To Breathe Again:
An Osteopathic Approach to Respiratory Failure due to SARS-CoV-2

Karli McMillan, D.O., PGY-4, Richard Feely, D.O., FAAO, FCA; Katherine Worden D.O., FAAO;

❖ kmcmil@midwestern.edu 19389 N 59th Ave, Glendale, AZ 85308

INTRODUCTION

❖ Respiratory failure is a potentially serious complication for patients infected with SARS-CoV-2. Early treatment protocols were not well established at the beginning of the global pandemic. At that time, the medications predicted to most effectively decrease morbidity and mortality were utilized. The Multicenter Osteopathic Pneumonia Study of the Elderly (MOPSE) showed Osteopathic Manipulative Treatment (OMT) significantly decreased length of stay for hospitalized pneumonia patients. The efficacy of OMT performed on ventilated patients in the setting of respiratory failure due to SARS-CoV-2 has not been documented.

❖ The purpose of this case study is to evaluate the possible efficacy of OMT in treating intubated respiratory failure patients affected by SARS-CoV-2

CASE PRESENTATION

Hospital Course

❖ 56-year-old African American female with past medical history of Hypertension and cesarean section x 2, presented to the emergency department with fever, non-productive cough and shortness of breath for the last 5 days. A Temperature of 102 °F and significant dyspnea on exertion prompted immediate admission into the hospital. She was placed on 3L/min of oxygen by nasal cannula on admission and labs were drawn. Chest X-ray showed bilateral lower lobe infiltrates. Initial labs were concerning for a hypercoagulable state. The patient's increasing oxygen demand over the next twelve hours warranted BIPAP placement and follow-up lab draws with arterial blood gas (ABG). Patient showed marked respiratory acidosis requiring intubation and transfer to the ICU.

❖ Upon admission to the ICU, osteopathic manipulation was added to the SARS-CoV-2 medical management protocol. OMT performed twice daily for 20-minute sessions.

❖ Patients' labs and vitals were monitored daily. Respiratory status stable on day 8, extubated successfully and transferred to general medical floor.

❖ Observed for additional 6 days after discharge from ICU due to continued dyspnea on exertion. Discharged home on day 14 of hospital course.

IMAGING

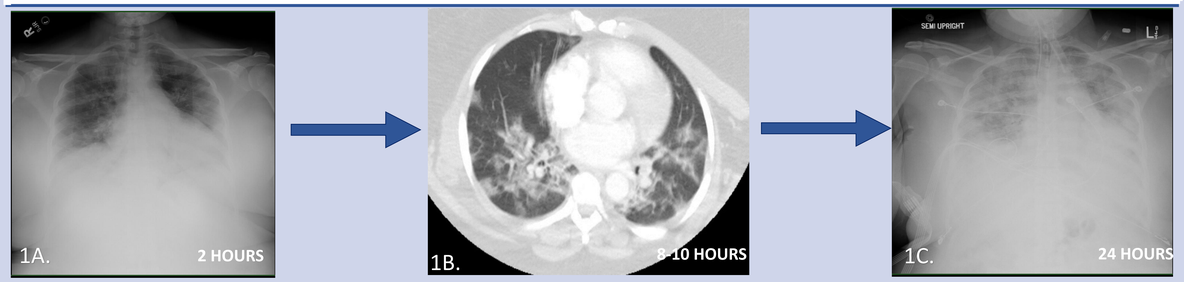


Figure 1 Description: Images shown in chronological order of worsening pulmonary status post hospital admission. (1A) Chest X-ray performed 2 hours after hospital admission showing moderate bilateral lower lobe pulmonary infiltrates. (1B) CT Pulmonary angiogram with concern for possible pulmonary embolism showing ground-glass opacities in bilateral middle and lower lobes. Performed 8 hours after admission. (1C) Chest X-ray performed approximately 24 hours after admission due to worsening respiratory status.

INITIAL LABS	
Ferritin	2,280 mcg/L
D-Dimer	1,213 ng/mL
ABG	**pH 7.434, PCO2 37.7, PO2 48.9,** HCO3 25.3

Table 1: Pertinent lab values drawn upon patient admission to hospital

24 HOUR LABS	
Ferritin	780 mcg/L
D-Dimer	1,366 ng/mL
ABG	**pH 7.312, PCO2 49.7, PO2 59.4,** HCO3 25.3

Table 2: Repeat lab draw at 24 hours post hospital admission which promptly required intubation and transfer to ICU

OSTEOPATHIC TREATMENT PROTOCOL Performed twice daily	
1. Soft tissue release to thoracic spine	5. Suboccipital inhibition
2. Rib raising	6. Myofascial release to Thoracic inlet
3. Indirect Myofascial release to diaphragm	7. Thoracic lymphatic pump
4. Soft tissue release to Cervical spine	8. Pedal pump

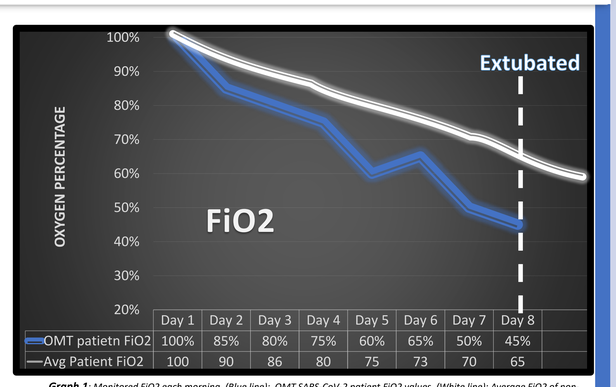
Table 3: 8- step OMT protocol (previously described in MOPSE study[10]) performed twice daily for 20 minutes in chronological order at every encounter.

