Single Osteopathic Manipulative Treatment Session Eliminates Percutaneous Coronary Intervention-Induced Upper Thoracic Pain in Elderly Male

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Abstract

Restoration of blood flow is critical to a blocked coronary blood vessel. With respect to the heart, two main procedures, coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) revascularize the area to prevent future blockages. Post-procedurally, bed rest iatrogenically produces non-life-threatening back pain.[1,2] No exact guideline for the duration of post-procedural bed rest exists but recommendations range from 2 to 24 hours.[1] However, research has shown that bed rest beyond 4 hours significantly increased the presence of post-procedural back pain.[1,2] Osteopathic manipulative treatment (OMT) is the term ascribed to a number of categories of manual techniques used by osteopathic physicians to treat somatic dysfunctions, to complement conventional management in patient care. In this case report, we discuss a patient with post-procedural upper thoracic pain that resolves with OMT, demonstrating that OMT may play a useful post-PCI role in the care of patients who undergo stent procedures.

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Background

Coronary artery bypass grafting (CABG) is the standard of care for untreated three-vessel or left main coronary artery disease.[3] However, since 2009, the number of patients choosing CABG operations has decreased because of the increasing number of patients choosing percutaneous coronary intervention (PCI).[4] The latter involves the use of drug-eluting stents. Increased popularity for PCI correlates with increased utilization of resources by patients post-PCI for recurrent angina and chest pain.[5,6] Despite the usual pharmacological treatment of ACE-inhibitors and statins in patients with coronary artery disease, additional management for recurrent angina is determined by two underlying mechanisms: structural, which includes analgesics or opioids, or functional, which includes nitrates, beta-blockers, and calcium-channel blockers.[6] One study showed that 28% of patients post-PCI had costs of $14,524 and $19,977 after the first and third years post-PCI because of more medical care and inpatient hospitalizations.[5] Thus, non-pharmacological strategies need to be incorporated to reduce this financial burden. In particular, studies have shown the therapeutic effect of osteopathic manipulative treatment (OMT) on patients post-CABG with improved outcomes.[3,4,7] However, there may also be a therapeutic benefit of OMT on patients post-PCI, as demonstrated in this case of a patient with upper thoracic pain following PCI that was effectively treated with OMT.

Report of Case

Presentation

An 82-year-old man presented to the emergency department with acute-onset unilateral upper thoracic pain following a PCI procedure in the right coronary artery (RCA) via radial artery access 3 days prior. His pain was not present upon discharge after the PCI procedure. The new-onset pain was localized to his left upper thoracics and was a constant dull ache. The patient had increased shortness of breath, even with a lower baseline level of exertion since having the procedure. The patient noticed that rolling onto his shoulders, especially the right, caused him to wince and point to his left upper thoracic paraspinal musculature. He felt that this pain limited his mobility. There were no alleviating factors. Palpation to the area reproduced the pain. The patient denied chest pain, nausea, vomiting, diaphoresis, lightheadedness, new coughing, or new orthopnea. He did not endorse any inciting actions, events, or trauma that could account for this new pain, and his post-procedural bed rest was only 1 hour, due to the less invasive access via the radial artery.

Medical History

The patient's past medical history included myocardial infarction, and comorbidities of coronary artery disease, hypertension, asthma, and arthritis. The patient's allergies included iodinated radiocontrast agents (swelling) and nuts (hives). The patient's past surgical history included 2 PCI procedures. The first, in 2017, involved 1 stent in the left anterior descending artery (LAD) and 1 in the reversed posterior descending artery (RPDA) for a myocardial infarction. The most recent procedure, in 2019, involved 1 stent in the RCA for declining ejection fraction. For social history, the patient quit tobacco products 30 years ago (6 pack-year smoking history), consumed alcohol socially, and lived at home with his son. Regular medication included the following taken by mouth: amlodipine 10 mg, aspirin 81 mg, atorvastatin 80 mg, carvedilol 12.5 mg, isosorbide mononitrate 30 mg, losartan 100 mg, clopidogrel 75 mg, one vitamin C tablet, and one vitamin D3 tablet. Relevant prior imaging included an echocardiogram showing an ejection fraction of 45-50%, mild mitral and tricuspid regurgitation, and increased pulmonary pressures in 2018 and a pharmacologic stress test showing an ejection fraction of 35% and fixed inferoapical defect 3 months prior to presentation in 2019.

