

# Morphological Variation of the Carotid Sinus Location

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## Abstract

**Background:** Carotid sinus massage is widely used to detect carotid sinus hypersensitivity in patients presenting with syncope. Recent guidelines recommend 5 to 10 seconds of carotid sinus massage in supine and upright positions with beat-to-beat monitoring, but somebody did not respond to the procedure.

**Method and result:** The aim of this study was to describe the common Carotid Artery Bifurcation (CB). Measurements were performed on 100 cadavers by the direct inspection method. The vertebra level of CB was differently distributed in distance of the whole neck measured along the vertebral column between upper borders of C1-C2 to lower border of C5. 54% of the level of CB was asymmetrical between the right and left side.

**Conclusion:** We showed the anatomical variation of carotid sinus location. Anatomical locations of the carotid sinus bifurcation indicated wide variability. This variation was found to have an impact on the pressure transmission at the carotid sinus region in those individuals that displayed the superior/inferior range of carotid sinus loci.

**Keywords:** Carotid sinus massage; Carotid artery bifurcation; Autopsy

## Introduction

Carotid sinus hypersensitivity (CSH) is the exacerbation of a reflex present in healthy individual. The European Society of Cardiology defined this condition as Asystole lasting for at least 3 seconds, or a drop in systolic blood pressure of at least 50 mmHg, provoked by 5 to 10 seconds of Carotid Sinus Massage (CSM) [1]. It is characterized by prolonged heart rate slowing or a profound drop in systolic blood pressure in response to carotid sinus massage [2]. Although CSM is generally safe, there are some potentially serious complications, of which the best known include Thromboembolic stroke and prolonged Asystole or Hypotension. CSH is a well-recognized cause of syncope and falls in older persons. [3]. In foreign literature, predictors of cardio-inhibitory response have been described in only a few studies, most of which with a small number of patients [3,4]. Doubts still exist about the clinical meaning of the cardio-inhibitory response [5,6]. It is generally accepted that a blow or a short compression of the side of the neck stimulating the carotid sinus can lead to circulatory collapse resulting from activation of an arterial baroreflex controlling the heart rate. We examined the variability of carotid sinus location.

## Materials and Methods

100 subjects were randomly selected. At autopsy, all measurements were performed on 100 subjects (40 female and 60 male), ranging in age from 18 to 104 years. The subjects died of natural or traumatic causes and were candidates for autopsy because of medico-legal reasons. The study was approved by the ethical committee of our university. However, the ethics committee waived the need for consent from the patients' next of kin because the autopsy was dictated by law. Carotid bifurcation level was compared to the level of cervical vertebra.

## Results

Most of Carotid Bifurcations (CB) was found at the level of C3. The vertebra level of CB was differently distributed in distance of the whole neck measured along the vertebral column between upper borders of C1-C2 to lower border of C5 (Chart 1). 54% of the level of CB was asymmetrical between the right and left side. To illustrate the diversity that may occur in the anatomical location of the carotid sinus, autopsy

of the carotid bifurcation were obtained and matched to the cervical vertebra images (Figure 1). Anatomical locations of the carotid sinus bifurcation indicated wide variability.

## Discussion

Most previously reported cases occurred when carotid sinus massage was used in an attempt to terminate supraventricular tachycardia, and many patients were reported to have had other coexisting condition including Ischemic Heart Disease, Heart failure

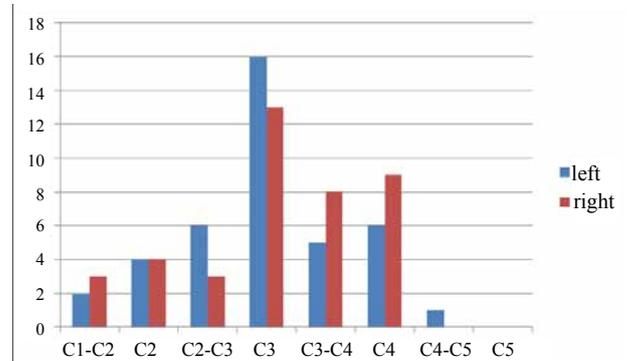


Chart 1: Location of the carotid bifurcation (CB) according to the cervical vertebra.

