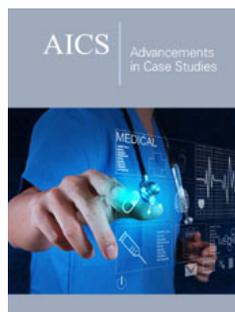


# External Jugular Vein Terminates in Cephalic Vein, an Anatomical Variation During Neck Dissection & its Clinical Impact

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## Abstract

We report an unusual termination of external jugular vein on the right side of the neck during routine dissection in a 72-year-old female cadaver in which the right external jugular vein drains directly into the cephalic vein, running in front of the medial 1/3 of the clavicle. Detailed knowledge of anatomical variations in this part of the human body is so vital in intervention radiology, intravenous infusion, and surgical procedures involving the head and neck region.

**Keywords:** External Jugular vein; Axillary vein; Subclavian vein; Anatomical variation

**Abbreviations:** EJV: External Jugular Vein; SV: Subclavian Vein; CV: Cephalic Vein; TCV: Transverse Cervical Vein; OH: Omohyoid Muscle

## Introduction

With the advanced technology and instrumentation utilized in medical practice, precise interventional radiology & implantation of an artificial cardiac pacemaker [1], in addition to orthopedic surgeons dealing with fracture and dislocation of the clavicle, it is valid to know different forms of variations of the venous tree in the lower neck. Anatomically, facial veins join retromandibular and posterior auricular veins forming the external jugular vein (EJV), which throughout its course runs deep to superficial fascia and platysma muscle. In the lower posterior triangle of the neck, both (EJVs) end in subclavian veins (SV) after piercing the investing layer of deep fascia lateral to the sternoclavicular joint [2]. Developmentally, between 4th & 7th weeks of embryonic life anterior cardinal veins appear; those veins drain the cephalic part of the embryo; blood will be channeled from left to right as a lot of anastomosing channels exist between the anterior cardinal veins, this anastomosis eventually forms the left brachiocephalic vein [3]. The full idea about venous drainage map in the lower neck is vital in central venous line insertion and surgical access incisions as well as internal fixation of fractured clavicles in certain occasions. Main focus of this work is to highlight specific points regarding the anatomical variation of the venous channel in the lower neck, which is vital for clinicians, surgeons, and radiologists.

## Case Report

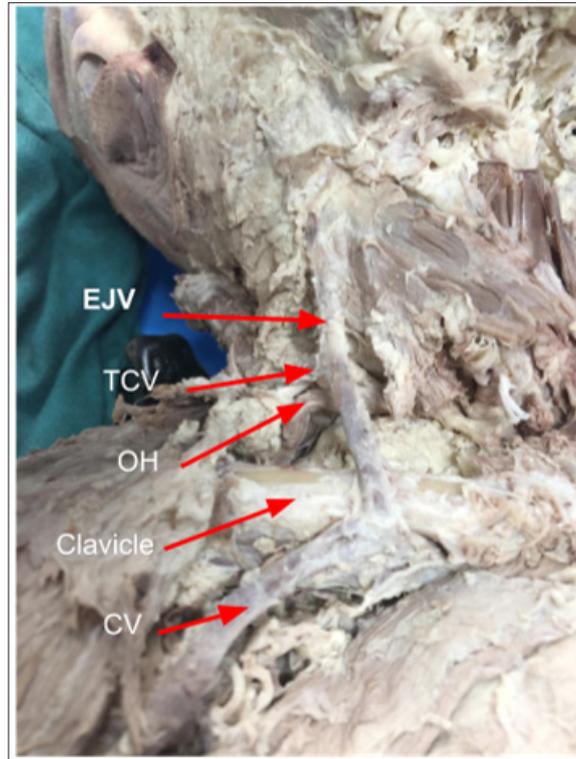
While completing a routine human cadaver dissection lab, at the graduate-level, in the Department of Biology at Chatham University (Pittsburgh, Pennsylvania), we discovered an unusual unilateral variation in the course of the right EJV, in a 72-year-old female. An iPhone 7 mobile phone was utilized to photograph the case (Figure 1). The following findings were observed: these right-sided vessels appear larger than the left side, the EJV runs over the clavicle & joins the terminal part of the cephalic vein (CV). The transverse cervical vein (TCV) is located superficial to the omohyoid muscle (OH). Deep dissection of axilla shows angiogenesis of axillary vein as the brachial veins continue proximally joining the cephalic vein, large subscapular vein substitutes axillary vein (Figure 2).

