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Osteopathic Manipulative Medicine in the Treatment of Hypertension: An Alternative, Conventional Approach

[Reviews in Depth: Review in Depth]

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Abstract

The branch of medicine known as osteopathy was founded by Andrew Taylor Still in the mid to late 19th century. Osteopathy is a philosophy of medicine. Osteopathic physicians use techniques collectively referred to as osteopathic manipulative medicine (OMM). One of the most common diseases suffered by those residing in westernized nations is hypertension. Although osteopathic physicians are taught to incorporate OMM into the management of medical disorders, the usefulness of OMM in treating hypertension is less clear. This review reflects on the past 90 years of biomedical literature and attempts to address the utility of OMM used alone, or in combination with other treatments including antihypertensive medication, for the effective management of hypertension. Preliminary evidence may suggest a role for OMM in treating hypertension within the context of a multifaceted and long-lasting treatment regimen that may include traditional pharmacotherapeutics. To have universal acceptance, controlled and blinded outcome studies are needed to determine the effectiveness of OMM for the routine treatment of hypertension.

Elevated systemic blood pressure is one of the most prevalent and important public health concerns in both westernized and developing countries. It is estimated that there are nearly 50 million hypertensive patients in the United States alone. [1] Our basic understanding of the etiology and pathophysiology of elevated arterial pressure has improved over the years. However, in 90% to 95% of existing cases, the etiology and thus the potential means of prevention or cure is still largely unknown. [2] As a consequence, most cases of hypertension are treated nonspecifically, resulting in a large number of minor side effects from treatment and a relatively high (50–60%) noncompliance rate. [2] Several studies have demonstrated that improved control of blood pressure in hypertensive patients has a significant impact on morbidity and mortality from cardiovascular disease and stroke. [3–6] However, the third National Health and Nutrition Examination Survey (NHANES III) trial demonstrated that only 53% of patients treated for hypertension had blood pressure actually controlled to less than or equal to 140/90 mm Hg. [1] Given these data and the seriousness of the effects of hypertension on the individual and society as a whole, both economically and socially, the physician must look for more effective ways to approach the hypertensive patient. Can osteopathy contribute to the physicians' ability to more effectively combat hypertension?

The intellectual roots of osteopathic medicine were conceived in the mid to late 1800s by Andrew Taylor Still, MD, who believed the medical practices of the day often caused more harm than good. Still focused on developing a system of medical care that would promote the body's innate ability to heal itself. Osteopathic medicine is an established and recognized system of diagnosis and treatment that emphasizes the structural and functional integrity of the musculoskeletal and other organ systems of the body. [7] Osteopathic physicians use their hands to diagnose and treat somatic dysfunction. A somatic dysfunction is defined as an impaired or altered functional state of related components of the soma. [7] Somatic dysfunction is a very broad term that involves disharmony of the connective tissue, muscle, bone, joint, nerve, and/or fluid, including lymph. The diagnosis of a somatic dysfunction is based on the physician's palpatory skills. Through years of experience, physicians who practice osteopathic manipulation learn how to discern subtle changes in tissue texture. For example, soft tissue may take on a "boggy" feel due to small amounts of edema. Chronic alterations of tissue have a more "ropy" texture.

The osteopathic manipulative techniques used are categorized according to the physician's findings such as generalized muscle spasm, bony alterations, or even somatic responses to visceral disease. Patient participation in these techniques is also considered. [7] For example, in a patient who has spasm of the myofascia, the physician may use isometric contractions to activate the Golgi tendon reflex to inhibit neuronal impulses at the spinal level. This will help to relax extrafusal fibers of

the main muscle mass. Thrusting techniques ("joint-popping") are sometimes used to increase the motion of small- or large-caliber joints. Operator generated rhythmic motions may propel lymphatic fluids. Other more subtle approaches may involve spontaneous release of soft tissue strain by turning down gamma gain to the involved pathology and thus providing for a more normal relationship of the length of the extrafusal to intrafusal muscle fibers. Osteopathic considerations also include the articulations, membranes, fluctuation of the cerebrospinal fluid, motility of the central nervous system, and the connective tissue attachments of the cranium to a mobile pelvis. Also, the operator may create a manual fulcrum and observe the unfolding of the body's inherent biodynamic healing forces. The end point of 1 or a combination of the above approaches may allow for a normalization of imbalances between the sympathetic and parasympathetic nervous systems, and improved vascular motion which would result in a more balanced homeostatic mechanism.

A review of the literature reveals that osteopathic manipulative medicine (OMM) has been demonstrated to be of benefit to some patients with a wide variety of cardiovascular diseases. [8–14] The majority of this literature examines the effect of OMM on hypertension. This paper will focus on the latter and explore the utility of OMM as a therapeutic modality in the treatment of hypertension.

