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Anesthesiology
1999; 90:308-11

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Cannulation of the Cervical Epidural Venous Plexus: A Rare Complication of Retrograde Internal Jugular Vein Catheterization

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PERCUTANEOUS retrograde cannulation of the internal jugular vein (IJV) is a widely used technique for cerebral venous sampling in intensive care treatment of head-injury patients. Although a multitude of complications

associated with IJV catheterization have been described, epidural venous plexus cannulation with this technique has not been reported.

We report a case of unintentional cannulation of the anterior venous plexus of the cervical epidural space during retrograde catheterization of the right IJV in a polytrauma patient.

Case Report

A 17-yr-old boy was admitted to the emergency room of the San Raffaele Hospital after a motor vehicle accident. The patient was comatose and underwent computed tomography of the head and the thorax and was found to have cerebral and pulmonary contusions.

At admission to the neurointensive care unit, he had mild anisocoria, and pupillary reflexes were bilaterally present. The Glasgow Coma Score was 6, and he was sedated and mechanically ventilated. A central venous catheter was placed in the right subclavian vein, and intracranial pressure was monitored by intraventricular catheter.

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Received from the Neurosurgical Intensive Care Unit, Department of Anesthesia, University of Milano, IRCCS San Raffaele Hospital, Milano, Italy. Submitted for publication March 26, 1998. Accepted for publication August 6, 1998.

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Key words: Cerebral venous sampling; head injury; vertebral plexus.

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Fig. 1. Laterolateral radiograph of the neck.

To perform serial cerebral venous sampling, it was decided to place a catheter in the right jugular bulb through the IJV, using a retrograde technique.¹ With the patient in a flat neutral position, a point 2.5–3 cm lateral to and 2 cm above the medial end of the right clavicle is selected, and the skin is punctured with a 20-gauge needle that is passed in a cranial direction for 3 to 4 cm at an angle of 30° in the sagittal plane for localization of the vein. When the IJV is localized, the vein is catheterized using the Seldinger technique.¹

On the first attempt, the catheter (Certofix 18-gauge; Braun, Melsungen, Germany) advanced into a branch of the facial vein, as assessed by radiograph, and was removed. On the second attempt, the vein was localized by means of a new puncture, and the catheter was moved forward for 16–18 cm to place the catheter tip in the jugular bulb. Blood was easily aspirated through the catheter, and venous oxygen saturation was normal (73%). The position of the catheter was checked with anteroposterior and laterolateral radiographs of the neck, which revealed misplacement of the catheter (fig. 1). Computed tomography of the neck and the head revealed that the catheter was positioned in the anterior epidural space of the cervical spinal canal (fig. 2). The catheter was then withdrawn and a new catheter was inserted *via* the right IJV, and eventually the tip of the catheter was placed correctly in the jugular bulb.

The patient showed no complication or sequelae from the unintentional cannulation of the anterior venous plexus of the cervical epidural space. The neurologic examination after the event was unchanged, the patient could easily move the neck and had no pain or function alteration of the right arm and hand.

Discussion

Numerous complications using the IJV cannulation technique have been reported, including early damage to pleura, mediastinum, heart, great blood vessels, thoracic duct, and nerves in the neck and chest.^{2–6} Although by using this technique, inadvertent vertebral artery puncture, resulting in fistula formation,^{7–10} pseudoaneurysm,¹¹ or fatal stroke,¹² and cervical dural puncture can occur,¹³ to our knowledge, unintentional cannulation of the cervical epidural venous plexus during an IJV catheterization technique has not been reported.

According to the radiograph (fig. 1) and the computed tomography scan (fig. 2), the catheter seems to have cannulated the intervertebral vein at the emergence from the intervertebral foramen of C6-C7. Then, the catheter went forward into the anterior cervical epidural space, advanced upward into the internal venous plexus, and stopped at the level of C2-C3 intervertebral disk (fig. 1). The oxygen saturation value (73%) of the blood, easily withdrawn through the catheter, confirmed that the catheter was positioned in a vein.

