REVIEW ARTICLE

Osteopathic Considerations in the Management of Chest Pain

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Chest pain is one of the most common reasons for patients to seek medical care, accounting for about 1 to 3% of office visits to a primary care provider. The most common cause of chest pain is musculoskeletal in origin. A thorough osteopathic history and physical will help accurately diagnose musculoskeletal chest pain. Some common musculoskeletal causes of chest pain include costochondritis, lower rib pain syndrome, posterior chest wall pain syndrome, and muscle strain. Osteopathic manipulative medicine can be incorporated into the treatment of musculoskeletal chest pain.

INTRODUCTION

Chest pain is one of the most common reasons for patients to seek medical care, accounting for about about 1 to 3% of office visits to a primary care provider.[1] Of these visits, the most common cause of pain is musculoskeletal, not cardiac, in origin.[1,2]

The complaint of chest pain must be considered seriously. It can represent life-threatening medical conditions potentially involving the cardiovascular, pulmonary and gastrointestinal systems. Other causes of chest pain are less critical and can be associated with musculoskeletal dysfunctions.[3] In the hospital setting, about 20% of patients with undifferentiated chest pain are admitted for suspected acute coronary syndrome (ACS). There is an estimated cost of $8 billion for the initial care of these patients who are later discharged without a diagnosis of coronary artery disease.[4]

Since medical training teaches physicians to first rule out conditions associated with symptomatic "red flags," we must be mindful to keep other causes in our differential. Osteopathic physicians are trained to approach patients as a unit, a whole person. When history, physical examination and pertinent diagnostic tests have ruled out life-threatening causes and provide no answer for the cause of pain, it is important to remember the osteopathic principles and treatments that can help provide the necessary care for patients.

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EPIDEMIOLOGY

The number of patients with chest pain secondary to a musculoskeletal source is more common in patients presenting to their primary care clinician than an emergency department.[2] It also occurs more frequently among women than men. In Disla et al.'s study that examined the incidence of musculoskeletal chest pain, 69% of patients diagnosed with costochondritis were women.[5] In the primary care setting, frequencies of the different etiologies of chest pain are musculoskeletal 36-49%, cardiovascular 15-18%, gastrointestinal 8-19%, pulmonary 5-10% and psychiatric 8-11%.[6]

NON-MUSCULOSKELETAL CAUSES OF CHEST PAIN

The differential diagnosis of patients presenting with chest pain ranges from benign musculoskeletal etiologies to life-threatening diseases such as myocardial infarction, esophageal rupture, perforating peptic ulcer, pulmonary embolus and tension pneumothorax.[7] It is important to rule out cardiovascular, pulmonary and gastrointestinal causes of chest pain before definitively diagnosing musculoskeletal chest pain.

Coronary artery disease can lead to ischemic chest pain, which may be present in a spectrum of cardiovascular diseases including stable angina, unstable angina, non-ST elevation myocardial infarction, and ST elevation myocardial infarction.[8] Patients with myocardial infarction (MI) present with substernal chest pain, usually radiating to the shoulder, jaw or arm, which is exacerbated by exertional activity and relieved by rest or nitroglycerine. In one study (n= 94 patients), Lusiani et al. found that 32% of patients presented with atypical symptoms of MI, including abdominal pain,

paroxysmal dyspnea and symptoms of pulmonary edema, with the frequency of symptoms being 33%, 17% and 13%, respectively. These atypical symptoms were most prevalent in women over the age of sixty-five years.[9] Thus, in elderly patients, risk factors for coronary artery disease should be assessed.[10]

The most common gastrointestinal cause of chest pain is gastroesophageal reflux disease (GERD), which is characterized by squeezing or burning substernal chest pain radiating to the back, neck, arms or jaw.[11] Peptic ulcer disease (PUD) can also cause chest pain and may lead to a perforation of the gastrointestinal lining which is a life-threatening emergency. Patients with perforated PUD may present with a sudden onset of severe, sharp abdominal pain.[8] Esophageal rupture, another life-threatening gastrointestinal cause of chest pain, is characterized by odynophagia, tachypnea, dyspnea, cyanosis, fever and shock.

