participating in the patients care, careful positioning to prevent any aortocaval compression.

B. LATERAL POSITIONING HELPS WITH HEMODYNAMIC STABILITY.

This is True. Lateral positioning is considered an ideal position for a spine surgery in the 3rd trimester as there is relief of any compression on the IVC and aorta and preserves hemodynamic stability.

C. FETAL TRANSFER OF DEXMEDETOMIDINE.

This is not True. Due to its high placental lipophilicity, dexmedetomidine moves less freely across placenta into fetal circulation.

D. SURGERY SHOULD BE THE FIRST CHOICE FOR TREATMENT

This is not True. Conservative treatment should be the first choice—pain medications, physical therapy, local anesthetic and steroid injections (recommended only after weighing pros and cons in patients with symptoms attributable to disc pathology presenting acutely with signs of radiculopathy). Surgery should be offered only when the patient has debilitating symptoms with risk of developing cauda equina syndrome or permanent neurological deficit.

4. **CAUSES OF RENAL INJURY AFTER A SPINAL SURGERY IN PRONE POSITION ARE ALL, EXCEPT:**

A. Hypotension.
B. Fluid overload.
C. Balanced solution administration.
D. Anemia.
A. HYPOTENSION

This is true. Hypotension causes sympathetic system activation, release of antidiuretic hormone, and the renin–angiotensin–aldosterone system increases angiotensin II activity. The net result is water retention, increased sodium absorption, and the preservation of GFR. Later, if hypoperfusion is not corrected, angiotensin II eventually causes vasoconstriction of both the afferent and the efferent arterioles, and as a consequence, reduces GFR. Below a MAP of 75–80 mm Hg, the autoregulatory efficiency declines abruptly. MAP < 55 for more than 20 minutes could result in AKI.

B. FLUID OVERLOAD

This is true. Fluid overload causes increase in intraabdominal pressure leading to compartment syndrome leading to compression of renal veins and constriction of renal arteries via sympathetic activation resulting in decreased renal perfusion.

Goren et al
C. BALANCED SOLUTION.

This is false. A balanced solution is better than normal saline for intraoperative fluid therapy to maintain intravascular volume and preserve organ perfusion. Saline administration leads to hyperchloremia which is associated with poor renal perfusion, resulting in AKI.

Goren et al
D. ANEMIA

This is true. A large observational study involving non-cardiac surgery patients found preoperative anemia and early postoperative decrements of hemoglobin to be associated with AKI. Perioperative anemia and perioperative PRBC transfusions are risk factors for AKI in cardiac surgery, such that every unit of transfused blood increases the incidence of cardiac surgery-associated AKI by 10–20%. Hence it is imperative to optimize patients’ Hb status using measures during surgery to reduce blood loss and avoid unnecessary PRBC transfusion.

Goren et al
5. 30 Y/O PATIENT WITH A H/O ARNOLD CHIARI MALFORMATION WITH RESIDUAL SYRINX PRESENTS FOR C-SECTION. TRUE STATEMENTS REGARDING ANESTHETIC MANAGEMENT FOR C-SECTION IN THIS PATIENT ARE ALL, EXCEPT:

A. Symptomatic patients should avoid normal vaginal delivery.
B. Airway may be difficult.
C. General anesthesia with adequate muscle relaxation.
D. Neuraxial Aesthesia is not contraindicated.
A. SYMPTOMATIC PATIENTS SHOULD AVOID VAGINAL DELIVERY

This is true. Even if decompressed Arnold Chiari malformation patients can have residual syrinx. These patients could be symptomatic and have herniation during 2\textsuperscript{nd} stage of labor, hence should always have elective c-section.

B. AIRWAY MAY BE DIFFICULT

This is true. Airway may be difficult because of the Chiari, multiple surgeries on neck and pregnancy. Hence, one should choose the safest technique to establish an airway. Awake fiberoptic with adequate topicalization could be an effective and safe choice if situation arises.

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C. GENERAL ANESTHESIA WITH ADEQUATE MUSCLE RELAXATION.

This is true. General anesthesia should be administered with adequate muscle relaxation to prevent muscle movement and injuries. Intubation and extubation should be without coughing or bucking to prevent increase in ICP and risk of herniation.

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D. NEURAXIAL ANESTHESIA IS NOT CONTRAINDICATED

This is false. Neuraxial anesthesia is in fact contraindicated for fear of herniation in patients who have a remnant syrinx and are symptomatic.

Neuraxial anesthesia can be administered to patients who have had corrective surgery and in whom the MRI shows the cerebellum has ascended up the foramen magnum.

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