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**Figure 1:** The location of the CB to the corresponding level of cervical vertebrae (C4 level).

and Atrioventricular Block. Parry in 1799, Waller in 1862, and Landois in 1865 were among the first authors to report that a compression of the side of the neck could lead to circulatory collapse [7]. However, they gave no pathophysiological explanation for the phenomenon. In 1868, Czermak wrote that it was the result of direct excitation of the Vagal Nerve [8]. Hering in 1924 performed animal experiments and observed that compression of the neck influenced heart rate [9]. He explained this observation by a mechanical stimulation of the carotid sinus, thus describing the arterial Baroreflex. Franke delineated in his papers different types of responses of the syndrome of the carotid sinus with important inter individual variations [10]. The regulatory effect of carotid sinus stimulation is often used in cardiology for diagnosis and therapy [11,12]. Rossen et al. did not, however, observe any cardiac arrest in more than 100 healthy strangled subjects, although when the neck compression was maintained for over 30s, he did note Bradycardia [13]. Observations have shown that response to sinus carotid stimulation have important inter individual variations and that there is no evidence suggesting that carotid stimulation alone can provoke death. A significant anatomical variation in the location of the carotid sinus was measured and the location of the carotid sinus should be verified. This variation was found to have an impact on the pressure transmission at the carotid sinus region in those individuals that displayed the superior/inferior range of carotid sinus loci. The pressure stimuli would not be located over the locus of the carotid sinus. The clinically relevant variations of the location of carotid bifurcation should be considered by physicians during neck examination.

## Disclosures

A significant anatomical variation in the location of the carotid sinus was measured and the location of the carotid sinus should be verified. This variation was found to have an impact on the pressure transmission at the carotid sinus region in those individuals.

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## References

1. Brignole M, Alboni P, Bergfeldt L, Blane JJ, Bloch Thomsen PE, et al. (2004) Guidelines on Management (Diagnosis and Treatment) of Syncope e Update 2004. *Europace* 6: 467-537.
2. Huang SKS, Ezri MD, Hauser RG, Denes P (1988) Carotid sinus pypersensitivity in patients with unexplained syncope: clinical, electrophysiologic, and long-term follow-up observations. *Am Heart J* 116: 989-996.
3. Kerr SRJ, Pearce MS, Brayne C, Davis RJ, Kenny RA (2006) Carotid sinus hypersensitivity in asymptomatic older persons: implications for diagnosis of syncope and falls. *Arch Intern Med* 166: 515-520.
4. Brignole M, Menozzi C, Gianfranchi L, Oddone D, Lolli G, et al. (1991) Carotid sinus massage, eyeball compression, and head-up tilt test in patients with syncope of uncertain origin and in healthy control subjects. *Am Heart J* 122: 1644-1651.
5. Goldlist B, Naglie G (1995) Carotid sinus syndrome in the elderly. *Am J Med* 98: 100-101.
6. Coplan NL (2006) Carotid sinus hypersensitivity and syncope cause/effect or true/unrelated. *Arch Intern Med* 166: 491-492.
7. Lewis T (1932) A lecture on vasovagal syncope and the carotid sinus mechanism. *Br Med J* 1: 873-876.
8. JN Czermak (1879) Untersuchungen uber die Wirkung starker Vagus-Reizung auf den Herzschlag. *Pflug Arch Eur J Physiol* 1: 788-794.
9. Hering HE (1924) Die Sinusreflexe vom Sinus caroticus warden durch einen Nerven vermittelt, de rein Ast des Nervus glossopharyngeus ist, *Munch Med Wschr* 71: 1265-1266.
10. Franke H (1968) Heart rhythm disorders in hyperactive cartid sinus reflex. *Internist* 9: 289-296.
11. Schweitzer P, Teichholz LE (1985) Carotid sinus massage. Its diagnostic and therapeutic value in arrhythmias. *Am J Med* 78: 645-654.
12. Hess DS, Hanlon T, Scheinman M, Budge R, Desai J (1982) Termination of ventricular tachycardia by carotid sinus massage. *Circulation* 65: 627-633.
13. Rossen R, Kabat H, Anderson JP (1943) Acute arrest of cerebral circulation in man. *Arch Neurol Psychiatry* 50: 510-528.