Tension pneumothorax and pulmonary embolism are life threatening pulmonary causes of chest pain. Although the initial presentation of tension pneumothorax can vary, development of severe dyspnea, tachycardia and hypotension can occur over time. Patients may also have distended neck veins and tracheal deviation.[8] Stein et al. found that the most common symptoms of pulmonary embolism were dyspnea (73%), pleuritic chest pain (66%), cough (37%) and hemoptysis (13%).[12]

MUSCULOSKELETAL CAUSES OF CHEST PAIN

There are several key factors to consider in a patient's history when evaluating musculoskeletal causes of chest pain. Musculoskeletal chest pain includes pain related to the thoracic spine and the anterior chest wall's bony, cartilaginous and muscular structures.[13] The pain has an insidious onset and a prolonged duration that lasts for hours to days. A recent history of repetitive activity may favor the diagnosis of musculoskeletal chest pain. Deep breathing, turning, or arm movement may exacerbate the pain, which is frequently sharp and localized to a specific area near the costochondral junction.[10]

Costochondritis (also known as costosternal syndrome or anterior chest wall syndrome) is characterized by achy, sharp, pressure-like pain and tenderness of multiple joints in the costochondral junction. Pain is usually unilateral and aggravated by movements of the upper body, deep breathing or exertional activities. Signs of inflammation and swelling are usually absent. The mechanism of pain is believed to be mechanical derangement, muscular imbalance or neurogenic inflammation.[14] Diagnosis is based mainly on the ability to reproduce the pain by palpation of tender areas. Bösner et al. demonstrated that two of the following four features, localized muscle tension, stinging pain, pain reproducible by palpation and absence of cough, are associated with the diagnosis of anterior chest wall syndrome.[15]

Lower rib pain syndrome (also known as rib-tip syndrome, slipping rib syndrome, twelfth rib syndrome and clicking rib syndrome) is characterized by pain in the lower chest or upper abdomen. A tender point on the costal margin and pain that is reproduced by pressing on this area is also a characteristic of this syndrome.[16]

Posterior chest wall pain syndrome, also known as thoracic spinal pain syndrome, is relatively common in workplace settings and is associated with chest pain.[17] Thoracic disc herniation is a cause of posterior chest wall pain that should be considered in patients with dermatomal pain. Costovertebral joint dysfunction is another cause in which the patient presents with pain that is made worse with coughing or deep breathing. Palpating the costovertebral junction often reproduces the pain. There may also be areas of local hyperalgesia.[18]

Strains of the intercostal, pectoralis, internal and external oblique and serratus anterior muscles are another common cause of musculoskeletal chest pain. Acute onset of muscle strain is usually caused by trauma or overuse while gradual onset of muscle pain results from tension or anxiety. Muscle tears may present with sudden pain in the region followed by swelling and bruising.[1]

Some less common causes of chest pain are sternalis syndrome, Tietze's syndrome, xiphoidalgia and spontaneous sternoclavicular subluxation. Sternalis syndrome is localized tenderness over the body of the sternum and palpation to the area causes pain to radiate bilaterally. Tietze's syndrome is characterized by painful, localized swelling in costosternal, sternoclavicular and costochondral joints.[19] Xiphoidalgia is localized tenderness over the xiphoid process of sternum.[20] Spontaneous sternoclavicular subluxation is an anterior or cranial displacement of the clavicle that usually occurs on the dominant-hand side in women 40-60 years old. This displacement may occur due to heavy repetitive activity. Radiography can also show sclerosis of the medial clavicle in spontaneous sternoclavicular subluxation.[21]

