ARTERIAL CANNULATION: SIMPLE SWAYING MANEUVER MAY BE AN ANSWER TO COUNTER FAILURE/COMPLICATION RATES

Deepak Gupta* and Hassan H. Amhaz**

Arterial cannulation is a commonly performed procedure in patients requiring hemodynamic monitoring in the perioperative period. Although not an exceedingly complex procedure, there can be an increase in cannulation failure rates and complications if simple maneuvers are ignored.

Firstly, the intima-media thickness of radial artery is approximately 0.3 mm\(^1\) while the inner luminal diameter of the radial artery is approximately 3 mm as measured by angiography at its ideal insertion point. This ideal insertion point is at least 10 mm proximal to the R-U line (the surface marking line drawn latero-medially across the radial-ulnar styloid processes)\(^2\) so that the bifurcation point of the radial artery can be avoided during cannulation. Secondly, while cannulating the radial artery, anesthesia care providers may use either the Seldinger or modified Seldinger technique\(^3\). With the Seldinger technique, the radial artery is punctured with a needle; after successful puncture, a separate non-integrated guidewire is threaded into the artery through the needle; over this in-situ guidewire, the catheter is slid over into the artery after removal of the needle. In the modified Seldinger technique (the most commonly used technique at our institution), the radial artery is punctured with a catheter-over-the-needle-over-the-integrated-wire assembly; successful needle puncturing the artery is appreciated by arterial blood flashback, then the guidewire is threaded into the artery through the needle, and subsequently once it is ensured that the guidewire has been threaded without any resistance into the arterial lumen, the catheter is slid over the needle-guidewire assembly.

Hereafter, the simple maneuver that is the focus of this letter is being explained based on the modified Seldinger technique for radial artery cannulation (with 4.45 cm long AK-04020, Integrated Seldinger technique Radial Artery Kit Version by ARROW® Arterial Products, Teleflex Incorporated, Morrisville, North Carolina, United States) [Fig. 1]. The described technique requires the swaying of the catheter-needle-guidewire assembly as a single unit and in that regards the sturdiness of the needle is apparently very essential to not allow the displacement of the assembly during the Swaying Maneuver.

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* Department of Anesthesiology Wayne State University/Detroit Medical Center Detroit, Michigan, United States-Financial.
* M.D.
** M.D., M.S.

Corresponding Author: Dr. Deepak Gupta, Box No. 162, 3990 John R, Detroit, MI 48201, United States, Tel: 1-313-745-7233, Fax: 1-313-993-3889. E-mail: dgupta@med.wayne.edu
The basics underlying the Swaying Maneuver are simple. Per longitudinal section of an artery, it is always presumed that modified Seldinger technique cannulation can assume/follow just only one pathway after the arterial blood flashback has been visualized [Fig. 2]. However, when we change this two-dimensional viewpoint to a three-dimensional view, we realize that per transverse cross-sectional anatomy of the artery, the modified Seldinger technique can assume not one but three different pathways after the initial flashback. To better understand and explain these three different pathways, we need to divide the circular "walls" of the artery into (a) anterior "wall" meaning anterior-quarter of circumference that is nearest to the skin and is intentionally punctured for arterial cannulation, (b) posterior "wall" meaning posterior-quarter of circumference that is farthest away from the skin and is intentionally avoided unless the proceduralist intends to trans-fix the artery with transarterial through-and-through puncture of an artery, and (c) side "walls" meaning medial-lateral-quarters (two in number) of circumference that have never been discussed much but are the focus of this current letter.