RESULTS

❖ FiO2 was monitored each morning prior to initial OMT session *(see graph 1).* Notably improved oxygen demand was compared to similar cases, as seen below

❖ Ten SARS- CoV-2 patients with similar past medical history and hospital course, who did not receive OMT, were compared while in the ICU.

- ❖ 100% of patients, received full course of ceftriaxone/doxycycline on admission, 1 dose of IL-6 monoclonal antibody (tocilizumab/Actemra) and 1 dose of convalescent plasma.
- ❖ 50% were intubated for 4-5 days longer than this patient.
- ❖ 30% of patients died while intubated on days 11-18.
- ❖ 20% remained intubated for an additional 12-14 days.

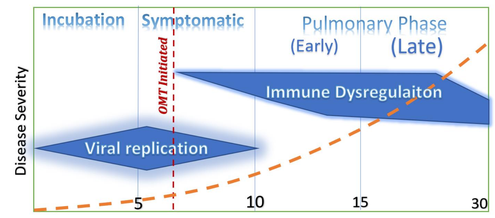


	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
OMT patietn FiO2	100%	85%	80%	75%	60%	65%	50%	45%
Avg Patient FiO2	100	90	86	80	75	73	70	65

***Graph 1:** Monitored FiO2 each morning. (Blue line): OMT SARS-CoV-2 patient FiO2 values. (White line): Average FiO2 of non-OMT SARS-CoV-2 patient. (Dotted white line): OMT patient extubated on day 8 of hospitalization. Noted decreased days of intubation with OMT patient in comparison to average FiO2 values of Non-OMT patients.*

DISCUSSION

❖ Aim of treatment was to initiate OMT within 24-48 hours of admission before inflammatory response occurs prompting immune dysregulation (activation of possible cytokine storm, Mast cell activation etc…)



Graph 2: SARS-CoV-2 clinical course. Viral replication increases, causing symptoms to appear. The inflammatory response occurs when viral replication decreases prompting immune dysregulation (Cytokine storm, Mast cell activation etc..), (Orange line): increase in inflammatory response with disease severity over time. (Red Line): OMT initiated on Day 6 of patient's disease course.

❖ This patient experienced rapid respiratory function improvement and decreased length of stay compared to similar patients who did not receive OMT utilizing the 8-step OMT protocol using techniques previously described in the MOPSE study[10].

❖ Modifications needed during the treatment process due to patient environment. This study is limited by being a single case that occurred early in a pandemic for which no standard medical treatment protocol had been established. Future studies could include a clinical trial of the adjunctive use of OMT for ventilated SARS-CoV-2 patients.

CONCLUSION

❖ This study supports the efficacy of OMT for decreasing adverse clinical outcomes in patients affected by SARS-CoV-2. Future investigation utilizing OMT in SARS-CoV-2 ventilated patients to evaluate its affect on the body's inflammatory response may improve clinical outcomes in these hospitalized patients.

ACKNOWLEDGMENTS

❖ **To the nurses, doctors, and workers of the COVID ICU: your dedication, empathy and hard work has touched the lives of thousands. My sincere thanks for all the sacrifices you have made.**

REFERENCES

1. Breithaupt, et al. Thoracic lymphatic pumping and the efficacy of influenza vaccination in healthy young and elderly populations. J Am Osteopath Assoc 2001, 101: 21-25.
2. Chikly, BJ. Manual techniques addressing the lymphatic system: origins and development. JAOA 2005, 105(10): 457-464.
3. Dery MA, et al. The effects of manually applied intermittent pulsation pressure to ventral thorax on lymph transport. Lymphology 2000, 33:58-61.
4. Gamber, R. et al. Cost-effective osteopathic manipulative medicine: a literature review of cost effectiveness analyses for osteopathic manipulative treatment. JAOA 2005, 105(8), 357-367.
5. Hodge, LM et al. Abdominal lymphatic pump treatment increases leukocyte count and flux in thoracic duct lymph. Lymph Res Bio 2007, 5: 127-134.
6. Kirschenbaum, et al. Effect of continuous lateral rotational therapy on the prevalence of ventilator-associated pneumonia in patients requiring long-term ventilatory care. Crit Care Med 2002, 30: 1983-1986.
7. Knott, EM, et al. Increased lymphatic flow in the thoracic duct during manipulative intervention. JAOA 2005, 105(10): 447-456
8. Measles, JW Jr. The effect of lymphatic pump on the immune response: preliminary studies on the antibody response to pneumococcal polysaccharide assayed by bacterial agglutination and passive hemagglutination. J Am Osteopath Assoc 1982, 82: 28-31.
9. Noll et al. Efficacy of osteopathic manipulation as an adjunctive treatment for hospitalized patients with pneumonia: a randomized controlled trial. Osteopathic Medicine and Primary Care 2010, 4(2): 1-13.
10. Noll, DR et all. Clinical and Research Protocol for Osteopathic Manipulative Treatment of Elderly patients with Pneumonia. JAOA 2008, 108(9): 508-516
11. Noll, DR, et al. Benefits of osteopathic manipulative treatment for hospitalized elderly patients with pneumonia. JAOA 2000, 100(12): 776-782.