THE UTILITY OF OSTEOPATHIC MANIPULATIVE MEDICINE

Early Studies

As early as 1914, John Downing concluded that osteopathic treatment offered one of the best methods of normalizing abnormal blood pressure. [8] Downing found that OMM helped decrease blood pressure presumably by improving cardiovascular circulation and relaxing the musculoskeletal system. Confirming the results of Downing almost 50 years later, Thomas Northup in 1961 offered OMM as a method to relax tense tissue and lower blood pressure. [9] Several cases were outlined in which OMM was helpful in reducing both systolic and diastolic blood pressure. Northup found that the most effective of such techniques involved cranial manipulation, which, for example, involves gentle mobilization of the temporal bones. Osteopathy in the cranial field may facilitate better central venous drainage by alleviating dural tension and restriction of the bones, which compromise the jugular foramen. The relationship of the cardiorespiratory centers of the medulla to the fourth ventricle are also appreciated and "cradled" by the osteopathic physician. In addition, Northup used techniques to rotate specific vertebrae while providing mild traction to the cervical spine. In 1964, Harold Blood described several OMM approaches that he used to successfully treat hypertension. [10] Several patients with moderate hypertension were kept normotensive via manipulation. Patients with higher blood pressures were adequately treated with a combination of manipulation and pharmacotherapeutics.

Recent Studies

In the late 1960s, Celander et al and Fichera et al described alleviation of hypertension through the use of soft tissue manipulation of the upper thoracic and cervical vertebrae in both humans and dogs. [15,16] This study noted a cumulative synergism of multiple simultaneous treatments accomplishing a greater blood pressure reduction than a single treatment. In addition, Celander et al examined the effect of OMM on the autonomic nervous system by studying the fibrinolytic enzyme system and fibrinogen levels. The application of soft tissue manipulation therapy caused a decrease in plasma fibrinogen and total fibrinolytic activity consistent with an increased parasympathetic tone and decreased sympathetic tone. By making these observations, the authors may have supplied the first basic scientific justification for the effects of OMM on hypertension and autonomic nervous function.

Brown and colleagues in 1970 conducted the first published larger-scale study on the effectiveness of soft tissue manipulation applied to the cervical and thoracic paraspinal muscles in reducing blood pressure. [17] With a patient pool of 86 individuals (44 hypertensive and 42 normotensive controls), significant reductions in both systolic and diastolic pressures were observed with OMM alone. The authors concluded that OMM should be considered in combination with various pharmacologic agents as an effective treatment modality for mild to moderate hypertension.

A year later, in 1971, Bayer reported on the application of OMM to treat hypertensive vascular disease of unclear origin. [18] In the report, Bayer put forth several hypotheses to explain the positive effects of OMM on elevated blood pressure. OMM was viewed as an agent of skeletal muscle relaxation and an anxiolytic, thus causing a decrease in mean arterial pressure, and was likened in this regard to a "physical placebo." Bayer went on to specifically describe a technique to relax the plantar fascia that produced a resultant decrease in systolic blood pressure. Primary musculoskeletal disorders were believed to be aggravators of hypertension in certain patients because of the mental and/or physical discomfort induced by these illnesses. OMM served to correct these dysfunctions, thereby reducing pain and improving mobility of the musculoskeletal system. Consequent reductions in blood pressure were attributed to reflex actions of the autonomic nervous system; reduction of the sympathetic and amplification of the parasympathetic nervous systems serving to decrease heart rate and lessen

vasoconstriction. Soft tissue myofascial techniques applied to the thoracic and lumbar spine were found to lower systolic pressure, and to a lesser extent, diastolic pressure. The rationale was that treating the thoracic and lumbar spine would lead to decreases in sympathetic tone to organs, tissues, and blood vessels of the body, thereby decreasing blood pressure. The intimate relation of the sympathetic division of the autonomic nervous system with the thoracic and upper lumbar spine, as mentioned by Bayer, could be taken advantage of to normalize these areas of the spine through osteopathic manipulation. Bayer concluded that while the use of OMM in managing essential hypertension was not a cure, it did represent a valuable adjuvant to the medical regimen.

Gerber reported on the workup and office management of hypertensive patients in 1976. [11] In support of previous studies, Gerber alluded to OMM as a beneficial treatment of hypertension and peripheral vascular disease. He hypothesized that techniques of manipulation might act to release vasodilative prostaglandins, either locally or in distant segmentally related vascular beds, thus leading to a decrease in blood pressure. In addition, Gerber saw manipulation as a method to decrease the state of excitability of the sympathetic nervous system, thus encouraging peripheral vasodilation and blood pressure reduction. In addition, OMM was offered as a way to promote the relaxation of tense muscles and increase flexibility, thus helping to reduce blood pressure.

