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Needle entry angle to prevent carotid sheath injury for cervical TFESI

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Background

Cervical Transforaminal epidural steroid injection (TFESI) is associated with the risk of the spinal cord or brain infarction. Although most concerns have been focused on the injection route to prevent injury of vertebral artery, there was no previous study for needle entry angle mainly regarding the carotid sheath. This study aims to suggest the rotation angles of fluoroscopy to bypass the carotid sheath according to vertebral levels for cervical TFESI.

Methods

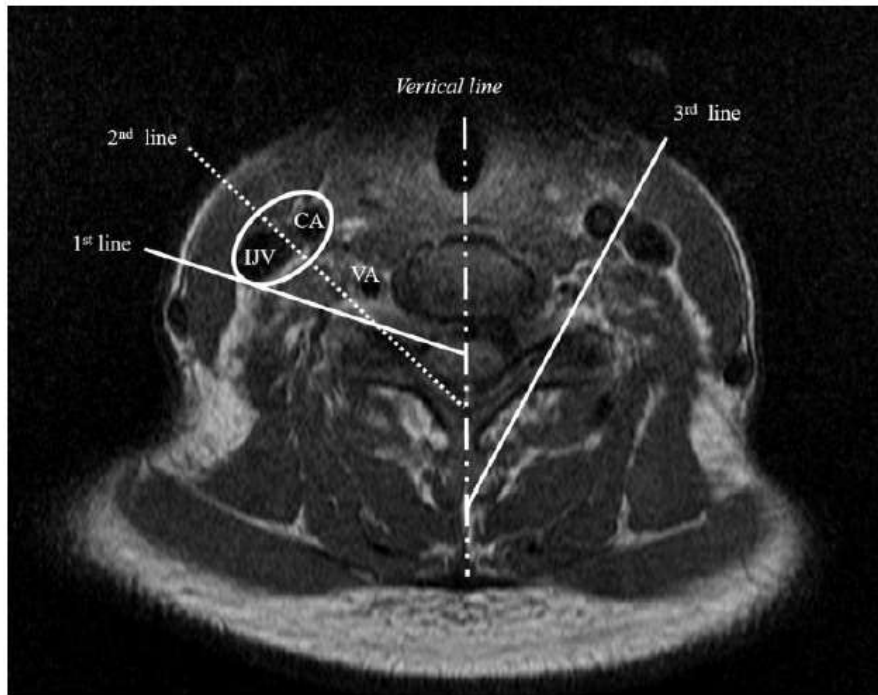
From January 2009 to October 2017, patients who underwent cervical spine magnetic resonance image (MRI) were analyzed. In the axial sections of cervical spine MRI, three angles to the vertical line were measured (α : angle not to insult carotid sheath, β : angle for the conventional TFESI, γ : angle not to penetrate carotid artery). (Fig. 1)

Results

α angles tended to increase for the upper cervical levels (C6-7: 53.3°, C5-6: 65.2°, C4-5: 75.3°, C3-4: 82.3°). Otherwise, β angles for conventional TFESI showed a constant value of 45 to 47 degrees (C6-7: 47.5°, C5-6: 47.4°, C4-5: 45.7°, C3-4: 45.0°). γ angles increase as the higher cervical levels as α angles (C6-7: 25.2°, C5-6: 33.6°, C4-5: 43.0°, C3-4: 56.2°). (Fig. 2)

Conclusions

The risk of penetrating injury of major vessels in carotid sheath tends to be higher at the upper cervical level. Considering the angle to avoid the carotid vessels in an axial section of CT or MRI in addition to vertebral artery might contribute to safe TFESI procedures.



CA; carotid artery

IJV; internal jugular vein

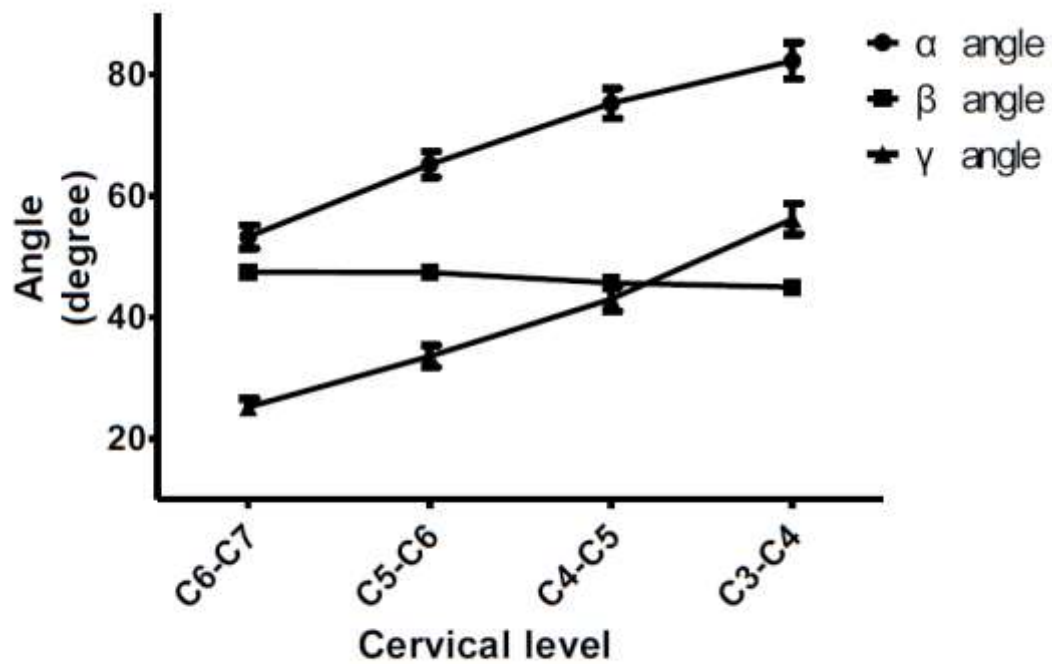
VA; vertebral artery

1st line: needle entry line to avoid carotid sheath (α angle)

2nd line: needle entry line along the posterior wall in the neural foramen (β angle)

3rd line: needle entry line to avoid carotid artery in the sheath (γ angle)

Fig 1. Measurement of needle entry angle



Total (N=168)		C6-C7	C5-C6	C4-C5	C3-C4
α angle	AVR	53.3	65.2	75.3	82.3
	STD	12.4	13.7	15.8	18.6
	95% CI	51.4 - 55.2	63.1 - 67.4	72.8 - 77.8	79.3 - 85.3
β angle	AVR	47.5	47.4	45.7	45.0
	STD	6.5	5.6	5.6	5.3
	95% CI	46.5 - 48.6	46.6 - 48.2	44.9 - 46.5	44.1 - 45.8
γ angle	AVR	25.2	33.6	43.0	56.2
	STD	8.9	11.4	12.9	16.2
	95% CI	23.9 - 26.6	31.8 - 35.4	41.0 - 45.0	53.7 - 58.8

AVR; average, STD; standard deviation, CI: confidence interval

Fig 2. The measured value of α angle, β angle and γ angle