## Physiological effects of Trendelenburg positioning in hypotensive patients

*Crit Care Nurse 2011;31:38-62*

<table>
<thead>
<tr>
<th>Cardiovascular</th>
<th>Pulmonary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight increase in mean arterial pressure</td>
<td>Reduced vital capacity</td>
</tr>
<tr>
<td>No increased preload</td>
<td>Increased work of breathing</td>
</tr>
<tr>
<td>Dilated right ventricle</td>
<td>Decreases in PaO2</td>
</tr>
<tr>
<td>Decreased right ventricular ejection fraction</td>
<td>Increases in mechanical impedance of lung and chest wall</td>
</tr>
<tr>
<td>Decreased cardiac output</td>
<td>Decreased tidal volume</td>
</tr>
<tr>
<td>Increase in systemic vascular resistance</td>
<td>Decreased lung compliance</td>
</tr>
<tr>
<td></td>
<td>Increases in PacO2</td>
</tr>
</tbody>
</table>

### 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

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**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 titling 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.”


- “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.”


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


- “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.”


- “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.