



ANATOMICAL OVERVIEW: POSITIONAL RELATIONSHIP OF INTERNAL JUGULAR VEIN AND COMMON CAROTID ARTERY

Dr Shobha K

Assistant Professor, Dept. of Anatomy, BGS GIMS, Bengaluru

Dr Shubha R

Professor, Dept. of Anatomy, KIMS, Bengaluru

ABSTRACT The internal jugular vein and common carotid artery are two significant structures in the neck for the blood supply of the head and neck region. A thorough knowledge of their relation is important to avoid unexpected injuries during various diagnostic or interventional procedures. A dissection study was conducted to examine the relative positions of the internal jugular vein and the common carotid artery in the neck, yielding significant observations.

KEYWORDS : Internal jugular vein, Common carotid artery, Cricoid cartilage, Clavicle

INTRODUCTION

The main arterial supply of head and neck is derived from the carotid system of arteries and the internal jugular vein forms the main system for venous drainage in this region.

The two are encased in a condensation of deep cervical fascia, the carotid sheath. They are also accompanied by vagus nerve and constituents of ansa cervicalis in this part of their course¹.

During the course in the neck, the internal jugular vein descends vertically applied to lateral side of internal and common carotid artery. It may course lateral, in front of (overriding) and rarely medial to common carotid artery².

Internal jugular vein is often chosen by clinicians and anaesthetists for central venous access because the landmarks are easily identifiable.

Along with surgeries of the common carotid artery for various clinical conditions, procedures in this region can be performed safely with knowledge of the location of the arteries to avoid damaging a major blood supply to the head and neck³.

Therefore, a proper knowledge of the relations of these two important structures in the neck will optimise surgical approaches when operating within the region. Not many dissection studies have been done to explore the relation between internal jugular vein and carotid artery in Karnataka/India. Therefore, this study is particularly important.

Methodology

The internal jugular vein was studied in 50 embalmed human cadavers irrespective of sex. The cadavers were from Indian adult population and comprised 50 right and 50 left sides of the neck of 50 human cadavers.

The gross dissection was done following the guidelines of Cunningham's manual.

Relevant findings regarding location of IJV in relation to common carotid artery was noted.

The data obtained was recorded, analyzed and compared with that of the previous studies.

RESULTS

Observations of the location of the IJV in relation to the CCA: Two important anatomical surface landmarks in the neck have been used here- the cricoid cartilage and the clavicle for the sole reason of easy accessibility.

Definition of positions observed:

Anterior: total overlap of IJV and CCA

Lateral: the IJV and CCA are separated from each other

Anterolateral: IJV and CCA contacting

These relations were observed at two levels:

Level-1: level of cricoid cartilage

Level-2: just above level of termination of IJV behind the clavicle.

The relation between different positions of IJV and CCA Observed in this study include lateral, anterolateral and anterior.

Table 1: Association Between Relations of Different Positions of IJV to CCA at Level-1 on Both Sides

Relation IJV-CCA Level-1	Right side		Left side		Total
	Number	Percentage	Number	Percentage	
Anterior	6	12	8	16	14
Anterolateral	30	60	37	74	67
Lateral	14	28	5	10	19
Total	50	100	50	100	100

Table 2: Association Between Relations of Different Positions of IJV to CCA at Level-2 on Both Sides

Relation IJV-CCA Level-1	Left side		Left side		Total
	Number	Percentage	Number	Percentage	
Anterior	3	6	34	68	37
Anterolateral	10	20	13	26	23
Lateral	37	74	3	6	40
Total	50	100	50	100	100

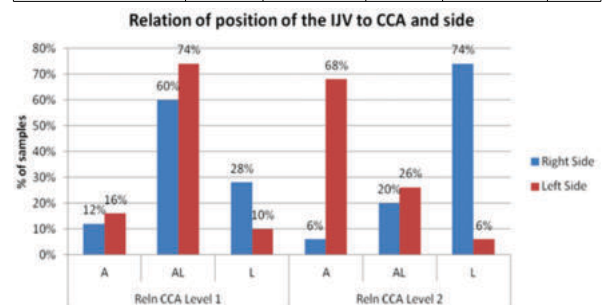


Figure 1: Bar Diagram Showing Relation of Different Positions of IJV and CCA on Right and Left Sides

DISCUSSION

The internal jugular vein and the common carotid artery are two important structures in the neck anatomically and clinically. An attempt to study their relative positions was made and compared with other studies. The literature includes several studies examining the relative positions of the internal jugular vein (IJV) and common carotid artery (CCA), categorizing their orientations as anterior, anterolateral, lateral, posterolateral, posterior, posteromedial, and medial. Most of these studies have utilized ultrasound methods.

In the following table of comparison, the method used is also included. This might help a proper discussion of the differences observed in these different studies.