As visualized in the transverse cross-section of an artery [Fig. 2], the needle-wire assembly can be in the center where the antero-posterior height/distance is maximum as it is equal to the inner luminal diameter; or it can be closer to side "walls" (either the medial one or the lateral one) wherein the antero-posterior height/distance will be less than the inner luminal diameter. This miniscule decrease in height/distance becomes significant when advancing the guidewire followed by the catheter as even the 3 mm inner luminal diameter in itself is very small distance at the center for manipulations of radial artery cannulation assembly. For this reason, when there is a arterial blood flashback, the catheter-needle-guidewire assembly has to be tilted from its original insertion angle (typically a 45° angle) at the time of arterial puncture to less than a 20° angle at the time of threading the guidewire into the arterial lumen so as to align the advancing guidewire along the longitudinal axis of the arterial lumen. Despite all this, the catheter tip may not have reached in the arterial lumen (stuck either within the arterial wall or outside the arterial wall) because of 0.3 mm intima-media thickness and at least 2 mm long bevel tip of 22-gauge-needle extending beyond the 20-gauge-
catheter tip [Fig. 3]. If the arterial puncture does not occur in the center (something that is beyond operator's control when using palpation method alone), the probability of reduced arterial blood flashback when tilting from an approximate 45° angle to less than a 20° degree angle increases as the anterio-posterior height/distance decreases as we move away from the center. Henceforth, the probability of the non-advancement of guidewire in spite of arterial blood flashback also increases; and herein if guidewire is forced further despite the resistance, the "stiff" guidewire can create false lumen within the arterial wall, can shear the catheter and can cause the non-functional/complicated arterial wall cannulation site.

The Swaying Maneuver is explained as follows: Firstly, it has to be ensured that the needle-bevel indicator on the catheter-needle-guidewire assembly indicates an anterior-facing bevel [Figure 1]. Then, once the assembly has punctured the arterial wall (as confirmed by arterial blood flashback) at a 45° angle to the skin, the angle is slowly reduced to an approximate angle of 20°. If the flashback is sustained during this reduction of angle, the needle is most likely aligned in the center and the guidewire will easily advance into the arterial lumen. If the flashback stops or slows while reducing the assembly’s angle, the needle bevel has likely apposed the anterior "wall" of the artery. This can be corrected by stopping any further reduction of the angle and rather a slight increase in the angle to a point to ensure the return of the sustained and good arterial blood flashback. At this point, if advancement of the guidewire is smooth, then the assembly is likely to be still relatively near the center of the artery and arterial cannulation should follow without difficulty. However, the scenario that’s commonly encountered is when there is a arterial blood flashback and yet the guidewire fails to advance despite performing the above mentioned maneuvers. In this case, the needle-guidewire assembly is in such close proximity to the medial or lateral "wall" of the artery that swaying of the entire assembly in the medio-lateral plane/direction must be done while maintaining the current arterial entry angle in the anterio-posterior plane. Whether this proximity is to the medial "wall" or lateral "wall" cannot be asserted unless the operator is confident that while palpating the artery, he/she had punctured the artery from the lateral side or the medial side of the palpable arterial pulsations. Irrespective of the operator's perceptions, if there is a reduction or cessation of the arterial blood flashback when swaying the assembly medially, then the assembly is likely closer to the medial "wall" of the artery and lateral redirection is required for re-negotiation of guidewire's advancement into the artery's center. Conversely, reduction or cessation of flashback when swayed laterally will indicate apposition to the lateral "wall" and hence will require medial redirection of the assembly. Once there is resumption of sustained and good arterial blood flashback, the guidewire should be advanced as by then, its advancement direction would have been re-negotiated centrally by the Swaying Maneuver allowing for successful arterial cannulation [Fig. 4].

In summary, when using the modified Seldinger technique for arterial cannulation, it is critical to understand the relationship among the catheter-needle-guidewire assembly, changes in angle, adequacy of flashback, and ease of guidewire advancement to help construct a mental image of the arterial catheter’s position within the spatial coordinates of the artery being cannulated. Using the described Swaying Maneuver adds the final spatial clue that will allow for the central redirection and smooth advancement of the guidewire resulting in successful cannulation of the artery.
References


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† Train-of-four
‡ Post-tetanic count
§ Second twitch

**REFERENCES:**
1. BRIDION Summary of Product Characteristics (SPC)

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