

Benefits of osteopathic manipulative treatment for hospitalized elderly patients with pneumonia

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While osteopathic manipulative treatment (OMT) is thought to be beneficial for patients with pneumonia, there have been few clinical trials—especially in the elderly. The authors' pilot study suggested that duration of intravenous antibiotic use and length of hospital stay were promising measures of outcome. Therefore, a larger randomized controlled study was conducted. Elderly patients hospitalized with acute pneumonia were recruited and randomly placed into two groups: 28 in the treatment group and 30 in the control group. The treatment group received a standardized OMT protocol, while the control group received a light touch protocol. There was no statistical difference between groups for age, sex, or simplified acute physiology scores. The treatment group had a significantly shorter duration of intravenous antibiotic treatment and a shorter hospital stay.

(Key words: osteopathic manipulative treatment, pneumonia, hospitalization)

Disease in the pulmonary viscera is associated with increased somatic dysfunction in the upper thoracic spinal segments, probably mediated through the autonomic nervous system.^{1,2} Osteopathic philosophy holds that impaired function in the musculoskeletal system limits the body's inherent ability to fight disease—a concept that led osteopathic physicians to use osteopathic manipulative treatment (OMT) to treat pneumonia.^{3,4} The theory and rationale for using OMT for pneumonia have been described⁵; however, clinical trials testing the effectiveness of manipulation for pneumonia are scarce.

Osteopathic manipulative treatment combined with antibiotic therapy in children with respiratory tract infections has been reported to reduce the length of hospital stay.⁶ In one study involving subjects with chronic obstructive pulmonary disease, adjunctive OMT was shown to reduce the severity of illness, PCO₂, oxygen saturation, total lung capacity, and residual volume.⁷ Similarly, Stiles⁸ advocated that adjunctive OMT can shorten the length of hospital stay for individuals with asthma and pediatric pneumonia.

Previously, we conducted a controlled pilot study to evaluate the efficacy of

adjunctive OMT in elderly patients hospitalized with pneumonia.⁹ Although the subject population was small, the results suggested that OMT might reduce the need for intravenous (IV) antibiotics as well as length of hospital stay. Therefore, a larger randomized controlled study was conducted to evaluate the efficacy of OMT in treating hospitalized elderly patients with pneumonia.

Methods

Individuals 60 years of age and older who were hospitalized with acute pneumonia and treated initially with IV antibiotics were recruited for the study. To be included, subjects had to have a new pulmonary infiltrate on a chest x-ray (consistent with pneumonia) and at least two other clinical findings consistent with acute pneumonia. These clinical findings included fever, leukocytosis, new cough, and acute change in mental status. Patients were excluded from the study if they had a lung abscess, tuberculosis, lung cancer, acute rib or vertebral bone fractures, or metastatic disease of the bones. Manipulative intervention began within the first 24 hours of admission or within 24 hours of the diagnosis of nosocomial infection. The study protocol was approved by the institutional review boards of the University of North Texas Health Science Center at Fort Worth and by the Osteopathic Medical Center of Texas.

Patients were randomly placed into either a treatment group or a control group. Both groups received conventional medical treatment for pneumonia as directed by their attending physicians. The attending physician controlled medical management, choice of antibiotic, when to change IV to oral antibiotic treatment, and date of discharge. To prevent bias, the attending physician was blind to patient group assignment, and no treatments were done in the presence of the attending or house staff physicians. Patients, family, and hospital staff were not told into which group the patients had been placed. Both groups received a structural examination before each treatment session. Unblinded data on the presence and severity of somatic

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dysfunction were collected from structural examinations; however, those findings are beyond the scope of this article and are not presented. (The main structural examination findings have been published, however.¹⁰)

Subjects in the treatment group received a standardized OMT protocol treatment consisting of seven osteopathic manipulative techniques and nonstandardized osteopathic manipulative treatments from an OMT specialist. The seven treatment techniques in the standardized portion of the protocol were bilateral paraspinal inhibition, bilateral rib raising, diaphragmatic myofascial release (redoming the diaphragm), condylar decompression, soft tissue technique to the cervical muscles, myofascial release to the anterior thoracic inlet, and the thoracic lymphatic pump, all of which have been described.^{5,11}

Second-year osteopathic medical students performed the standardized treatments and structural examinations. Before seeing any patients, all students were trained in proficiency, standardization of the protocol techniques, and data collection. The treatment techniques were given in the order listed, over 10 to 15 minutes, twice a day, 7 days a week until a study end point was reached. There was no set time for each technique, but the total duration of the standardized protocol was not to exceed 15 minutes.

