

# Anaesthesia News

## Anaesthesia teaching for Post Graduates

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## PRONE Position – Basics

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### DESCRIPTION:

In the full horizontal prone position (also known as “ventral decubitus”), the patient rests horizontally facing the table, allowing maximum exposure of the posterior aspect of the body.

### Used for:

Back or neck procedures (cervical to sacral)

Procedures of the occipital or postero-lateral cranium

Sacral, perianal & perineal procedures



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(<https://anaesthesianews.wordpress.com/2018/10/23/prone-position-basics/pronesideview/>)

**POSITIONING STEPS:**

1. Note preoperatively, any patient limitations in positioning (neck or arms). The patient is anesthetized and intubated, and the endotracheal tube is secured, while patient is lying in the supine position, on either a stretcher or bed. This is accomplished by moving the OR table to one side, so the patient (on stretcher or bed) can be pulled into position for induction, near the anesthesia machine and needed equipment. The OGT, EGS and humidifier should be placed at this time.
2. After intubation and induction are accomplished, the anesthesia provider gives permission for other OR team members to assist in moving the OR table back, next to the stretcher or bed,

- aligning both in front of the anesthesia machine. The anesthetist frees and secures all lines ( IV, Art-line, Central-lines, etc.) in preparation for turning of the patient. (Please note: There should be a draw sheet on the OR table before moving patient onto it, for later positioning of the patient arms.)
3. With multiple assistants, the anesthesia circuit is briefly disconnected by the CRNA as he or she simultaneously commands the head, with one hand securing the airway (or ETT), and attends to the position of all lines. At the command or 1-2-3count of the CRNA, the patient is carefully flipped prone onto the OR table.
  4. While other OR team members assist in the prone positioning of the patient, the CRNA continues to maintain the airway, reconnects the circuit, ensures proper functioning of the ventilator (or ability to hand ventilate patient in the case of a LMA), and checks and secures lines.
  5. Parallel thoracic or chest rolls (made from tightly rolled sheets and blankets or manufactured gel rolls) are placed under the thorax, lateral to the breasts, following the long line of the body to free the abdomen from compression. Care is given not to compress the breasts with the rolls or cause undue pressure under the axilla.
  6. The head is positioned prone, with face placed in a foam prone-cutout pillow (with ETT, OGT and EGS exiting out the side), in a skull-pin head clamp, or in a rocker-based face/forehead rest. It can alternatively be placed laterally, using a gel donut, pillow or blankets, while avoiding forced rotation of the pronated head . Eyes, ears, and nose should be checked to assure that these areas are free from pressure. Most important: The C-spine should be in neutral alignment (check for neutral position of the neck in all 3 planes). The tube should be free without kinking or undue traction, and the anesthesia provider should be able to visually see or reach in and check all connections.
  7. The arms are padded and positioned to prevent nerve stretch or compression. This can be accomplished in a variety of ways depending on the exact nature of the surgery and access required (check with the surgeon). The arms are secured to prevent accidental dislocation or trauma from movement or falling off of table during the procedure.
  8. Legs are maintained in the long axis of the body. Knees should be padded with egg crate or gel. Pillows should be placed under the calves and feet to take pressure off the lumbar spine and prevent pressure sores on toes.
  9. The patient is secured to the table with tape or a belt across the thighs immediately under the buttocks.

#### EQUIPMENT:

- Thoracic/Chest Rolls
- Blankets
- Gel Pads
- Egg crate
- Pillows
- Belt
- Arm Boards
- Foam Face Pillow
- Tape
- Straps

#### PRONE – Arms caudad

#### DESCRIPTION:

Positioning of the arms along the long axis of the body (at sides) while in the ventral decubitus position to prevent against injury, nerve damage, vessel compression, pressure ulcers or other trauma during the procedure.

Used for:

Surgical procedure requiring the surgeon to be right alongside of the patient for close access to the surgical site where arms would otherwise be in the way of procedure, as in head, neck and upper spine (cervical and thoracic) procedures.