There are systemic diseases that can cause musculoskeletal chest wall pain such as rheumatoid arthritis (RA), ankylosing spondylitis and fibromyalgia. RA is an autoimmune disease that classically arises in women of late childbearing age and it is characterized by destruction of cartilage and ankylosis or fusion of the joint. Clinical features include joint pain with morning stiffness that improves with activity. Joint-space narrowing, loss of cartilage and osteopenia are typically seen on x-ray. In a recent study of 412 subjects, RA subjects (19%) had significantly more pain and swelling in the sternoclavicular joint than healthy controls (1.9%). Also in the RA group, ultrasound abnormalities such as osteophytes (29%), synovitis (15%) and erosions (11%), were recorded in 89 sternoclavicular joints (43%) compared with 36 (17%) in the healthy control.[22]

Ankylosing spondylitis is a chronic inflammatory disease of the spine and sacroiliac joints. It is commonly seen in younger patients with a history of chronic low back pain and morning stiffness. Any deficits while examining forward flexion of lumbar spine in a younger patient may suggest ankylosing spondylitis.[23]

Fibromyalgia is characterized by chronic widespread musculoskeletal pain with sleep disturbances and fatigue. Patients with fibromyalgia can have specific bilateral tenderpoints in the upper and mid-cervical, trapezius, lateral gluteal, lateral trochanteric, medial knees and anterior costochondral regions.[1]

OSTEOPATHIC PHYSICAL EXAMINATION

A general physical examination, including an osteopathic structural exam (OSE), should be conducted to rule out cardiovascular, pulmonary, gastrointestinal and other visceral causes of chest pain. There is no "one-size-fits-all" approach to these patients, as there are many different causes.[24] Findings associated with

non-musculoskeletal causes of chest pain may include exertional pain, cough, fever, dyspnea and pain exacerbated by deep breathing.[10]

OSE findings may assist in diagnosing or ruling out visceral causes of chest pain. A viscerosomatic reflex is caused by stimulus from an internal organ that produces a reflex response in the musculoskeletal system sharing the same spinal segment innervation.[25] Chronic irritation and inflammation of the stomach lining that leads to tissue texture changes and thoracic cage somatic dysfunctions from T5-T9 is an example of a viscerosomatic reflex. Somatic dysfunction, tissue texture changes, or temperature variations may be due to viscerosomatic reflexes.[25] Chapman points may also be associated with a visceral cause of chest pain. These points are "plaque-like changes" that represent visceral dysfunction or pathology and may play an important role in narrowing down the differential diagnosis of chest pain.[25] Viscerosomatic findings are summarized in Table 1.

The initial examination for non-visceral chest pain should start at the spine and shoulders using observation, palpation and range of motion testing.[10,26] Physicians should note any tissue texture changes, asymmetry, restriction of motion and tenderness (TART) through direct palpation of the anterior and posterior chest wall. Acute changes will present with edema, tenderness, pain and tissue contraction. Chronic changes will present with tenderness, fibrosis and ropy changes.[25] Physicians should then assess the mobility of the thoracic cage with respiration and the range of motion (passive and active) of the cervical, thoracic and lumbar spine. Any areas of restriction in the spine or rib cage should be noted. Tenderness or pain in the thoracic cage that is reproduced with movement is highly suggestive of a musculoskeletal cause of chest pain.[10] Cervical spine somatic dysfunctions may contribute to postural strains and lead to pain in the chest and upper thoracic regions. Anterior structures, including the costochondral and chondrosternal joints, should also be examined.[27] Other key areas to assess may include the diaphragm, thoracic outlet and upper extremities. It is important to do a complete structural exam so as not to miss dysfunctions in other areas that may be contributing to the presenting pain.

TABLE 1:

Osteopathic Structural Findings Associated with Non-musculoskeletal Causes of Chest Pain.[24]

