

6. Parkes AR: Traumatic ischaemia of peripheral nerves with some observations on Volkmann's ischemic contracture. *Br J Surg* 32:402-409, 1944
7. Schreiber SN, Leibowitz MR, Bernstein LH: Limb compression and renal impairment (crush syndrome) following narcotic and sedative overdose. *J Bone Joint Surg* 54-A:1683-1692, 1972
8. Matsen FA III. Compartmental syndrome. An unified concept. *Clin Orthop Rel Res* 113:8-14, 1975
9. Rorabeck CH, MacNab I. The pathophysiology of the anterior tibial compartment syndrome. *Clin Orthop Rel Res* 113:52-57, 1975
10. Mubarak S, Owen CA: Compartmental syndrome and its relation to the crush syndrome: a spectrum of diseases. A review of 11 cases of prolonged limb compression. *Clin Orthop Rel Res* 113:81-89, 1975
11. Oken DE: Modern concepts of the role of nephrotoxic agents in the pathogenesis of acute renal failure. *Prog Biochem Pharmacol* 7:219-247, 1972
12. Schulze VE Jr: Rhabdomyolysis as a cause of acute renal failure. *Postgrad Med* 72:145-158, 1982
13. Garland H, Moorhouse D: Compressive lesions of the external popliteal (common peroneal) nerve. *Br Med J* 2:1372-1376, 1952
14. Costley DO: Peripheral nerve injury. *Int Anesthesiology Clin* 10:189-206, 1972
15. Little DM Jr: Posture and anaesthesia. *Can Anaesth Soc J* 7:2-15, 1960
16. Tondare AS, Naokarni AV, Sathe CH, Dave VB: Femoral neuropathy: A complication of lithotomy position under spinal anaesthesia. Report of three cases. *Can Anaesth Soc J* 30:84-86, 1983

Anesthesiology
60:238-240, 1984

CVP Catheter Placement from the Antecubital Veins Using a J-Wire Catheter Guide

SUSAN L. SMITH, M.D.,* MAURICE S. ALBIN, M.D.,† RICHARD R. RITTER, M.D.,‡ LEONID BUNEGIN, B.S.§

Catheterization of a central vein is used for measurement of central venous pressure (CVP), for rapid administration of fluids or blood products, and when accurately placed, removal of entrained air embolism is possible. Insertion of a CVP catheter from the basilic or cephalic veins of the arm offers few complications, but success often is hampered by an inability to advance the catheter into the larger intrathoracic veins. Using a catheter system equipped with a lumen-following J-wire guide, we inserted central venous catheters from antecubital sites and evaluated ease of insertion and final catheter position.

METHODS

Seventy-seven adult patients undergoing elective neurosurgical or general surgical procedures were studied. All were felt to clinically require and consented to CVP monitoring. All catheters were inserted by members of the resident staff or faculty of our Department.

After application of a tourniquet, the antecubital fossa

was prepared and draped in a sterile fashion. An antecubital vein was cannulated with either a 14- or 16-gauge 7.5-cm over-the-needle Teflon® catheter or 18-gauge thin-wall 7.0-cm needle. Catheter or needle placement was confirmed by aspiration of blood. The tourniquet was removed and a flexible, angiographic wire catheter guide with a J-tip (3.0 mm radius on the J-curve, 150 cm length, 0.078 cm OD) was inserted through the catheter or the 18-gauge needle. The wire was advanced until the tip was felt to be beyond the shoulder and into the intrathoracic veins. The length needed was estimated by external measurement from the antecubital fossa to the mid-clavicle. Any obstructions encountered were passed by manipulation of the wire and/or reposition of the patient's arm. The needle/catheter then was removed over the wire and a siliconized polyethylene catheter (0.195 cm OD and 60 cm long) advanced over the wire to its hub. The wire was removed, aspiration of blood through the catheter confirmed, and an iv infusion connected to document flow. The catheter then was connected to a pressure transducer and oscilloscopic display and the pressure wave form evaluated to determine whether or not the catheter was in the right ventricle. Position of the catheter was documented radiographically. The catheter hub then was secured and a sterile occlusive dressing placed over the site of cannulation. Failure of placement was defined as either inability to cannulate an antecubital vein or inability to pass the J-wire or catheter into the central veins. §

* Fellow in Neuroanesthesia.