The application of each technique was fitted to each individual's physical condition and unique somatic dysfunction found on structural examination. For example, the students giving the standardized protocol were able to spend more time applying muscle inhibition or rib raising on those paraspinal segments with somatic dysfunction and less on those segments relatively free from somatic dysfunction. Where appropriate, an attempt was made to achieve local tissue texture changes, myofascial release, or better segmental function before going on to the next region or technique.

To address somatic dysfunction not adequately treated by the standardized protocol, each patient was seen by an OMT specialist who was allowed to use any technique he felt appropriate to

address specific somatic dysfunction. The duration and frequency of these nonstandardized treatments were at the discretion of the specialist and were not tracked.

Subjects in the control group received a standardized light touch protocol treatment, with care taken not to move myofascial structures or to articulate joints. These standardized sham treatments lasted 10 to 15 minutes and were given twice a day, 7 days a week until a study end point was reached. Light touch was applied to the same regions and for the same duration as in the treatment group standardized protocol. To control for contact time, the OMT specialist performed a structural examination without treatment on each control group subject for the same approximate frequency and duration as subjects in the treatment group.

All patients in both groups were treated in the supine position in bed. The three possible end points for the study included discharge from the hospital, ventilator-dependent respiratory failure, or death. All standardized protocol treatments were started within the first 24 hours of admission or diagnosis. The OMT specialist saw subjects in both groups within the first 48 hours of admission or diagnosis of nosocomial pneumonia.

Demographic information collected included age, sex, race, smoking habits, and whether pneumonia was acquired in the community, nursing home, or hospital. Prior use of antibiotics before hospitalization, use of systemic steroids, aspiration pneumonia, and the number of medications on admission were also recorded. The Simplified Acute Physiology Score (SAPS) was used to obtain an estimate for severity of illness.¹² The SAPS encompasses 14 common clinical measures, which were available on admission for all study participants.

Leukocyte counts were obtained on admission and on days 3 and 5 of the hospital stay. Patients who received systemic steroids were excluded in the analysis of the leukocyte counts. Patient vital signs (temperature, pulse, and respiratory rate) from each shift were recorded. An oral temperature of greater than

99.4°F was considered a fever. A chest x-ray was obtained on hospital days 1 and 5, and the change in pneumonic infiltrates from day 1 to day 5 was compared. Pneumonic infiltrates were classified as worse (extension of the pneumonic process or development of an effusion), unchanged (no change in the pulmonary infiltrates), improved (diminished pulmonary infiltrates), or resolved (resolution of the pulmonary infiltrates). The chest x-ray films were reviewed and classified by a specialist in pulmonary medicine.

Data collected on continuous measures obtained from this study were tested for significance using an analysis of variance. Chi-square analysis was used on categorical variables to test for significance of difference in the distribution between treatment and control groups. An alpha level of 0.05 was set for tests of significance, and the SAPS measure was used as a statistical control for initial severity of the illness.

Results

Between November 1996 and May 1998, 68 patients met criteria for the study. Five patients declined to participate in the study, and five withdrew from the study shortly after enrolling. Two of these patients were withdrawn from the study because of a change in diagnosis: one from pneumonia to congestive heart failure, the other from pneumonia to progressive pulmonary fibrosis. One patient was excluded because of inability to cooperate with the treatment protocol due to advanced dementia. Two patients in the treatment group withdrew themselves from the study because of increased joint and muscle soreness after the first day of OMT—in both cases, the muscle tenderness was transient. The first individual who withdrew had a history of fibromyalgia and osteoarthritis and was the first participant in the study. The second individual later was diagnosed with a pulmonary malignancy. None of the other study participants complained of muscle soreness associated with OMT.

Fifty-eight eligible patients completed the study protocol and were randomly placed into two groups: 28 in the treatment group and 30 in the control group.