In 1977, Stiles examined the osteopathic approach to treating hypertension. He observed that specifically designed and appropriately administered osteopathic care promoted a patients' emotional and musculoskeletal relaxation. [12] Stiles noted that the upper thoracic areas of the spine are the location for sympathetic ganglia that distribute postganglionic sympathetic outflow to the cardiac plexus. Stiles postulated that somatic dysfunction in the upper thoracic region could lead to facilitation (a lowering of the synaptic threshold of the dorsal horn of the spinal cord) of motor supply to the cardiac plexus, which may lead to tachycardia and/or increased stroke volume. Stiles additionally noted that sympathetic output from the thoracolumbar area sends vasomotor supply to both the adrenal glands and the kidneys. He noted that increased vasomotor tone to the kidney could increase peripheral resistance within the kidney, thereby decreasing glomerular flow. Secondary increases in the secretion of antidiuretic hormone from the pituitary gland, and aldosterone from the adrenal glands, could lead to retention of fluid and electrolytes. In addition, facilitation of sympathetic supply to the adrenals could cause increased production and secretion of catecholamines. Stiles observed that all of these factors could collectively contribute to a hypertensive state. Finally, Stiles described the role of poor lymphatic return on the total body physiology. Inefficient lymphatic flow produces an inability of protein substances to be adequately returned to the vascular system. Thus the patient with poor lymphatic return has the potential of developing a rapid hypoproteinemia, which may affect fluid and electrolyte balance, encouraging shifts of fluid from the intravascular to the extravascular compartments. The decreased intravascular volume would trigger the aldosterone and antidiuretic hormone compensatory mechanism, further complicating the hypertensive state. Stiles's report clearly supports a role for appropriately tailored and administered OMM in the management of hypertension.

Mannino performed a crossover study to ascertain the effect of osteopathic manipulation on serum aldosterone levels in hypertensive patients. [19] The study used Chapman's neurologic reflex techniques to treat the adrenal glands. These neurologic reflexes are mediated by excess sympathetic tone on the vasculature, including the arterioles, venules, and lymphatics. The response of the tissues may involve congestion and tension of the myofascia. The treatment involves a rotatory motion to points that are situated along the dermatomal lines of embryological development (Figs. 1–3);[20–22] in the case of the adrenal glands, along the lower thoracic region. Significant declines in aldosterone levels were observed within 36 hours of manipulation. However, no significant reduction of systemic blood pressure was demonstrated. Mannino hypothesized that manipulation-associated aldosterone reductions may have resulted from an interruption or dampening of a positive feedback loop to the adrenal medulla from the sympathetic nervous system. A dampening of the circulating catecholamine concentrations would diminish the effects on the cardiovascular reflex, which in turn exerts its influence on the renin-angiotensin-aldosterone axis. Mannino also questioned why the decrease in serum aldosterone did not lead to a significant alteration in blood pressure. He pointed out that each patient in the study did have a significant drop in blood pressure following the administration of spironolactone prior to the study. Mannino hypothesized that perhaps not enough time was allocated for an eventual decrease in blood pressure to develop. He noted that spironolactone typically takes 5 to 7 days to exert its maximal effect on blood pressure.