† Professor of Anesthesiology and Neurosurgery.

‡ Professor of Anesthesiology.

§ Instructor in Anesthesiology.

Received from the Department of Anesthesiology, The University of Texas Health Science Center at San Antonio, and The Audie Murphy Veterans Administration Hospital, San Antonio, Texas. Accepted for publication August 2, 1983.

Address reprint requests to Dr. Albin: Department of Anesthesiology, University of Texas Health Science Center, San Antonio, Texas 78284.

Key words: Veins: antecubital, cannulation; Equipment: J-wire.

§ This unit was supplied by Cook Incorporated, Bloomington, Indiana, as the Albin-Bunegin CVP Kit.

RESULTS

Seventy of 77 cannulations were successful (91%). In four patients, we were unable to cannulate an antecubital vein. In the other three, the wire guide would not advance into the central veins. In three of the 70 successful placements, a second venipuncture was necessary due to the inability to pass the wire centrally. All three of these patients were cannulated initially in the cephalic vein, and the second catheterization was made via the basilic vein.

Thirty catheterizations (42.9%) were performed from the right arm and 40 (57.1%) from the left. Seventy-one per cent of successful catheterizations were done from the basilic vein. All but three catheters were in final position radiographically in the superior vena cava or appeared to be at the superior vena cava right atrial junction. One was in the ipsilateral internal jugular vein, one in the inferior vena cava, and one in the right ventricle. These were repositioned by withdrawing the catheter while observing the pressure waveform or withdrawing and readvancing the catheter using the catheter tip as an intravascular electrocardiographic lead. In three patients, isolated premature ventricular contractions were seen as the catheter was advanced to the hub. These resolved when the catheter was pulled back and were felt to be secondary to irritation of the right ventricle by the catheter tip or the wire. In one case, the initial pressure tracing showed a right ventricular waveform and the catheter was withdrawn until an atrial pattern was obtained. The complete catheterization procedure time averaged 4 min. All catheters remained in place for post-operative monitoring without complications.

DISCUSSION

Placement of any central venous catheter entails a risk of major complications of approximately 1%.¹ Although a large proportion of complications bear little relation to the site of insertion (cardiac or vascular perforation, catheter sepsis, air embolism, thrombosis, catheter coiling or knotting), each insertion site and technique has its own attendant risks.^{2,3}

Insertion of a CVP catheter from the antecubital fossa avoids the risk of pneumothorax and may be more comfortable for the patient. Unfortunately, placement often is unsuccessful due to an inability to pass the catheter into the subclavian vein. Both the basilic and cephalic veins enter the axillary vein just inferior to the clavicle at its outer third. The angle of entry is often acute, and the cephalic vein especially is replete with valves and small branches at this point. Webre and Arens reported a 55% failure rate using the cephalic vein, all of which could not be advanced beyond the shoulder.⁴ The success rate

TABLE 1. Success Rates and Placement Problems in Antecubital CVP Insertions

	Success Venipuncture (%)	Success Placement (%)	Most Common Malposition (%)
Holt, 1967 ¹¹	85.7	88.0	Axillary vein (7.1)
Dietsch, 1971 ⁶	100.0	74.0	Internal jugular
Langston, 1971 ²	100.0	75.0	Internal jugular (16)
Johnston, 1972 ¹²	100.0	82.0	Internal jugular (15.1)
Kellner, 1972 ¹³	97.5	75.4	Internal jugular
Webre, 1973 ⁵	100.0	59.0	Peripheral vein (21)
Shang Ng, 1973 ⁴	100.0	78.5	Internal jugular (22.1)
Woods, 1974 ¹⁴	87.3	75.5	Internal jugular (7.5)
Lumley, 1975 ¹⁵	100.0	73.6	Internal jugular (12.3)
Kuramoto, 1975 ²	100.0	70.0	Axillary vein (20)
Bridges, 1979 ¹⁶			
Basilic Vein	100.0	72.5	Internal jugular (27.5)
Cephalic Vein	100.0	76.0	Peripheral vein (24)

