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An Observational study about the levels of bifurcations in Common Carotid Artery among male & female cadavers

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ABSTRACT

Introduction: The carotid arterial system which begins from the common carotid arteries (CCAs) is the main arterial supply of the head and neck. The knowledge of point of bifurcation of CCA is very important in surgeries of head and neck region to prevent vascular accidents, during catheterization of carotid arteries and intra-arterial administration of chemotherapeutic agents. The carotid arteries lying anterolaterally in the neck are the major structures commonly injured in penetrating wounds of the neck Hence this study to evaluate the variations, levels of divisions among both male and female cadavers in Local Medical Teaching Institutes. **Methods:** This Observational based descriptive study design was conducted to describe the CCA bifurcation. Study was undertaken in 30 adult formalin fixed cadavers The dissections were carried out according to the instructions given in Cunningham's manual of practical anatomy . The level of bifurcation of common carotid artery was noted and correlated with the upper border of thyroid cartilage. The age of death ranged from 24 to 78 years and all specimens were fixed in 10% formaldehyde solution. **Result:** A total of thirty unclaimed adult cadavers of 3 females and 27 males or 60 specimens (30 cadavers, left and right sides). The height of cadavers ranges from 154 cm – 180 cm.The level of bifurcation of the common carotid artery was at the level of upper border of thyroid cartilage in 78.33%. Only 11.66%) showed the higher level . 10 % showed the lower level of bifurcation in the range of 2 mm to 10 mm below the level of upper border of thyroid cartilage. The bifurcation levels were symmetrical on both sides. **Conclusion:** The present study finds the incidence of bifurcation of common carotid was more or less constant at the level of upper border of thyroid cartilage. Clinicians / Surgeons need to take the standard and variable heights of the carotid bifurcation into consideration; to avoid unnecessary complications.

Keywords: Common Carotid Artery, Variations , Bifurcations , Thyroid Cartilage.

INTRODUCTION

The neck region not only serves to connect the head with the rest of the body, it also houses structures within it that act as conduits for blood and nerve impulses traveling both to and from the brain. [1] Many important structures are crowded together in the neck, such as muscles, glands, arteries, veins, nerves, lymphatics, trachea, esophagus, and vertebrae (within them the cervical segment of the spinal cord); consequently, the neck is a well known region of vulnerability. [2] The structures of the neck are packed so tightly that nearly every lesion expresses itself as a visible or palpable bulge; neoplasms and infection can affect any of the lymph nodes in more than a dozen of the fascial spaces in the neck, Persistent embryonic structures may occupy spaces no longer assigned to them. [3]

The carotid arterial system which begins from the common carotid arteries (CCAs) is the main arterial supply of the head and neck. Like other arteries in the vascular system, the carotid arteries can become diseased with cholesterol plaque; this condition may result in carotid artery stenosis. Atherosclerosis of the carotid arteries is a major cause of stroke and transient ischemic attack. Plaques typically form in the common carotid artery bifurcation and extend distally into the

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internal carotid arteries (ICAs). [4]The two common carotid arteries differ in length, for the right usually arises from the brachiocephalic artery behind the sternoclavicular joint, while the left arises from the arch of the aorta and has therefore a thoracic as well as a cervical course. [5] The bifurcation of common carotid arteries normally occurs below the superior border of the thyroid cartilage. [6] Conventional angiography is considered the most reliable method for diagnosis of carotid bifurcation diseases, such as stenosis.[7] Accurate interpretation of the level of the bifurcation of common carotid artery with non invasive techniques remains an important goal and external anatomical landmarks can be clinically useful in predicting the bifurcation level of the carotid artery. [8]The knowledge of point of bifurcation of CCA is very important in surgeries of head and neck region to prevent vascular accidents, during catheterization of carotid arteries and intra-arterial administration of chemotherapeutic agents. [9]

The carotid arteries and the jugular veins lying anterolaterally in the neck are the major structures commonly injured in penetrating wounds of the neck. [2]The disruption of CCA, ECA and ICA may cause a bleeding that can threaten life. [10] Carotid artery injury is uncommon but not a rare complication of various diagnostic and therapeutic procedures. The consequence of inadvertent carotid artery injury may be quite devastating, but its incidence can be reduced by understanding the mechanisms of injury, i.e., how and when it happens. Properly managing the complication can reduce a patient's mortality and morbidity.[11] A high common carotid artery bifurcation possesses a higher risk of being hit by intra articular screws during procedures on cervical the vertebrae. [12-14]Thus, knowledge on the anatomical variations of the carotid bifurcation (CB) is necessary for the correct interpretation of results obtained by means of different radiological procedures and for vascular surgical procedures in the region mainly because of the significant rates of the occurrence of variations. Hence this study to evaluate the variations , levels of divisions among both male and female cadavers in Local Medical Teaching Institutes .

METHODOLOGY

This study was performed in Department of Anatomy in close association with the Department of Forensic Medicine & Toxicology and Pathology in the teaching Medical Institutes in and around Raipur, CG. Observational based descriptive study design was conducted to describe the CCA bifurcation.

The present study was undertaken in 30 adult formalin fixed cadavers procured from the division of Anatomy. The dissections were carried out according to the instructions given in Cunningham's manual of practical anatomy. [15]The level of bifurcation of common carotid artery was noted and correlated with the upper border of thyroid cartilage. If the level of bifurcation was above or below the upper border of thyroid cartilage, the distance between the upper border of thyroid cartilage and bifurcation were measured. All the specimens were photographed and results were tabulated.

