Sitting position

see also Semisitting position.

The sitting position in neurosurgery was more popular in the 1970s and 1980s [1) 2)] than it is today because of associated complications and acceptable alternative positions (except for some specific circumstances).

Over time, it has been modified to the semisitting position to reduce associated complications such as hemodynamic instability, VAE, and tension pneumocephalus. Hence, the semisitting position is more frequently used now than the sitting position However, some experts feel that the risks of the sitting position have been greatly overstated.

Advantages

1. improved drainage of blood and CSF out of surgical site

2. enhanced venous drainage which helps reduce venous bleeding and also ICP

3. easy ventilation due to unencumbered chest

4. patient's head may be kept exactly midline, aiding operator orientation and reducing risk of kinking of vertebral arteries

Disadvantages/risks

1. possible air embolism

2. fatigue of operator's hands

3. increased surgical risks from placement of CVP catheter (required to treat possible AE): e.g. pneumothorax with subclavian vein catheterization, thrombosis

4. risk of post-op hematoma at the operative site may be increased because potential venous bleeders may remain occult while the patient is sitting, but may manifest when patient returns to a horizontal position post-op. However, one study found no such increased incidence

5. risk of post-op subdural hematoma: 1.3% of p-fossa cases

6. possible brachial plexus injury: prevent this by not allowing patient's arms to hang at the side. Instead, fold them across abdomen

7. midcervical quadriplegia: presumably due to flexion myelopathy. The combination of the sitting position with hypotension9 or neck flexion with possible compression of the anterior spinal artery, ±

cervical bar, and elevation of the head thus reducing the arterial pressure may all contribute

8. sciatic nerve injury (piriformis syndrome): prevent this by flexing patient's knees (reduces tension on sciatic nerve)

9. extent of post-op pneumocephalus is more pronounced, and may increase the risk of tension pneumocephalus11; see Pneumocephalus

10. venous pooling of blood in the LEs under anesthesia may cause relative hypovolemia and should be counteracted by binding the LEs prior to positioning

11. decreased cerebral blood flow due to lower hemodynamic arterial pressure.

Air embolism (AE). A potentially fatal complication of any operation when an opening to air occurs in a non-collapsible vein (e.g. diploic vein or a dural sinus) when there is a negative pressure in the vein (e.g. when the head is elevated above the heart). Air is entrained in the vein and can become trapped in the right atrium of the heart, which may impair venous return, causing hypotension. May also produce cardiac arrhythmias. Paradoxical air embolism can occur in the presence of a patent foramen ovale or pulmonary AV fistula, and may produce ischemic cerebral infarction.

Greater negative pressures occur in the sitting position due to the extreme elevation of the head, but AE can occur in any operation with the head elevated higher than the heart. Incidence: a wide range has been quoted in the literature, and depends on the monitoring method used: ≈ 7–25% incidence with the sitting position using Doppler monitoring is an estimate.

For operations with a significant risk of AE, a right atrial CVP line is recommended (to aspirate air), and monitoring for air embolism; options include: transesophageal echo (the most sensitive), precordial Doppler monitoring. (Although technically the risk of air embolism includes any case where the head is higher than the right cardiac atrium, practically it is limited to cases where the head of the bed is ≈ > 30° which is mostly limited to the sitting position for posterior fossa tumors.) Diagnosis and treatment:

AE should be suspected in any operative case in which the surgical site is higher than the heart when there is any unexplained hypotension or decrease in EtCO2.

● transesophageal echocardiography (TEE). Bubbles can be seen on the 2D echo display

pros: considered the most sensitive monitoring modality

cons: significant false positive rate, expensive, invasive, requires experience and vigilance

● precordial Doppler U/S: probe may be placed over 2nd to 4th intercostal space either to right or left of sternum, or posteriorly between the scapula and spine. AE is heralded by a change in sonic intensity and character at first by a superimposed irregular high-pitched swishing sound, and then as more air is entrained so called "mill wheel" or machinery sounds dominate

pros: the most sensitive of the non-invasive techniques

cons: difficult in morbidly obese patients and in certain patient positions (e.g. prone or lateral), interference from other sounds in the OR, requires vigilance The earliest indication of AE may be a rise in the end-tidal nitrogen (requires mass-spectrometer on monitor), then a fall in the end tidal pCO2 occurs. Machinery sounds in the precordial Doppler also suggest AE. Hypotension may develop.