Evaluation

On initial emergency department physical examination, the patient was well-appearing, in no acute distress, awake, alert, interactive, and sitting comfortably in bed. The patient had moist mucous membranes, and no jugular venous distention, scleral icterus, conjunctival pallor or injection. There were normal heart sounds with no murmurs, rubs, or gallops and +3 radial pulses bilaterally. The lungs were clear to auscultation, with good aeration throughout all lung fields bilaterally, and no accessory muscle use, but there was mild shortness of breath while getting out of bed. The abdomen was soft, nontender, and nondistended with normal bowel sounds and without rebound, guarding, or organomegaly. The extremities were warm and well perfused without evidence of lower extremity edema. The neurologic exam was non-focal. There were no lesions or rashes. There was no initial osteopathic structural examination.

Despite his lack of chest pain on presentation, some important differential diagnoses at the time included cardiac-related events that might refer to the upper thoracics, such as stent thrombosis, restenosis, coronary dissection, or an acute myocardial infarction. Pulmonary differentials included pulmonary embolus, pneumonia, or pulmonary edema. Musculoskeletal back pain was also on the differential.

The patient's vital signs included the following values: temperature 96.9°F, pulse 61 beats per minute, respiratory rate 18 breaths per minute, blood pressure 130/73 mmHg, and oxygen saturation 97% on room air. The patient's labs included an initial troponin level of 0.17, a negative D-dimer, and a chest x-ray showing small effusions at the lung bases and lower lobe compressive atelectasis. The patient was admitted to telemetry and started on IV heparin. The patient had watchful trending of troponin levels and continued dual antiplatelet therapy. The patient had a negative telemetry and a downward trending troponin level of 0.17 to 0.12. He also had negative serial EKGs. A cardiology consult was deemed unnecessary.

On admission to the medical floor, physical examination revealed no significant changes, and there was no osteopathic structural examination. Notwithstanding the negative visceral workup, the patient continued to complain of the same left upper thoracic pain, worse with side-lying on the right, which therefore suggested a somatic component.

Follow-up evaluation of the patient 1 day later included an osteopathic structural examination which revealed the following somatic dysfunctions: left-greater-than-right boggy paraspinal hypertonicity of T3-T7, ribs 3-7 bilateral costotransverse decreased articular mobility, right-greater-than left restricted range of motion of the shoulders in abduction, left-greater-than-right tenderness of T3-T7, and suboccipital myofascial restriction. Despite the application of a lidocaine patch at T3-T7 on the right, his upper thoracic pain was a 7/10. OMT was explained to the patient, and he consented to the procedure.

Treatment

A single session of OMT was applied, using rib raising directed at the costotransverse articulations of the upper thoracics, as well as myofascial release to the paraspinal muscles and suboccipital release. Within moments of initiating OMT, the thoracic pain was reduced from 7/10 to 4/10, and the right-greater-than-left shoulder restriction was decreased. However, the patient then complained of left-greater-than-right shoulder tightness, to which muscle energy to the left shoulder's restricted motion was applied. Upon completion of OMT, the patient reported a 0/10 pain and felt freer movement in the shoulders. There were no adverse reactions to the OMT. With sustained resolve of pain after OMT, the patient was discharged 5 hours later on that same day with no other interventions or analgesics needed, and with a suggested follow-up to the local OMT clinic, if the pain should return. Following up 1.5 years after this presentation, the patient stated that his upper thoracic pain never returned after his treatment so he did not arrange a follow-up for OMT. He has required neither medical care nor inpatient hospitalizations related to his now-eliminated pain.