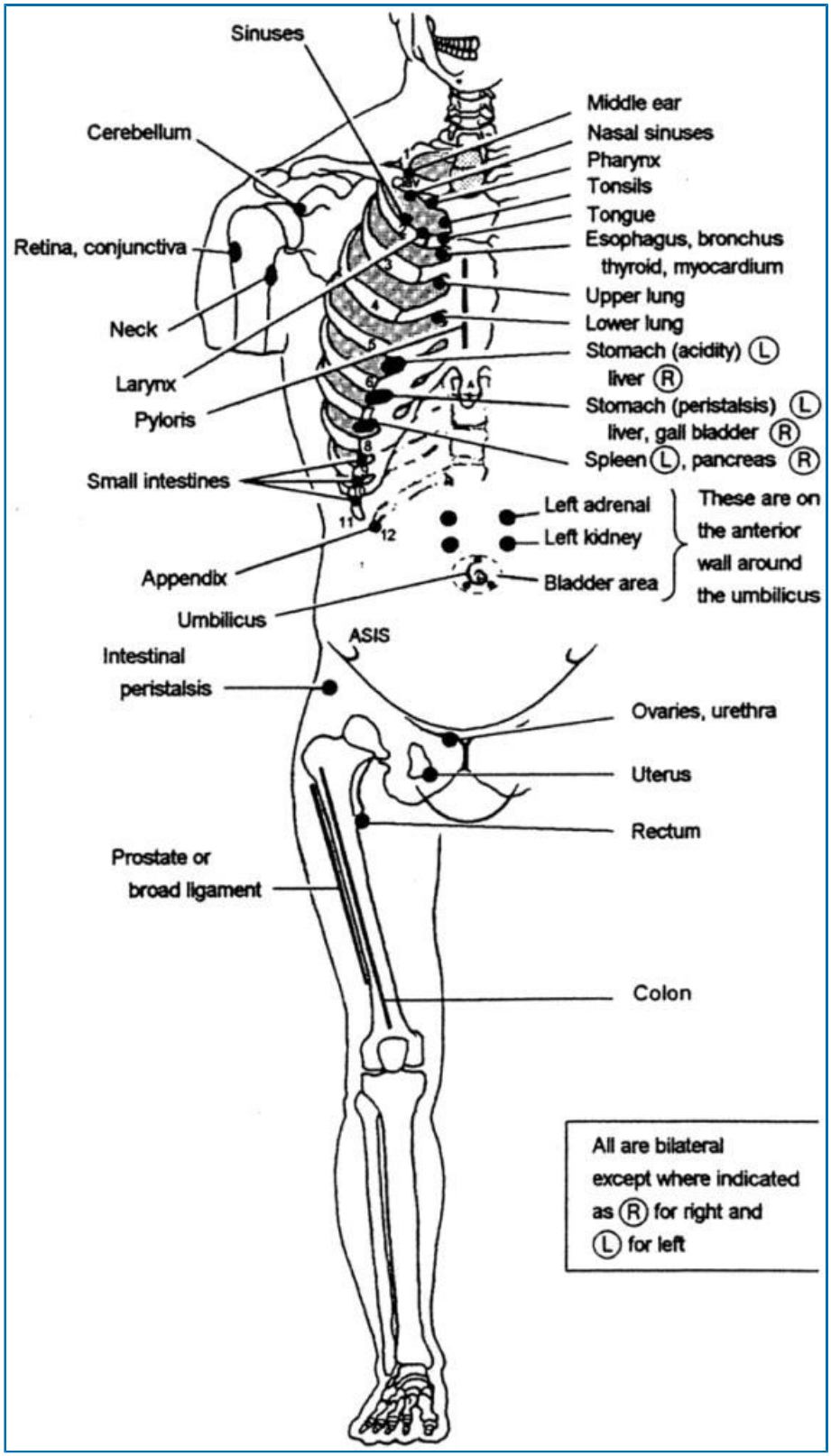

FIGURE 1. Chapman reflexes: anterior points. Reproduced with permission from Kuchera ML, Kuchera WA. *Osteopathic Considerations in Systemic Dysfunction*, 2nd ed. Columbus, OH: Greyden Press; 1994.

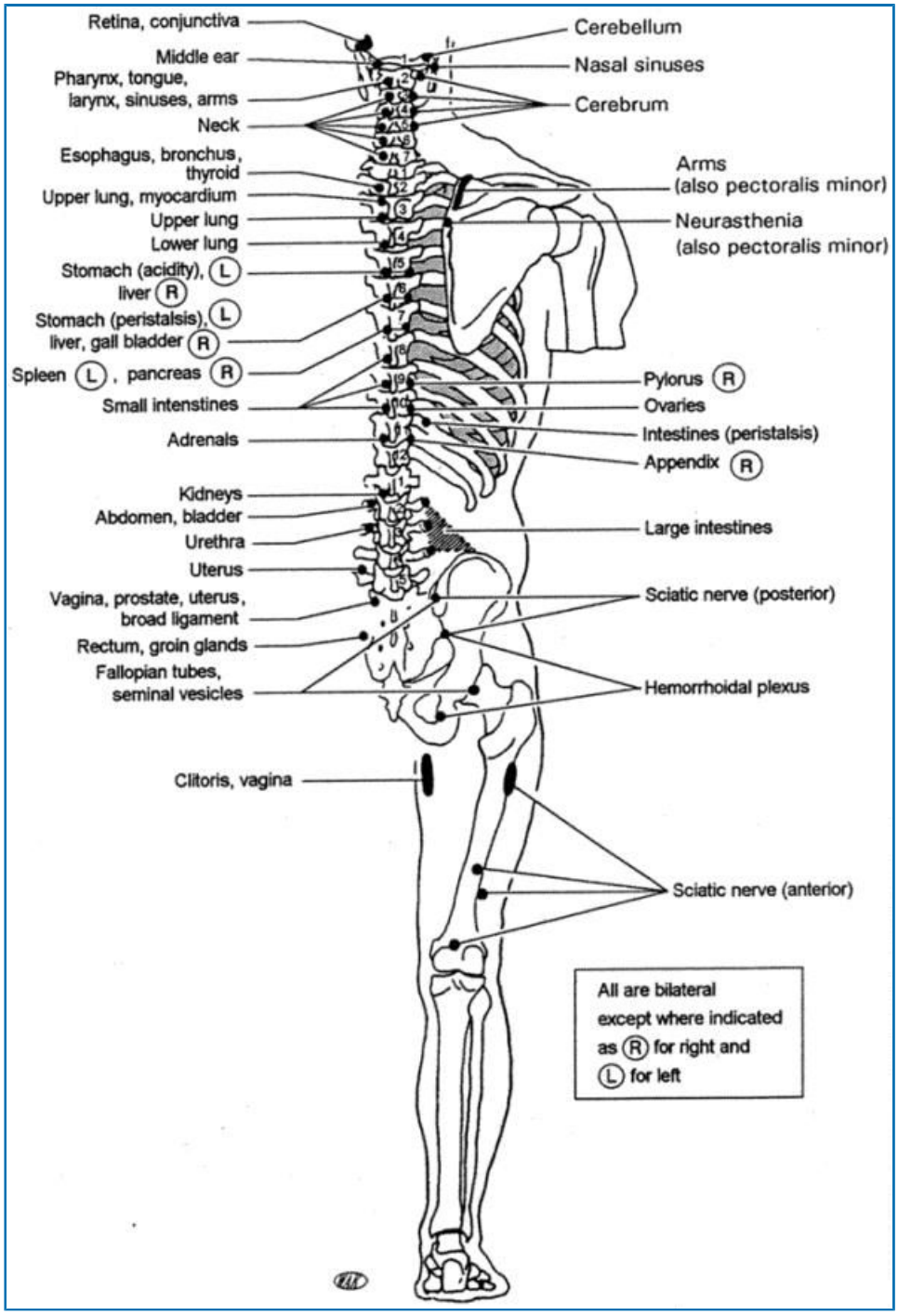

FIGURE 2. Chapman reflexes: posterior points. Reproduced with permission from Kuchera ML, Kuchera WA. *Osteopathic Considerations in Systemic Dysfunction*, 2nd ed. Columbus, OH: Greyden Press; 1994.

