Osteopathic Manipulative Treatment for Pertussis in the 19th and 20th Centuries: A Structured Historical Literature Review

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Background: Cases of pertussis, or whooping cough, have increased in recent years despite widespread vaccination and adequate antibiotic treatments. Osteopathic physicians may want to consider using osteopathic manipulative treatment (OMT) as an adjunctive treatment modality for pertussis; however, suitable OMT techniques are not specified in the research literature.

Objective: To search the historical osteopathic literature to identify OMT techniques that were used in the management of pertussis in the pre-antibiotic era.

Methods: A structured literature review of electronic databases and historical osteopathic journals and books was conducted. Included were information on OMT techniques used for patients with pertussis.

Results: The 24 identified sources included 8 articles and 16 book contributions from the years 1886 to 1958. Most sources were published within the first quarter of the 20th century. Commonly identified OMT techniques included mobilization techniques, lymphatic pump techniques, and other manipulative techniques predominantly in the cervical and thoracic regions.

Conclusion: The wealth of OMT techniques for patients with pertussis that were identified suggests that pertussis was commonly treated by early osteopaths. Further research is necessary to identify or establish the evidence base for these techniques so that in case of favorable outcomes, their use by osteopathic physicians is justified as adjunctive modalities when encountering a patient with pertussis.

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Pertussis, or whooping cough, is a highly contagious disease caused by the bacterium *Bordetella pertussis*.[1] The course of infection occurs in 3 stages; during the second stage, called the paroxysmal stage, bursts of rapid coughs occur, followed by a long inspiratory effort—the "whoop."[1] These coughing bouts usually develop 5 to 10 days after exposure and may last anywhere from 1 to more than 6 weeks. After that, if no complications occur, gradual recovery occurs with less severe, nonparoxysmal coughing, which typically lasts for another 2 to 3 weeks.[2]

Pertussis affects mostly small children and newborns and can be life-threatening for infants younger than 6 months, particularly when cyanosis and vomiting develop during coughing fits. Other complications can be secondary bacterial pneumonia or respiratory arrest.[1]

A range of antibiotics for the treatment of pertussis are available; however, they need to be administered in the first 2 to 3 weeks after exposure, before the paroxysmal symptoms occur, to lessen the symptoms.[2] If antibiotics are given after this timeframe, they will still be effective in eliminating the bacteria, but they will not help change the course of the infection.[2]

Pertussis vaccines, which have been available since the 1940s, facilitated the control of pertussis infections. However, since the 1980s, annual pertussis incidence has been gradually increasing, with almost 50,000 cases in the United States in 2012.[2] Acquired pertussis immunity through vaccination may have decreased because of the transition to the use of acellular vaccines in the 1990s and development of antibiotic resistance of pertussis strains.[1] The Centers for Disease Control and Prevention suggest that most pertussis cases go unrecognized owing to the characteristic symptoms not being present.[2] With these unmet needs of conventional pertussis prevention and treatment in mind, adjunctive treatments potentially could aid in addressing these shortcomings.

In the early 19th century, infectious diseases such as pertussis, scarlet fever, measles, diphtheria, dysentery, and tuberculosis were frequent causes of death in US children.[3] Osteopathy, as osteopathic medicine was known until the second half of the 20th century, and specifically osteopathic manipulative treatment (OMT), was often used to manage infectious diseases of childhood in the pre-antibiotic era.[4(pp134,142),5(pp491-494),6,7,8(p279)] (Although the term *osteopathic manipulative treatment* is reserved for manipulation provided by osteopathic physicians, rather than *osteopathic manipulative therapy*, which was provided by US-trained osteopaths in the 19th or early 20th century or by current foreign-trained osteopaths, the present article uses *osteopathic manipulative treatment*, or *OMT*, globally for improved readability.) The typical cough in pertussis was seen by early osteopaths as an imbalance of the complex interrelationship of structure and function, caused by a disintegration of irritated muscles[9(p226)] and ligaments as well as local inflammation causing loss of mobility of bony and articulating structures.