Discussion

According to the *Glossary of Osteopathic Terminology*, 3rd edition,[8] OMT is the therapeutic application of manually guided forces by an osteopathic physician to improve physiologic function and/or support homeostasis. It is used to treat somatic dysfunction, which is defined as impaired or altered function of related components of the body's framework, and is characterized by positional asymmetry, restricted range of motion, tissue texture abnormalities, and/or tenderness.[8]

There are various physiologic reflexes, some of which can be affected by properly-applied OMT. A reflex has an input and output relationship, in which the afferent (sensory) limb travels from the somatic or visceral tissues to the brain and spinal cord, while the efferent (motor) limb travels from the brain/spinal cord to a somatic or visceral structure. The spinal cord's gray matter divides into ten layers, the most osteopathically important of which are I and IV, as nociceptors from both somatic and visceral structures share similar afferent limbs and terminate on common interneurons.[9] This shared relationship is important with regard to the sympathetic nervous system, from T1-L2. Increased sympathetic input reduces the firing threshold of the shared interneurons, causing a facilitated segment. This facilitation amplifies all incoming inputs to the area and hence all outputs to the innervated tissues, and in increased outflows to higher centers.[9] This results in somatic activation (tissue texture changes, tenderness, motion changes, etc.).[9] These changes maintain the facilitation of the spinal circuits.[9]

One such physiologic reflex, and one that we believe is demonstrated in this patient, is the viscerosomatic reflex. This reflex occurs when visceral stimuli produce patterns of reflex in segmentally related somatic structures, such as paraspinal musculature, that make for palpable diagnostic clues.[10] While it is possible that the patient could have inadvertently mechanically strained his back coincidental to the timing of his PCI, which would lend itself more so to a somato-somatic reflex, there are a few factors that corroborate a visceral origin to the reflex. A reflex of visceral origin is more diffuse and poorly localized than a reflex of somatic origin.[10,11] In the setting of the cardiac viscera, palpable tissue texture changes are present spanning multiple upper thoracic levels,[12,13] as was seen in our patient who underwent a cardiac procedure just 3 days prior from coronary artery disease and decreased ejection fraction. In contrast, somato-somatic reflexes are theoretically not continuously stimulated because they tend to be postural or movement related, and they tend not to span multiple spinal levels.[10] Our patient's left upper thoracic pain was exacerbated with right side-lying versus only occurring when right side-lying; however, his chief complaint was persistent upper thoracic pain, regardless of movement. We surmise that a contributing factor related to the exacerbation in right side-lying is the fact that his stent was placed in the right coronary artery, which, based on its anatomic location, would receive more pressure when lying on the right, intensifying the somatic complaint, versus its being off-loaded when lying on the left side. Further support for a viscerosomatic reflex in our patient is the boggy paraspinal tissue texture and rubbery end-feel to the rib-raising action on the costotransverse articulations along corresponding ribs 3-7.[10] Johnston referred to this costal relationship in viscerosomatic reflexes as "linkage."[14] To summarize, with respect to what we believe was a viscerosomatic reflex, the acute visceral irritation with PCI and stent placement caused increased nociceptive input, resulting in segmental facilitation, causing diffuse changes and pain in the segmentally related somatic structures, on which one could intervene with OMT.

Research has shown that OMT can modulate autonomic responses.[7,15,16] In this patient, rib raising and myofascial release to the thoracic spine, as well as suboccipital release, were used to balance the autonomic tone between sympathetic and parasympathetic activity, especially as related to the viscerosomatic reflex arc. The muscle energy technique applied to the shoulder was used to release the myofascial and articular tension of the region, which was likely present due to the functional and anatomical fascial tensegrity relationships of the anterior and posterior structures of the pectoral girdle.

A limitation is that this case represents one patient. Further studies with a larger patient population are warranted to determine if OMT can reproducibly improve stent-related back pain.

Conclusion

This case demonstrates how gently yet specifically-applied OMT can improve stent-related back pain, as a manifesting complication of a viscerosomatic reflex occurring through the arc of facilitation. Successfully applying OMT to the affected somatic structures normalized their function, reducing the afferent activity, which allowed the central facilitation to subside, and ultimately led to the cessation of perceived pain and the patient's discharge home without the need for further hospital intervention or analgesia, which also contributed to decreased overall healthcare costs.

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