

# A New Supraclavicular Approach to Subclavian Venous Catheterization

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## ABSTRACT

Supraclavicular approach to access the right subclavian vein is easier and associated with fewer complications as compared to infraclavicular approach. Needle is directed at an angle of 10° medially from the sagittal plane and 35° posteriorly from the coronal plane, just at the clavisternomastoid angle, to locate the subclavian vein.

## INTRODUCTION:

Infraclavicular approach to subclavian vein catheterization poses some difficulty in locating the vein in first attempt, because it is distant to skin entry point. Particularly in obese persons it becomes more difficult and often extra length needle is required. Unfortunately, it is associated with several critical complications, such as arterial puncture and pneumohaemomothorax. These complications may be due to vague anatomical landmarks, such as controversial skin entry points and ambiguous targets located far from the insertion site<sup>1,2</sup>

When subclavian vein cannulation is not regularly performed, it may lead to infrequent success and major complications<sup>3, 4</sup>; not surprisingly, physician experience reduces the risk of complications<sup>5</sup>. For example, physicians who had performed 50 subclavian vein cannulations encountered 50% fewer complications<sup>6</sup>. Although this may suggest that only experienced health care professionals should perform this procedure, this may not be practical in emergency situations or in teaching and small hospitals. Accordingly, any strategy to simplify subclavian vein cannulation may result in fewer complications, and therefore, greater patient safety.

As an alternative, the supraclavicular subclavian vein approach was suggested by Yoffa<sup>7</sup>. Owing to well defined surface landmarks and the

consistency of the practice, subsequent reports noted better success and fewer complications with the supraclavicular approach than with the infraclavicular approach<sup>8-10</sup>. However, the supraclavicular approach has been performed in the past without precise anatomical information, and physicians have been hesitant to use this technique but with time well defined landmarks with successful attempts has encouraged the physicians to use this technique with confidence.<sup>11</sup>

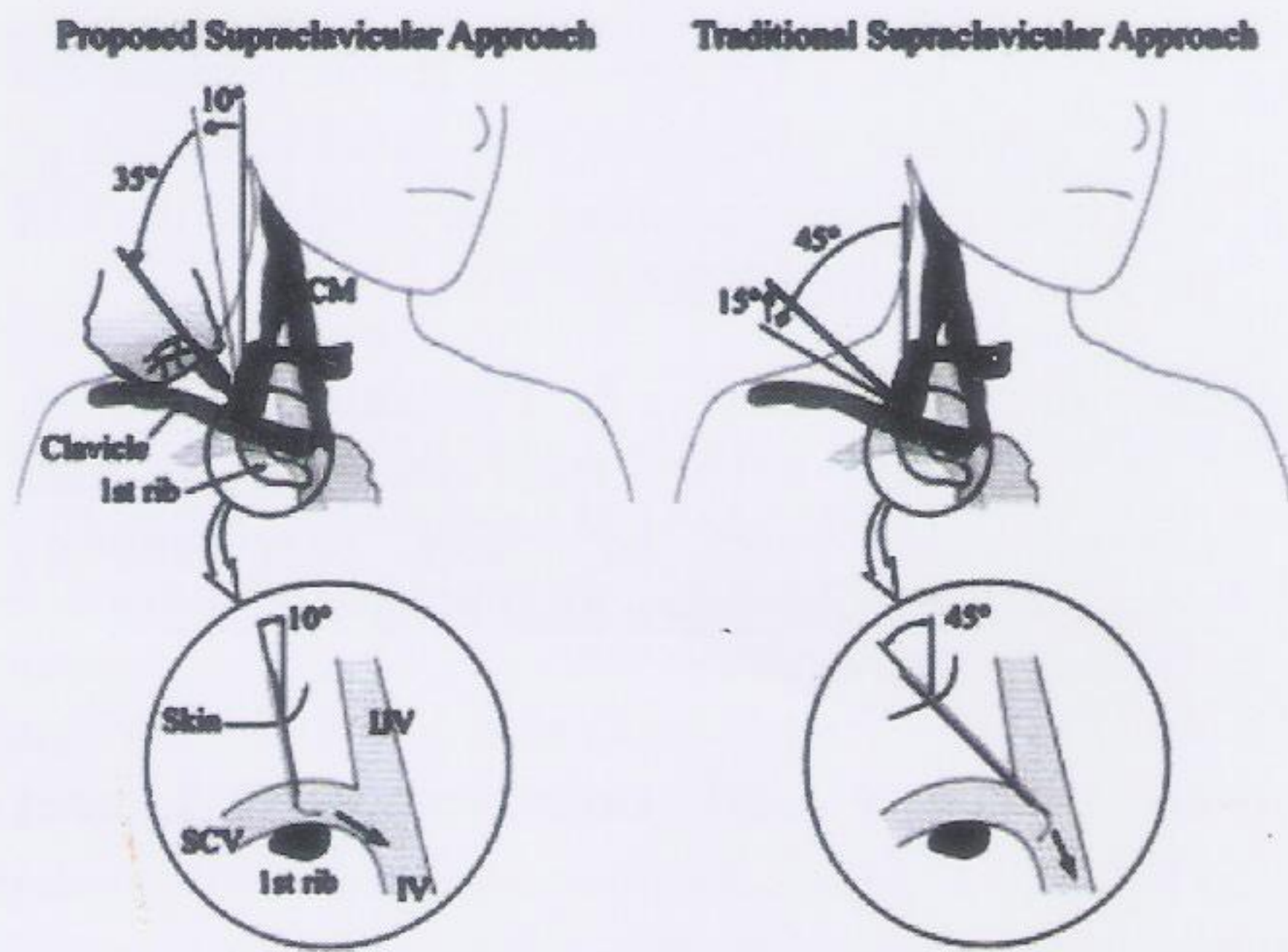
## METHOD:

All catheterizations should be performed by an experienced person. This procedure has been explained for a patient to be anaesthetized in an operating room. After induction of anaesthesia, patients are placed in the supine position with the right arm by the side. The operating room table is level and a rolled towel is not placed under the shoulder. To identify the sternocleidomastoid muscle, the patient's head is minimally turned away from the catheterization side.

Puncture of the subclavian vein is performed while ventilation of the intubated patient is held at end-expiration to prevent inadvertent puncture of the lung. After skin preparation, a 1.25 inch 21G finder needle attached to a syringe is directed at an angle of 10° medially from the sagittal plane and 35° posteriorly from the coronal plane, just at the clavisternomastoid angle, to locate the subclavian

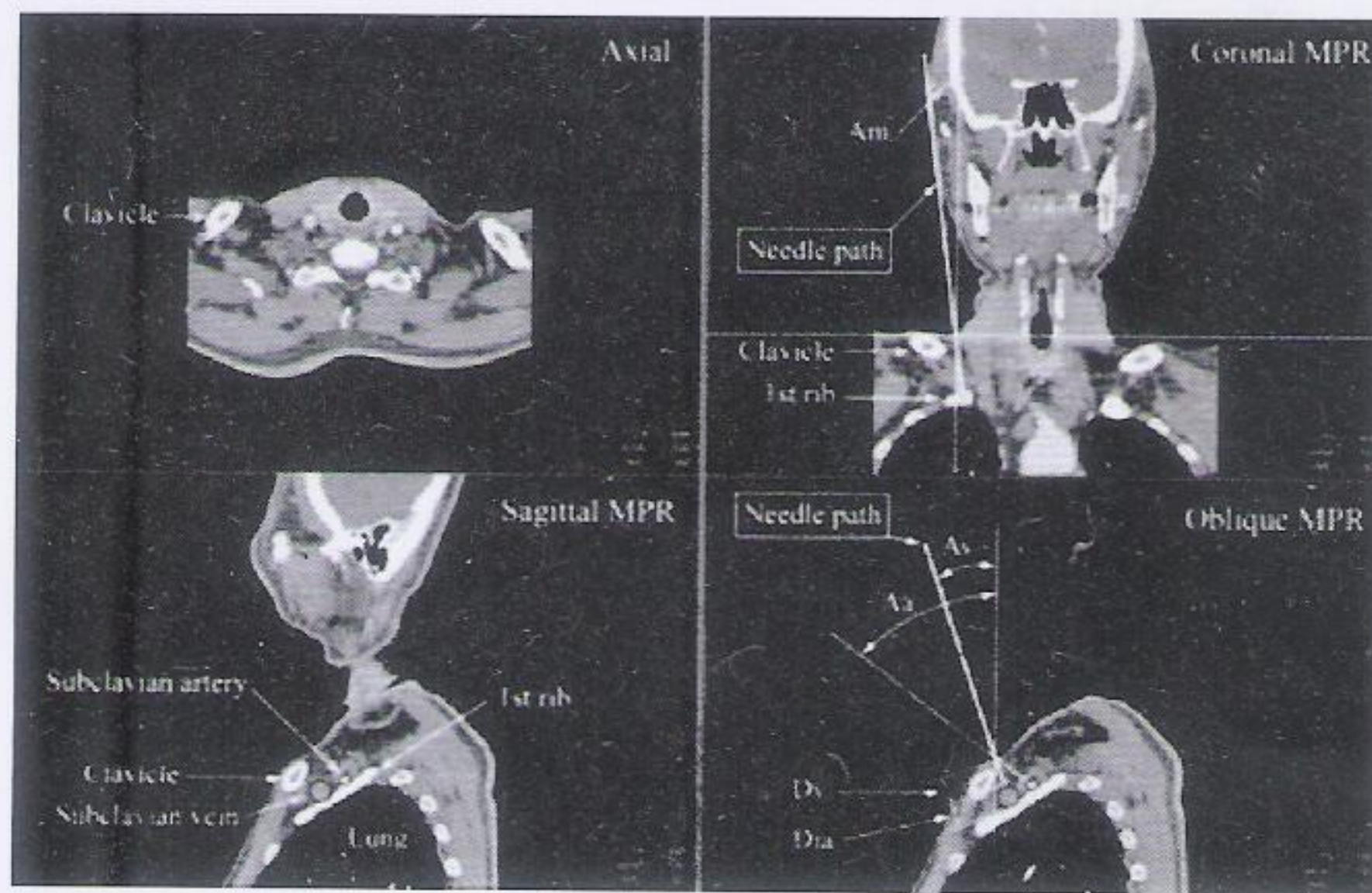


Fig 1: Comparison of Purposed Supraclavicular Approach with the traditional approach



vein (Fig 1, 2). In case of failure, the individual anatomy and approach angles are carefully reconfirmed before the second trial. Once the

Fig 2: MPR views at different planes showing anatomical land marks



subclavian vein is accessed with the finder needle, a large bore (17G) introducer needle is inserted following the direction and depth of the finder needle. A guide wire is inserted when free flow of venous blood is obtained. Care is taken to keep the bevel of the introducer needle and the J-tip of the guide wire toward the medial side of the body to prevent the guide wire from being threaded into the ipsilateral axillary vein. If difficulty in threading a guide wire is encountered, the bevel of the introducer needle is slightly rotated or the direction of the J-tip is readjusted to face the medial side. After catheter path dilation, single or double-lumen central venous catheter is inserted

## DISCUSSION:

Central venous catheterization can be performed through various veins, such as the femoral vein<sup>12</sup>, internal jugular vein<sup>13</sup>, and brachial vein<sup>14</sup>. The subclavian vein is one of the most frequently used central venous routes. The subclavian vein's skin puncture site is less likely to become infected than the other venous puncture sites<sup>15</sup>, and the patients are free to move their arms and heads. The right one is preferred to the left subclavian vein because of the higher risk of chylothorax<sup>16</sup> or vascular perforation<sup>17</sup> with the left subclavian vein.

Yoffa<sup>7</sup> first described the supraclavicular approach of the subclavian vein as follows: The approach of a needle by 15° anterior and 45° medial direction from just behind the clavisternomastoid junction ensured successful puncture of the subclavian vein (Fig. 1). A variety of arguments for the advantages of the supraclavicular approach include constant surface landmarks, large target size, high overall and initial success rate<sup>8</sup>, successful performance despite lack of experience<sup>9</sup>, significantly reduced complications<sup>10</sup>, and adequate position of catheters<sup>11</sup>. Nevertheless, physicians have been hesitant to use this technique because exploring the deeply concealed target beneath the sternum seemed too dangerous.