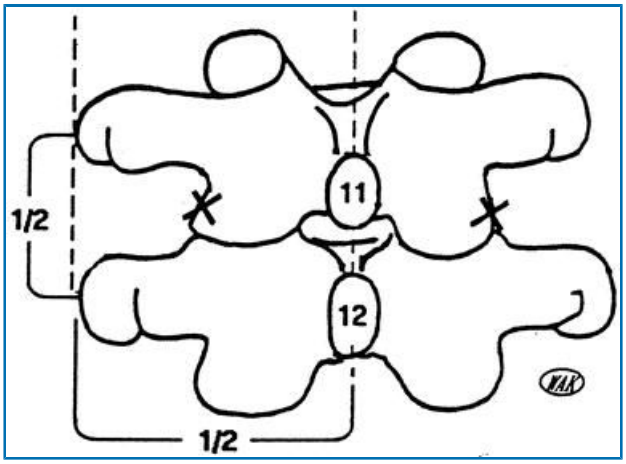

FIGURE 3. Rotatory stimulation of the posterior Chapman's points (T11-12) have been shown to effectively lower blood pressure and decrease serum aldosterone levels. Reproduced with permission from Kuchera ML, Kuchera WA. *Osteopathic Considerations in Systemic Dysfunction*, 2nd ed. Columbus, OH: Greyden Press; 1994.

Morgan and coworkers in 1985 studied the effects of osteopathic manipulative treatment on hypertension. [23] This controlled trial included 29 subjects who were randomly assigned to 2 treatment groups. The patients in group 1 received weekly spinal manipulation of the occipitoatlantal joint, T1 (the first thoracic vertebrae) through T5, and T11 through L1 (the first lumbar vertebrae). Those in group 2 received sham manipulation in the form of soft tissue massage of T6 through T10 and from L4 to the sacrum. The regions to be manipulated were chosen because a literature review indicated that manipulative treatment of these regions was routinely used in the management of patients with hypertension, and because major autonomic outflows are present at each location. Contrary to some of the previous studies, the results of Morgan et al failed to demonstrate a reduction or control of systemic blood pressure following either of the 2 manipulative treatments. Morgan et al noted the possibility that a different manipulative protocol effective at lowering systemic blood pressure might be found, and added that such an effective manipulative protocol could represent a safe and economical adjunct to drug therapy and lifestyle modifications in the treatment of hypertension. They called for future studies to investigate manipulative treatment protocols effective at lowering systemic blood pressure, and toward determining if certain types of hypertensive patients respond favorably to manipulative treatment.

Case reports have demonstrated significant improvement of urinary output with osteopathic manipulative treatment in patients who were refractory to conventional treatment. [24,25] One such case was a 19-year-old African American woman who presented with oliguria and peripheral edema secondary to nephrotic glomerulopathy. The patient was treated with diuretics and albumin. However, there was no response to treatment by the fifth day of hospitalization. The patient was subsequently treated with osteopathic manipulation. Within 45 minutes, a diuresis of 400 mL was noted. Over the next 2 days the patient voided several more liters of urine. The patient was not only discharged at day 8, but treatment with cyclophosphamide was also avoided. The osteopathic treatment of this patient was directed to the thoracolumbar junction, which is an area of sympathetic output to the adrenal glands and kidneys. The soft tissues of the suboccipital and sacral areas were also addressed with osteopathic manipulation to allow for uninhibited parasympathetic nerve flow to the kidneys, ureters, and adrenal glands. In addition, the operator released tensions in the myofascia of the thoracoabdominal diaphragm, which allowed for a more negative chest pressure to improve lymphaticovenous return. Induction of rhythmical motions throughout the body further encouraged fluid movement to the intravascular space with eventual excretion of excess fluid.

DISCUSSION

Osteopathic manipulative therapy has long been used in the treatment of a wide variety of illnesses including hypertension. Much of the past literature reflects clinical observations made by physicians in their offices. There are too few controlled studies on the use of OMM in the treatment of hypertension to adequately assess the effectiveness of this form of treatment. One controlled study has revealed no benefit of OMM in reducing blood pressure; however, it did affect an endocrinologic mechanism implicated in hypertension. [19]

From a physiologic perspective, the rationale of why OMM might work to lower blood pressure is understandable. Most individuals with essential hypertension demonstrate vascular and cardiac hyperreactivity to sympathetic stimuli. [20] A prolonged sympathetic stimulus to the kidney creates a functional retention of water and salt, thereby increasing arterial pressure. [20] Increased sympathetic tone produces an increased catecholamine secretion. Catecholamines stimulate

vasoconstriction in the subcutaneous, mucosal, splanchnic, and renal vascular beds by [alpha]-receptor–mediated mechanisms. Catecholamines increase myocardial contractility, heart rate, and cardiac output. Sympathetic stimulation also increases renin release by a direct [alpha]-adrenergic receptor-mediated effect. Since renin secretion activates the angiotensin-aldosterone system, angiotensin-induced vasoconstriction supports the direct effects of catecholamines on blood vessels. Aldosterone-mediated sodium reabsorption complements the direct increase in sodium reabsorption induced by sympathetic stimulation. 19 These factors promote a hypertensive state. Therefore, the use of OMM to decrease sympathetic tone can be theorized to promote a reduction of blood pressure.