### **Prone – Arms Cephalad**

#### **DESCRIPTION:**

Positioning of the arms while in the ventral decubitus position along side of the head to prevent against injury, nerve damage, vessel compression, pressure ulcers or other trauma during the procedure.

#### **USED FOR:**

- surgeon desires access to the middle to lower spine
- procedures involving the sacral, perianal or perineal area
- procedures involving posterior iliac crests for bone harvesting
- procedures of posterior thighs or hips



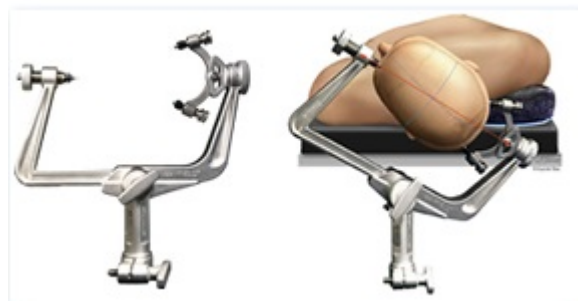
## **PRONE – Horizontal with mayfield's**

### **DESCRIPTION:**

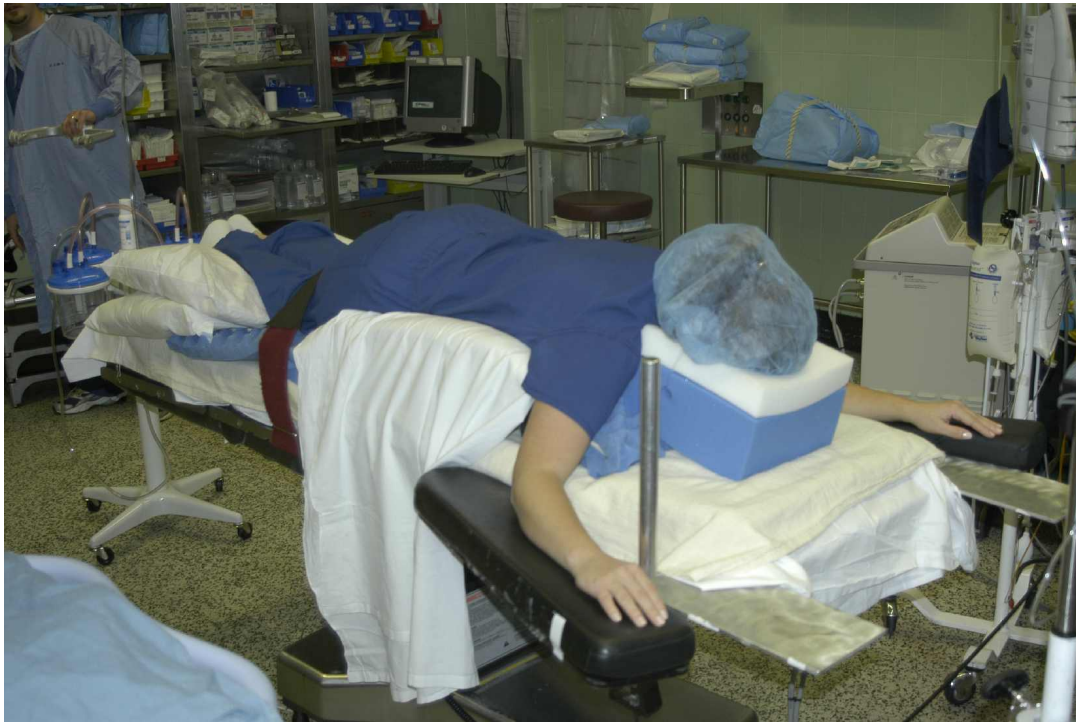
While prone, the head is placed in Mayfield tongs by the surgeon to facilitate surgical access to the neck or cranium.

Used for:

- Back or neck procedures (cervical to sacral)
- Procedures of the occipital or postero-lateral cranium







### **PRONE – Horizontal with horseshoe headrest**

#### **DESCRIPTION:**

While prone, the head is rested on a horseshoe headrest to facilitate surgical access to the neck or cranium.