Table 3: Comparison of Different Relative Positions of IJV and CCA

Author	Position of IJV in relation to CCA				Study method
	Normal location/ Anterolateral/ Contacting	Overriding/ Anterior/ Overlapping	Distant/ Lateral/ Separating	Medial/ Reversal	

Denys-Uretsky (1991)	92%	-----	1%	2%	USG
Lin et al (1998)	69.3%- Rt 66.4%- Lt	26%- Rt 27%- Lt	4.8%- Rt 1.9%- Lt	3.9%- Lt	USG
Shoja et al (2008)	84%- Rt 91.8%- Lt	1.4%- Rt 1.8%- Lt	14.2%- Rt 6.4%- Lt	0.5%- Lt	USG
Lim et al (2006)	-----	12.5%	85.2%	1.1%	CT
Ishizuka et al (2010)	54%- Rt 45%- Lt	12%- Rt 22%- Lt	34%- Rt 33%- Lt	-----	CT
Shanta-Chandrasekaran (2011)	51.9%- Rt 65.4%- Lt	25.9%- Rt 19.8%- Lt	22.2%- Rt 14.8%- Lt		Colour Doppler
Present Study	60%- Rt 74%- Lt	12%- Rt 16%- Lt	28%- Rt 10%- Lt		Dissection

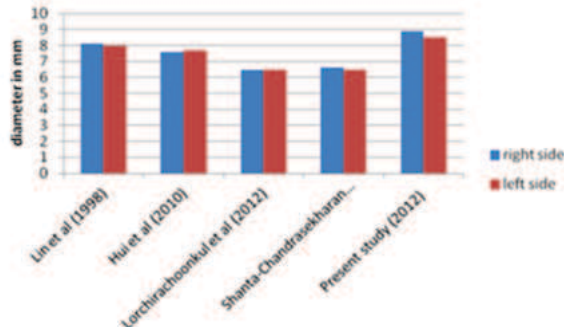


Figure 2: Bar Diagram Showing Comparison of Mean Diameter of Right and Left CCA Visualized by Different Methods

The results of the above table show that the most common relation of the IJV is anterolateral to the CCA, which is also described as contacting type by Ishizuka et al⁴. In this regard, the present study is comparable with most of the other studies by different authors even though the study method used was dissection. Lim et al⁵ however observed that the most common location of the IJV was separating type. This could be because they did not consider any relation as anterolateral and possibly all such relations were included in the separating variant in their definition of location of IJV relative to the CCA.

The Denys- Uretsky study⁶ also shows a significant difference in that they observed a normal position of IJV relative to the CCA in 92%. The patients here were either in Trendelenburg position or were asked to perform Valsalva manoeuvre during the procedure. This could probably explain the difference⁷. The significant difference noted between the present study and that of Shoja et al⁷ could be explained on the basis that their study was done using USG with the transducer directed perpendicular to the skin.

The same has been explained by Sibai et al (2008) who had done a study on 100 subjects which showed that with transducer directed perpendicular to the skin, the relative positions of the IJV and carotid artery showed a higher extent of anterolateral and anterior locations with an additional 6% of total overlap. They conclude that the transducer direction had a significant impact on the assessment of the location of the IJV relative to the carotid artery⁸. Also, different studies done using USG are done at different degrees of head rotation and with or without neck extension.

The lack of standardized guidelines and terminology using USG, also noted by Gordon et al could explain the discrepancies in different USG studies⁵.

A doppler ultrasound study observed safe relation of IJV to common carotid artery (lateral or anterolateral) on left side 80% and on the right side 74%. The dangerous relation (anterior) of IJV to common carotid artery on left side 20% and on right side 26% which is statistically significant ($p < 0.001$). Such dangerous relation may end up in arterial puncture while cannulating the IJV with landmark guided approach⁹.

In the present study it was observed that when compared to level 1 (at the level of cricoid cartilage) where most of the IJV were placed

anterolateral, at level 2 (just above the level of its termination), most IJV were placed laterally. This could be possibly explained relating it to their course in the neck wherein, at the lower ends both internal jugulars tend to the right, so that the right comes to lie farther from the right CCA while the left vein tends to overlap the left CCA¹⁰.

Understanding the relative positioning of the IJVs in relation to the CCAs is crucial for various clinical applications, including central venous catheter placement, jugular venous access, and surgical interventions in the neck region. Awareness of these positional variations can help minimize complications, such as vascular injury or incorrect catheter placement. Additionally, recognizing the anatomical nuances may aid in diagnostic imaging and enhance the accuracy of procedures involving the neck's vascular structures.

CONCLUSION

Knowledge of relative positions of IJV and CCA in the neck is significant for various diagnostic and interventional procedures in this region. Most literature available on the relations have included USG, doppler and CT for studying the relation of IJV and CCA in the neck. The present study explores a new dimension for studying the relative positions of these two important structures in the neck i.e., dissection. This study in addition to adding valuable information, will open new ways and possibilities to secure these two important structures in the neck during various diagnostic and interventional procedures.

Abbreviations

IJV- Internal Jugular Vein
CCA- Common Carotid Artery
USG- Ultrasonography
CT- Computed Tomography

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