Prone Position

The prone position is used for spinal cord, occipital lobe, craniosynostosis, and posterior fossa procedures. The prone position has also been referred to, aptly, as the concorde position because, for cervical spine and posterior fossa procedures, the final position usually entails neck flexion, reverse Trendelenburg positioning, and elevation of the legs, usually with pillows. This orientation serves to bring the surgical field to a horizontal position.

Before turning the patient to the prone position, the anesthesiologist should ensure that the venous catheter and endotracheal tube are secure and that appropriate personnel are available to prevent injury during the turn. The anesthesiologist should have a plan for detaching and reattaching monitors in an orderly manner to prevent an excessive monitoring "window." Awake tracheal intubation and prone positioning can be employed in patients with an unstable cervical spine in whom an unchanged neurologic status should be confirmed before induction of anesthesia in the final surgical position. It is also occasionally performed in very obese patients.

The head can be positioned in a pin head holder (applied before the turn), a horseshoe headrest, or a disposable foam headrest. Complications of the prone position to which there must be constant attention are retinal ischemia and blindness from orbital compression. This problem may be compounded by low arterial pressure, low hematocrit level, and poor cerebral venous drainage. 56 It must be intermittently ascertained, such as every 15 minutes and after any surgery-related head/neck movement, that pressure has not come to bear on the eye. Various degrees of pressure necrosis of the forehead and maxillae can also occur, especially during prolonged spinal procedures. Other pressure points to be checked include the axillae, breasts, iliac crests, femoral canals, genitalia, knees, and heels. An antisialogogue, such as glycopyrrolate, may help to reduce loosening of tape used to secure the endotracheal tube.

An objective during prone positioning, especially for lumbar spine surgery, is the avoidance of inferior vena caval compression. Impairment of vena caval return diverts blood to the epidural plexus and increases the potential for bleeding during laminectomy. This avoidance is an objective of all the spinal surgery frames and is accomplished very effectively by both the Relton-Hall and the Andrews variants. This does, however, introduce a risk of air embolism, although clinical occurrences have been very infrequent.

There should be attention to preventing injury to the patient's tongue in the prone position. With both cervical and posterior fossa procedures, it is frequently necessary to flex the patient's neck substantially to facilitate surgical access. This reduces the anteroposterior dimension of the hypopharynx, and compression ischemia of the base of the tongue (as well as the soft palate and posterior wall of the pharynx) can occur in the presence of foreign bodies (endotracheal tube, esophageal stethoscope, oral airway). The consequence is "macroglossia" and unexpected



postextubation airway obstruction. Accordingly, unnecessary paraphernalia in the pharynx should be avoided. Omitting the oral airway entirely is unwise because the tongue may then protrude between and be trapped by the teeth as progressive swelling of facial structures occurs during a prolonged procedure with the patient in the prone position. A bite block akin to those used with laryngeal masks prevents this problem without adding bulk to the hypopharynx.

The aim of a study of Dho et al. from the Seoul National University Hospital, was to analyze the positional effect of MRI on the accuracy of neuronavigational localization for posterior fossa lesions when the operation is performed with the patient in the prone position.

Ten patients with posterior fossa tumors requiring surgery in the prone position were prospectively enrolled in the study. All patients underwent preoperative navigational MRI in both the supine and prone positions in a single session. Using simultaneous intraoperative registration of the supine and prone navigational MR images, the authors investigated the images' accuracy, spatial deformity, and source of errors for PF lesions. Accuracy was determined in terms of differences in the ability of the supine and prone MR images to localize 64 test points in the PF by using a neuronavigation system. Spatial deformities were analyzed and visualized by in-house-developed software with a 3D reconstruction function and spatial calculation of the MRI data. To identify the source of differences, the authors investigated the accuracy of fiducial point localization in the supine and prone MR images after taking the surface anatomy and age factors into consideration.

Neuronavigational localization performed using prone MRI was more accurate for PF lesions than routine supine MRI prior to prone position surgery. Prone MRI more accurately localized 93.8% of the tested PF areas than supine MRI. The spatial deformities in the neuronavigation system calculated using the supine MRI tended to move in the posterior-superior direction from the actual anatomical landmarks. The average distance of the spatial differences between the prone and supine MR images was 6.3 mm. The spatial difference had a tendency to increase close to the midline. An older age (> 60 years) and fiducial markers adjacent to the cervical muscles were considered to contribute significantly to the source of differences in the positional effect of neuronavigation (p < 0.001 and p = 0.01, respectively).

This study demonstrated the superior accuracy of neuronavigational localization with prone-position MRI during prone-position surgery for PF lesions. The authors recommend that the scan position of the neuronavigational MRI be matched with the surgical position for more precise localization ¹⁾.

Factors contributing to spinal cord infarction occurring in surgery performed in the prone position ²⁾.

References

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