

Carotid Sinus Syndrome And Hypersensitivity – A Frequent Cause of Syncope

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ABSTRACT

The autonomic nervous system, the body's control system, maintains bodily functions, heart rate, digestion, respiratory rate, and many others. The carotid sinus syndrome is an exaggerated response to stimulation of carotid sinus baro-receptor and it is described as an autonomic nervous system disease. The history of the condition in the context of its contemporary understanding is reviewed in this article and recommendations made in how we view pacing in the context of this intriguingly opaque condition.

Keywords: Autonomic nervous system, heart rate, respiratory rate, response to baroreceptor.

INTRODUCTION

The ancient Assyrians used carotid compression to dull the pain associated with ritual circumcision(Ask-Upmark E 1935). This shows the relationship of the carotid sinus with impaired consciousness. Carotid baroreceptors, are located in the bilateral part of neck near the bifurcation/separation into internal and external carotid arteries. They play an important physiological role in heart rate and blood pressure control. Carotid sinus hypersensitivity (CSH) occurs when stimulation of carotid arteries offers greater than expected fall rate and a fall in blood pressure(Munster AB et al.,2016). Causes, vagal activation or sympathetic inhibition. CSH is a precursor for the Carotid sinus syndrome (CSS). Most commonly, CSS occurs with syncope and in older individuals. There are commonly three types of CSS observed (Fig.1).

- Cardioinhibitory
- Vasodepressor
- Mixed

Cardioinhibitory CSS:

The most common CSS type observed and is associated mainly with bradycardia -slow heart rate or temporary systole. Asystole that exceeds 3 seconds is produced by the Carotid sinus massage (CSM) in this condition. (Shojaa MM, Et al.,2009)

Vasodepressor CSS:

It has clinical features similar to cardioinhibitory and mixed CSS and is well-marked by a decrease in systolic blood pressure. However, older patients present with recurrent unexplained falls, and this type happen more often than the other forms.

Mixed CSS: Mixed CSS is the combination of the other two types of CSS.

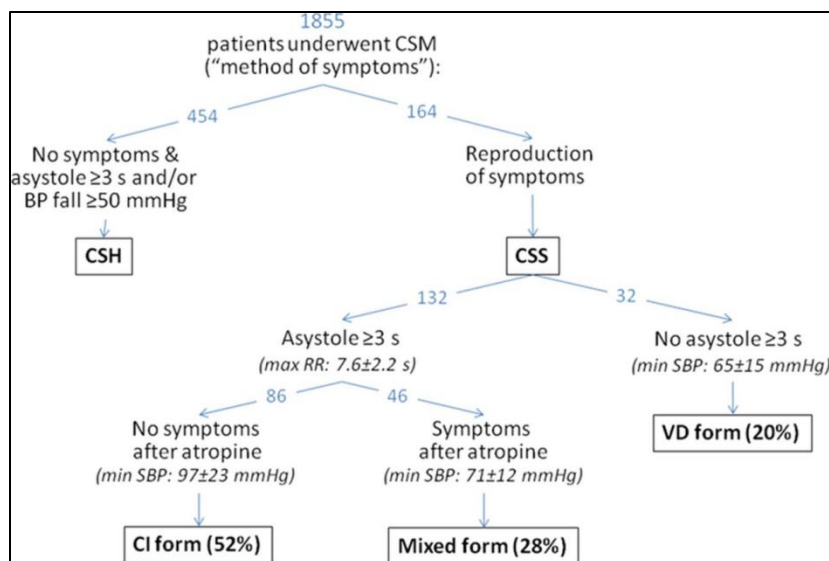


Fig. 1: Types of CSS

Pathophysiologic Rationale for Carotid Sinus Syndrome

Exaggerated heart rate and changes in blood pressure (carotid sinus hypersensitivity) is provoked by stimulation of the carotid sinus in normal humans. Stimulation through the carotid sinus pressure or massage can provoke syncope (carotid sinus syndrome) in some individuals. The afferent component of the carotid sinus reflex is from the sinus *via* neuronal projections to the nucleus tractus solitaries(Sharafkandi A 1987) via Hering's nerve and the glossopharyngeal nerve. The efferent expressions of the nerves are mediated by the vagus nerve in cardioinhibitory CSS(Ambroise Paré) and by sympathetic withdrawal and arterial hypotension in mixed CSS and vasodepressor CSS(Hillier Parry C 1799). The histology of the intima and the nerve terminals in CSS is normal (Waller A 1862) and for certain, the carotid sinus and its projections are unlikely culprits. Both the vasodepressor and the cardioinhibitory effects of CSM continue despite the termination of carotid stimulation(Czermak J 1866).

Moreover, the management of CSH is not denervation of the carotid sinus (Braun L, Samet B, 1928). The potent relationship between electromyographically demonstrated sternocleidomastoid muscle denervation and CSH during CSM is found by (Sollman T, Brown ED 1912). The chronic loss of innervation of the sternocleidomastoid muscles may cause increased sensitivity of the baroreflex arc and hence CSH as per the study conducted by (Hering HE, 1923; Hering HE, 1927).

