

Anesthesiology  
60:481-482, 1984

## Doppler Localization of the Internal Jugular Vein Facilitates Central Venous Cannulation

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The internal jugular vein (IJ) is an important access to hemodynamic monitoring of the central venous system. Cannulation of the IJ is accomplished by noting its anatomic relation to surface landmarks and to palpable carotid pulsations.<sup>1-3</sup> Although success rates for IJ cannulation are high, serious complications occasionally occur. In addition to pneumothorax and carotid puncture, catastrophic hemorrhage has occurred after accidental arterial puncture in the heparinized patient following cardiopulmonary bypass,<sup>4,5</sup> and a number of neurologic complications have been related to needle probing during cannulation attempts.<sup>6,7</sup> To avoid multiple needle probes and hopefully reduce the incidence of complications, we investigated the use of an ultrasonic Doppler to locate the IJ prior to its catheterization.<sup>8</sup>

### METHODS

Forty-three adult patients scheduled for major vascular or cardiac surgery had right IJ catheters inserted under the supervision of a staff anesthesiologist. The veins were cannulated by the Seldinger technique, with the use of an 18-gauge needle‡ for the initial puncture.<sup>9</sup> The patients were assigned randomly to one of two groups. In the control group, needle exploration was guided by anatomic landmarks delineating the "central" approach. In the experimental group, a Parks Model 811-Doppler§ with a 10-mHz pencil probe was used to identify the IJ near the level of the cricoid cartilage. The pencil probe was held at a 45° angle to the surface of the neck, and the skin overlying the IJ was marked with indelible ink. Subsequently, the site was cleansed with betadine solution and sterilely draped prior to catheterization. As a simple measure of cannulation accuracy, we recorded the number of patients in each group that required only one

needle pass to correctly place the guide wire. In two additional patients, a catheter was inserted in the external jugular vein when the carotid artery sounds could not be separated clearly from the "windstorm"-like IJ venous sounds. Data from each group were compared by the chi-square statistic using Yates' correction.<sup>10</sup> Ninety-five per cent confidence intervals for proportions were taken from a binomial distribution table.<sup>11</sup> This protocol was reviewed and approved by the institutional Human Studies Committee.

### RESULTS

The results of the 43 catheterization procedures are presented in table 1. The difference between groups remains significant even if the two patients in which carotid and venous sounds could not be separated clearly are included in the experimental group as failures (multiple passes). All Doppler studies in the operating room were completed in less than 3 min. The only complication was a carotid puncture without sequelae in the control group (*i.e.*, without the Doppler).

### DISCUSSION

The complications associated with three anatomic approaches to internal jugular catheterization have been described by Defalque.<sup>12</sup> Since many such complications probably are a direct result of needle exploration, we evaluated a noninvasive method of identifying the IJ described by Ullman and Stoelting.<sup>8</sup> The proportion of patients cannulated with a single pass in the control group reported here (28.6%) compares favorably, within sample size limitations, to the 43.3% noted in a recent report by Goldfarb and Lebrec, based on an experience with 1,000 patients.<sup>13</sup> These authors also found that 42.7% of patients required three or more passes to cannulate the internal jugular using anatomic landmarks; therefore, an advantage of accurate localization seems apparent. Another advantage of the Doppler technique may be that palpation of the carotid during cannulation is not required, since Bazaraal and Harlan's<sup>14</sup> ultrasonographic study of the neck suggested that palpation of the carotid can distort anatomic relationships and also can narrow the vein lumen by compression.

In conclusion, we found that the use of an ultrasonic Doppler provided accurate, noninvasive localization of the internal jugular vein and reduced unnecessary needle

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Received from the Department of Anesthesiology, Mayo Clinic and Mayo Foundation, Rochester, Minnesota 55905. Accepted for publication September 19, 1983. Supported in part by a Burroughs-Wellcome fellowship—1982 (Dr. Legler).

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Key words: Equipment: Doppler. Veins: jugular; cannulation.

‡ Cordis percutaneous entry tray, Cordis Corporation, P.O. Box 525700, Miami, Florida 33152.

§ Parks Medical Electronics, Inc., P.O. Box BB, Beaverton, Oregon 97075.

TABLE 1. Patients Having Internal Jugular Cannulation

|                 | Single Pass of Needle | Multiple Passes of Needle | Total No. of Patients | Single Pass Success Rate |
|-----------------|-----------------------|---------------------------|-----------------------|--------------------------|
| With Doppler    | 17                    | 5                         | 22                    | 77.3%<br>(54.6–92.2)*    |
| Without Doppler | 6                     | 15                        | 21                    | 28.6%<br>(11.3–52.2)     |

$\chi^2 = 10.24; P = 0.0014. \chi^2$  (corrected) = 8.38;  $P < 0.005.$

\* 95% confidence intervals.

exploration. The size of our study limits definitive conclusions about complication rates; however, we believe the Doppler can be a useful aid for internal jugular cannulation.

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Anesthesiology  
60:482–484, 1984

## Hemodynamic and Two-dimensional Transesophageal Echocardiographic Analysis of an Anaphylactic Reaction in a Human

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While anesthetized for aorto-bifemoral reconstruction, a 60-year-old man had an anaphylactic reaction to the antibiotic sodium cefazolin (Ancef®; Smith Kline, Philadelphia, Pennsylvania). During the reaction, hemody-

namic and two-dimensional transesophageal echocardiographic (2-D TEE) measurements indicated that profound hypotension occurred because of decreases in left ventricular preload and afterload and not because of myocardial dysfunction.

## REPORT OF A CASE

A 60-year-old, 82.5-kg man was admitted to our hospital because of the acute onset of numbness and weakness in his legs. Absence of pulses in the legs led to the diagnosis of aortic occlusion. An aortogram revealed occlusion of the left renal artery and both femoral arteries by a thrombus, and blood flow to the legs and right kidney was minimal. An echocardiogram revealed a large pedunculated thrombus in the left ventricle and pronounced abnormalities in anteroseptal and lateral wall motion. A cardiac surgeon advised against immediate removal of the left ventricular mass, but because of threatened loss of the lower extremities and impending renal failure, an aorto-bifemoral bypass graft, right renal revascularization, and left nephrectomy were planned.

The patient's medical history included many years of poorly controlled hypertension and severe coronary artery disease. Four years

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Received from the Departments of Anesthesia, Medicine, Pharmacology, and Cardiology, University of California, San Francisco, California. Accepted for publication September 21, 1983. Supported in part by National Institute on Aging Program Project 1 PO1 AGO3104-01,02.

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Key words: Allergy. Heart: echocardiography. Measurement techniques: two-dimensional transesophageal echocardiography.