	OSTEOPATHIC FINDINGS	
Origin	**Viscerosomatic Reflexes**	**Chapman Points**
Cardiac	T1 - T5	Anterior: 2nd ICS Posterior: T2 lamina of TP
Pulmonary	T2 - T7	Anterior: • 3rd ICS: Upper Lung • 4th ICS: Lower Lung Posterior: • Between T3-T4 TP: Upper Lung • Between T4-T5 TP: Lower Lung
Gastrointestinal	Upper GI Tract (Stomach-Duodenum): T5-T9 Middle GI Tract (Jejunum - Proximal transverse colon): T10-T11 Lower GI Tract (Distal 1/3 of transverse colon - Rectum): T12-L2	Anterior Points: • 5th ICS: Liver, Gallbladder (right), Stomach acid (left) • 6th ICS: Gallbladder (right), Stomach peristalsis (left) • 6th or 7th ICS: Spleen (left), Pancreas (right) • 7th - 10th ICS: Small intestine • Tip of 12th Rib: Appendix Posterior Points: • Between T5 - T6 SP: Liver (right), Stomach acid (left) • Between T6 - T7 SP: Liver, Gallbladder (right), Stomach peristalsis (left) • Between T7 - T8 SP: Spleen (left), Pancreas (right) • Between T8 - T 11 SP: Small intestine • T12 TP: Appendix

Abbreviations: ICS - intercostal space; SP - spinous process; TP - transverse process.

A neurologic examination can be conducted to assess sensory and motor disturbances, evaluate peripheral reflexes and to rule out compression of cervical or thoracic nerve roots. Laboratory or radiographic studies can be conducted to rule out cardiac, pulmonary or abdominal disease, to assess for rheumatic disease and to directly assess specific anatomic regions of the chest wall.[10]

OSTEOPATHIC EVIDENCE-BASED TREATMENT

Once a musculoskeletal cause for chest pain has been determined, the osteopathic physician can treat it medically, as shown in Table 2, and with Osteopathic Manipulative Treatment (OMT) There are a limited number of high-quality studies available showing effective management of musculoskeletal thoracic pain.[28] However, manipulation can be an important aspect of treatment that should be considered in patients presenting with musculoskeletal chest pain. A recent systematic review investigated the effectiveness of non-invasive interventions for patients with chest pain and found that manipulation, as compared to acupuncture and placebo, may lead to a reduction in pain intensity. It was also noted that patients with a recent onset of pain who received multimodal management were 40% more likely to report improvement in their chest pain. This multimodal approach can include manual therapy, soft tissue therapy, exercise, heat or ice application and advice.[28]

The goals of osteopathic manipulative treatment are to relieve pain, improve circulatory and lymphatic function and to normalize autonomics or any viscerosomatic reflexes. The choice of technique to utilize depends on the patient's somatic dysfunction findings and the physician's comfort in performing the technique. In general, direct techniques, or treatment modalities that place the body into structural restrictions to treat the dysfunction, may be too painful in an acute presentation. Indirect techniques tend to be gentler and should be considered if the patient cannot tolerate direct techniques due to pain. The manipulative prescription will vary based on the patient presentation and the patient's response to treatment.[29]

TABLE 2:

Management of Musculoskeletal Chest Pain. [27]

	Considerations	Examples
Heat / Cold	Overload and overuse injuries may lead to muscle strains. Encourage patient to stop activity that may further exacerbate the injury.	Heat: Muscle spasm Cold: Reduce swelling and discomfort, acute
Topical Agents	Counsel patients on safety of application.	Capsaicin cream Salicylate-containing cream or gels Topical NSAIDs Lidocaine Patch
NSAIDs	Often used and important in patients with inflammation. Be sure that patients are aware of potential adverse effects (i.e. peptic ulcer disease, exacerbation of renal insufficiency) and that they are taking these medications appropriately.	Ibuprofen Naproxen
Muscle Relaxants	May be used, especially with acute muscle spasm. Avoid long term therapy, use in elderly patients and patients with a history of drug abuse.	Cyclobenzaprine Methocarbamol Benzodiazepines
Antidepressants	Can be used for chronic pain or pain that is neuropathic or osteoarthritic in origin.	Tricyclic antidepressants SSRIs and SNRIs
Anticonvulsants	Chronic pain	Gabapentin
Injections	Can use local glucocorticoid and/or anesthetic, often useful for arthritic pain	Hydrocortisone Methylprednisolone Triamcinolone
Narcotics	Avoid in patients with musculoskeletal chest pain. Should only be considered in isolated cases of acute exacerbations.	Short-acting, mild (i.e. codeine)
Psychiatric Evaluation	Evaluate patients for psychiatric factors that may contribute to presenting symptoms	Anxiety, depression, panic attacks