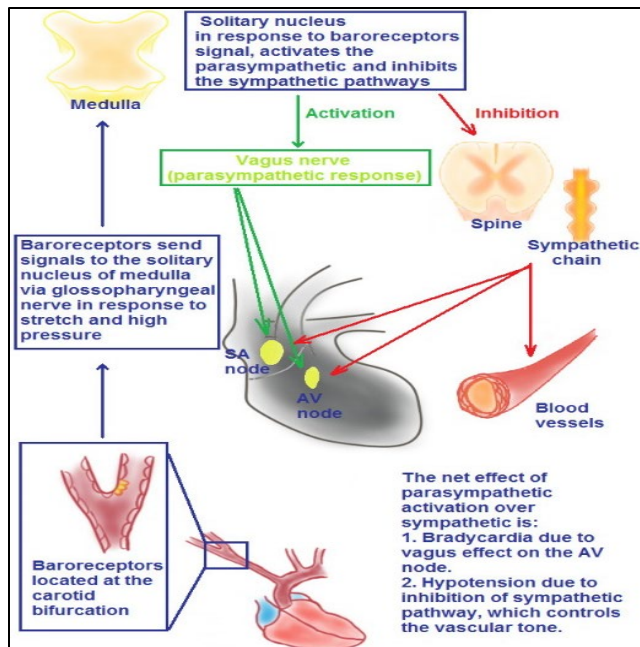


Fig.2 Pathophysiology for Carotid Sinus Syndrome

The older individuals with CSS was found to have increased cardiac sympathetic neuronal activity suggesting that CSS is a clinical manifestation of autonomic dysregulation (Koch E 1924; Koch E, 1931)

Diagnostic Test for Carotid Sinus Syndrome

The current standard diagnostic test for CSS is 10 seconds CSM, right then left during electrocardiographic and blood pressure monitoring (de Castro F 1928). The presence of prolonged asystole confirms the diagnosis of CSS (Heymans C1929). The duration and the position of CSM are the factors influencing the diagnosis of CSS (Sunder-Plassman P 1930)

CSS Triggers

CSS is mostly triggered by tight collars and neck movements. Other triggers are occasional, such as neck tumors, neck surgery or neck irradiation. CSS can also occur without these local triggers but still represents recurrent syncope (Mehrmann K 1925.)

Clinical features

There are a few or no early signs presented in patients with syncope. It mainly affects males, and the patients usually have evidence of cardiovascular disease, sinus node disease and atrioventricular block.⁽¹¹⁾ The recurrence of syncope is common high mortality rates were

observed earlier. In cardioinhibitory patients the detected arrhythmia is sinus arrest without escape rhythm is 72% when monitored by a special delayed hysteresis pacemaker or by an implantable loop recorder . There is difficulty in determining whether CSS and vasovagal syncope is the imputable reason for syncope.

Treatment

Carotid sinus massage was conducted initially using established protocols with 5-10 second of bilateral, sequential CSM conducted at the point of maximal pulsation of the carotid arteries. It is done in supine position followed by 70 degree head-up tilt position. Pacing treatment was introduced for this form in the 1970s and became popularly practiced. (Mandelstamm M, et al., 1928). Though the results were satisfactory, neither the diagnosis nor the therapy became recognized practice. CSM was considered dangerous and not practiced in many places A tilt-test performance came in practice for this form of CSS after many years of treatment struggles. Increased volumes of fluid and increased salt consumption was recommended to patients (Roskam J. 1930). The difficulty was in the management of the coincidence of hypertension. This coincidence of hypertension has to be considered important in patients with drug therapy of recurrent syncope.(Gurdjian ES et al., 1957 Gurdjian ES et al., a 1958). These drugs may lower blood pressure during symptoms but are likely to increase blood pressure to dangerous levels.(Nathanson MH 1933 Parry SW et al.,2000). Firstly reduction or cessation of hypotensive medication should be advised (Weiss S, Baker JP1933). In addition, fludrocortisone and midodrine are the drugs prescribed, but both are harmful to hypertensive patients. However, midodrine adds to its side-effects of urinary retention in males as well.(Parry SW, Kenny RA 2005,Voss DM, Magnin GE 1970). A newly developed drug, droxidopa may help, but there is no sign of evidence available yet in CSS management. Hence, therapies of vasodepressor CSS are highly unsatisfactory and often difficult (Shen WK et al., 2017).

Conclusion

CSS is a common reason of syncope but infrequently. It is dominant in the case of males at the age of 40 years or above and is diagnosed by carotid sinus massage with reproduction of spontaneous symptoms. Its rate is underestimated as the CSM is not systematically performed in clinical practice. Cardiac pacing is the only therapy effective in the prevention and control of CSS.

Author contribution

Bhaskaran Sathyapriya, Jayesh S Raghavendra. conceived of the presented idea. Swamikannu Bhuminathan, Kesavaram Padmavathy, Adugula Chandrakala, Arun Shriram A and Shreevithya D encouraged and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

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Study significance . The study implements history of the condition in the context of its contemporary understanding is reviewed in this article and recommendations made in how we view pacing in the context of this intriguingly opaque condition.

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