Used for:

- Back or neck procedures (cervical)
- Procedures of the occipital or postero-lateral cranium



### **PRONE – Wilson Table**

#### **DESCRIPTION:**

A specialized table for the prone position that allows the thorax and abdomen to hang freely.

Used for:

- Back or neck procedures (cervical to sacral)
- Procedures of the occipital or postero-lateral cranium



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### **PRONE – Jackson Table**

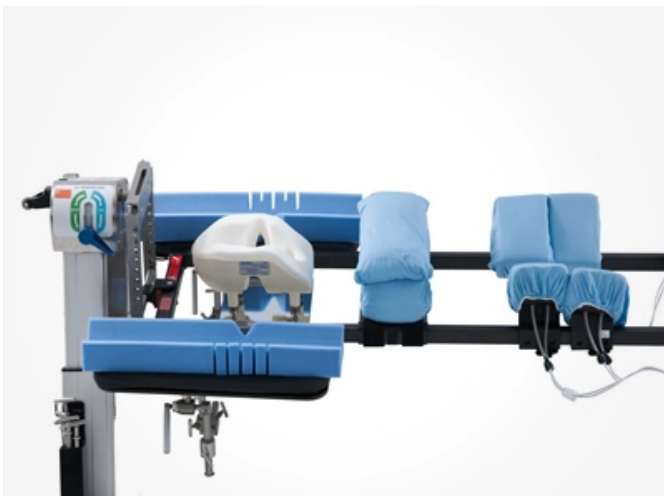
#### **DESCRIPTION:**

A specialized table for the prone position that allows the thorax and abdomen to hang freely.

Used for:

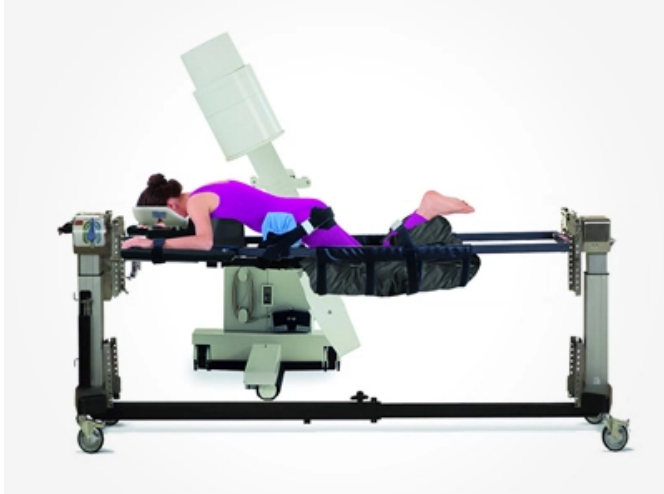
Back or neck procedures (cervical to sacral)

Procedures of the occipital or postero-lateral cranium



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with-proneview1/)



([https://anaesthesianews.wordpress.com/2018/10/23/prone-position-basics/jackson-spinal-d\\_revnb\\_11\\_18\\_10/](https://anaesthesianews.wordpress.com/2018/10/23/prone-position-basics/jackson-spinal-d_revnb_11_18_10/))

### PRONE – Jack Knife

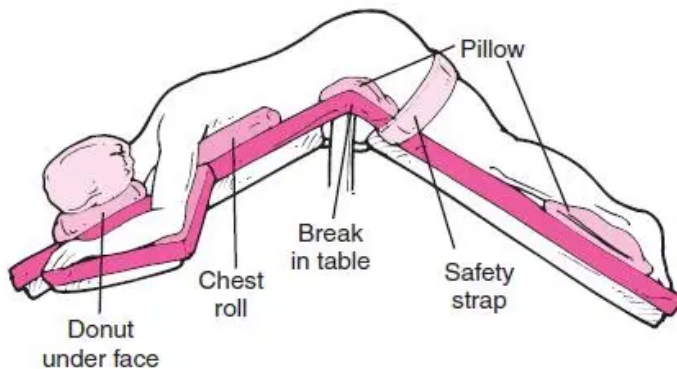
#### DESCRIPTION:

While prone, the patient is bent from the hips so that both the thorax and thighs are lower than the hips to facilitate access to the perianal, sacral, perineal, and lower alimentary canal areas.