From an anatomic perspective, the preganglionic neurons of the sympathetic nervous system exit the spinal cord in the region of the thoracolumbar spine. (Fig. 4). 21 The preganglionic neurons of the parasympathetic nervous system leave the central nervous system in the third, seventh, ninth, and tenth cranial nerves and in the second through fourth sacral nerves (Fig. 5). 21 In addition, the relationship of the sympathetic chains to the ribs is important (Fig. 6). 21 The sympathetic chains lie immediately anterior to the heads and necks of the ribs in the thorax. The sympathetic ganglia lie inferior to the junction between the head and neck of the ribs but posterior to the pleura. Osteopathic manipulative medicine seeks to take advantage of these anatomic and physiologic relationships in the treatment of hypertension. Osteopathic manipulation of the thoracic spine and ribs offers a method to modulate the sympathetic tone to the heart, kidneys, adrenal glands and peripheral vasculature. A reduction of sympathetic tone leads to a decrease in blood pressure, while an increase of parasympathetic tone also leads to a reduction in blood pressure.

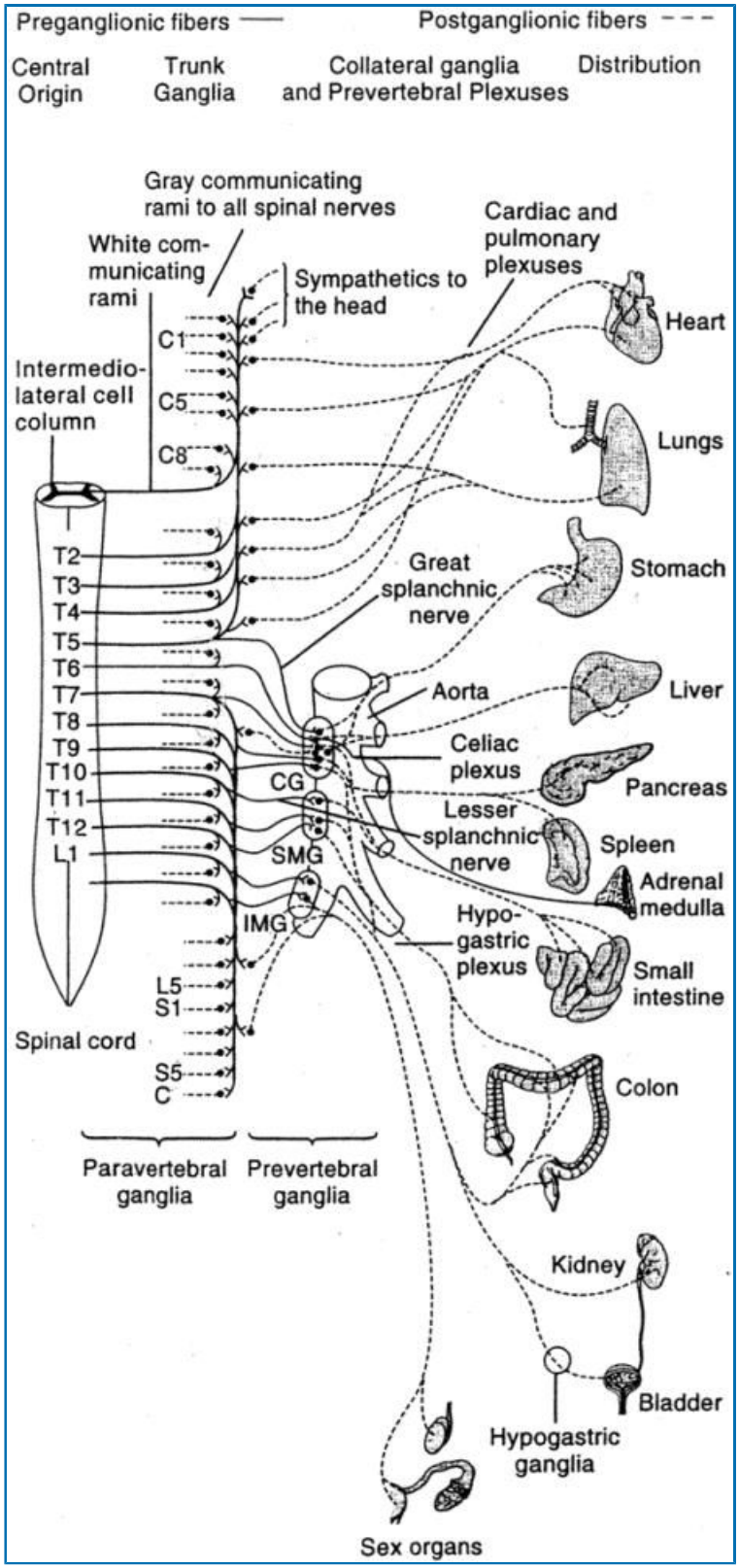

FIGURE 4. Sympathetic division of peripheral autonomic system. CG indicates celiac ganglion; IMG, inferior mesenteric ganglion; SMG, superior mesenteric ganglion. Reproduced with permission from Chusid JG. *Correlative Neuroanatomy and Functional Neurology*. Los Altos, CA: Lange Medical Publishers; 1985.

