

NERVE PLEXUS INJURY WITH INTERNAL JUGULAR CANNULATION

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SUMMARY

Internal jugular vein is the most common route for central venous cannulation. Nerve injury, though reported, as early as 1972 is a rare complication of this procedure.¹ We are reporting a case of cervical and upper brachial nerve plexus injury with internal jugular vein cannulation.

Keywords : Venous cannulation, Nerve injury, Postoperative complication.

Introduction

Central venous cannulation is performed for venous pressure monitoring and rapid administration of drugs and fluids. The right internal jugular vein is preferred by most anaesthesiologists because of easy of accessibility and high success rate. Even though the complication of pneumothorax is avoided with this route there can be other life threatening complications like arterial puncture. The reported incidence of arterial puncture being 9.3%.¹

Case report

A 16 year old girl with moderate mitral stenosis and severe mitral regurgitation was posted for elective mitral valve replacement. She had NYHA class 2 cardiac symptoms, for which she was on digoxin, furosemide and potassium chloride. Her symptoms were controlled with the above medications. The preoperative blood investigations were within normal limits. The chest X-ray showed cardiomegaly and electrocardiogram showed left atrial enlargement. Echocardiogram done revealed ejection fraction of 59% with normal left ventricular function. The patient weighed 33 kg. She was kept nil by mouth overnight and received premedication with diazepam 5 mg and metoclopramide 5 mg. Oxygen was administered via Hudson mask while the patient was being transferred to the operating theatre. In the theatre oxygen saturation and electrocardiogram were continuously monitored. Direct blood pressure monitoring was performed with left radial artery cannulation. Peripheral venous cannula was inserted

before induction. Induction was with titrated doses of intravenous morphine and diazepam, supplemented with oxygen, nitrous oxide and halothane. When fully paralysed after pancuronium the patient was intubated with no. 7 cuffed endotracheal tube. After securing the airway she was positioned for right internal jugular cannulation. The area was cleaned and draped for the procedure under aseptic condition. A 22 gauge needle was used to locate the vein just lateral to the carotid artery at the level of the thyroid cartilage. Multiple attempts failed to locate the vessel. Hence the landmarks were reassessed and it was found that the needle entry was far too lateral. The neck was found to be rotated more to the left side. The landmarks were identified again and the vessel was successfully located just lateral to the carotid artery. The vessel was cannulated with an 18 gauge triple lumen catheter by Seldinger technique. The distal lumen was connected to a pressure transducer for central venous pressure recording and proximal lumen for infusion of fluids. The surgery and anaesthesia were otherwise uneventful and she was transferred to the intensive care unit for elective postoperative ventilation. The postoperative period was uncomplicated and she remained haemodynamically stable. The day after extubation she was found to have weakness of the right upper limb, right shoulder and inability to hold her head up. There was no involvement of the diaphragmatic muscles. A neurological examination confirmed weakness of proximal muscle of the right upper limb and sternocleidomastoid. The proximal muscles had a power of grade 4 with normal reflexes. No local swelling was noticed over the neck. The cervical X-ray did not show soft tissue swelling or vertebral compression. Neurologist confirmed the diagnosis of brachial plexus injury. The laboratory investigation showed a phosphokinase level of 1491 IU/L⁻¹. Intravenous injections of methylprednisolone 500 mg was administered for three days and she received passive physiotherapy exercises. The response to the above was excellent and she regained full recovery within three days. The patient was discharged after 8 days with no other sequelae.

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Discussion

The incidence of nerve injury though uncommon, has been reported as early as 1972. These include Horner's syndrome² accessory nerve injury,^{3,4} brachial plexus injury^{5,6} permanent paralysis of C₅⁷ and phrenic nerve.⁸ The patient in this report had developed transient neurological deficit of the lower cervical roots and upper brachial plexus roots. Other causes of nerve injury with cardiac surgeries such as stretching, compression and hyperabduction of the arm at the shoulder are unlikely in this patient. These were not possible as the arms were positioned by the side during surgery. We believe direct nerve injury would be the most likely cause as there were multiple failed attempts at locating the vessel. The close proximity of the plexus to the internal jugular vein when both course through the outer scalene groove imposes a high chance of direct injury during the procedure. Studies have shown that the upper trunk gets damaged when the needle is placed too laterally and lower root is involved with other difficult cannulation. With our patient there were multiple attempts to locate the vessel, the needle entry was found to be laterally placed and the upper trunk of the brachial plexus were involved. The smaller seeker needle used in this patient could have reduced the extent of nerve damage and hence the recovery was rapid and complete.