Used for:

- Procedures of the occipital or postero-lateral cranium

Sacral, perianal & perineal procedures



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## Andrews Frame (Seated Prone)



### Physiological changes in the prone position

#### Cardio Vascular System:

1. Decrease in cardiac index (CI of 24%)
2. Mean arterial pressure (MAP) was maintained by increased systemic vascular resistance (SVR), and pulmonary vascular resistance (PVR)
3. No changes were noted in mean right atrial or pulmonary artery pressures (PAP)
4. The position of the heart at a hydrostatic level above the head and limbs may have caused reduced venous return to the heart and consequently a decreased CI
5. It has been suggested that the decrease in CI could be attributed to increased intra-thoracic pressures causing a decrease in arterial filling, (also decrease in left ventricular compliance) leading to an increase in sympathetic activity via the baroreceptor reflex.
6. Obstruction of the IVC is likely to play a role in reducing cardiac output.
7. Increased surgical bleeding: Obstruction to venous drainage forces blood to return to the heart by an alternative route (usually the vertebral column venous plexus of Batson). As these veins are thin walled, containing little or no muscle tissue and few valves, any increase in pressure is transmitted and causes distension. This causes increased blood loss during lumbar spinal surgery.

#### Respiratory

1. There is a relative increase in functional residual capacity when a patient is moved from supine to prone position. FVC and FEV1 change very little. The increase in FRC seems to be related to a reduction of cephalad pressure on the diaphragm and the reopening of atelectatic segments.
2. In the prone position, blood flow may be relatively uniform as gravitational forces are opposing rather than augmenting the regional differences in pulmonary vascular resistance
3. Redistribution of lung ventilation is a proposed mechanism by which gas exchange is thought to improve in the prone position.
4. A recent review suggested that pulmonary vascular and bronchiolar architecture may be more important than gravity in supine and prone positions in determining ventilation and perfusion distribution.

## Complications associated with the prone position

### 1. Injury to the central nervous system

#### Injuries from arterial occlusion

- Turning a patient from the supine to the prone position should be performed carefully, avoiding excessive neck movement and allowing normal blood flow in the carotid and vertebral arteries.
- Occlusion of the vertebral arteries has been reported.
- It would seem prudent to maintain neutral neck alignment to minimize the risk of occluding the carotid or vertebral arteries.

#### Injuries from venous occlusion

- Cervical laminectomy in the prone position supported by chest rolls developed new neurological deficits immediately after the operation (hemiparesis, quadriparesis, and paraparesis). It was thought that the use of chest rolls caused a degree of increased venous pressure which, when combined with mild arterial hypotension led to decreased perfusion pressure in the spinal cord and ischemia.

