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Uncontrolled Asthma: Osteopathic Manipulative Treatment Applied in a Rural Setting

Jesus Sanchez, Jr.

Asthma is a clinical entity with a constellation of symptoms that include wheezing, shortness of breath, chest tightness and cough.[1, 2] Elucidated pathways have revealed components of inflammation and bronchospasm of the airways that lead to intermittent airway obstruction causing difficulties in breathing, and in severe cases, asphyxiation resulting in death.[1, 3] Despite several experiments and numerous studies, asthma is not fully defined as of yet.

Exploring the natural history of asthma has raised awareness of the variability within the disease continuum.[1] Asthma commonly begins in infancy, as one study found, 5% of infants had at least one physician encounter for reported wheezing within the first year of life.[4] The age range from infancy into adolescent years found asthma to be associated more with exposure to respiratory infections, such as Respiratory Syncytial Virus (RSV), and persistent symptoms of asthma occurring in those children with atopy.[5] Asthma that is termed "allergic," was found to develop most often during the second decade of life with some persistence into adulthood.[1]

Epidemiology

It is estimated that asthma affects 5% of the population in the United States, accounting for approximately 4,500 deaths, 470,000 hospitalizations and two-million emergency department visits annually.[1] The Center for Disease Control and Prevention reports that the prevalence of asthma among children in the U.S. has increased from 3.6% in 1980 to 5.8% in 2003. Additionally, asthma was found to be the third leading cause of hospitalization of people under the age of 18 years, trailing only pneumonia and injuries.[3]

In 2002, the National Health Interview Survey by National Center for Health Statistics and CDC reported 30.8 million people having been diagnosed with asthma during their lifetime. Adults had a lifetime asthma diagnosis of 21.9 million compared to 8.9 million for children 0-17 years. Among all racial and ethnic groups, Puerto Ricans have the highest rate of lifetime asthma. Puerto Ricans were almost 80% more likely, and non-Hispanic blacks and American Indians were about 25% more likely to have ever been diagnosed with asthma than non-Hispanic whites. In adults, females were 7% more likely than males to be diagnosed with asthma, but among children males were more likely, than females to have an asthma diagnosis.[7]

Furthermore, children between the ages of 5 to17 years missed 14.7 million school days due to asthma. The data also showed that there were 13.9 million outpatient and private physician visits, 1.9 million visits to the emergency deptartment, 484,000 hospitalizations for asthma, and 4,261 deaths. Females had a 50% higher outpatient visit rate compared to males. Non-Hispanic blacks were most likely to die from asthma, and had an asthma death rate over 200% higher than non-Hispanic whites and 160% higher than Hispanics.

Pathophysiology

Asthma as a disease has been characterized by intermittent airway obstruction, also termed reversible airway obstruction. It is proposed to consist primarily of two major components. The first component is bronchospasm or hyperresponsive bronchial smooth muscle, which is mediated through beta-adrenergic receptors and interlukin-13 (IL-13) that act directly on bronchial smooth muscle and epithelium to elicit hyperreactivity.[1] The second component is the inflammatory mechanism leading to edema of the airways. Two principal immune mechanisms linked to the inflammatory process involve the T helper cells, of which secrete multiple cytokines and interleukins, and the hypersensitivity pathway as mediated by IgE produced by the B cells, which leads to activation and degranulation of mast cells, basophils, eosinophils and other airway cells.[2] This in turn leads to the well-known process of histamine release and the subsequent inflammatory response.

Gross pathologic features consist of over inflation of the lung through a process known as "air-trapping," especially in individuals who expire in status asthmaticus. Other features are the mucus plugs, composed of mucus, serum proteins, inflammatory cells and debris, occluding the medium and small-sized bronchi and bronchioles. In fact bronchiectasis has been described as a complication in 15 % to 20% of asthmatic patients. Microscopic pathologic features include both goblet cell hyperplasia and submucosal gland hypertrophy. One study reported that there may be up to a three-fold increase of both goblet and mucin cells in asthmatic patients vs. controls.[6]

Repetitive episodes of inflammation lead to a production of matrix proteins and growth factors that in turn can potentially cause airway remodeling. This may include the theory that frequent damage to the epithelium and subsequent repair also contribute to remodeling. It is also thought that remodeling, with increased muscle mass, mucosal edema and reduced elasticity, may lead to decreased efficacy of bronchodilators.[1]

Anatomic considerations

There are key anatomic considerations when utilizing osteopathic manipulative treatment (OMT) in asthmatic patients. The thoracic cage houses some of the most important organs in the human body, namely the heart, lungs and great vessels. It is one of the most intricate and dynamic regions of human anatomy, with an orchestrated movement of over 146 joints.[17, 18] Although asthma is considered a disease of the respiratory system, the osteopathic approach will evaluate the thoracic cage itself as well as the anatomic regions above and below the thorax. The thoracic inlet and thoracic vertebrae T1 are well documented as being transition zones between the cervicothoracic junction and the site of somatic dysfunctions

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via the concept of the facilitated segment. Specifically, viscerosomatic reflexes of the sympathetic nervous system have been identified in the region of T1-6.

Another, important consideration is the perpetually dynamic interplay between the autonomic (sympathetic and parasympathetic) nervous system. The sympathetic nerve fibers of the lungs arise from the sympathetic chain ganglion at the level of T1-6. While the parasympathetic nerve fibers travel within the vagus nerve as it exits the jugular foramen of the cranial vault and makes its way down the cervical region and through the thoracic inlet, where it then diverges onto the lungs. Therefore, while the osteopathic physician may alter sympathetic outflow by directly working on the thoracic vertebrae, a change in the parasympathetic outflow will require intervention above the thorax in the cervical region, specifically the atlantoccipital joint (C1) and atlantoaxial joint (C2) level, as well as the cranial vault.

