Complications associated with prone positioning in neurosurgery: integrative review

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Disclosure

The authors have no disclosures to report. I acknowledge my continuing obligation to disclose to AANS/NREF/NPA, promptly and in writing, any change in my circumstances. I further acknowledge that if there is any case where my private interest conflict with the interests of AANS/NREF/NPA, I will indicate that I may have a conflict and abstain from any vote, speaking engagement, planning related to that issue.
The selection of a position in surgical procedures is based on different parameters and factors, such as the surgical site, prevention of complications and non-commitment of the patient’s vital functions. A good surgical position is the one that offers maximum safety to the patient, with the least discomfort possible and makes the surgeon perform easier.

The positioning of the neurosurgical patient is an important aspect of the preoperative care. It is necessary, because of the long duration of surgical procedure and due to the accuracy need of the area to be manipulated, that the chosen position is physiologically favorable, safe and comfortable to the neurosurgeon and anesthesiologist approach.
Methods

Key words:
- Prone positions
- Complications
- Positioning in neurosurgery

Articles in English, Portuguese, Spanish, and French
Publication between 1980 and 2018
50 articles
Results

- The prone position causes an increase intra-abdominal pressure, stasis of blood at in the extremities, causing reduction of systolic volume and cardiac index, herewith the increased central venous pressure. Its events result in a significant rise in heart rate and peripheral vascular resistance.

- Regarding cerebral hemodynamics, there are different consequences of the prone position, which is due to different possibilities of positioning the head. The neutral position implies a reduction of jugular venous resistance and increase of jugular venous flow. The positioning below the heart causes an increase of jugular venous resistance and elevation of intracranial pressure.
Results

- The prone position is associated with increased intraocular pressure; it is associated to the rise of intraocular pressure, closed angle glaucoma, central retinal artery occlusion, **visual loss**, ischemic optic nerve neuropathy, retinal central artery occlusion, cortical blindness, and subconjunctival hemorrhage.

Risk factors

- Male
- Age > 65 years
- Diabetes mellitus
- Obesity

Frequency

- 0.0008% to 0.003% in prone positions surgeries
Results

- The stroke is a complication associated to the occlusion of vertebral arteries, due to the not neutral head positioning and improper movements, and, dissection of the carotid and vertebrobasilar arteries leading to an injury of the intima and formation of thrombosis. One way to reduce the risk consists in maintaining the head on body axis. There are greater risks associated to elderly patients, like malignant neoplasm, obesity and recent history of major surgery.

- The rotation and extension of the head increase the risk of brain vascular events and are associated with a reduction of venous return, that can cause intracranial pressure elevation.
Results

- Between plexopathies, the most common is the brachial plexus injury, mainly present when there is abduction higher than 90°. The risk factors for plexopathies are diabetes, hypovolemia, hypothermia, malnutrition, hypertension, alcoholism or previous paresthesia. In these patients, the use of other positions should be evaluated.

- The prone position, in the musculoskeletal system, is well known as responsible for pressure ulcers and compartment syndrome. The diagnosis of compartment syndrome is hard and sometimes is lost, due to similarity with other complications as neuropathy of peripheral nerves. The pressure ulcers itself is related to surgery time.
Discussion

- Neurosurgical procedures usually involve positions that result in system effects, in particular, cardiopulmonary. Therefore, every procedure needs to be highly monitored, and the hemodynamic state of the patient must be continuously evaluated. Besides that, it is essential to examine patients at risk to get licenses to adopt particular positions.
- The prone position has been associated with several visual, muscular, neurological and hemodynamic complications, offering risks for patients with heart disease, obesity, and patient with deformity of the thoracic wall.
Conclusions and summary points

- Complications: stroke, increased intraocular pressure, close angle glaucoma, ischemic optic nerve neuropathy, cortical blindness, subconjunctival hemorrhage, spinal cord infarction, plexopathy, herniated disc;
- Most common complication: visual loss;
- Risk factors of complications: age > 65 years, obesity, chronic diseases, diabetes mellitus, male;
- The prone positioning require risk monitoring, identification of comorbidities, intraoperative care.