Venous air embolism monitoring

There are significant differences between sensitivities of various Venous air embolism monitoring modalities and the clinical significance of them because of its high sensitivity, it is recommended to use transesophageal echocardiography (TEE) for early diagnosis of venous air embolism, but this method requires special equipment and experience. However, owing to the high sensitivity of TEE, the incidence of VAE and the risk of false positives are increased.

Venous air embolism on only TEE or precordial Doppler without end-tidal carbon dioxide ETCO2 or hemodynamic changes may be clinically insignificant.

In clinically significant VAE, ETCO2 decreases and/or hemodynamic changes are observed.

There are different data about VAE in the literature. Various monitoring methods were used for the diagnosis of VAE, and various severity classifications were used for VAE in these studies, and most studies are retrospective.

Many studies have used different ETCO2 values for the diagnosis of clinically significant VAE. Feigl et al determined this limit as 3 mm Hg, while Ammirate et al determined it as 5 mm Hg.

In a retrospective study, M. Ammirati et al reported that ETCO2 decreased by more than 5 mm Hg in 26.8% of 41 patients who were operated in the semisitting position.

Wang et al, 15.4% of 26 patients who underwent surgery in the semisitting position reported VAE. In a series report by M. Kurihara et al, 26% of the 23 patients operated in the semisitting position had a VAE, whereby ETCO2 decreased by more than 5 mm Hg.

In a study by Feigl et al about evaluation of the risk of paradoxical venous air embolism in patients with patent foramen ovale, the rate of patients with an increase in ETCO2 of more than 3 mm Hg was found to be 9.6% (5/52). In a prospective study reported by H. Türe et al, investigating the effect of the degree of head elevation in the semisitting position on the VAE; clinically important VAE was detected in 8% of the group with a head elevation of 30° and 50% in the group with a head elevation of 45°.

In the study, of Durmuş et al. they use 40° head elevation, and they did not detect clinically significant VAE that led to a decrease in ETCO2 levels of more than 5 mm Hg or hemodynamic changes. Gravity-dependent supine position for lateral supracerebellar infratentorial approach was described by Awad et al. Although this position may reduce the risk of VAE, the gravitational

advantages are limited compared with the semisitting position. The lateral supracerebellar approach is not ideal for midline lesions. In thedynamic lateral semisitting position, lateral supracerebellar, midline supracerebellar, and retrosigmoid approaches can be applied. In a study about the occurrence and management of postoperative pneumocephalus using the semisitting position by Machetanz et al, tension pneumocephalus was reported in 3.3% of 429 patients in the semisitting position. In the study, of Durmuş et al. they did not detect tension pneumocephalus in any of the patients. It is possible that the number of patients in the study is insufficient to conclude on tension pneumocephalus; however, they think that placing the patient from the lateral semisitting position to the lateral decubitus position during the dura mater suturing stage might play a role in preventing the tension pneumocephalus by increasing the intracranial pressure in this final step of the surgery. J. H. Palazón et al. reported that mean cerebral perfusion pressure values fell slightly when the head was elevated to 30° (3.5 mm Hg) compared with the supine position, and a greater reduction was achieved when the head was elevated 45° (7.1 mm Hg) compared with the supine position.

While performing the supracerebellar approach using the dynamic lateral semisitting position, placing the patient in the lateral decubitus position during the dural and extradural stages, probably increases the cerebral perfusion pressure. This manipulation can protect the cerebral tissue against possible hemodynamic changes. Another benefit of the dynamic lateral semisitting position is that the surgeon can combine retrosigmoid and supracerebellar approaches with a simple manipulation on back section angle of the operating table. Although the number of our cases is small, we think that the dynamic lateral semisitting position, which we apply safely in various localizations and pathologies, can be an alternative to other positions used in supracerebellar approaches. The safety of this position can be tested by using it in more cases in the future [1)]

1)
Durmuş YE, Kaval B, Demirgil BT, Gökalp E, Gurses ME, Varol E, Gonzalez-Lopez P, Cohen-Gadol A, Gungor A. Dynamic Lateral Semisitting Position for Supracerebellar Approaches: Technical Note and Case Series. Oper Neurosurg (Hagerstown). 2023 May 31. doi: 10.1227/ons.0000000000000758. Epub ahead of print. PMID: 37255298.