for CVP cannulation as performed from the arm varies from 59% to 88% (table 1). Most of the complications are not unique to insertion from the arm, although malposition may be more common from that approach.^{5,6} Catheter tip advancement (up to 9 cm when the arm is abducted) may be more likely as a result of arm movement, leading to misleading measurements or vessel trauma.^{7,8} Cutaneous infection has been reported in up to 10% of patients with cutdowns of the antecubital veins.⁹

Blitt *et al.* first used a J-wire to successfully pass a catheter intrathoracically from the external jugular vein in 96 of 100 attempts.¹⁰ The flexible curved tip of the J-wire easily traverses valves, angulations, and tortuous vessels. Catheter placement is accomplished once the wire is guided past obstructions. This technique has not been reported previously to facilitate CVP catheterization from the antecubital fossa. In our experience, the wire could be threaded centrally in all cases in which the guide was placed in the basilic vein and in 78% of those placed in the cephalic vein (20/26). Obstructions were infrequent, and repositioning of the arm or wire rarely was needed. There were only three cases of malposition (4.3%), all of which were repositioned easily. In no case was the catheter coiled or knotted, and all pressure measurements were felt to accurately reflect central venous pressure.

Use of a J-wire guide appears to significantly improve the chance of successful placement of central venous pressure catheters from antecubital veins, especially the basilic vein. This site may pose less risk of serious complications, and this method removes some major obstacles to use of the arm veins for cannulation. Accurate catheter placement should be evaluated by pressure measurements, radiographically, and/or electrocardiographically.

REFERENCES

1. Peters JL: Current problems in central venous catheter systems. *Intensive Care Med* 8:205-208, 1982

2. Langston CS: The aberrant central venous catheter and its complications. *Diagnostic Radiology* 100:55-59, 1971
3. Shang Ng W, Rosen M: Positioning central venous catheters through the basilic vein. *Br J Anaesth* 45:1211-1214, 1973
4. Webre DR, Arens JF: Use of cephalic and basilic veins for introduction of central venous catheters. *ANESTHESIOLOGY* 38:389, 1973
5. Lingfelter AL, Guskiewicz RA, Munson ES: Displacement of right atrial and endotracheal catheters with neck flexion. *Anesth Analg* 57:371-377, 1978
6. Dietel M, McIntyre JA: Radiographic confirmation of the site of central venous pressure catheters. *Can J Surg* 14:42-52, 1971
7. Kalso E, Rosenberg PH, Vuorialho M, Pietila K: How much do arm movements displace cubital central venous catheters? *Acta Anaesth Scand* 26:354-356, 1982
8. Van Dijn B, Bakker PM: Appraisal of the dislocation of central venous catheter tips using subclavian and arm veins. *Anaesthetist* 26:138-140, 1977
9. Craig RG, Jones RA, Sproul CJ, Kinyon GE: The alternate methods of central venous system catheterization. *Am Surg* 34:131-134, 1968
10. Blitt CR, Wright WA, Petty WC, Webster TA: Central venous catheterization via the external jugular vein: A technique employing the j-wire. *JAMA* 229:817-818, 1974
11. Holt MJ: Central venous pressures via peripheral veins. *ANESTHESIOLOGY* 28:1093-1095, 1967
12. Johnston AOB, Clark RG: Malpositioning of central venous catheters. *Lancet* 12:1395-1397, 1972
13. Kellner GA, Smart JF: Percutaneous placement of catheters to monitor "central venous pressure." *ANESTHESIOLOGY* 36:515-516, 1972
14. Woods DG, Lumley J, Russel WJ, Jack RD: The position of central venous catheters inserted through arm veins: A preliminary report. *Anaesth Intensive Care* 2:43-47, 1974
15. Lumley J, Russel WJ: Insertion of central venous catheters through arm veins. *Anaesth Intensive Care* 3:101-104, 1975
16. Bridges BB, Carden E, Takacs FA: Introduction of central venous pressure catheters through arm veins with a high success rate. *Can Anaesth Soc J* 26:128-131, 1979