The historical osteopathic literature of the pre-antibiotic era contains numerous referrals to the use of OMT for the diagnosis and management of pertussis; however, further descriptions of the osteopathic approach to treating patients with pertussis disappeared in the literature at the time of the introduction of pertussis vaccines and antibiotic treatments. The question remains whether elements of the historical interventions described can be used in adjunctive treatments today. The purpose of the present historical literature review was to identify manipulative techniques for patients with pertussis that could potentially aid in establishing an OMT protocol for further investigating whether the addition of OMT to conventional medicine could benefit patients with pertussis compared with conventional treatment alone.

Methods

A narrative structured literature review was performed by searching the following electronic databases from inception to March 26, 2018: PubMed, Physiotherapy Evidence Database (PEDro), Osteopathic Medicine Digital Repository (OSTMED.DR), Cochrane (all databases), Index to Chiropractic Literature (ICL), and *The Journal of the American Osteopathic Association* (*JAOA*) database. Additionally, a range of early osteopathic books and historical journals (*Journal of Osteopathy* [1894-1964], *The Journal of the American Osteopathic Association* [start 1901], *The Osteopathic Physician* [1901-1924], *Osteopathic Magazine* [1914-1955], and *The Osteopathic Profession* [1933-1967]) were manually searched at the A.T. Still Research Institute in Kirksville, Missouri.

The keywords *pertussis*, *whooping cough*, *osteopathic*, *musculoskeletal*, *manipulation*, *manual and physical therapy*, *physiotherapy*, and *chiropractic* were used to identify potentially suitable articles and studies. Articles from books and journals were included if they contained information on potential causes of whooping cough with respect to osteopathically

identified dysfunctions and OMT techniques. Identified eligible information was narratively synthesized in table format and categorized into osteopathically identified dysfunctions commonly managed and OMT techniques commonly performed.

Results

The electronic literature search did not yield articles that met the inclusion criteria. The hand-searched literature review resulted in 24 identified sources comprising 8 journal articles and 16 book contributions. Of these 24 resources, 20 were essays, 2 were case reports, 1 was a combination of essay and case report, and 1 was a research study. Four books were issued toward the end of the 19th century, 17 sources were published within the first quarter of the 20th century, and the remaining 3 sources were published between 1950 and 1960.

OMT Approaches and Concepts

The following general concepts of early OMT were identified:

- Release of muscular blockages and adjustment of bony lesions,[5(p143),6,8(p429),10(p134),11(p4),12(pp35,42),13(pp30-31),14(p8),15(p384),16,17,18(pp317-318),19] for example, by the principle of exaggeration of the lesions[15(p11)]
- Fever-associated treatments[11(pp3-6)]
- Lymphatic drainage[7(p219),8(p182),9(p52),14(p8),16(p165),20]
- Treatment influencing the blood circulatory system and the nervous system[5(p143),9(p226),11(p3),12(p42),13,14(p8),15(p385)]
- Treatment of parts of or the entire respiratory system[5(p143),6,12(p42),13(p63),14(p8),15(p385),16,17,21]
- Influencing the activity of the visceral system[5(p144),6,12(p42),13(p122),14(pp8,30),17,25(p493)]
- Treatment of the urinary system[5(p613),14(p8),15(p385)]
- Management of complications[6,22(p181),23,25(pp447,493)]
- Prevention of spreading of the disease[24,25(pp493-494)]

Body Regions Commonly Treated

Seventeen sources were identified that describe the treated body regions in pediatric patients with pertussis. Most sources proclaimed treatment of cervical and/or thoracic structures, such as the cervical spine, the clavicle, and the ribs, and many sources included treatment of the entire spine (**Table 1**).

Specific OMT Techniques

A variety of techniques, commonly carried out at the head and neck, thoracic, and abdominal area, were identified. These techniques are predominantly based on mobilization, soft tissue, and manipulation. A list of the techniques and sources identified is shown in **Table 2**.

Frequency and Duration of OMT

Frequency of treatment varied from source to source. One source advised daily treatment until cured,[4(p142)] whereas 2 advised treatments twice per day[12(p42)] until a major improvement of the symptoms could be noticed,[11(p5)] then reducing to once per day. Another source proposed treatment 3 times per week.[13(p122)] Purse[20] began treatment daily for 2 weeks, then reduced to treatment on alternate days for another 2 weeks, followed by treatments 3 times weekly for 2 more weeks.

