

Title: CAROTID ARTERY PUNCTURE WITH INTERNAL JUGULAR CANNULATION
Using the Seldinger Technique: Incidence, Recognition, Treatment, and Prevention

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Introduction: Cannulation of the central circulation to measure right and left heart filling pressures and facilitate rapid administration of volume or inotropes is essential in the management of patients who are critically ill or require major surgery. Difficulty in advancing and positioning long lines threaded from the femoral or antecubital veins as well as limited access under the surgical drapes have restricted their use in the operating room. Shorter lines can be advanced from the subclavian, external jugular, or internal jugular veins. The risk of pneumothorax associated with the subclavian cannulation is well documented, making this an unpopular route in patients who are about to be anesthetized, while difficulty in consistently gaining access to the central circulation via the external jugular has restricted the use of this route. Despite the risk of puncturing the carotid artery, which is in close apposition to the internal jugular vein throughout its course in the neck, percutaneous cannulation of the internal jugular vein has gained widespread acceptance among anesthesiologists because of a high success rate and supposed minimal morbidity. The straight line path to the right heart has made this route particularly popular in cases where a pulmonary artery catheter is to be introduced. We have reviewed our experience in the central circulation cannulation of 1125 patients who underwent open heart surgery. These cannulations were all performed prior to the induction of anesthesia by residents under supervision or by attending staff.

Methods: Our method of internal jugular cannulation utilizes the apex of the triangle formed by diverging bellies of the sternocleidomastoid, staying lateral to the carotid pulse and aiming for the ipsilateral nipple. A 20 gauge needle-catheter combination, whose catheter accepts a 0.025 inch wire (not all 20 gauge catheters do!), is introduced and advanced until blood is aspirated to identify the vein. The 20 gauge catheter is then threaded into the vein, the needle removed, and the guidewire passed through the catheter, which is then removed. A blade is used to enlarge the skin puncture and an 8F catheter-introducer advanced over the wire into the vein. After removal of the wire and introducer, the 8F sheath can serve as a CVP line or be used to introduce a pulmonary artery catheter.

Results: On 104 occasions internal jugular cannulation was not attempted because either a central line was already in place or another route, usually the external jugular, was used electively, or because of a contraindication to internal jugular cannulation. Relative contraindications in our institution include prior surgery (one patient with a previous radical neck dissection and two with previous carotid endarterectomies in this series), presence of a bruit or history of transient ischemic attacks, or a hemorrhagic diathesis. The data for the other 1021 patients

are summarized as follows:

Attempted Int. Jug. Cannulation	Successful Int. Jug. Cannulation	Arterial Puncture of 1021)	Swan-Ganz Cath Passed of 973)
1021 (90.1% of 1125)	973 (95.3% of 1021)	43 (4.2% of 1021)	513 (52.7% of 973)

On forty-eight occasions (4.7% of 1021 attempts) internal jugular vein cannulation was abandoned because of technical difficulties. In 43 cases an artery was punctured with a 20 gauge needle-catheter combination. In five of these cases the attending physicians were unaware of this complication and an 8F catheter sheath was introduced using the Seldinger technique. When the introducer was removed from the sheath, the arterial nature of the cannulation was obvious. Of these five patients, three underwent the scheduled surgery without incident after delays of two hours, five days, and thirteen days. Two patients were not operated on: one died forty-eight hours later of his basic coronary disease while waiting for surgery and the other died twelve hours later of exsanguination into the right hemithorax after being stable throughout the immediate postpuncture period.

Discussion: This retrospective analysis has enabled us to appreciate better the incidence of arterial puncture during attempted internal jugular cannulation. There was no morbidity associated with arterial puncture with a 20 gauge needle-catheter combination. More disturbing is the fact that in five of forty-three arterial punctures it was not appreciated that an artery had been entered with a 20 gauge catheter and an 8F sheath was introduced into the artery. As a result of this review we recommend that:

1. Cannulation of the external jugular be considered first. (This is presently being attempted more frequently in our institution).

2. When the internal jugular vein is used, attach the 20 gauge catheter to a transducer and confirm a venous waveform and pressure before passing the guidewire of a Seldinger set.

3. In contrast to published reports (1), should an 8F sheath be passed into an artery, we recommend leaving the catheter in place (sealing it off with a stopcock) and then immediately exploring the neck to close the hole in the artery in view of the possibility of fatal bleeding from a defect of this size in an artery as demonstrated by our one patient. Once the defect has been closed, we feel it is then safe to proceed with the scheduled operation.

(1) McEnany MT & Austen WG: Life-threatening hemorrhage from inadvertent cervical arteriotomy. *Ann Thorac Surg* 24:233-236, 1977.