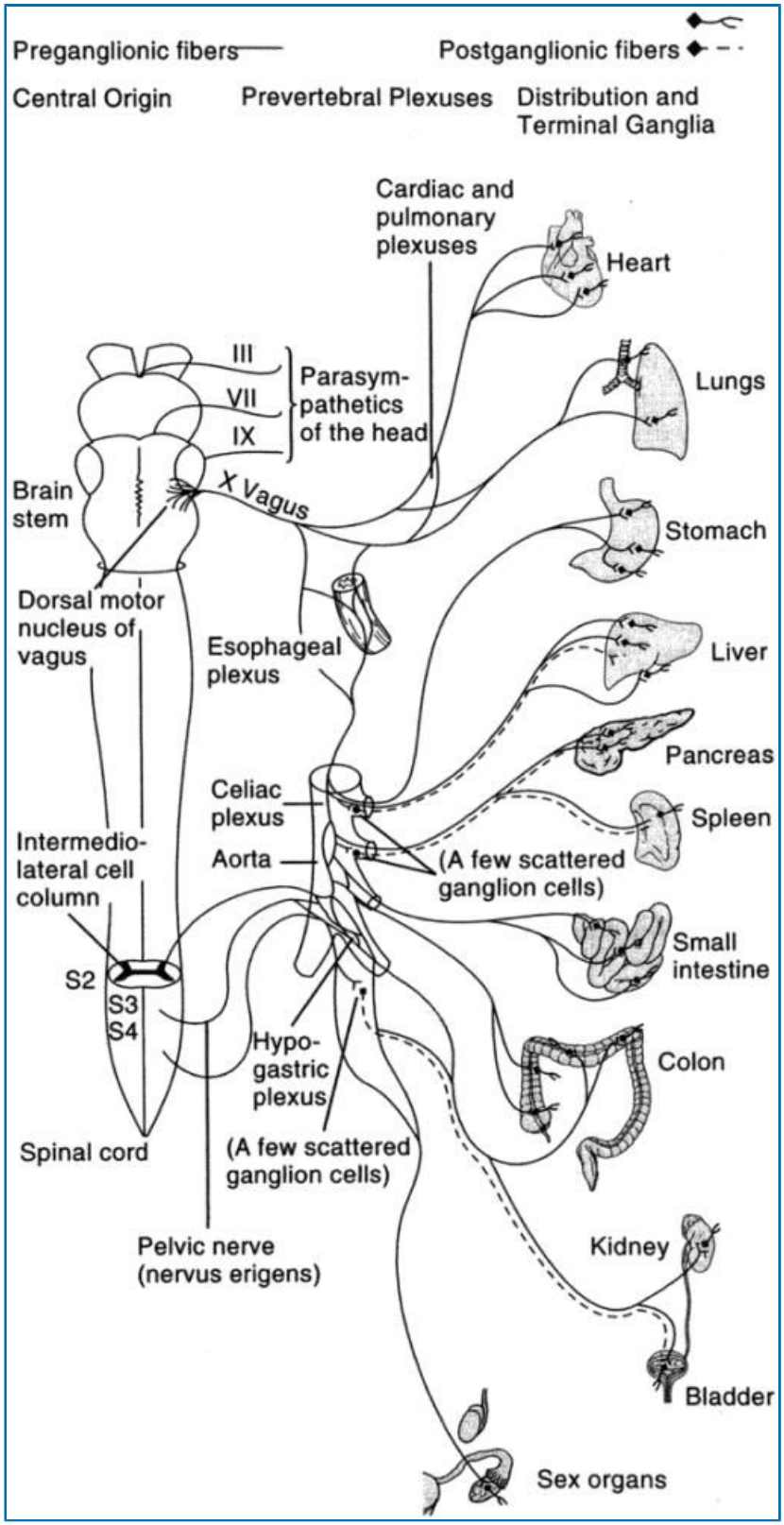

FIGURE 5. Parasympathetic division of peripheral autonomic system. Reproduced with permission from Chusid JG. *Correlative Neuroanatomy and Functional Neurology*. Los Altos, CA: Lange Medical Publishers; 1985.