Harris[14(p8)] treated 25 patients with pertussis 2 times per week over an average period of 3 weeks. Purse[20] advised treatment for 6 weeks, whereas McConnell and Teall[6] advised treatment for several months.

Complementary Advice

Miscellaneous proposals were provided with manual treatment. A nutritious, easily digestible diet was advised by 5 sources,[6,12(p42),13(p122),25(p493),17] 1 of which advised to eat nothing the first day and very little at a time afterward and to induce vomiting in case of an overloaded stomach.[12(p41)] Keeping the child warm was suggested by 3 sources.[5(p144),6,12(p42)] Three sources reported advising the patient to spend as much time in the open air as possible.[6,13(p122),17]

Table 1.
Summary of Body Regions Treated in Patients With Pertussis in Historical Osteopathic Literature

Region	Source
Head	18(p429), 19
Carotid artery	5(p612), 6
C1/C2/upper cervical spine	5(p143), 6, 16, 18(p429), 19
Soft tissue of the lower cervical region	4(p134), 5(p143), 6(pp167-168), 12(p42), 13(pp30-31,63), 14(p8), 15(p384), 16, 17, 20, 27(p90)
3rd-5th dorsal nerve	5(p143), 6, 8(p97), 14(p8), 15(p384), 16, 20
Lower cervical spine	8(p97), 14(p8), 15(p384)
Angle of the jaw	12(p42), 14(p8), 15(p385)
Larynx	14(p8), 15(p385), 26
Hyoid bone	12(p42), 14(p8), 15(p384)
Trachea	12(p42), 14(p8), 15(p385)
Entire spine	5(p144), 6, 13(p32), 16(p164), 18(p429), 19, 26, 27
Thoracic spine	15(p384)
Upper dorsal area	6, 14(p8), 15(p384), 26
Shoulder	15(p13)
Tissues of the back	17(p232)
Spinal ligaments, posterior scapula, rhomboids, levator scapulae, and anterior scapular muscles	15(p13)
Spinal muscles between the upper part of the shoulder blades	12(p42)
Clavicle	5(p143), 6, 8(p97), 14(p8), 15(p384), 20
Ribs	5(p143), 12(p42), 13(p40), 14(p8), 15(p385), 16, 17, 24, 25(p493)
Respiratory tract, not further specified	24
Thorax	24
Heart	5(p143), 6, 14(p8), 15(p385)
Kidneys	5(p613), 14(p8), 15(p385)
Abdomen	12(p42)
Digestive system	5(p613), 14(p8)
Paralyzed muscles and muscles other than spinal	5(p144), 6
Nervous system other than phrenic nerves, vagi nerves, and superior ganglia	5(p143), 6

Discussion

The aim of this structured literature review was to identify OMT approaches for the management of pertussis, as it was commonly applied in the pre-antibiotic era. Twenty-four sources with a variety of records on different aspects of the use of OMT were identified, including body regions treated, techniques applied, and advice given.

Table 2.
Summary of Osteopathic Manipulative Treatment Techniques Applied in Pediatric Patients With Pertussis