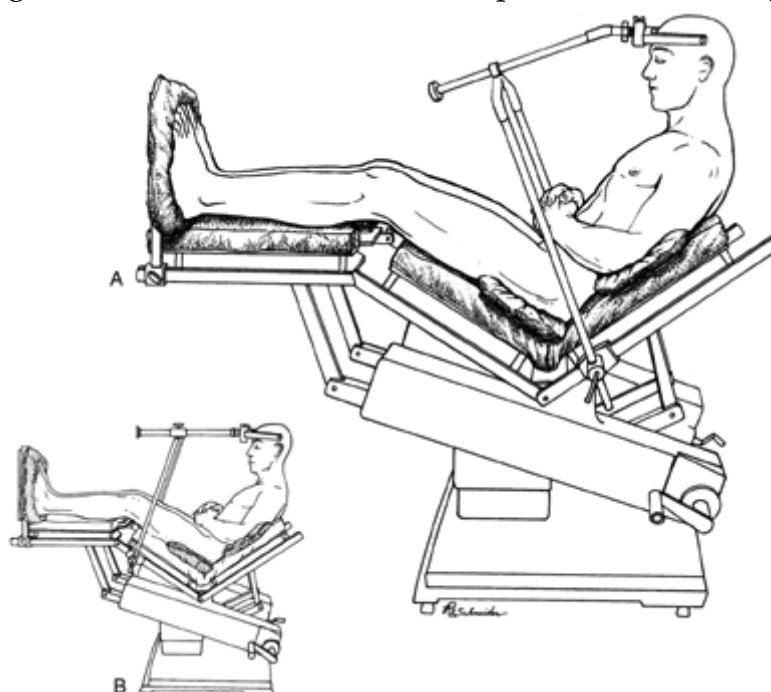
#### Air Entrapment

- Entrapment of air into the cranial cavity is common after neurosurgical procedures and occurs in all operative positions.
- There is a case report of quadriplegia as a result of air entrapment into the spinal cord after posterior fossa exploration. It was thought to have occurred as a result of the head down prone position allowing entrapped air in the posterior fossa to pass through the foramen magnum.

#### Cervical Spine Injury

- Excessive neck flexion in a patient undergoing an 8.5h operation in the 'Concorde' position with the neck flexed and the chin approximately one finger breadth from the sternum resulted in complete and permanent C5/6 sensory and motor deficit level after operation. This was presumed to result from overstretching of the cervical cord in a narrow spinal canal and bulging C/6 disc

with consequent ischemia.



- Another patient undergoing lumbar spine surgery awoke with a T6 sensory level as a result of a prolapsed intervertebral disc at C6/7. Excessive neck extension together with the muscle relaxation of general anesthesia was blamed.

### **1. Injury to the peripheral nervous system**

- Peripheral nerve injury may occur in patients under anesthesia in any position and is thought to be the end result of nerve ischemia from undue stretching or direct pressure. Prone positioning may lead to a different pattern or frequency of injury than supine positioning.

#### **Distribution of peripheral nerve injuries**

- Brachial plexus damage.
- Ulnar neuropathy
- Axillary nerve injury attributed to arms being abducted above the head.
- Musculocutaneous and radial nerve injuries have also been reported.
- In the lower limb sciatic nerve injury and Damage to the lateral cutaneous nerve of the thigh is a much more commonly recognized complication of prone positioning.

## **III. Pressure Injuries**

### **1. Direct pressure injuries**

#### **Pressure necrosis of the skin**

- Direct pressure is a common cause of anesthesia related injury which can occur in the prone position. Close attention to positioning of the face, ears, breasts, genitalia, and other dependent areas to prevent pressure sores or skin necrosis has been advocated.

#### **Tracheal compression**

- There are reported cases of tracheal compression occurring in the prone position.

#### **Salivary gland swelling**

- Bilateral painful swelling of the submandibular glands after surgery in the prone position with the head rotated has been reported. It probably resulted from stretching of the salivary ducts leading to stasis and acute swelling.

#### **Shoulder dislocation**

- The distribution of pressure in the prone position can lead to anterior dislocation of the shoulder.

### **1. Indirect pressure injuries**

#### **Macroglossia and oropharyngeal swelling**

- Three cases of macroglossia and oropharyngeal swelling have been described in the prone position.
- The proposed mechanism for macroglossia and oropharyngeal swelling suggests that excessive flexion of the head and the presence of a tracheal tube cause kinking and obstruction of the internal jugular vein in the neck which in turn obstructs venous drainage from the lingual and pharyngeal veins.

#### **Mediastinal compression**

- The chest wall is usually able to support the patient's weight without compression of the structures within it. However this may not be the case with congenital anatomical abnormalities.
- In pectus excavatum this is more pronounced.

### **Visceral ischemia**

- Hepatic ischemia with progressive metabolic acidosis and elevated LFTs has been described after prolonged surgery in the prone position. This was thought to be due to abdominal compression.

### **Avascular necrosis of the femoral head**

- There are reports of patients undergoing decompressive surgery for spinal stenosis with a hypotensive anesthetic technique developing collapse of the femoral head. The cause was thought to be a combination of deliberate hypotension and increased venous pressure from the prone position.