Yet another major anatomic component to address is the diaphragm. With the average respiratory rate between 10 to 18 breaths per minute, at minimum the diaphragm will move approximately 14,400 times in a day. The role of the diaphragm goes beyond mere movement as it is intimately connected to the cardiac and pulmonary pleura above and the hepatic and gastric pleura below. In essence, the movement of the diaphragm not only changes the intra-thoracic and intra-abdominal pressures, but also alters the circulation and lymphatic flow in these respective areas.[17] Finally, the mechanical movement of the diaphragm provides an intermittent compressive force on the previously mentioned organs that resembles a visceral "massage" of both the thoracic and abdominal contents.

Osteopathic principles and philosophy

Focusing on the patient as a "whole," is a simplified view of the principles and philosophy of osteopathic medicine. Andrew Taylor Still, MD, DO, founded osteopathic medicine in 1874 and during this time established the tenets of the body's own inherent capacity for health and well being, the importance and interrelationship between structure and function, the removal of impediments to the optimal flow of the body's fluids and nerve function, and the concept that the body is an integrated unit.[14] To achieve this one must look at a patient collectively and evaluate their physical, mental, emotional and spiritual state. Additionally, in today's world, the clinician must also consider psycho socioeconomic implications that patients face. In fact, numerous studies have mentioned the significant impact of emotional triggers and poor-outcomes in asthmatic individuals with inadequate support systems and insufficient self-care. Not to mention the national and global difficulties in providing accessible healthcare for impoverished patients. Even if patients were able to receive the medications indicated, their response to these medications, as discussed earlier, would be dependent on multi-factorial elements ranging from genetics to the environment. In short, one would have to approach the patient as an individual and treat the person, not the disease.

Elucidation of applicable techniques

Given the above discussion, OMT can provide several different modalities that may benefit an asthmatic patient. First, by using myofascial release (MFR) and balanced ligamentous tension (BLT) to address thoracic cage and diaphragm impediments, one can restore optimal diaphragmatic motion for that patient. Additionally, an articulatory technique such as "rib raising" will help to mobilize the thoracic cage, as well as, stimulate the sympathetic chain ganglion and alter sympathetic outflow to the visceral organs. Similarly, using soft tissue techniques such as paraspinal inhibition of the cervical region and a suboccipital release will alter the parasympathetic outflow. This dynamic interplay will promote a balancing between the bronchodilation and bronchoconstriction and pulmonary secretions controlled by the autonomic nervous input. Finally, osteopathy in the cranial field has been shown to be extremely effective in patients who have suffered a hard fall with mechanical injuries to the head or sacrum that have triggered an asthma attack.[19]

Evincing case study

During a rural rotation, a twelve year-old female patient with a history of uncontrolled severely persistent asthma was brought in by her mother from school to the clinic. This patient was well known to the clinic, as she would be seen 2-3 times per week for her symptoms. She was often times sent to the clinic during school hours. The patient comes from an economically challenged family and was also noted to be non-compliant with her medications. On this particular visit, the patient ran out of her albuterol MDI and was having an asthma attack. The clinic staff approached the patient in a somewhat dismissive manner, stating that the patient was only trying to get out of school. Upon examination, the patient exhibited diffuse expiratory wheeze throughout all lung fields, moderate accessory muscle use and a pulse oxymetry reading of 93%. The staff was immediately notified to begin a nebulized albuterol treatment. The benefits and risk of Osteopathic Manipulative Treatment were explained to both the parent and patient and consent was obtained. Structural examination revealed Occipitoatlantial joint to be extend rotated right- side bent left with compression, cervical paraspinal hypertonicity, thoracic inlet restriction, T1 flexed rotated right- side bent right, right ribs 1-5 inhalation somatic and bilateral diaphragm restriction with paradoxical motion. During the interim of standard medical care, the patient was given OMT that included a subocciptal release and rib-raising articulation. During the administration of these techniques the patient's oxygen saturation increased from 93% to 97% and was noted to have decreased involvement of accessory muscles use prior to medication administration. The treatment was continued concomitantly as the nebulized albuterol treatment was delivered. Upon completion of the osteopathic and pharmacological intervention, the patient's accessory muscle use subsided and the oxygen saturation stabilized at 98%.

This patient did not return to the clinic for approximately 12 days. Given this patient's previous pattern of two to three clinic visits per week, it would appear that the OMT utilized helped temporarily stabilize her symptoms for a significant number of days. One may argue that refilling her medications was what improved her symptoms. However, it was well known that the patient had exacerbations of her symptoms despite the frequent use of her medications. Therefore, the osteopathic approach utilized on this patient appears to have made an impactful change to the disease pattern and use of healthcare resources.

Discussion

Given its multi-factorial nature, asthma is difficult to treat and requires a comprehensive evaluation on the part of the clinician. A multifaceted approach, including diet, allergen prevention, medication, and alternative modalities such as Osteopathic Manipulative Treatment may work synergistically to control the symptoms of an asthmatic patient and potentially modify the severity. It has been the experience of this author that Osteopathic modalities applied to asthmatic patients during an exacerbation has allowed for rapid resolution of symptoms, prior to and during the administration of any medication. The clinical experience gained from this case study has inspired this author to develop a current research project on the efficacy of Osteopathic Manipulative Treatment in the asthmatic population. This research has received IRB approval and is currently ongoing.

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Please address correspondence to:

Jesus Sanchez, Jr., DO
Downey Regional Medical Ctr
11500 Brookshire Ave.
Downey, CA 90241

CME Quiz

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