Neurosurgical procedures in sitting position need advanced cardiovascular monitoring.

There is an ongoing debate about the sitting position (SP) in neurosurgical patients. The SP provides a number of advantages as well as severe complications such as commonly concerning venous air embolism (VAE). The best monitoring system for the detection of VAE is still controversial.

In a retrospective analysis Günther et al compared 208 patients. Transesophageal echocardiography (TEE) or transthoracic Doppler (TTD) were used as monitoring devices to detect VAE; 101 cases were monitored with TEE and 107 with TTD.

The overall incidence of VAE was 23% (TTD: 10%; TEE: 37%), but the incidence of clinically relevant VAE (drop in end-tidal carbon dioxide above 3 mmHg) was higher in the TTD group (9 out of 17 VAE, 53%) compared to the TEE group (19 out of 62 VAE, 31%). None of the patients with recorded VAE had clinically significant sequelae.

In this small sample they found more VAE events in the TEE group, but the incidence of clinically relevant VAE was rare and comparable to other data. There is no consensus in the definition of clinically relevant VAE. [3)].

The sitting position is a safe positioning technique if Transesophageal echocardiography (TEE) monitoring is used [4)]

Invasive arterial blood pressure measurements for systolic (ABPsys), diastolic (ABPdiast) and mean arterial pressure (MAP) are established monitoring technologies for these kind of procedures. A noninvasive device for continuous monitoring of blood pressure and CO based on a modified Penaz technique (volume-clamp method) was introduced.

The surgical field remains clean during the whole procedure. The venous pressure is very low and there is less venous bleeding. The main disadvantage of this position is the occurrence of air embolism which is rapidly and precisely diagnosed with the trans-esophageal Doppler. The air can be aspirated from the right atrium with the central lines placed in the correct position pre-operatively.

The sitting position is generally preferred for the supracerebellar approach because it allows gravity to work in the surgeon’s favor by facilitating cerebellar retraction and reducing venous bleeding and pooling in the operative field. The disadvantage involving the risk of air embolus can be minimized by taking proper precautions.

The sitting position can be employed with acceptable rates of morbidity and mortality. However, these reports were prepared by groups performing 50 to 100 or more of these procedures per year, and the hazards of the sitting position may be greater for teams who have less frequent occasion to use it. With increasing frequency, the sitting position is being avoided through the use of one of its alternatives (prone, semilateral, lateral positions). However, we are likely to continue encountering it because even surgeons who are inclined to use alternative positions may opt for the sitting position when access to midline structures (the floor of the fourth ventricle, the pontomedullary junction, and the vermis) is required. Nonetheless, alternative positions for posterior fossa surgery exist and should be considered when a patient has contraindications to the sitting position.

Because controversy exists regarding continued use of the seated position for neurosurgical

procedures, this prospective (1981-1983) and retrospective (1972-1981) analysis of 554 seated patients was done to establish the incidence and severity of venous air embolism (VAE) related to type of surgical procedure and anesthetic technique; to examine the impact of specific monitoring practices on detection, morbidity, and mortality; and to establish the incidence of other complications related to the seated position (hypotension, quadriplegia, and arterial air embolism (AAE)). The overall morbidity and mortality related to the seated position was 1% (2 VAE, 1 AAE, 2 hypotension, 1 myocardial infarction) and 0.9% (1 VAE, 1 AAE, 2 hypotension, 1 quadriplegia), respectively. There has been no mortality since 1975. N2O did not seem to increase the incidence or severity of VAE. The seated position is safe in experienced hands if appropriate surgical and anesthetic skills are exercised in patient selection and management. Caution is advised in patients with atherosclerotic cardiovascular disease, severe hypertension, cervical stenosis, and right to left intracardiac shunts [5].

see Pneumocephalus in the sitting position

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