An Osteopathic View of Urinary Tract Infection

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Objectives

• At the end of this presentation the participant will be able to:
  • Give a definition of:
    • The urinary tract
    • Urinary tract infection (UTI)

• Describe the osteopathic approach to UTI using the Five Model system

• List and describe:
  • Somatic dysfunctions that may be associated with UTI
  • Osteopathic manipulative treatment techniques (OMT) useful in treating patients with UTI
Urinary Tract – Definition

Anatomy of the Urinary System

- Consists of two kidneys, two ureters (upper urinary tract), a urinary bladder, and a urethra (lower urinary tract).
The Five Model Approach
The Biomechanical Model
The Biomechanical Model
• The kidneys are located in the retroperitoneal space between T12 and L3.

• The kidneys are supported only by fascial connections through the renal fat. The primary attachment is through the diaphragmatic fascia as well as the psoas major fascia. The lower aspect of the renal fascia is in contact with the quadratus lumborum muscle.
The Biomechanical Model

• Both the lateral and medial lumbocostal arches cross posterior to, and are in contact with, the kidneys
• The arches are in turn connected to rib 12
• Lateral traction on the twelfth ribs can provide tension on the arches and thereby affect the kidneys, ureter, and fascial structures.
The Biomechanical Model

• The kidneys are associated with the diaphragm and the pleura superiorly, psoas and quadratus lumborum muscles inferiorly, and peritoneum anteriorly, and they lie deep to ribs 11 and 12
• We can take advantage of the psoas and quadratus lumborum muscles to affect changes directly
• We can also use the relationship with the diaphragm to affect changes more indirectly
The Biomechanical Model
The Biomechanical Model
The Biomechanical Model

- The subcostal nerve, iliohypogastric nerve, and the ilioinguinal nerves cross the kidneys posteriorly.
- Irritation of surrounding structures can lead to irritation of these nerves, which can cause some of the typical renal pain syndromes.
The Biomechanical Model

• The ureters travel along the course of the psoas muscle and are attached via the psoas fascia

• The psoas in turn attaches to the lesser tubercle of the femur. Using the femur as a handle onto the psoas muscle, the practitioner can alter the tone in the ureter, decrease smooth muscle spasm, and assist the passage of stones

• For example, if the femur is flexed and externally rotated, psoas muscle tone and ureter tone are decreased. This may aid in decreasing pain and allow a stone to pass easier over the pelvic brim and into the bladder
The Biomechanical Model

• The bladder sits in the pelvic cavity, which is an osseous container with a muscular floor.
• The muscular floor is made up of the pelvic diaphragm, which not only supports pelvic structures but aids in structural integrity of the external urethral sphincter.
• The bladder is attached via the pubovesicular and puboprostatic ligaments; otherwise it is free in the pelvis.
The Biomechanical Model

• Urinary continence is maintained by contraction of the sphincter musculature
• This is assisted by the urogenital dia-phragm
• Pubic shear, pubic/pelvic counterstrain tender points, pelvic diaphragm trigger points, and innominate and sacral somatic dysfunction can lead to pelvic shape and tone changes, which can torque the urogenital diaphragm and lead to incontinence
• By treating these findings with manipulation and affecting the structural mechanics, as well as normalizing muscular tone, we can help restore optimal function
The Biomechanical Model

• During thoracic inhalation, the diaphragms contract and the spinal curves flatten
• The base of the sacrum moves posteriorly and the overall shape of the thoraco-abdominal-pelvic cylinder changes
• These changes in shape create pressure changes in the thorax and abdomen throughout respiration
• During inhalation, the kidneys move inferiorly along the psoas muscle. The superior aspect moves anteriorly and the entire kidney rotates externally. The bladder follows the motion of the sacrum and moves both superiorly and posteriorly. The ureters will follow the motion between the kidneys and bladder
The Biomechanical Model