Data from Hockley C et al⁹ showed that 13% of patients had somatosensory evoked potential changes during central venous cannulation and there were no postoperative sequelae. Somatosensory evoked potentials may allow early prediction of impending injury, but it will detect only sensory and not motor deficits. During the procedure if the patient feels paraesthesia, the needle should be withdrawn and repositioned again. It is also advisable to do a neurological assessment of the concerned nerve roots after the procedure in case of any doubt. This can prevent the delay in detection and management of nerve plexus injury. This is more applicable in a patient who is electively ventilated in the postoperative period.

Though the incidence of neuropathy among cardiac surgical patients in our hospital is very minimal, vigilance remains the cornerstone for preventive management. Hence patients in whom there was difficulty in accessing the vein with multiple attempts should be followed up closely. The insertion of the cannula in an awake patient has the advantage that direct nerve contact will be felt as paraesthesia. In cases where there is a suspicion of such injury and those patients who are electively ventilated, an early electromyography and nerve conduction study in the immediate postoperative period will be helpful. The medical and conservative management can be started early and recovery hastened.

The anatomical landmarks can be altered if the patient's head is turned too much laterally during the procedure. The percentage overlap of the carotid artery and internal jugular vein increases significantly at 40 to 80 degree head rotation to either side. The head should be kept at less than 40 degree rotation.¹⁰ This has to be kept in mind during the positioning. The success rate of internal jugular cannulation using anatomic landmarks has been found to be around 95%. Factors like obesity, neck deformity, previous surgery at the cannulation site, hypovolemia, and inability to lie flat can complicate the anatomy. In these patients ultra sound guided cannulation has a definite advantage that it minimizes the vascular and neurological complications, and decreases the number of cannulation attempts and failures.¹¹ This can lead to increased financial and technical burden and is not always practical. The advantages have been demonstrated in different patient population and among operators of different experience level. The safest way to prevent any complication is that an experienced person should do the procedure, if not, it should be supervised.

A delay in diagnosis can markedly increase the morbidity and mortality in the perioperative setting. This was true in our patient as she was electively ventilated postoperatively. The complication of the nerve injury is usually not evident till the patients are awake and extubated. Management is primarily conservative, with splints, physiotherapy and steroids. Our patient had good response to the above treatment and had a full recovery.

In case of neuropathy there should be strict followup and the progress should be closely monitored. It should be confirmed whether it is pure sensory or with motor involvement. In case of pure sensory neuropathy it is relatively safe to wait for 5 days as recovery should occur within this time.¹² Since our patient had combined motor and sensory involvement a neurologist was immediately consulted. The treatment led to full recovery of motor and sensory function within 3 days. Briscoe et al¹³ has reported extensive neurological damage from a malpositioned central venous cannula due to extravasation of fluids. Absence of local swelling and inadvertent arterial puncture during the procedure rules out this possibility. Idiopathic brachial neuritis, which is characterised by patchy weakness and atrophy of muscles and preceded by intense pain, were not features in our patient.¹⁴ Documentation of the absence of any symptoms of neuropathy in the preoperative and early postoperative period will delineate the onset of perioperative neuropathies. This will also safeguard the anaesthesiologist against medico legal issues as well. When haematoma occurs after an accidental arterial puncture, a high degree of suspicion for local compressive effect should be entertained.

In conclusion we would like to stress the importance of vigilant postoperative follow up in patients where there is the slightest suspicion of any direct nerve injury, or in cases of arterial puncture during the procedure. The correct placement of the central venous cannula should always be confirmed with venous pressure tracing and chest radiography in the postoperative period.

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HISTORICAL FORUM

THE BODOK SEAL

- A MEMORABLE INVENTION

The Bodok seal was introduced at a time which corresponded with the introduction of the pin index safety system into the Anesthesia machine in 1958.

Amongst the various duties assigned to the anaesthesiologist in the 50's, fitting the regulator to the gas cylinder was one. A fibre washer resembling the one used in the water tap was used to provide the all important air tight seal. This lead to constant compression and wear and tear and the fibre washer used to get splayed and become firmly adherent to the metallic surface. The offending washer had to be forcibly removed by use of forceps. In an attempt to prise out the wayward washer, many anaesthesiologists have also injured their fingers! The humble Bodok seal was introduced at this time to the great relief to the anesthesiologists.¹

Today, the Bodok seal forms an integral part of the safety system in the Anesthesia machine. It consists of a 2.4 mm neoprene washer^{2,3} with a peripheral metal ring¹ which prevents splaying of the washer. The central hole snugly fits over the nipple on the machine and the opening in the spindle of the cylinder is being replaced as it can get stuck to the

spindle and disappear. The metal ring can also get cracked, resulting in a constant leak. Only one washer should be fitted between the stem and the yoke.³ More than one washer results in the protrusion of the pins resulting in the failure of the pin index safety system. Anaesthesiologists of the 50's must have said "bless the Bodok"¹ when it was introduced. One really wonders how anaesthesiologists managed before its birth.

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