TABLE 3:

Osteopathic Manipulative Treatment

Technique	Basic Steps[24]	Indications	Cautions[24]
Myofascial Release	Direct or Indirect technique; There are many variations of myofascial release. Once an area of altered fascia has been identified, it is important to remember the mechanics involved, the anatomic relationships of the area being treated, and neural influences. A parallel or perpendicular stretch can be applied to hypertonic muscles.	Presence of somatic dysfunction in the connective tissues, i.e. fascia, muscles.[24] Helpful in patients with musculoskeletal chest pain.[4]	Open wounds, fractures, concomitant disease, internal injuries.
Facilitated Positional Release	Indirect technique; Place the patient in a neutral position while monitoring the point. A force of compression, traction, or torsion is then applied to release tissue tension and/or articular restriction.	Can be used to address superficial tissue texture change, as well as deep intrinsic muscles.[24]	Use caution in patients with osteoporosis, malignancy, rheumatologic disorders, congenital malformations, or stenosis.
Counterstrain	Indirect technique; Once most tender point is located, establish a pain scale. Passively position patient to position of greatest ease and reduced tenderness. Hold position for 90 seconds (120 seconds for ribs) while patient is relaxed.	Presence of tender points;[24] useful in patients with fibromyalgia.[30]	Fracture or ligamentous tear
Progressive Inhibition of Neuromuscular Structures	Direct technique; Locate a "primary point" (PP), the most sensitive point in the region. Locate an "end point" (EP), a point proximal or distal to the first. Determine a path between the two points. Maintain pressure on EP throughout. Initiate pressure at PP for 20-30 seconds. Compare sensitivity of PP to a secondary point (SP). If PP is less, continue with SP's until 2 cm from EP.	Hypertonicity of muscles. Hypertonicity of the pectoralis minor muscle has been associated with chest pain.[24]	Few contraindications. Avoid use with localized inflammation, abscesses, or infection.
Muscle Energy	Direct technique; Bring joint to the "feather's edge" of the restrictive barrier and direct the patient to move that part towards the direction of freedom. Physician applies an isometric counterforce to resist movement for 3-5 seconds, followed by post-isometric relaxation for 3-5 seconds. Re-engage barrier and repeat 3-5 times.	Consider treating muscles of respiration which may be restricting proper rib motion.	Patient unable to follow verbal commands. Patient with low vitality (i.e. post-surgical, post-myocardial infarction). Use caution in patients with acute injury.
Articulatory	Direct technique; Repetitive movement of a joint through its full motion until the restrictive barrier is engaged to increase range of motion.	Use when restrictive barrier is in the joint or periarticular tissues. Arthritic and frail patients tolerate this well.[24] Helpful in patients with musculoskeletal chest pain.[4]	Fracture/dislocation, neurologic entrapment, vascular compromise, local malignancy, local infection, bleeding disorder.
High Velocity Low Amplitude (HVLA)	Direct technique; Engage the barriers, while isolating the segment to be treated. A short and rapid thrust should be applied to the area during exhalation.	Somatic dysfunction with a firm barrier.[24] Has been shown to be useful in patients with musculoskeletal chest pain.[3,4] Can be used on spine and ribs to help mobilize thoracic cage.	Local metastases, osseous or ligamentous disruption. Cervical HVLA: Advanced rheumatoid arthritis, Down syndrome, advanced carotid disease.
Lymphatic Drainage	Always free restrictions at transition areas/ diaphragms first. Many different vibratory or oscillatory techniques can then be used to augment movement of lymph.	Acute somatic dysfunction, sprains/strains, inflammation, edema, tissue congestions.[24]	Deep venous thrombosis, certain stages of cancer, certain bacterial infections.

