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Straight Back Syndrome: positive response to spinal manipulation and adjunctive therapy – A case report

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Straight Back Syndrome (SBS) has been recognized for over 50 years. Not to be confused with flat back syndrome in the lumbar spine, SBS patients present with an obvious loss of the thoracic kyphosis accompanied by apparent heart symptoms. The main purpose of this article is to describe a patient diagnosed with SBS, whose symptoms were successfully managed using spinal manipulative therapy as well as ancillary modalities. The use of diagnostic and laboratory tests are essential to differentially diagnose cardiac disease from SBS. Genesis and incidence of this condition is also discussed as well as roentgenometric analysis. A suggested diagnostic algorithm is presented as well.

KEY WORDS: *syndrome, straight back, thoracic, kyphosis, mitral valve*

Le syndrome du dos droit (SBS) est reconnu depuis plus de 50 ans. À ne pas confondre avec le syndrome du dos plat de la partie lombaire de la colonne vertébrale, les patients souffrant du SBS présentent une importante diminution de la cyphose dorsale accompagnée de symptômes cardiaques apparents. L'objectif principal de cet article est de décrire le diagnostic d'un patient qui souffre du SBS, et dont les symptômes ont été repérés avec succès grâce à la manipulation vertébrale ainsi que des moyens auxiliaires. L'utilisation d'un diagnostic et de tests en laboratoire sont essentiels pour différencier un diagnostic de maladie cardiaque d'un diagnostic de SBS. L'origine et l'incidence de cette maladie sont également discutées, ainsi que l'analyse radiologique chiropratique. Une proposition d'algorithme de diagnostic est également présentée.

MOTS CLÉS : *syndrome, dos droit, dorsale, cyphose, valvule mitrale*

Introduction

Straight back syndrome (SBS) is a thoracic deformity characterized by loss of the normal upper thoracic spinal kyphosis. This deformity leads to a reduced anteroposterior diameter of the chest causing a compression or "pancaking" of the heart and great vessels so as to appear enlarged. This is accompanied by a leftward displacement of the heart, resulting in cardiac murmurs[1], chest pain and tracheal compression[2]. Mitral valve prolapse (MVP) has been reported in 64% of patients.[2] Misdiagnosis of straight back syndrome as pericardial absence has also been cited.[3] A study investigating the relationship between SBS and MVP showed echocardiograms to be normal in 36% of patients diagnosed with SBS; however, 58% of these patients demonstrated mitral valve prolapsed.[4] Despite the fact that this syndrome has been recognized for over 50 years, it is not commonly considered as a differential diagnose and thus the incidence is unknown.[5] However, given that this

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syndrome is often associated with heart symptoms, it is important that health care practitioners are made aware of SBS and consider it as a differential diagnosis in a patient presenting with symptoms that can appear to be cardiac in nature. This is especially true in cases of atrial septal defect which can resemble the symptom picture of SBS.[6] This particular study describes the case of a patient with thoracic pain, who presented to a chiropractor also with cardiac symptoms but was ultimately diagnosed with and treated for symptoms related to SBS.

Case Report

All written consents, Research Ethics Board (CMCC) approvals were obtained from the patient prior to publishing this manuscript.

History

A 38 year old Caucasian, non-smoking male, presented to a chiropractic clinic with complaints of intermittent left arm paresthesia and left-sided chest pain and tightness rated at 3-4/10 (0=no pain, 10=most pain) and unrelenting. He also reported chronic, intermittent, daily mid-thoracic pain and tightness over the past year. Symptoms of mid-thoracic pain were verbally rated at 7/10. Shortness of breath was also reported once per month. Chronic daily fatigue has also been an issue over the past year following his recent divorce. Trauma or prior surgeries were denied. Occupational factors (sitting, computer work) aggravated his arm and chest symptoms which seemed to abate during his off-time. There did not appear to be any association between his arm pain and cervical stiffness, but his mid-thoracic and chest symptoms often occurred together.