Table 1
Demographic Characteristics of Subjects (N=58)*

Variable	Group	
	Treatment (n=28)	Control (n=30)
■ Age, y	77.0±17.2	77.7±17.1
■ SAPS [†] score	9.4±4.0	9.6±3.5
■ Gender		
□ Female	14 (50.0%)	14 (46.7%)
□ Male	14 (50.0%)	16 (53.3%)
■ Race/ethnicity		
□ Black	3 (10.7%)	6 (20.0%)
□ Hispanic	1 (3.6%)	1 (3.3%)
□ White	24 (85.7%)	23 (76.7%)
■ Tobacco use [‡]		
□ Yes	5 (18.5%)	6 (20.7%)
□ No	22 (81.5%)	23 (79.3%)
■ Systemic steroids [‡]		
□ Yes	2 (7.1%)	5 (17.2%)
□ No	26 (92.9%)	24 (82.8%)
■ Type of pneumonia		
□ Community-acquired	16 (57.1%)	15 (50.0%)
□ Nursing home-acquired	11 (39.3%)	14 (46.7%)
□ Hospital-acquired	1 (3.6%)	1 (3.3%)
■ Aspiration pneumonia		
□ Likely aspirate	6 (21.4%)	10 (33.3%)
□ Unlikely aspirate	20 (71.4%)	20 (66.7%)
□ Unknown	2 (7.1%)	

*Data are presented as mean ± SD for continuous variables and as number (%) for categorical variables.

[†]SAPS = Simplified Acute Physiology Score.

[‡]Totals may not add up to n because of missing values.

The patients' baseline characteristics by group are summarized in *Table 1*. There were no significant differences between groups for age, sex, race, smoking habits, use of steroids, or use of antibiotics before hospitalization. The mean SAPS score was similar for both groups [treatment, 9.39 ± 3.98 (SD); control, 9.57 ± 3.45 ; $P = .86$]. Chi-square analysis revealed no significant differences between groups for type of pneumonia (community-, nursing home-, or hospital-acquired). *Table 2* shows the incidence by group of a past medical history of 15 common problems noted on chart review. Chi-square analysis revealed no significant differences

between groups for any of the 15 past medical history problems evaluated.

Results of the duration of antibiotic treatment and length of hospital stay are shown in *Table 3*. There were no significant differences between groups for the mean duration of oral antibiotic use in the hospital (treatment, 1.39 ± 1.40 days; control, 1.36 ± 1.82 days; $P = .95$). Mean duration of IV antibiotic use in the hospital was significantly shorter for the treatment group (treatment, 5.25 ± 2.17 days; control, 7.33 ± 2.82 days; $P = .005$). Mean duration of total antibiotic treatment in the hospital was also significantly shorter in the treatment group

(treatment, 6.14 ± 2.32 days; control, 8.13 ± 2.52 days; $P = .003$). The treatment group also had a significantly shorter mean length of hospital stay (treatment, 6.6 ± 2.94 days; control, 8.6 ± 2.92 days; $P = .014$).

Data collected on temperature, pulse, and respiratory rate are summarized in *Table 4*. There were no significant differences between groups for the mean number of shifts with a recorded fever, respiratory rate greater than 22 breaths/min, or pulse rate greater than 100 beats/min. However, there was a significant difference between groups for the change in mean temperatures on days 2 and 5 of the hospital stay. For day 2, mean temperature change dropped 0.58 ± 1.2 degrees for the control group and rose 0.23 ± 1.3 degrees for the treatment group ($P = .023$). On day 5, the mean temperature change dropped 1.0 ± 4.4 degrees for the control group and rose 0.1 ± 1.4 degrees for the treatment group ($P = .043$).

The mean serum white blood cell (WBC) count for days 1, 3, and 5 are summarized in *Table 5*. Two patients in the treatment group and 6 in the control group were excluded from the WBC count analysis because they were on systemic steroids during their hospital stay. There were no significant differences between groups for mean WBC count on days 1, 3, or 5. However, there was a significant difference in the rate of change in the white blood counts between days 1 and 3 (treatment, -2341 ± 3862 ; control, -5945 ± 5055 ; $P = .014$). By day 5, these differences in the change in WBC counts were no longer statistically significant.

