INTRODUCTION

Tibial fractures are the most common long-bone fracture, and are associated with significant short- and long-term morbidities, including malunion or nonunion, persistent pain, and decreased bone density even decades later. However, the role of osteopathic manipulative treatment in the management of acute fracture is scarcely mentioned in the literature. This case demonstrates that osteopathic manipulation can address acute, even severe, trauma in ways that are effective and well-tolerated and that may even promote bone healing.

CASE DESCRIPTION

History of Present Illness

The inpatient Osteopathic Manipulative Medicine (OMM) Service was consulted to see a 45-year-old female who was post-operative day one status post (s/p) closed reduction and external fixation of fractures of her right tibia and fibula. The patient had been a passenger in a bus accident; radiographs performed in the Emergency Department revealed severely comminuted fractures of the distal tibial and fibular shafts; multiple bone fragments; and diffuse soft-tissue swelling. At the time of consultation, the patient reported significant ankle swelling and ankle pain that was well-controlled with morphine. She denied motor and sensory loss of the right foot at the location of one of the fixation rods; decreased sensation to light touch on the dorsum of her right ankle. Physical exam confirmed a marked decrease in edema of the right distal lower extremity. She was treated with OMM daily throughout the remainder of her admission. Subsequent treatments continued to focus on fluid drainage and decreasing the severity of fascial strains. All treatments were well-tolerated and resulted in significant symptomatic and clinical improvement.

Past Medical/Surgical History

Ovarian cancer, s/p total abdominal hysterectomy and chemotherapy. Right tibial and fibular fractures due to a fall at age 14; she was casted at that time.

Physical Exam

Vital signs within normal limits. Alert, oriented, in no acute distress. Head, neck, heart, lungs, and abdomen all unremarkable. External fixation hardware in place to the distal tibia and fibula, with the above noted moderate-to-severe somatic dysfunction due to acute trauma. As part of her post-operative management, plan was for treatment with OMM to decrease fascial strains, promote fluid drainage, and palliate pain. Optimizing lymphatic function was the priority of her first treatment: balanced ligamentous techniques were employed to address the strains through her cervicothoracic, thoracolumbar and lumbopelvic regions as well as her diaphragmatic restriction. In addition, a gentle, oscillatory fluid fluctuation was performed at the patient’s knee was a vital component of her initial treatment. As discussed, osteocytes are also responsive to fluid drainage and decreasing the severity of fascial strains. All treatments were well-tolerated and resulted in significant symptomatic and clinical improvement.

Hospital Course

The day after her first OMM treatment, the patient reported significant decreases in both pain and swelling of her right ankle. Subsequent treatments continued to focus on fluid drainage and decreasing the severity of fascial strains. All treatments were well-tolerated and resulted in significant symptomatic and clinical improvement.

DISCUSSION

Although Julius Wolff first argued in 1892 that bone responds to the forces placed upon it, current research has elucidated that the cellular level the ways in which bone adapts to mechanical forces. Intertitial fluid flow within the lacuno-canalicular system activates osteocytes, likely via stretch-activated ion channels, thereby converting a mechanical signal to a chemical one. Mechanical activation of osteocytes leads to production of numerous signaling molecules, including bone morphogenic proteins, which are critical mediators of fracture healing. This ever-ongoing process of remodeling in response to its environment is at the core of bone’s structure and function, its architecture and its self-healing.

This case brings into stark relief the dynamic responsiveness of bone: a history of prior fractures, post-chemotherapy osteoporosis, then a second trauma resulting in an extraordinary degree of damage. That this responsiveness is mediated by mechanotransduction would seem to make the topic of fracture healing prime for the application of osteopathic principles and practices. Yet acute orthopedic injury is rarely discussed in the literature and, when mentioned, typically involves injuries of lesser severity. This case serves as evidence that the use of OMM in the setting of acute trauma may offer significant benefits.

While inflammation is a necessary phase of healing, if the capacity of the lymphatic system is overwhelmed, edema persists. This contributes to localized ischemia, nutritional deprivation of involved tissues, and pain. Addressing lymphatic function has been a focus of osteopathic medicine since its inception. Based on the osteopathic assessment of this patient, the goals of her treatment included removing obstructions to lymphatic drainage and promoting lymph formation. A respiratory-circulatory approach aptly addresses the first goal; the restrictions and fascial strains of the patient’s cervicothoracic junction, diaphragm and lumbopelvic regions were all addressed.

Another osteopathic approach is to stimulate lymph generation, i.e., to facilitate the movement of fluid from the interstitium into lymphatic vessels. It is interstitial fluid flow – whether due to inherent motions associated with pulse respiration or performed through therapeutic motions designed to create a fluid fluctuation – that drives the process of lymph formation. Thus, the fluid fluctuation performed at the patient’s knee was a vital component of her initial treatment. As discussed, osteocytes are also responsive to interstitial fluid flow, and recent evidence supports the use of various mechanotransducing modalities to stimulate bone healing. This raises the intriguing question of whether an osteoidically induced fluid fluctuation may also have a stimulatory, but as yet unstudied, effect on bone healing.

Osteopathic Manipulative Medicine offers a range of treatment approaches; all of the ones utilized in this case were gentle enough to be easily tolerated. The fields of orthopedic and osteopathic medicine are in agreement that somatic alterations due to fracture may persist for years. This patient’s clinical and symptomatic improvement are indicative of the pivotal role OMM might play in acute, even severe, trauma. Current research in the fields of manual lymph drainage, mechanotransduction, and bone physiology support the claim that the acute setting is precisely where OMM may have its most potent effects.