Technique/Treated Body Region	Description	Rationale Provided	Source
Head and Neck			
Atlas	With patient sitting, apply soft but firm pressure onto 2 points of the vertebra: inside and back of the transverse processes of the atlas.	Blocks sensory pathways, relaxes neck muscles, slows breathing	18(pp317-318), 19
Stimulation of head circulation	With patient sitting, extend one arm above the patient's head and use the other hand to press on the angle of the ribs between the scapula and spine, beginning at the 2nd dorsal vertebra on the ipsilateral side. Lower the arm backward and sideways, and lower your thumb an inch to the next lower rib. Repeat until the 10th rib is reached. Treat both sides.	NA	13(p40)
	Manipulate muscles at front and side of neck; end with soft but firm extension of the neck without rotation.	NA	11(p4)
Vasomotor center	Apply pressure to the upper cervical vertebrae (the vasomotor center).	Slows heart rate	11(p3)
Stimulation of neck circulation	Turn head slightly from side to side 2 to 3 times.	Liberates circulation of the neck	13(p32)
Muscles beneath the ear	With patient sitting, apply gentle pressure and work muscles beneath and close up to the ear, drawing them downward; increase pressure if patient can bear it.	Treats the fifth cranial nerve	12(p24)
Inhibiting the phrenic nerve	With patient sitting, press against the front of the patient's spine in the middle of the neck; use reasonable pressure and hold for 2 minutes.	NA	12(p28)
Stretching the neck	With one hand under the chin and the other hand at the base of the skull, pull steadily until the body moves; turn head gently from side to side 2 or 3 times. Repeat several times.	Relieves the circulation in the neck and between vertebrae of entire spine	13(p32)
General neck treatment/ manipulating the cervical region in the back of the neck	With upper hand on forehead, turn the patient's head away from you. At the same time, with fingers of the lower hand close to the spine and near the base of the skull, press firmly, drawing the deep muscles toward you and upward. Continue as low as 7th vertebra, and treat both sides of the neck.	NA	12(p27), 13 (p30)
Manipulation of the muscles in the side of the neck	Continuation of treatment of cervical region in the back of the neck: With one hand on the patient's forehead turning the head away, use the other hand to pull the muscles to the side of the neck from the angle of the jaw to the clavicle toward you without letting them slip on the skin. Treat both sides of the neck.	NA	13(p31)
Manipulation of the front of the neck	With one hand on the patient's forehead, place the finger and thumb of the other hand on either side of the trachea to manipulate from the chin down to the clavicle, moving the structures horizontally.	Essential movement in all throat diseases	13(p63)
Springing the jaws forward	Place the fingers of both hands behind the angle of the lower jaw on each side. Ask the patient to open his or her mouth; press jaw lightly forward, then ask the patient to slowly close the mouth but provide some little resistance. Repeat 3 or 4 times.	NA	12(p47)
	Let the lower jaw spring softly downward and outward.	NA	14(p8)

(continued)

Tabe 2 (continued).
Summary of Osteopathic Manipulative Treatment Techniques Applied in Pediatric Patients With Pertussis

Technique/Treated Body Region	Description	Rationale Provided	Source
Treatment for whooping cough	Gently soften and stretch the deep tissues under the patient's jaw, drawing the tissues toward the chin.	NA	12(p35)
Hyoid bone	Draw the patient's hyoid bone forward as much as possible, several times (drawing on one side at a time might be easier). Grasp the hyoid between thumb and finger and move it vertically and laterally.	Relaxes omohyoid and hyoid muscles	15 (pp24,382-383)
Treatment for the voice	Grasp the patient's trachea above and below the larynx and gently stretch apart, then gently twist from side to side. Repeat several times.	Stretches larynx	12(p51)
Treating the trachea	Manipulate the trachea by using the finger and thumb placed on either side of the trachea, moving structures crosswise to the neck; in this manner, work the front of neck from the chin down to the collar bone.	Stretches larynx	13(p63)
	Treat close to the trachea; gently stretch and loosen the tissues surrounding the trachea on both sides for the full length, all the way under the collar bone as far as possible; move the trachea horizontally.	Helpful during the spasm; separates the cartilages and make them flexible	12(p40), 15 (p383)
Spine			
Springing the spine	With patient sitting, grasp wrists and extend arms above head while placing knee between scapulae and applying pressure there, bring arms downward with backward movement. Repeat several times, each time 2 inches lower until 12th dorsal vertebrae.	Used in all affections of heart, lungs, and throat	13(p35)
	Patient lies on side, practitioner in front of patient; with one hand, grasp uppermost arm just above elbow; with other hand, hold under spinous processes of any portion of the spine under treatment; use arm as lever and bring it forward and downward.	Releases tension in deep structures; restores free play between bony parts; removes pressure from blood vessels and nerves	15(p10)
Rotating the spine	A principle of exaggeration of the lesions was applied to address many bony luxations. Further increase malposition, and then apply pressure in such a direction as to force the structures back toward normal position at the same time as the part in question was released from its condition of exaggeration.	Releases tension and loosens adhesion; useful for reducing lateral luxations in upper spine, as well as lesions in lower spine	15(p11)
Stretching the spine	With the help of an assistant, stretch the patient's spine by traction from the ankle to the axilla.	Releases pressure on spinal nerves; improves circulation of spinal cord	11(p4)
Upper spine	Elevate an arm of the patient and start to press between the margo superior of the scapula and spine while slowly descending the arm. Repeat while applying pressure to the point 1 inch lower until end of scapula is reached. Manipulate contralateral side in same manner.	Releases tension and restrictions in the spine	10(p142)
Vertebrae and heads of ribs	Adjustment of the vertebrae and the heads of ribs; apply direct pressure downward to all spinal parts.	Forces vertebrae or heads of ribs into place; stretches deep and anterior spinal ligaments; relieves lateral spinal lesions	15(pp10-11)