The change in the pulmonary infiltrate from day 1 to day 5 was evaluated for 25 subjects in the treatment group and 29 in the control group. The pulmonary infiltrates improved for 10 persons in the treatment group and 8 in the control group. There was no change in the pulmonary infiltrates for 8 persons in the treatment group and 13 in the control group. Six persons in the treatment group and 4 in the control group had worsening of the pulmonary infiltrate. The infiltrates resolved for 1 patient in the treat-

Table 2
Past Medical History of Comorbid Conditions for Subjects at Baseline (N=58)*

Condition	Treatment group (n=28)		Control group (n=30)	
	No.	%	No.	%
☐ Asthma	4	14.3	4	13.3
☐ Coronary artery disease	7	25.0	11	36.7
☐ Congestive heart failure	6	21.4	7	23.3
☐ Chronic bronchitis	4	14.3	3	10.0
☐ Chronic obstructive pulmonary disease	13	46.4	8	26.7
☐ Stroke	5	17.9	7	23.3
☐ Dementia	9	32.1	14	46.7
☐ Diabetes mellitus	6	21.4	3	10.0
☐ Hypertension	15	53.6	14	46.7
☐ Pancreatitis	1	3.6	0	0.0
☐ Pressure sore	2	7.1	2	6.7
☐ Peptic ulcer disease	5	17.9	4	13.3
☐ Peripheral vascular disease	5	17.9	7	23.3
☐ Swallowing dysfunction	6	21.4	13	43.3
☐ Seizure disorder	1	3.6	3	10.0
☐ Percutaneous endoscopic gastrostomy tube	4	14.3	6	20.0

*Data are presented as number (%) positive for each condition. No differences between groups were significant at the .05 level.

ment group and for 4 in the control group. Chi-square analysis revealed no significant differences between groups for change in pulmonary infiltrates. Twenty-five subjects in the treatment group and 27 in the control group were alive when discharged from the hospital. In the treatment group, 1 person died and 2 had ventilator-dependent respiratory failure. Three persons died in the control group. Chi-square analysis showed no significant difference between groups for the study end points.

Discussion

We found that adjunctive OMT reduces the duration of total antibiotic treatment and length of hospital stay in hospitalized elderly patients with pneumonia.

Past studies evaluating the efficacy of OMT for systemic disorders have compared conventional care with OMT to conventional care without OMT.^{6,13} However, without a placebo-controlled group, it is impossible to account for the effect of increased physical contact in the treatment group or to blind the personnel involved in conventional patient care to group assignment. By using a light touch control group, we were able to blind the attending physicians and house staff to patient group assignment and control to some degree the effect of increased physical touch in the treatment group. We also attempted to control for the touch and contact time by ensuring that the control group had approximately the same amount of touch and contact time

as the treatment group. A weakness of this study is that the number of nonstandardized sessions with the OMT specialist was not tracked; however, the specialist attempted to see both groups for the same amount of time and frequency. Most participants received one visit from the OMT specialist within the first 48 hours of diagnosis and another visit before discharge.

The OMT seemed to be well tolerated in this elderly, acutely ill, frail population. Transient muscle tenderness after treatment was the only adverse event reported, occurring in only two individuals. However, it was severe enough for them to request leaving the study. Although the techniques are standardized, the force of touch and degree of

Table 3
Duration of Antibiotic Therapy and Length of Hospital Stay*

Measurement	Treatment group	Control group	P value
■ Duration of antibiotic therapy, d			
□ Oral antibiotics	1.4±1.4	1.4±1.8	.952
□ Intravenous antibiotics	5.3±2.2	7.3±2.8	.002
□ All antibiotics	6.1±2.3	8.1±2.5	.003
■ Length of stay, d	6.6±2.9	8.6±2.9	.014

*Data were analyzed using one-way analysis of variance and are presented as mean ± SD for each measurement. Duration of antibiotic therapy and length of stay were measured in days.

Table 4
Number of Febrile, Tachypnea, and Tachycardiac Shifts and Change in Mean Daily Temperature*

Measurement	Group		P value
	Treatment	Control	
■ Febrile shifts, No.	3.0±4.0	3.3±2.8	.738
■ Tachypnea shifts, No.	6.3±5.3	6.9±5.7	.673
■ Tachycardia shifts, No.	2.4±3.9	2.3±3.3	.927
■ Change in temperature, relative to the mean temperature on day 1†			
□ Day 2	-0.23±1.3 (n=25)	0.58±1.2 (n=28)	.023
□ Day 3	0.15±1.6 (n=23)	0.70±1.3 (n=28)	.190
□ Day 4	-0.10±1.8 (n=22)	0.58±1.3 (n=27)	.119
□ Day 5	-0.10±1.4 (n=17)	1.0±1.8 (n=26)	.043
□ Day 6	0.22±1.8 (n=10)	1.1±1.8 (n=22)	.145

*Data were analyzed using one-way analysis of variance and are presented as mean±SD for each measurement. Duration and length of stay were measured in days.