### **Peripheral vessel occlusion**

- There are reports of compression of the axillary artery being detected by pulse oximetry or radial artery monitoring.
- In a patient positioned on a four post Relton Hall spinal frame, shifting of the pelvis laterally on the frame caused occlusion of the femoral artery leading to mottling of one leg and absence of the dorsalis pedis pulse. Repositioning restored normal blood flow.

### **Limb compartment syndrome**

- It would seem that this is associated with flexion of the hips and knees and resultant impaired blood flow.

### **Ophthalmic Injury**

- The two injuries most commonly described are ischemic optic neuropathy and central retinal artery occlusion.

### **Aetiology**

- Prone positioning can lead to ophthalmic injury by direct external pressure by a headrest or other support apparatus on the orbital contents causing an increase in intraocular pressure which may lead to retinal ischemia and visual loss. This is usually linked with examination findings consistent with central retinal artery occlusion.
- Ischemic optic neuropathy is not associated with direct pressure and may be due to inadequate oxygenation of the optic nerve causing ischemic damage and failure of impulse transmission.
- Perfusion pressure to the optic nerve can be defined as the difference between MAP and intraocular pressure or venous pressure, whichever is the greater.
- Prone positioning tends to increase venous pressure and peak inspiratory pressure which in turn increase intraocular pressure. This increased orbital venous pressure, decreased choroidal blood flow and reduced outflow of aqueous humor could decrease perfusion pressure to the optic nerve head and contribute to ischemic optic neuropathy.
- Visual loss after prone anesthesia and surgery is often characterized by long surgical duration, large blood loss and administration of large volumes of clear fluids.

### **Minimizing risk**

- It is important to position the head to maximize venous outflow from the eye and hence minimize any impairment of ocular perfusion.



- It may also be the case that in high risk patients keeping the head above the heart by means of a slight head up tilt can reduce risk.

## **1. Embolic complications**

### **Venous gas embolism**

- Venous gas embolism may result from atmospheric air entrainment or accidental direct delivery of exogenous gas.
- Efforts to minimize abdominal compression and thus IVC pressure in the prone position can result in an increased negative pressure gradient between the right atrium and the veins at the operative site. This increases the risk of air entrainment.
- Risks are minimized by maintaining intravascular volume and pressure and positioning the surgical site dependent relative to the heart.

### **Practical Procedures**

#### **Airway management**

- A variety of problems with the tracheal tube may occur while a patient is prone. Repeated obstruction of a tracheal tube after prone positioning as a result of bloody secretions draining under gravity from the right lower lobe.
- Use of the LMA as a primary adjunct is controversial but it has been used effectively. The LMA has been placed after prone positioning with the patient positioning themselves awake. This may avoid other adverse events related to the prone position such as soft tissue and nerve injury or spinal destabilization, but runs the risk of inability to maintain an adequate airway once anesthesia is initiated.