(continued)

Tabe 2 (continued).
Summary of Osteopathic Manipulative Treatment Techniques Applied in Pediatric Patients With Pertussis

Technique/Treated Body Region	Description	Rationale Provided	Source
Thoracic Area			
Depressing the first rib	Grab the patient's shoulder and press with the thumb deep beneath collar bone to depress the first rib; pull up on the head with the other hand to stretch the muscles of the neck. Repeat with turning the patient's face in a different direction before stretching.	Stretches different sets of muscles; activates lymphatic drainage	12(p52), 14(p8)
Raising the collar bone	Press deeply with the fingers of one hand beneath the clavicle; at the same time, raise the patient's bent arm over his or her face. Repeat with a different position of the fingers along the clavicle.	Activates lymphatic drainage	12(p55), 14(p8)
Rib raising	With patient lying sideways, raise the lowest rib with fingers of one hand while other hand stretches the patient's arm above the head; hold the arm a moment, then lower the arm and carry on rib raising for a minute longer; repeat with next rib above. Patient should inhale deeply through the nose while arm is being brought above head and exhale when arm is being brought down. Treat all ribs on both sides.	Stimulates the lungs, relieves the obstructed respiration; stimulates the heart's action; gives marked relief from the severe cough	5(p143), 15 (p385), 17, 16
Speading the ribs	Stand behind sitting patient who has his or her arms elevated; grab the ribs with both hands and raise and spread them while the patient brings his or her arms down. Repeat several times.	Achieves sufficient flexibility between the vertebrae	12(p56), 14(p8)
Elevating and compressing chest	Elevate and compress the patient's chest.	Eases respiration	21
Heart, head, vasomotors	With patient lying sideways, apply tips of both hands, placed next to each other along the spine and stretch the spinal muscles between the shoulder blades.	Treats the heart and regulates blood supply for the head (upper hand); treats the lungs (lower hand)	12(pp42,63)
Abdominal Area			
Kneading the abdomen	Patient on back, legs flexed, and arms at either side; with a little pressure, draw bowels up toward the umbilicus; with a hand placed flatly on farther side of abdomen, the other hand pushes bowels back again in a kneading motion. Treat entire abdomen, always drawing bowels upward toward the umbilicus.	Stimulates digestive system	12(p121)
Vibration over the abdomen	Create oscillatory movements, placing palm or fingers firmly on parts to be treated, arm held straight. There should be no or only little strain on your arm muscles. (Practitioners must be careful—this is a very powerful stimulant.)	Stimulates and strengthens neuronal function; improves venous circulation and lymphatic flow	11(pp4-5)
Other			
Paralyzed muscles	Manipulate and massage often. Carefully manipulate corresponding nerves and spinal centers.	NA	6
Treatment of infants	Place infant prone so that in the event of a coughing attack, the mucous can run out of the infant's mouth. Give a 3- to 5-min relaxation of the spinal muscles of the cervical and dorsal area followed by a 10-min lymphatic pump. Encircle the infant's chest; flexing the fingers alternately compress and relax the infant's chest at a rate of about 80 times per min.	NA	20

(continued)

Tabe 2 (continued).
Summary of Osteopathic Manipulative Treatment Techniques Applied in Pediatric Patients With Pertussis

Technique/Treated Body Region	Description	Rationale Provided	Source
Cyanosis treatment	Gently stretch muscles near the upper dorsal vertebrae. Apply a moist hot towel that had previously been dipped in boiling vinegar water and press it over the infant's larynx after a bit of cooling down; a bit later, after the attack, apply gentle spinal treatments and external manipulation of the larynx, pull hyoid bone and larynx forward.	Stops coughing attack	26

Abbreviation: NA, not available.