His employment required him to work night shifts for the past six years. Between 2007 and 2009, the patient underwent a number of medical diagnostic procedures, including blood work, echocardiogram, cardiac stress test, echocardiography and electrocardiogram (ECG) which were all deemed within normal limits. He attended a walk-in clinic and was diagnosed with "thoracic strain" and was prescribed Naproxen, physiotherapy and massage therapy. Treatments were ongoing for approximately six weeks and included upper back stretches and ultrasound applied to the upper trapezius. Unfortunately, all interventions had no effect on managing his thoracic, arm or chest symptoms.

FIGURE 1:
pectus excavatum

FIGURE 2:
loss of thoracic kyphosis

Social History

No family history of cardiovascular or MSK disorders was reported. He had not been taking any vitamins, minerals or nutriceuticals and reported having little time for any form of exercise as he was caring for his two young children.

Physical Assessment / Examination

a. Vitals

Blood pressure was recorded at 118/77, pulse 71. He was 170 cm and weighed 69 kg.

b. Prior Medical Testing

A sleep study showed obstructive apnea with oxygen desaturation and sleep fragmentation. X-ray report of the cervical spine stated cervical lordotic reversal, apex at C4-5 with mild joint / foramina narrowing. The C5-6 level was similarly involved. Mild thoraco-lumbar scoliosis, convex to the right was also reported.

c. Posture

Examination showed moderate s-shaped scoliosis and anterior head carriage. He exhibited mild pectus excavatum (Figure 1). There was moderately limited but pain-free active cervical mobility with posterior joint dysfunction located at C5-6. An obvious reduction of the thoracic kyphosis (Figure 2) was noted. There was reduced bulk of the rhomboid muscles bilaterally resulting in a concave-

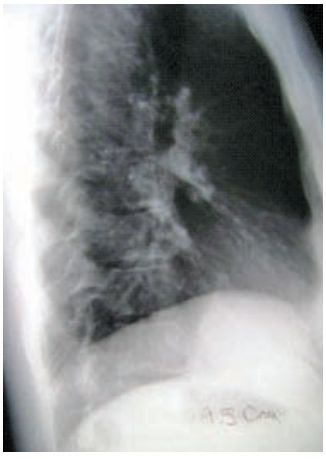

FIGURE 3: *lateral chest film showing thoracic spine flattening with a 9.5 cm antero-posterior measurement (T8 to posterior sternum)*

FIGURE 4: *Normal AP chest; no evidence of heart pancaking in the patient*

appearing upper thoracic spine. Active left and right lateral flexion of the thoracic spine showed an obvious loss of global movement throughout, with focal mobility at the T8-9 region only ("bent-stick" motion pattern: absence of segmental lateral flexion above and below an apex at T8-9).

d. Palpation

Rhomboid and levator scapulae muscles were reduced in girth, palpably ropy, taut and tender. Deep palpation of the latter provoked local and referred pain into the upper border of the trapezius. Motion and static palpation revealed severe loss of thoracic zygopophyseal/joint function from T1-9. Exquisite tenderness was also noted with posterior-anterior facet challenge at these levels. No referral was elicited on para-spinal examination. Costo-vertebral articulations were limited in their "bucket handle"[7] movement in this region with focal pain on direct palpation of the non-articulating tubercle of the first rib.

e. Orthopedic Testing

All orthopedic tests including Kemp's, cervical compression, thoracic compression and thoracic outlet provocation were unremarkable.[8] Neurologically, no obvious motor changes were seen in the upper extremities; however there was loss of sensation over the right C5 dermatome at the deltoid tuberosity.

Current Radiographic Assessment

Suspicion of SBS following initial physical examination led to chest and thoracic x-ray examination. It confirmed the moderate, s-shaped scoliosis. There was obvious loss of thoracic kyphosis (Figure 3). Chest AP was unremarkable for heart silhouette widening/pancaking (Figure 4). There are a number of roentgenometric procedures that have been used to determine the degree of thoracic kyphosis and alteration of the retro-sternal and retro-cardiac spaces. The method chosen in this case was documented by Davies[1], whereby a measurement is made from the anterior body of T8 to the posterior aspect of the sternum. The range of normal thoracic kyphosis varied from 12.68cm to 13.59cm. When reduced values are noted, the "straight back" nomenclature is applied. A second method used involves measuring the horizontal distance from T8 to a vertical line connecting T4 to T12.[1] AP values measured in the lateral chest projection were 9.5cm and therefore the SBS diagnosis was confirmed. (Figure 3).