CCA was exposed in the left and right side of the cadavers by the dissection technique which we use regularly for teaching; (According to the standard procedures of Cunningham's manual of dissection volume III). All dissections were carried out on the bodies placed in supine position on a flat surface with the neck in neutral position, bilateral CCAs, ECAs, and ICAs were dissected.

The age of death ranged from 24 to 78 years and all specimens were fixed in 10% formaldehyde solution. The upper limbs have been partially dissected by the medical students during the previous years and, the authors did further dissections under magnification, with the aid of a surgical microscope.

Official letters were submitted to the different Institutes / colleges, explaining the purpose and the importance of the study. Confidentiality was maintained at all levels of the study. Cadavers which were dry and difficult to dissect, those which were damaged by students before data collection were excluded from the study.Data was filled in Microsoft Excel & analysed using a computer software Epi Info version 6.2 (Atlanta, Georgia, USA).P value of 0.05 and less was considered as statistically significant.

RESULTS

A total of thirty unclaimed adult cadavers (3 females and 27 males) or 60 specimens (30 cadavers, left and right sides). The height of cadavers ranges from 154 cm – 180 cm.

The level of bifurcation of the common carotid artery was at the level of upper border of thyroid cartilage in forty-seven cases (78.33%). Only seven cases (11.66%) showed the higher level with the range of 3.2 mm to 19.3 mm above the level of upper border of thyroid cartilage. Six cases (10 %) showed the lower level of bifurcation in the range of 2 mm to 10 mm below the level of upper border of thyroid cartilage.(Table 1)

In the present study, the bifurcation levels were symmetrical on both sides.

Table 1 : Levels of Bifurcation of Common Carotid Artery

Levels of Bifurcation / Divisions / Variations	No. of Specimens	Percentage
Upper border of Thyroid Cartilage	47	78.33
Above the level of the upper border of Thyroid Cartilage	07	11.66
Below the level of the upper border of Thyroid Cartilage	06	10

DISCUSSION

The present study was undertaken in 30 adult formalin fixed cadavers procured from the division of Anatomy The dissections were carried out according to the instructions given in Cunningham's manual of practical anatomy. [15] The level of bifurcation of common carotid artery was noted and correlated with the upper border of thyroid cartilage. If the level of bifurcation was above or below the upper border of thyroid cartilage, the distance between the upper border of thyroid cartilage and bifurcation were measured. All the specimens were photographed and results were tabulated.

The findings of the present study were correlated with that of Ambali Manoj et al [16] and Al Rafiah A et al. [17] The level of bifurcation of common carotid artery was found to be at the upper border of thyroid cartilage in 89% of 59 cases studied by Lo A [18] and 50% by Lucev et al. [19] The present study shows the higher incidence with the frequency of 78.33 % Bifurcation as high as the hyoid bone or the styloid process and as low as the cricoid cartilage, or within 3.7 cm of its origin have previously been reported. [17] The higher level of bifurcation of common carotid artery was found to be 37.5% by Lucev et al. [10] The incidence of higher bifurcation is low in the present study(11.66 %). Lower cervical bifurcation of the carotid arteries was first reported by Orr in 1906. [19] The lower division of Common carotid has been recorded to as frequent as 30%. [20] It was reported to be 12.5% by Lucev et al. [19] Gulsen et al reported a case of bilateral low-lying bifurcation of the common carotid artery. [21]The incidence of low bifurcation was low in the present study (10%). In case of high bifurcation, the embolic material could extend into the common carotid artery instead of the external carotid artery with subsequent stroke.[22] A high common carotid is at a higher risk of impingement by intraarticular screws during procedures on cervical vertebrae. [23] Hypoglossal nerve lies closer in relation to the CCA bifurcation especially when it bifurcates at higher level. [24] Thoracic bifurcation of CCA may be associated with the Klippel-Feil anomaly. [25] Gulsen et al had encountered difficulties in a cervical discectomy operation in a patient with low-lying bifurcation of CCA. [21]Smith and Larsen reported that the left carotid bifurcation to be higher than the right in 50% of the cases and the right bifurcation higher than left in 22% of the cases. [25] In the present study, the bifurcation level was symmetrical on both sides.

Most anatomical text books and references in the literature describe the upper border of the thyroid cartilage as the bifurcation level, With the advent of the radiological investigations, and the need of a more accurate interpretation of them, external anatomical land marks turned to be useful, in regular clinical practice . The level of the CCA bifurcation is subject to individual variations; the CCAs may bifurcate higher or lower than the usual levels [17]; a high bifurcation is more common, the bifurcation can occur as high as the hyoid bone (C3) or even the styloid process, or as low as the cricoid cartilage (C6). Variations are of importance for surgical approaches in the head and neck region. [17]

CONCLUSION

The present study finds the incidence of bifurcation of common carotid was more or less constant at the level of upper border of thyroid cartilage . The incidence of higher level of bifurcation is more than lower level of bifurcation. Although the sample size is limited to generalize our data, Clinicians / Surgeons need to take the standard and variable heights of the carotid bifurcation into consideration; to avoid unnecessary complications. Further research needs to be done on large number specimens so that generalizations for the population will be more accurate.

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