

Importance of the Assessment of Arteries Located around the Internal Jugular Veins, in Addition to the Carotid Arteries in Pediatric Patients

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The use of bedside ultrasonography is currently widespread in pediatric critical care. The Internal Jugular Vein (IJV) is the preferred site of vascular access for bedside ultrasonography [1]. Randomized clinical trials and other prospective studies support the use of two-dimensional ultrasonography to augment landmark identification during Central Venous Catheter (CVC) placement in critically ill children [2].

Overlapping of the IJV with the Common Carotid Artery (CCA) is noted in 34-92% in children [3-6]. Therefore, during pediatric IJV cannulation, operators should be careful to avoid inadvertent puncture of the CCA. In the mid-1990s, a small-caliber Doppler probe was developed for the identification of the CCA and IJV [7]. The use of this small-caliber Doppler probe for pediatric IJV puncture subsequently became common in Japan after 2000 [8]. However, during puncture of the IJV, bright-colored blood occasionally emerged from the puncture needle despite using the Doppler probe. Moreover, we have occasionally noted the pulsation of an artery, other than the carotid artery, located just behind the IJV. We believe this vessel to be the Vertebral Artery (VA), and we feel the use of an ultrasound two-dimensional echo apparatus could yield evidence for this hypothesis.

A portable ultrasound echo apparatus, L10-5 MHz ultrasound probe (TiTAN; FujiFilm SonoSite, Co., Tokyo, Japan) as introduced into operating theaters in 2007, which has facilitated obtaining images of vessels during CVC placement in pediatric cases. Recent developments in ultrasound technology have improved the ability to obtain clear images of the small arteries located around the IJV in pediatric cases, including the 1-2-mm-wide transverse cervical artery [9]. However, when using portable ultrasound apparatus in 1 pediatric case, we experienced an inadvertent VA puncture, which was videotaped [10]. In an earlier study, Kayashima et al. (2012) [11] noted that the VA was located just behind the IJV in 7 of 55 children. Furthermore, in-plane images of the VA in pediatric cases have clearly indicated the anomalous origin of the VA, originating from the CCA, as well as an IJV spasm [12].

A few researchers have compared the use of the real-time ultrasound-guided approach with the anatomic landmark approach for locating the IJV. Grebenik et al. [13] questioned the use of ultrasonographic guidance for CVC placement in children, whereas Verghese and McGill [14] supported the use of ultrasonographic guidance. Grau et al. [15] indicated a statistical error and Dearlove [16] questioned the methodology of the abovementioned study of Grebenik et al. [13]. Nevertheless, Sigaut et al. [17] included the Grebenik study in their meta-analysis, but 4 groups-Lamperti et al. (2010) [18]; Corry and Arnold (2010) [19]; Patil and Jaggar (2010) [20]; and Faraoni (2010) [21] - raised questions regarding the study of Sigaut et al. (2009) [17]. Thus, it is difficult to compare the use of the real-time ultrasound-guided approach with the anatomic landmark approach for

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IJV cannulation in pediatric cases. Recent studies from 2007 to 2013 [22-26] have tended to support the use of ultrasonographic guidance. However, as indicated by Moureau et al. [27], the real-time ultrasound-guided approach may lack the standard minimal requirements for the training of insertion techniques, and may require a long training period, particularly in pediatric cases.

O'Leary and Bodenham [28] indicated that it is essential to confirm the presence of small arteries around the target veins by using color flow Doppler imaging. During CVC placement, the use of static ultrasonography via the anatomic landmark approach for locating the IJV has been recommended [27,29] as well as a combination of the pre-procedural ultrasonographic assessment and a real-time ultrasound-guided venipuncture [2,30]. In addition, we recommend that the relationships between the IJV and other arteries such as the CCA, VA, subclavian artery, transverse cervical artery, and inferior thyroid artery should be carefully assessed by using ultrasonography with Doppler color flow prior to puncture in pediatric cases. This assessment requires anatomical knowledge, as well as knowledge of the appearance of these arteries on ultrasonography. In addition to CCA, we believe that it is essential to carefully assess the other arteries located around the IJV to ensure safe CVC placement.

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