There are many different osteopathic manipulative techniques that can be utilized to address musculoskeletal chest pain. Myofascial release and soft tissue techniques can be used to reduce muscle spasm and restore symmetry, especially in patients with acute musculoskeletal chest pain.[4,24] Progressive inhibition of neuromuscular structures (PINS) and facilitated positional release (FPR) are also useful for decreasing hypertonic muscles.[24] Counterstrain is an effective technique for patients presenting with specific tender points, such as those seen in patients with fibromyalgia.[24,30] Articulatory techniques, including high-velocity low-amplitude (HVLA), can help to mobilize the thoracic cage in patients who present with decreased rib excursion, decreased range of motion, or facilitated segments with a firm endpoint.[3,4,24] Muscle energy and FPR may also be helpful with improving range of motion and decreasing muscle hypertonicity. Lymphatic techniques should be considered in patients with congestion, inflammation, or edema that may be contributing to chest pain, such as in cases of costochondritis and thoracic cage strains or sprains.[24] Gentle techniques may help balance autonomics in patients. Recent studies have shown that certain techniques have an effect on heart rate variability, increasing parasympathetic and decreasing sympathetic activity, in healthy subjects. There may be a role for these techniques in treating viscerosomatic reflexes post acute cardiac events.[31, 32] See Table 3 for a summary of possible techniques that can be used for patients with musculoskeletal chest pain, along with indications and cautions.

SUMMARY & CONCLUSION

Musculoskeletal problems are a common cause of chest pain in adults presenting to primary care physicians. The differential diagnosis of patients presenting with chest pain ranges from benign musculoskeletal etiologies to life-threatening disease. It is important to rule out cardiovascular, pulmonary and gastrointestinal causes of chest pain first. Reproducible chest wall tenderness is a major hallmark of chest pain of musculoskeletal origin. Integrating an osteopathic approach and manipulative treatment into patient care enables the physician to better diagnose and manage chest wall pain, especially when it is musculoskeletal in nature.

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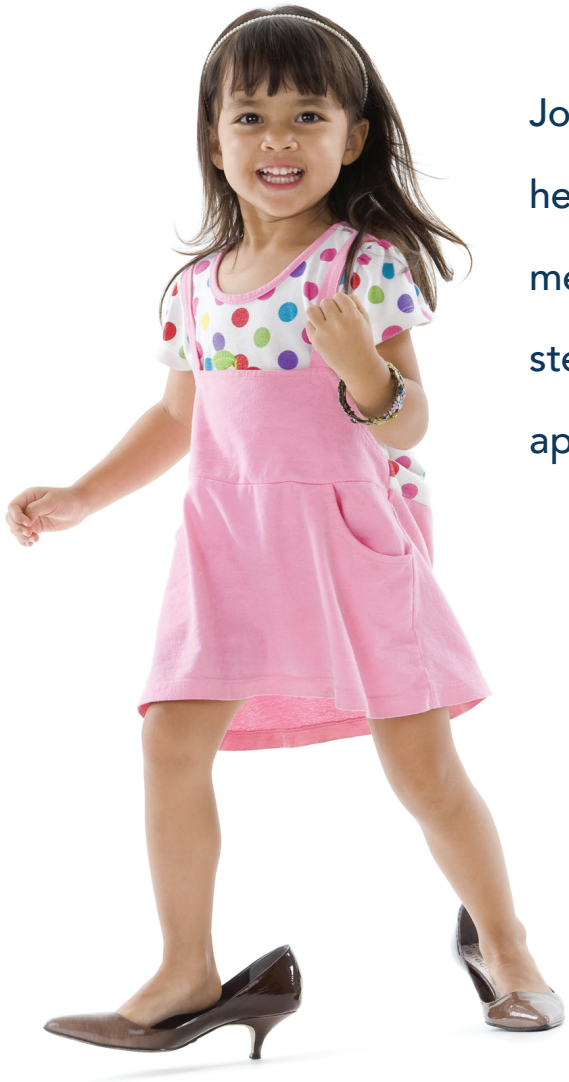

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