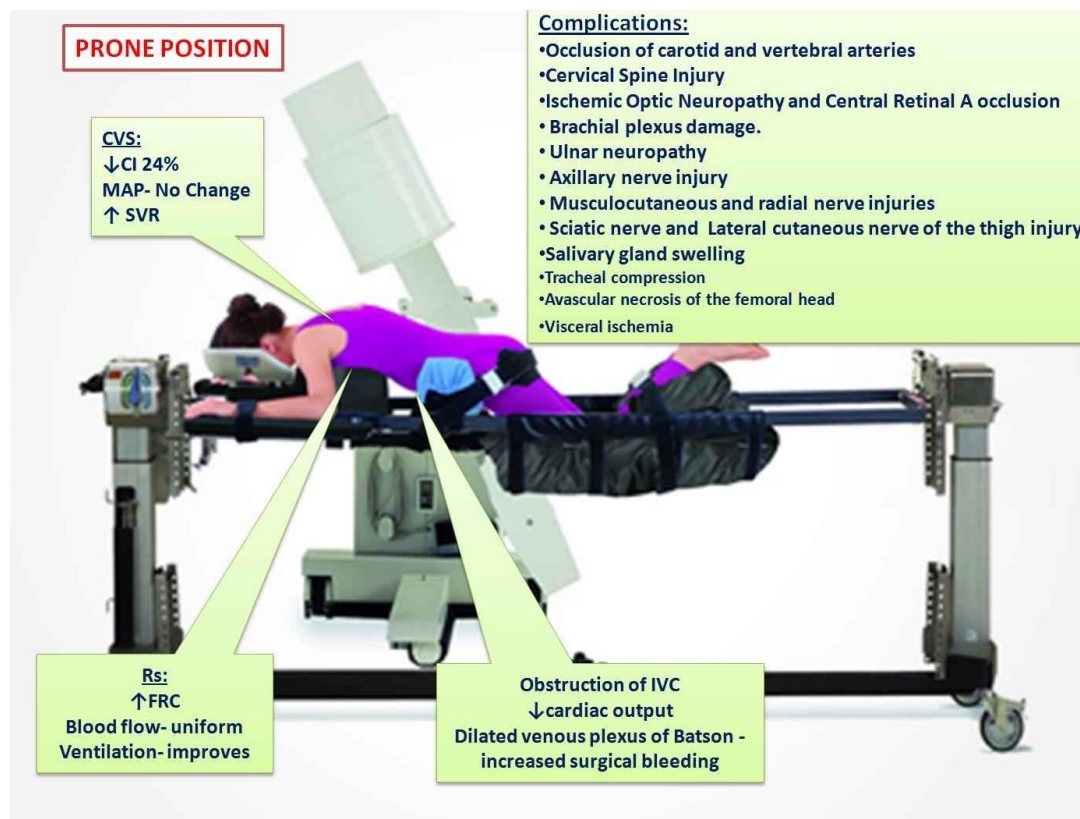
#### **Cardiovascular procedures**

- There are also several reports on the management of cardiac arrest in the prone patient. Conventional teaching has been that the patient should be returned to the supine position via the use of an additional table in the OR. However this may not always be possible, especially when there may be bulky surgical instrument protruding from the back. Chest compressions have been delivered successfully with the hands on the central upper back between the scapulae. A post cordial thump delivered between the shoulder blades to treat pulseless ventricular tachycardia has also been described.
- Defibrillation has been successfully undertaken using the anterior-posterior paddle position or paddle orientation on the left and right sides of the back. However, the use of posterior paddle positions may not deliver enough energy to the myocardium owing to the anterior displacement of the heart in the prone position and also increased transthoracic impedance with PPV. Biphasic shocks and anterior paddle or pad positioning has been recommended.

#### **To Minimise the Risks:**

- **Avoid prone position in the first place**
- **Position the patient carefully – head in neutral position, with no flexion, extension or rotation of the neck.**
- **Make sure the eyes are free. I just tape with a transparent dressing to keep them closed**
- **Head higher than the heart and no neck ties**
- **Keep surgery short (95% cases of prone/blindness cases are >6 hours). Stage surgery if possible.**

- **Avoid blood loss and anaemia, and think twice about induced hypotension**



Source:

1. University of Pittsburgh [http://www.pitt.edu/~position/Prone/prone\\_basic.htm](http://www.pitt.edu/~position/Prone/prone_basic.htm)  
([http://www.pitt.edu/~position/Prone/prone\\_basic.htm](http://www.pitt.edu/~position/Prone/prone_basic.htm)).
2. Anaesthesia in the prone position. Br. J. Anaesth. (2008) 100 (2): 165-183.  
<http://bjaoxfordjournals.org/content/100/2/165.full> (<http://bjaoxfordjournals.org/content/100/2/165.full>)

October 23, 2018 April 28, 2019 · Posted in Clinical Anaesthesia ·

## One thought on “PRONE Position – Basics”

1.



**Naeem Abbas** says:  
May 4, 2019 at 11:19 am

Kindly write notes for patient positioning in anaesthesia.. Whole types.. Thanks.. Dr Naeem Abbas postgraduate resident anaesthesia

Reply

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