†A negative value represents a net increase in the mean temperature.

joint articulation must be adjusted to the individual. The concept of treatment dosing is well established in the osteopathic medical literature.¹⁴⁻¹⁶ Even with proficiency training before seeing patients and direct supervision during the initial hospital treatment sessions, the students applying the treatment protocols are on a learning curve as they fit the proper “dose” to the individual. Overdosing

could contribute to posttreatment muscle soreness.

It has been theorized that OMT may improve the immune response to infection, as evidenced by a more robust fever and WBC response,⁵ and this study found some evidence to support the idea. The mean temperature tended to rise slightly in the treatment group and fall in the control group, relative to day 1, enough

to reach significance on days 2 and 5. But these differences in body temperature were relatively small and not large enough to be measured by the mean number of febrile shifts during hospitalization. In a study on the efficacy of adjunctive chest physiotherapy for patients hospitalized with pneumonia, the duration of fever was significantly increased in those under the age of 47 years, but not

Table 5
Mean Leukocyte Count for Hospital Days 1, 3, and 5 and
Change in Mean Leukocyte Count on Days 3 and 5 Relative to Day 1 of Hospital Stay*

Measurement	Group		P value
	Treatment	Control	
■ Leukocyte count†			
□ Day 1	13,685.7 ± 7,286.9	16,513.3 ± 7,532.9	.152
□ Day 3	11,961.5 ± 5,665.1	10,578.6 ± 3,563.7	.284
□ Day 5	10,486.4 ± 5,142.8	9,276.9 ± 3,409.7	.335
■ Change in leukocyte count from day 1			
□ Day 3	-2,341.7 ± 3,863.0	-5,945.5 ± 5,655.8	.015
□ Day 5	-4,529.1 ± 7,222.0	-6,800.6 ± 6,558.4	.299

*Data were analyzed using one-way analysis of variance and are presented as mean ± SD for each measurement.
†Per cubic millimeter.

in those over the age of 47 years.¹⁷ It may be that manipulation increases the febrile response in persons with acute pneumonia, but that this febrile response is more blunted in the elderly. The authors found that the mean WBC count decreased more in the control group than the treatment group relative to baseline, which is consistent with the idea that OMT boosts the number of leukocytes in circulation. However, this finding may only be an artifact from the higher mean leukocyte count present at baseline in the control group. Recently, transient basophilia was demonstrated in healthy individuals receiving lymphatic pump manipulation.¹⁸ However, the evidence that manipulation modulates fever or WBC counts in persons with acute pneumonia is not conclusive.

Physicians today are under constant pressure to discharge patients early from the hospital, because of the current prospective payment system and the influence of managed care. As soon as clinical improvement warrants, patients are empirically changed to oral antibiotic therapy in preparation for hospital discharge. The authors believe that this situation makes duration of IV antibiotic therapy a useful measure of clinical improvement. Differences in individual practice styles may influence duration of IV antibiotic use in the hospital, as some

physicians may change to oral antibiotic treatment sooner than others. However, because no physician in this study had a disproportionate number of control or treatment group patients under their medical management, this is an unlikely source of bias. Also, because of the number of physicians involved in medical management in this study (approximately 14 attending physicians), no one individual practice style would likely affect the results. The length of hospital stay is affected by other factors besides clinical resolution of pneumonia, including discharge placement issues and management of medical problems unrelated to pneumonia. For these reasons, the mean length of hospital stay is slightly longer than the mean duration of IV and oral antibiotic therapy.

Because of the prospective payment system and managed care, any modality that can reduce length of hospital stay will have significant economic implications. Adjunctive OMT has been reported as a means of reducing duration of hospital stay for a variety of disorders,^{6,8} and a recent small pilot study showed that OMT reduced length of hospital stay for patients hospitalized with acute pancreatitis.¹³ This study is the first to show that adjunctive OMT reduces both duration of IV antibiotics and length of hospital stay for elderly patients hospitalized

with pneumonia. If future studies validate the effectiveness of OMT in reducing the length of hospital stay for patients with pneumonia and other disorders, then OMT could become a common adjunctive modality used in the hospital setting. Some hospitals have osteopathic manipulative medicine consultative services available, but their number and types of cases treated are not well published. Future studies are needed to confirm this study's findings and to explore the role of adjunctive OMT for patients hospitalized for other disorders.

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