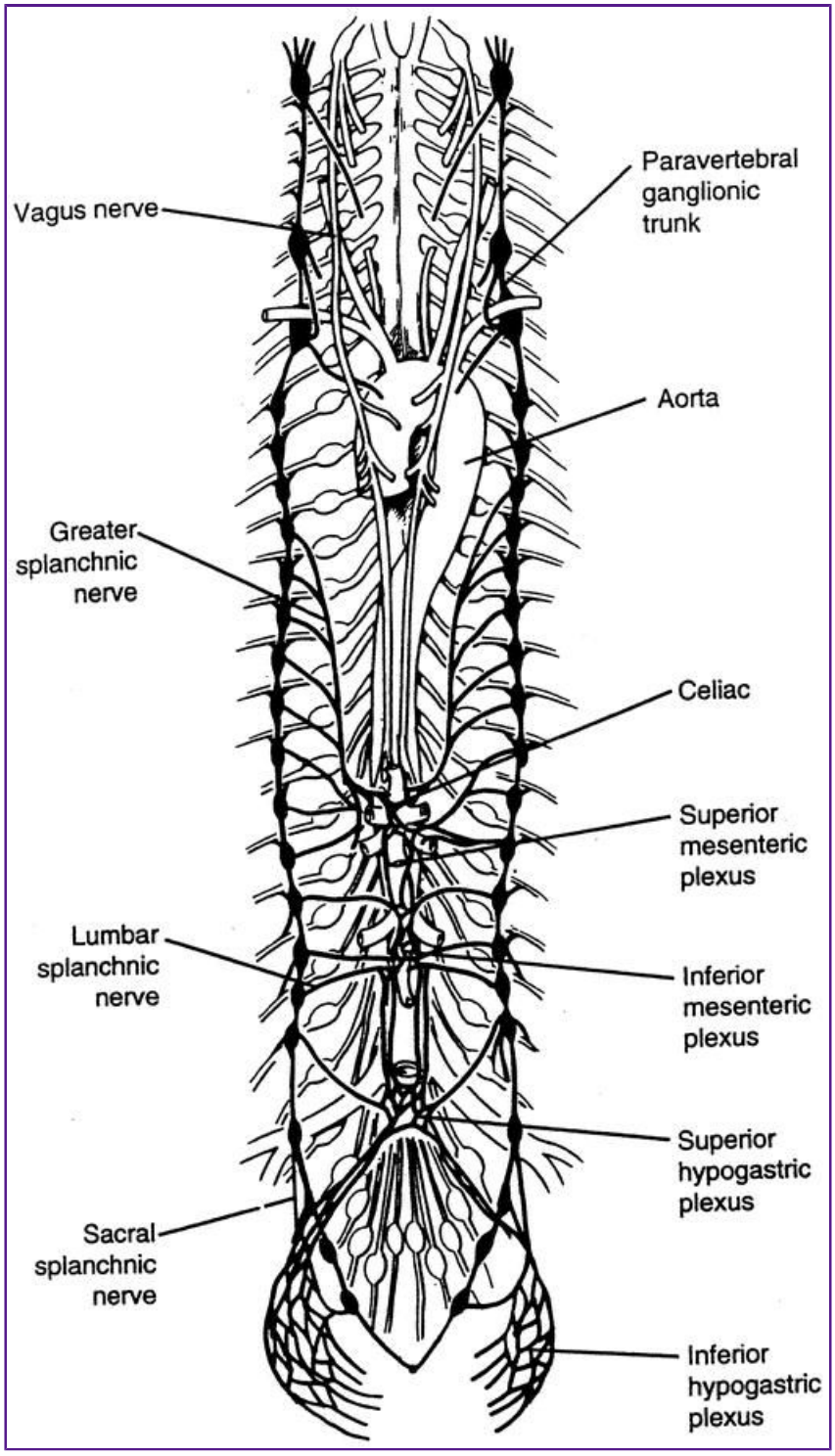

FIGURE 6. Paravertebral ganglia (sympathetic trunk) lying along median axis of body. Reproduced with permission from Rohen JW, Yokochi C. *Color Atlas of Anatomy*. New York: Igaku-Shoin Medical Publishers; 1983.

Although OMM alone may effectively decrease blood pressure, the reduction may be more dramatic and long-lasting if OMM is combined with lifestyle modifications and drug therapy. In this regard, OMM represents a method by which pharmaceutical dosages may be safely reduced while normotensive blood pressure is maintained. Potential medication dosage-related adverse effects may be reduced. In addition, the burden of expensive drug therapy may be mitigated because less medication and smaller dosages are used. OMM represents a potential method to promote a more cost-effective approach to the treatment of hypertension. The doctor-patient relationship will benefit from the hands-on contact that OMM provides to patients. Additionally, the reduction of debilitating pain via OMM will allow a patient to more easily relax and engage in exercise and physical activity, which may further reduce hypertension.

There is a need for further studies to determine the effectiveness of OMM on blood pressure reduction. Clinical outcome

studies may support and broaden the usage of osteopathic manipulative medicine. Double-blind placebo-controlled trials involving the use of OMM in a treatment group, and sham manipulation in a control group, would bring into question whether the concept of osteopathic manipulation involves more than external force. The effect of OMM when combined with other approaches such as lifestyle modification and drug treatment should also be explored. As OMM is considered a medical procedure, continuing medical education in hands-on diagnosis and treatment is available to the allopathic (MD) as well as the osteopathic (DO) physician. Because of its nature as a philosophy of medical science, a conventionally trained physician may consider osteopathy as an alternative approach. Ultimately, it is the patient who will most benefit from the incorporation of OMM into the overall treatment of hypertension.

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