One of the major factors contributing to the occurrence of this rare complication in our opinion could have been the depth of the needle insertion. In fact, the distance between the skin and C6 is almost doubled compared to the distance between the skin and the internal jugular vein. Recently, Miyamoto *et al.*¹³ reported cervical dural puncture in a neonate during central venous catheterization *via* the IJV and postulated that the dural puncture was mostly caused by the excessive depth of insertion of the needle. When performing the retrograde catheterization of the IJV, the needle should not be inserted too deeply, even if no blood is aspirated; the vein can be compressed by the needle, and blood often is aspirated during withdrawal of the needle, rather than during advancement of the needle.

There is no useful guide for the optimal depth of insertion of the needle for accessing the IJV. When cannulation of the IJV is performed by the high approach, in adult patients, the distance to the internal jugular vein ranges from 15.0 to 21.5 mm.¹⁴ In our patient, because of the retrograde catheterization of the IJV, the low cervical anterior approach was used. With this approach, usually the IJV is localized when the needle is passed in a cranial direction for 3 to 4 cm.¹

A particular risk of this technique is the angle of insertion of the needle. A rostral directed needle will line up well with the intervertebral foramina, especially if it is at

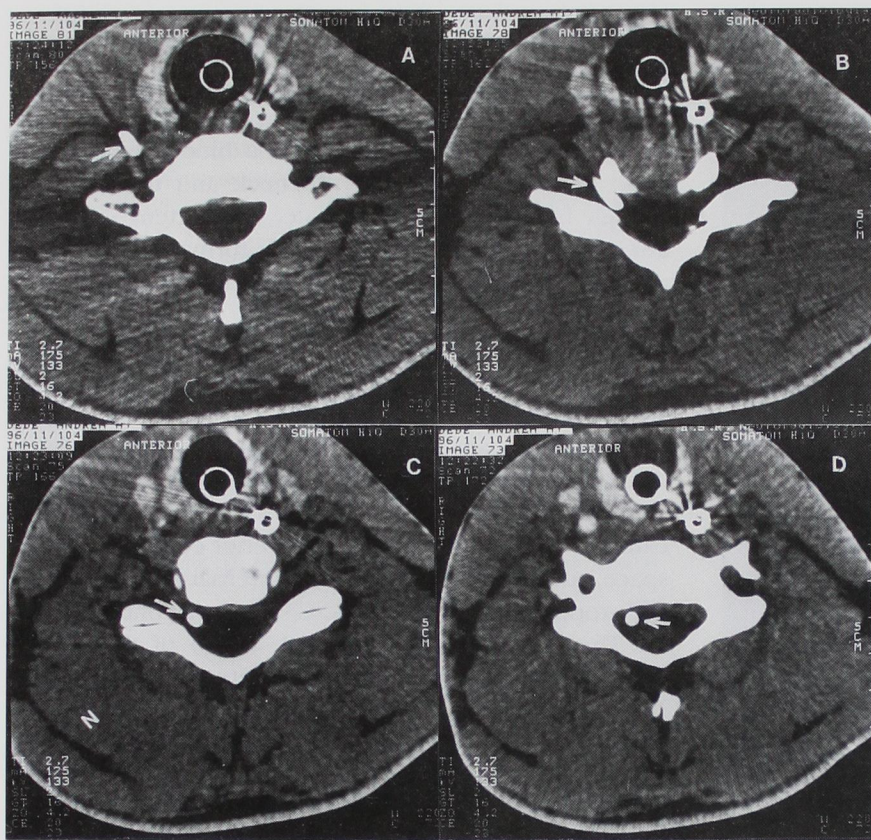


Fig. 2. Computed tomography scan of the head and the neck. Left side of the image is anatomic right. (A) The catheter (arrow) is seen at approximately the point at which it may enter the vessel. (B) The portion of the catheter is imaged where it enters the C6-C7 intervertebral foramen. (C) The catheter is approaching the epidural space. (D) The catheter is seen in the right anterior epidural space. The images show no deformation of the cord or hematoma.

all medially directed. This allows entry into the foramen and the canal. The overhanging transverse processes make central passage quite difficult if a needle is directed caudally, as in the more common approach for simple IJV cannulation. In our patient, improper positioning of the head or direction of the needle (not precisely in the sagittal plane), or both, could have facilitated intervertebral vein cannulation.