Of note, essays, studies, and case reports from the 19th century and the beginning of the 20th century must be interpreted with caution, as today's common research standards were not available at those times. Many of the reported techniques for the management of pertussis may be derived from empirical evidence and experience; however, one always must take the natural history of disease into account. In the case of pertussis, the disease is self-limiting. So, it is unclear whether the reported use of OMT was actually effective.

For example,[28] in the early days of osteopathy, case reports were often printed for marketing reasons and did not necessarily present accurate reports of the course of the disease.[28] Yet, they provide valuable insight into osteopathic practice of the time.

According to Gevitz,[28] the osteopathic approach to treating patients with infectious diseases in the United States changed beginning in 1930, when the manual treatment of osteopathic lesions evolved to an increasing combination of manual and pharmaceutical approaches. Early osteopaths acknowledged the microbiological background of infectious diseases but also considered osteopathic-specific etiologic factors, such as bony lesions, which were viewed as predisposing factors.[28] These therapeutic approaches showed multiple interdependent connecting aspects in the improvement of the body's homeostasis during pertussis. Releasing bony and muscular blockages to improve circulation and neuronal function is a central concept, as is the treatment of the immune system (eg, through treatment of the local and general lymphatic system and the spleen), the neurovegetative system (eg, through inhibition and somatovisceral reflexes), detoxification (eg, treatment of the liver), and excretion (eg, stimulation of the skin and kidneys). From the osteopathic perspective, in the case of an infection, manual therapy can empower the body's immune system to better fight off the microorganisms that cause the illness.[29,30]

The application of OMT to patients with pertussis at the end of the 19th century and in the first half of the 20th century was evident, as can be seen by the abundance of text sources published during that time. Given that the number of pertussis cases is on the rise, osteopathic physicians practicing today may well encounter patients with pertussis. In addition to the recommended treatment approaches by clinical guidelines, the identified array of treatment approaches and/or techniques could aid osteopathic physicians in complementing their conventional treatment efforts. Many of the identified techniques are still practiced today and are supported by a growing body of evidence demonstrating significant effects on the immune system and/or lung function in rodents, healthy people, and patients with various health conditions.[31-35] Although no modern clinical studies on OMT in pertussis were identified in the electronic database search, some of the identified techniques and approaches in combination with conventional therapy have been used in other clinical trials of OMT (eg, in patients with

breathing disorders and/or respiratory infections) and have shown superior effectiveness compared with conventional treatment alone.[36-40]

In case the osteopathic medical profession faces the need to develop a treatment protocol for a clinical study investigating the complementary effects of OMT in patients with pertussis, the identified OMT approaches could serve as a starting point for an expert panel to discuss which of these techniques, if any, could potentially be used and incorporated into a treatment protocol, which then could be tested in a pilot study.

This structured literature review had some limitations. The hand-screening of journals and books was performed in only 1 library and was limited to historical literature only, which generally is poorly covered in online databases. However, a comprehensive electronic database search complemented these efforts, aiming to identify more recent research that may have been eligible for inclusion. Also, this research was performed by only 1 author; hence, sources or text passages may have been missed as a result of a lack of double confirmation. Nevertheless, a wealth of information has been identified, with many approaches reported by several authors, indicating that these approaches may have been common at the time and could potentially be seen as representative when taking into consideration treatments for patients with pertussis.

Conclusion

Many OMT techniques for patients with pertussis were identified in the early osteopathic literature. Although not proven to be effective at the time of the authors' writings, some of these techniques and approaches are currently supported by a growing body of evidence. Considering increasing cases of pertussis in recent years, these approaches could potentially aid osteopathic physicians in the treatment of patients with pertussis, as well as assist researchers in the development of a standardized treatment protocol for a clinical study on the effectiveness of adjunctive OMT in patients with pertussis.

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