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Effect of Head Position on the Location of Venous Catheters Inserted via Basilic Veins

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Twenty-three to 35 per cent of catheters inserted through basilic arm veins for measurement of central venous pressure (CVP) are inaccurately placed. Of incorrectly placed catheter tips, 45 to 67 per cent lie in the internal jugular vein rather than in a central intrathoracic vein.¹⁻³ It has been suggested that to prevent the catheter tip from entering the internal jugular vein, the patient's head should be turned toward the arm of insertion.^{2,4} However, there has been no report of the effects of head positions on catheter locations. Therefore, we analyzed the locations of 100 central venous pressure catheters to determine the effect of position of the head during catheter insertion.

METHODS

In each of 100 preoperative patients, after skin preparation with an iodinated disinfectant, a 15-gauge, 53-cm† catheter was inserted into the basilic vein of the antecubital fossa of either arm. During the threading of the catheter proximally, intravenous fluid was allowed to flow at maximum rate. The arm was abducted or the clavicle elevated as required. The catheter was inserted its full length or until further insertion was impossible due to cessation of fluid flow. A record was kept of whether the patient's head was turned toward the arm of insertion with the chin touching the shoulder (ipsilateral) or was not turned toward either arm (mid-position). Postoperatively a roentgenogram of the chest was examined to determine the location of the catheter tip.

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RESULTS

The results are summarized in table 1. Turning the head ipsilaterally significantly reduced the number of catheters entering the internal jugular veins. Eighteen per cent of catheters entered an internal jugular vein during insertion with the head at mid-position, but only 4 per cent of catheters were located in an internal jugular vein with the head turned ipsilaterally during insertion ($P < 0.05$). Right atrial and superior vena caval locations were more frequently achieved when the head was turned ipsilaterally, 80 per cent successful, compared with 58 per cent success in placement when the head was at mid-position ($P < 0.05$).

With the head at mid-position 74 per cent of catheter tips were successfully located within an intrathoracic vein. Turning the head toward the arm of insertion resulted in placement of 92 per cent of catheters within an intrathoracic vein ($P < 0.05$). Of the 100 catheters inserted, 52 per cent were inserted via the right arm and 48 per cent via the left arm.

DISCUSSION

Failure to place a CVP catheter tip in an ideal central location does not necessarily prevent accurate central venous pressure measurement. Pressures measured in the external jugular and internal jugular veins can accurately approximate central venous pressures, but only when the head is not turned to either side (compressing the veins), and when the chest is not open.⁵ Failure to place the CVP catheter tip correctly can cause erroneous pressure readings when venous values are interposed between the catheter tip and central veins or when the catheter tip is against the wall of a vein. In addition, placement of the catheter tip into the jugular veins may result in serious problems in patients who run the risk of venous air

embolism or in patients undergoing intravenous hyperalimentation.

A catheter inserted via an extremity vein cannot be relied on to thread into a central vein. The cephalic vein is rarely used due to its 55 per cent failure rate, and was not used at all in this study.² The failure rates for accurate placement range from 23 to 35 per cent with basilic vein insertion.^{1-3,6} Fluctuation of the fluid meniscus with respiration is not a reliable guide to central vein placement since 85 per cent of catheters not centrally located still fluctuate with respiration.⁶ Altering the position of the head changes the angle of entry of the internal jugular vein into the subclavian vein. In one patient, chest x-rays showed that turning the head of the patient toward the arm of insertion and placing the chin onto the ipsilateral shoulder changed the angle of insertion of the internal jugular vein into the subclavian vein to 45 degrees from a 90-degree angle of entry with the head at mid-position.

In patients whose arm veins are not available, or when rapid accurate placement of a central venous catheter is needed, or the catheter is expected to be needed, for a long period, we frequently use internal jugular catheter insertion to ensure correct placement.^{7,8} Subclavian punctures in the immediate preoperative and intra-operative periods are usually avoided. Insertion via extremity veins remains the most common method of placement of CVP catheters at our institution.

In summary, turning the head of the patient toward the arm of insertion and placing the chin onto the ipsilateral shoulder during the threading of central venous catheters via extremity veins significantly reduces the number of catheter tips that erroneously enter the internal jugular vein, and significantly increases the success rate for intrathoracic placement.

TABLE 1. Effects of Position of the Head on Locations of Central Venous Pressure Catheter Tips

	Head Mid-position	Head Turned Toward the Arm of Insertion
Right atrium	5	3
Superior vena cava	24	37
Subclavian vein	8	6
Internal jugular vein	9	2*
Axillary vein	3	2
Long thoracic vein	1	0
Total number of catheters	50	50

* Significantly different from number with head at mid-position, $P < 0.05$.

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