## Discussion

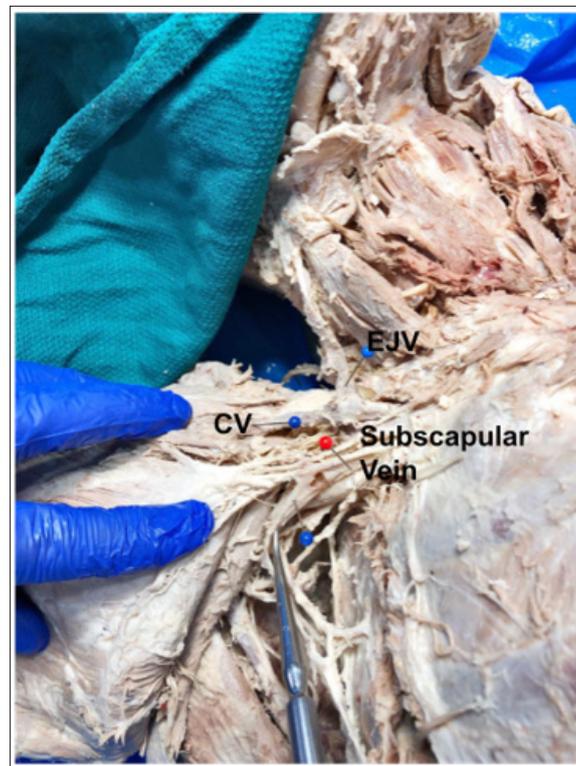
There have been numerous EJV variations noted in past literature; previous variations observed included abnormalities in both the confluence of the EJV as well as the location

[4]. In terms of confluences, the EJV was seen to divide forming two loops that rejoin prior to draining into the SV [5]. In another case, the EJV structure varied as it bifurcated into two vessels that did not rejoin prior to draining into the SV and the two vessels were larger

in size than the average EJV [6]. Variations in the veins draining into the EJV have also been observed such that the retromandibular vein does not divide into anterior and posterior divisions and remains as one trunk that has a connection with the facial vein [7].



**Figure 1:** External jugular vein drains directly into cephalic vein and lies superficial to clavicle. Transverse cervical vein lies superficial to omohyoid muscle.



**Figure 2:** Enlarged subscapular vein substitutes as the axillary vein.

The EJV has been seen to join with the cephalic vein and lie anterior to the clavicle; in a study of 55 cadavers, between 2 and 5 percent of the cadavers had this structure [8]. These findings are very much similar to the present findings in that the EJV joins with the CV and lies anterior to the clavicle. The present case differs in that, in addition to the EJV and CV connecting and lying superficially, the TCV is also located superficially as it passes anterior to the OH muscle, the brachial veins drain into the cephalic vein, and the subscapular vein is large in size and substitutes as the axillary vein. A review of the literature did not find any sources in which all of these findings occurred simultaneously.

It is important to consider these anatomical variations when performing procedures, interventions, & surgical fixation of fractured clavicle. A procedure that involves the head and neck regions, where these variations have been noted, is the repair of clavicular fracture through orthopedic surgery. Clavicle fractures comprise up to 5% of all adult fractures; they most commonly occur over the mid-shaft, and then the medial  $\frac{1}{3}$ , and least commonly occur over the distal  $\frac{1}{3}$  of the clavicle [9,10]. It was seen that surgical intervention, as opposed to nonsurgical treatment, improved prognosis in patients experiencing a mid-shaft clavicular fracture [11]. The variations noted in this present case report involve the EJV and CV laying superficial to the medial  $\frac{1}{3}$  of the clavicle; both a fracture to the clavicle and surgical intervention would put these venous structures at risk for injury.

Access through the CV, by means of venous cutdown, is commonly used for lead implantation of cardiac devices and is favorable as it has been seen to pose less risk compared to other techniques [12]. Variations in the CV can occur and result in higher failure rates due to difficulty distinguishing the vessels and passage failure; enlarged vessels and abnormal connections can result in the CV becoming the dominant vein of the arm, which can lead to venous occlusion and additional complications [13]. Variations, such as the ones discussed currently, should be considered when performing venography and lead implantation as success rates and complications can be influenced.

Access through the CV, by means of venous cutdown, is commonly used for lead implantation of cardiac devices and is favorable as it has been seen to pose less risk compared to other techniques [12]. CV variations can include abnormal venous confluences and the possibility of a decrease in vascular caliber. These variations can result in higher failure rates due to difficulty distinguishing the vessels and passage failure; enlarged vessels and abnormal connections can result in the CV becoming the dominant vein of the arm, which can lead to venous occlusion and additional complications [13]. In order to anticipate such variations, venography should be performed prior to surgical interventions, however, this is a costly procedure that makes it impractical to perform as a routine measure. Variations, such as the ones discussed currently, should be considered when performing lead implantation as success rates and complications can be influenced.

## Conclusion

Numerous anatomical variations have been observed in previous cases regarding the EJV. In the present case, we observed the EJV draining directly into the CV as well as the TCV being located superficial to the OH. In addition, the brachial veins drain into the CV and a large subscapular vein substitutes the axillary vein. Variations in the vasculature of the head and neck region should be considered by medical care providers when procedures and interventions are performed. The variations presented in this report include both the EJV and CV being located superficial to the clavicle, which would put them at risk of injury during both a clavicular fracture as well as the surgical repair. Variations in the vasculature to this area can also increase the risk of complications and injury during procedures such as lead implantation as the caliber and venous confluence may be altered. Awareness of these variations will help reduce medical error and unintentional injury to patients.

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