

Physiological effects of Trendelenburg positioning in hypotensive patients

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Cardiovascular

Slight increase in mean arterial pressure

No increased preload

Dilated right ventricle

Decreased right ventricular ejection fraction

Decreased cardiac output

Increase in systemic vascular resistance

Pulmonary

Reduced vital capacity

Increased work of breathing

Decreases in PaO₂

Increases in mechanical impedance of lung and chest wall

Decreased tidal volume

Decreased lung compliance

Increases in PacO₂

Tissue perfusion

No change in oxygen delivery

No change in oxygen extraction

No change in oxygen consumption

Gastrointestinal

Cephalad shift of abdominal contents

Increased abdominal pressure

Impaired diaphragmatic function

Impeded lung expansion

Neurological

Possible increase in intracranial pressure associated with increase

in central venous pressure

Distention of internal jugular vein

Key factors in safe and effective laparoscopic surgery are the ability to clearly view the working area and create a good surgical window. The Trendelenburg position is commonly used in open, laparoscopic and robotic-assisted procedures, in an attempt to improve the view of the surgical area, utilizing gravity to retract the bowels. This document is a reference to selected studies reviewing the clinical risks of head-down tilting positions during surgery.

- “Two cases of robotic radical cystectomy with ileal conduit urinary diversion surgeries having perioperative neurologic complications related to prolonged surgery in steep head down position are presented. In these patients, neurological deterioration occurred after extubation probably due to cerebral edema.”

Unpredicted neurological complications after robotic laparoscopic radical cystectomy and ileal conduit formation in steep trendelenburg position: two case reports. Acta Anaesthesiol Belg. 2010;61(3):163-6.

- “Pneumoperitoneum and 45 degrees Trendelenburg position caused 2- to 3-fold increases in filling pressures, without effects on cardiac performance. Filling pressures were normalized immediately after surgery. Lung compliance was halved.”

Hemodynamic Perturbations During Robot-Assisted Laparoscopic Radical Prostatectomy in 45 degrees Trendelenburg Position. Anesthesia & Analgesia. 13 January 2011

- “The Trendelenburg position in awake and anesthetized patients increased pulmonary arterial pressures (PAP), central venous pressure (CVP) and pulmonary capillary wedge pressure (PCWP). “

Hemodynamic changes due to Trendelenburg positioning and pneumoperitoneum during laparoscopic hysterectomy. Acta Anaesthesiol Scand. 1995 Oct;39(7):949-55.

- “Addition of Trendelenburg position, however, causes profound ischemia of the lower limbs, and this is followed during the recovery period by hyperperfusion that is confined to the muscle compartments, which may put patients at risk of developing lower limb compartment syndrome.”

Lloyd-Davies position with Trendelenburg-a disaster waiting to happen? Dis Colon Rectum. 1999 Jul;42(7):916-9; discussion 919-20.

- “Current knowledge related to the risk of CS when operating in these positions (Lloyd Davies and Trendelenburg tilt) is such that it can be deemed negligent to keep patients in this position (with legs higher than the heart) when not absolutely necessary.”

Compartment syndrome, rhabdomyolysis and risk of acute renal failure as complications of the urological surgery. Georgian Med News. 2007 Feb;(143):45-9

- “By limiting the elevation angle of the lower limb, blood flow to the calf muscles can continue above the ischemic threshold...If possible, the Trendelenburg position should be reversed every 2 hours...”

Combined risk factors leading to well-leg compartment syndrome after laparoscopic radical prostatectomy. Actas Urol Esp. 2009;33(8):920-924

- Physicians must be aware of the cumulative risk for postural complications when extreme positions are associated to long duration procedures in predisposed patients.

Rhabdomyolysis and compartment syndrome of two forearms after robotic assisted prolonged surgery. Ann Fr Anesth Reanim. 2010 Apr;29(4):301-3. Epub 2010 Mar 4.