A review of the literature revealed that the target of the traditional supraclavicular approach was the venous confluence of the subclavian and internal jugular veins rather than the subclavian vein itself<sup>18,19</sup>. With this proposed technique, the route from the overlying skin to the subclavian vein on the first rib is the shortest of any possible approach to the subclavian vein. Compared with the traditional supraclavicular approach, the distance to the target vein is always shorter during the proposed approach. Therefore, a 1.25 inch hypodermic needle could be used successfully as a finder needle in all cases. The underlying first rib serves as a barrier between the subclavian vein and parietal pleura reducing the risk of pneumothorax. Since the puncture site of the subclavian vein lies on the first rib inside the costoclavicular angle, the "pinch-off" syndrome from the catheters can be avoided<sup>20</sup>.



The subclavian artery should not be punctured unless the posterior angle is exceptionally increased (approximately 70°) or unless the skin entry point is moved posteriorly over 1 cm. Moreover, in thin patients it is possible to feel the pulsation of the subclavian artery over the supraclavicular fossa. Another warning of potential arterial puncture would be a sense of penetrating the anterior scalene muscle that usually lies anterior to the subclavian artery.

This proposed technique can be performed without changing the patient's position. A roll under the shoulder and caudal traction of the shoulder are not necessary. The approach can be performed by the anaesthesiologist from the head of the table. Therefore, this method can also be used as a rescue procedure when there is a need for central venous catheterization after the start of surgery.

On the basis of the rule of three by Hanley and Lippman-Hand<sup>21</sup>, we speculate that there might have been a complication rate as high as 5% because the recorded event rate of zero complications has a confidence interval of between 0 and 5. Full evaluation of the safety of the proposed approach will require a prospective, randomized study design adequately powered, and stratified to include adequate number of obese patients.

In conclusion, new supraclavicular approach to right subclavian venous access is associated with acceptable feasibility from skin entry at the clavisternomastoid angle, a puncture needle directed 10° medially and 35° posteriorly and ensured successful placement of catheters into the subclavian vein.

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