Management

The patient was diagnosed with chronic, idiopathic SBS. Treatment focused on symptomatic relief of chest tightness and constant thoracic symptoms. A pre-modulated bipolar electrotherapeutic current (80-120hz) was applied to the rhomboids and upper trapezius muscles. Spinal manipulative therapy from T3-8 was performed in a supine manner (Anterior Thoracic procedure)[7] for a period of 8

weeks, 2-3 times per week (total of 18 visits), followed by a simple, active pectoralis muscle stretch involving shoulder extension with scapular retraction (3 sets of 20 sec. inter-scapular contraction, 10 sec. rest). The patient was instructed to perform this 3 times per day to improve flexibility.

Results

The patient experienced considerable reduction of symptoms at the 6 week mark monitored using the Vernon – Mior neck pain / disability scale and Rolland Morris inventory. Values dropped from a rating of 8 to 2 and from 12 to 1 respectively. Absence of anterior chest pain was noted with reported reduction of thoracic stiffness rating of 7/10 to 2/10. Arm symptoms became less frequent (daily report to twice monthly) but upper trapezius tightness remained, requiring continued manipulation to the upper thoracic spine. Follow-up reporting at 6 months and re-examination at 23 months post treatment confirmed continued absence of chest symptoms including tightness, pain and shortness of breath.

Discussion

A review of the literature was conducted using search words: straight back syndrome, flat back syndrome, mitral valve prolapse using EBSCO, MEDLINE and Index to Chiropractic Literature data bases. Fifteen relevant articles were found, none more recent than 2007, the majority of which were published at least 20 years ago.

Rawlings[9] first proposed the straight back syndrome (SBS) in 1960 in the American Journal of Cardiology and described it as the absence of the normal dorsal curvature in the thoracic part of the spine resulting in the reduced antero-posterior diameter of the thorax. At that time, it was considered a form of 'pseudo-heart disease' but current perspective is more often associated with valvular heart disease.[10]

Diagnosis of straight back syndrome has changed slightly over the years. In 1956 De Leon et al.[4] first proposed the diagnostic criteria as follows: the antero-posterior diameter "a" is defined as the distance from the anterior border of T8 to the posterior border of the sternum on the lateral radiograph and the lateral diameter "b" is defined at the level of the diaphragm on the frontal radiograph. SBS is diagnosed when a/b is 1/3 or less.

In 1980, Davies et al.[1] modified the diagnostic criteria to evaluate a larger proportion of the chest diameter. They proposed that the lateral chest radiograph should be used to measure the distance, 'a' from the middle of the anterior border of T8 to a vertical line connecting T4 (top of anterior border) and T12 (bottom of anterior border). SBS is diagnosed when 'distance a' is smaller than 1.2cm.

As in Datey[15], the 2006 diagnostic criteria used by Yochum and Rowe[11], includes a lateral chest projection is taken and the distance between the posterior sternum and the anterior surface of the T8 body is measured. A measured average saggital diameter of less than 13cm in males and less than 11cm in females may indicate the presence of SBS. It is important to ensure that SBS is not confused with *flat back syndrome,* which is defined as the loss of the normal lordotic curvature of the lumbar spine most commonly associated with spinal fusion surgery.[12] Above all, it may be important for all health practitioners to consider SBS as a differential diagnosis for patients presenting with a chest complaint and to understand that such presentations are not always cardiovascular in nature. We have proposed a diagnostic algorithm (appendix 1) to heighten clinicians' awareness to this syndrome. Such yellow flags that are illustrated include: decreased antero-posterior chest dimensions, pectus excavatum and straightening of the thoracic spine. X-ray finding may include a pancaking cardiac silhouette appearing as cardiomegaly and prominence of the pulmonary artery.