Anesthesiology
60:240-242, 1984

Combined Cesarean Section and Clipping of Intracerebral Aneurysm

ROBERT L. LENNON, D.O.,* THORALF M. SUNDT, JR., M.D.,† GERALD A. GRONERT, M.D.‡

Intracranial bleeding associated with aneurysm in a female patient whose near-term pregnancy is complicated by systemic arterial hypertension requires consideration of several factors important to the survival of both the mother and infant. We present such a case below.

REPORT OF A CASE

A 35-year-old woman, G2 P1, had an intrauterine pregnancy at 32 weeks gestation complicated by mild pregnancy-associated hypertension. An intracranial aneurysm was suspected after the acute onset of severe occipital cephalgia, and a lumbar puncture revealed bloody cerebrospinal fluid (CSF). A 2 cm aneurysm at the junction of the right basilar and posterior cerebral arteries was delineated by both computer tomography and selective cerebral angiography. The size, location, and angiographic appearance suggested the need for urgent surgical repair. Recent sedation, used to prevent rebleeding, included phenobarbital, diazepam, and codeine. The patient is allergic to pen-

icillin. Her medical history included a previous hypertensive pregnancy; the infant was delivered by cesarean section due to cephalopelvic disproportion. General anesthesia for this delivery was uncomplicated. She was now scheduled for a cesarean section followed by a right frontal craniotomy.

Physical examination revealed a gravid 60-kg female in moderate distress due to cephalgia. Arterial blood pressure range was 90-135/60-85 mmHg, with a heart rate of 60-80 beats/min. She was intelligent and composed and consented to the planned procedures. All medications were discontinued. The next morning, incremental doses of morphine sulfate (total 8 mg) were injected iv while she was in her room for sedation. In the operating room, a quiet, calm atmosphere was maintained. Intravenous and arterial cannulae were inserted after infiltration with lidocaine. The fetal heart tones were stable at 150 beats/min. Propranolol was given iv in 0.5 mg increments to a total of 3 mg (until the heart rate decreased approximately 10 beats/min). Anesthesia was induced with thiopental 150 mg iv, and 8 mg of pancuronium provided skeletal muscle relaxation. Ventilation was controlled with inhalation of 1% halothane in oxygen. One minute preceding intubation of the trachea, 100 mg lidocaine iv was given. With the abolition of a response to supramaximal peripheral nerve stimulation, sodium nitroprusside 50 µg was administered iv and intubation of the trachea accomplished without incident. Anesthesia was continued with halothane, 0.5% in oxygen. There was no significant change in arterial pressure or heart rate, and halothane was discontinued 5-10 min prior to delivery.

The performance of the low transverse cesarean section was unhurried, resulting in delivery of a 2,540-g viable male infant 25 minutes after induction of anesthesia. Naloxone, 0.02 mg, was given im to the infant twice and, transiently, ventilation controlled; the Apgar score at five minutes was 9. The uterus was boggy, requiring massage and pitocin infusion for correction. Arterial blood pressure remained stable.

Upon completion of the cesarean section, the patient was turned to the left lateral decubitus position, and a malleable needle inserted

* Special Clinical Fellow in Anesthesiology, Mayo Graduate School of Medicine. Present address: LTC Robert L. Lennon, P.O. Box 42, 97th General Hospital, APO New York 09757.

† Professor and Chairman, Department of Neurosurgery, Mayo Medical School.

‡ Professor of Anesthesiology, Mayo Medical School.

Received from the Departments of Anesthesiology and Neurosurgery, Mayo Clinic and Mayo Foundation, Rochester, Minnesota 55905. Accepted for publication August 5, 1983.

Address reprint requests to Dr. Gronert.

Key words: Anesthesia: obstetric, neurosurgical. Brain: hemorrhage, edema.