In our patient, no complication (e.g., hematoma, infection, neural injury to the cord or to the dorsal root ganglion/peripheral nerve in the foramen) resulted from the inadvertent cannulation of the anterior venous plexus of the cervical epidural space.

In summary, excessive depth of insertion of the needle, during retrograde IJV catheterization, must always be avoided and can result in such a rare complication.

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Anesthesiology

1999; 90:311-2

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Cranial Nerve X and XII Paralysis (Tapia's Syndrome) after an Interscalene Brachial Plexus Block for a Left Shoulder Mumford Procedure

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IN 1904 the Spanish otolaryngologist Antonio Garcia Tapia described a syndrome of lower cranial nerve palsies in a bullfighter who had sustained a work-related injury. While inserting bandilleras, he was gored in the right side of the neck. He was immediately rendered aphonic and his tongue "dragged" when he spoke. Several hours later left hemiparesis developed. Tapia examined the bullfighter and noted the paralysis of the right vocal cord and deviation of the tongue to the right during protrusion. He hypothesized that the bullfighter suffered direct trauma to cranial nerves X and XII and then an embolus to the brain from a contusion of the nearby carotid artery. Tapia's eponym subsequently has been associated with various cranial nerve syndromes, with or without hemiparesis, in which cranial nerve X and XII palsies are consistent features.¹

Interscalene block of the brachial plexus is overall a safe technique in regional anesthesia, but numerous complications have been described.²⁻⁴ Transient hoarseness and a temporary Horner's syndrome are common.⁵

Received from the Department of Neurology, Naval Medical Center, San Diego, California. Submitted for publication April 30, 1998. Accepted for publication August 7, 1998. The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Navy, the Department of Defense, or the US Government.

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Key words: Cranial nerve palsy; dissection.

We report a case of injury to cranial nerves X and XII—Tapia's syndrome—in a patient who received an interscalene block for a Mumford procedure.

Case Report

The patient is a 44-yr-old man who presented with a left shoulder injury requiring surgical repair. Before the procedure, he received an interscalene brachial plexus block in the left side of the neck. With the patient's head turned to the opposite side, a 21-gauge needle was introduced into the interscalene groove at the level of the cricoid, and 50 ml of 1% mepivacaine with 0.2% tetracaine and 1:200,000 epinephrine was injected, aspirating at 5 ml intervals. At some point the patient experienced exquisite left-sided neck pain and perceived a change of sensation in his tongue. At examination he was hoarse and found to have a left Horner's Syndrome. He retained sensation below the axilla after the first injection; therefore, after several minutes, it was repeated with 20 ml of the anesthetic solution with good results. He was then administered general anesthesia and the operation was performed.

Examination 3 days after the operation revealed deviation of the tongue to the left during protrusion, left vocal cord paralysis, and a persistent partial left Horner's syndrome. Computerized axial tomography of the head and neck showed only increased prominence of left tonsillar fossa soft tissues. Magnetic resonance imaging of the brain and neck 2 weeks postoperatively showed fatty degeneration of the tongue on the left and tortuous carotid arteries, but otherwise was normal. Four weeks after surgery the patient was evaluated in the neurology clinic. At that time he looked well, but continued to evince pain when elevating the shoulders, and he spoke in a hoarse whisper. There was decreased sensation on the left side of the palate, but the palate elevated symmetrically. The tongue was atrophied on the left and still deviated to the left during protrusion. The remainder of the neurologic examination was normal. Magnetic resonance imaging and magnetic resonance angiography of the brain and neck performed 8 weeks after the operation and carotid ultrasonography performed 10 weeks after