There is much debate as to the etiology of straight back syndrome. It has been suggested that it is an autosomal dominant condition and antigenic determinants may be located on chromosome 6.[1] Though it had previously been suggested that the deformity occurs in intrauterine life, making it a congenital condition[13], other recent discussions tends to support that straight back syndrome may be a postnatal acquired condition[5]. Present literature remains unclear as to the cause of this syndrome.

Straight back syndrome usually comes to attention due to systolic cardiac murmurs detected during routine examination.[3] However, this is not always the case. In one study, half the patients diagnosed with SBS were asymptomatic[3]; therefore it is not plausible to only rely on incidentally found systolic cardiac murmurs for the diagnosis of this syndrome. Other common cardiac findings associated with SBS are: pulmonic ejection murmurs, palpable left para-sternal systolic impulses, loud delayed sounds of tricuspid valve closure, and exaggerated respiratory split-

ting of the second heart sound.[11] Palpitations and chest pain may be noted.[14] In some rare cases, SBS has been associated with tracheal compression and respiratory failure.[5,14] These symptoms are thought to be caused by compression of the heart and great vessels.[5]

Upon radiographic examination of patients with SBS, the PA chest view may demonstrate an unusual downward angulation of the anterior rib ends and the heart may appear displaced toward the left and appear enlarged.[11] However, the most significant and diagnostic finding is thought to be the straightening of the dorsal spine, visible on inspection, which is thereafter confirmed by palpation and a lateral radiograph of the thoracic spine which can be evaluated using the diagnostic criteria elaborated by Yochum and Rowe.[10,14] Electrocardiogram is normal in most cases, solidifying that SBS is not an actual organic cardiac complaint but rather a pseudoheart condition.[9] In one study, echocardiograms were normal in 36% and abnormal in 64% of patients.[4]

As previously stated, straight back syndrome has been associated with valvular defects. One study showed a strong association between SBS and mitral valve prolapse. In this study, 58% of patients with SBS were found to also have mitral valve prolapse (MVP).[10] Davies et al.[1] found that 67% of subjects with SBS had clinical or echocardiographic evidence of mitral valve prolapse while only 17.5% of subjects without SBS had evidence MVP. Muraki et al[15] studied the mechanism responsible for mitral valve prolapse in patients with SBS and concluded that antero-posterior flattening of the left ventricle predisposes to asynchronous motion of the papillary muscles at end-systole, causing leaflet malcoaptation (malalignment) resulting in mitral regurgitation. In contrast, Chen et al.[13] found that straight back syndrome does not increase the familial occurrence of mitral valve prolapse. They postulated that both SBS and MVP might be features of a more generalized disorder. These two features may occur together in the same individual or they may be dissociated. This evidence shows that though not all patients presenting with straight back syndrome have mitral valve prolapse, there is, however, an increased chance of its presence. Therefore, in the interest of caution, some authors suggest patients be investigated for associated mitral valve prolapse if a diagnosis of SBS is suspected.[1, 10] Even if complicated with MVP, specific treatment for SBS is generally not required.[5] Others, like Yochum and Albers[16] contend that the clinicians' familiarity with this syndrome could prevent unnecessary and expensive testing as well as having the psychological benefit to the patient that they do not have organic heart disease.

Summary

This manuscript described the successful management of a patient with musculoskeletal symptoms related to SBS. Although SBS has gained increased recognition since its initial reporting by Rawlings in 1960, further research is still required in order to comprehend the scope of this syndrome and to guide health practitioners towards its proper diagnosis and, in some cases, management of its associated musculoskeletal issues. Further studies will help provide a greater understanding and appreciation of its overall incidence as well as its correlation with MVP. The incidence of SBS is unknown owing partially to its under-diagnosis within the clinical realm. As successfully shown in this case study, patients with SBS may not require any form of invasive treatment and often benefit from conservative care for symptomatic relief. Here, it consisted of chiropractic manipulative therapy, soft tissue treatment, and active exercise. Above all, it is important for the chiropractic practitioner to rule out cardiogenic causes by way of medical referral prior to any treatment regimen for patients presenting with a chest complaint.

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Appendix 1: Diagnostic Algorithm comparing mitral Valve prolapsed to Straight Back Syndrome