- The pelvic diaphragm contracts and expands during the respiratory cycle
- The pumping action of the pelvic diaphragm aids in the movement of venous and lymphatic fluids
- Somatic dysfunction can alter the excursion of pelvic diaphragm contraction and lead to stasis of lymph and venous blood in the pelvis
- This leads to pelvic congestion, pain syndromes, and an inability to clear infections adequately
The Neurological Model

Biomechanical
The Neurological Model
The Neurological Model

- **Eye, Salivary glands**
- **Heart**
- **Upper extremities**
- **Esophagus, Trachea, Bronchi, Lungs**

**Upper GI Tract**
- **Proximal duodenum**
- **Some parts of the pancreas**
- **Liver**
  - **Gall bladder**
  - **Spleen**
  - **Stomach**

**Middle GI Tract**
- **Other parts of the pancreas**
  - **Distal duodenum**
  - **Jejunum**
  - **Ilium**
  - **Ascending colon**
  - **Proximal 2/3 of transverse colon**
  - **Kidneys**
  - **Adrenal medulla**
  - **Upper ureters**
  - **Gonads**

**Lower GI Tract**
- **Distal 1/3 of transverse colon**
- **Descending colon**
- **Sigmoid colon**
- **Rectum**
- **Appendix**
- **Lower Ureters**
- **Bladder**
- **Prostate**
- **Uterus & cervix**
- **Lower extremities**
The Neurological Model
The Neurological Model
The Neurological Model

- Most of the autonomic innervation to the kidneys is through the sympathetic system from fibers that originate from T 10–T 12.
- Sympathetic nervous system stimulation to the kidneys causes vasoconstriction of the afferent arterioles, which decreases glomerular filtration rate and results in decreased urinary output.
- Hypersympathetic stimulation to the kidneys has also been postulated to play a role in the genesis and etiology of essential hypertension through chronic vasoconstriction and sodium resorption.
The Neurological Model

- Increased sympathetic stimulation to the ureters from fibers originating from T10-L2 decreases ureteral peristalsis and can lead to spasm.
- This can cause a visceral pain syndrome but can also cause psoas spasm.
- This has been implicated in restricting the passage of kidney stones.
- Treating somatic dysfunction at these levels may help relax ureteral spasm through somatovisceral reflexes and allow stone passage.
- High velocity low amplitude, strain-counterstrain, muscle energy, or any osteopathic technique can be used as long as it addresses somatic dysfunction at the affected levels.
The Neurological Model

- Visceral afferent nerves from the bladder wall transmit to both L1-L2 and S2-S4 and are intimately involved in a complex interaction with the autonomic nervous system in the process of urination.
- Voluntary relaxation of the external urethral sphincter and decreased sympathetic tone are simultaneously required.
- In addition, there must be relaxation of the internal urethral sphincter, which occurs through a parasympathetic reflex from S2-4.
The Neurological Model

• When our patients are in pain, anxious, or otherwise affected, a complicated series of metabolic and autonomic changes occur, which can lead to urinary retention and incontinence

• Osteopathic treatment can improve autonomic balance and thus lead to improved function

• Acute viscerosomatic reflex or segmental facilitation is characterized by warmth, muscle spasm, tenderness, and moisture

• These are explained by the physiological processes of vasodilation, reflex stimulation of alpha motor-neurons in the deep back musculature, activation of the inflammatory cascade, and vasomotor activation, respectively

• These are the basic findings that characterize somatic dysfunctions.
The Respiratory-Circulatory Model
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The Respiratory-Circulatory Model

• From the macroscopic perspective, the respiratory-circulatory model views the movement of blood and lymph throughout the body
• From the microscopic view, we focus on the exchange of oxygen and nutrients and removal of metabolic waste products at a cellular level
The Respiratory-Circulatory Model

• During inhalation, the thoracic diaphragm will contract, flatten, and move inferiorly; the pelvic diaphragm also moves inferiorly. During exhalation, the pelvic diaphragm returns to an elevated position and the thoracic diaphragm retains its typical shape.

• This pumping action occurs during each breath and creates gradients that not only create air movement but help move lymphatic fluid and venous blood more along their course.
The Respiratory-Circulatory Model

- During times of inflammation or obstruction, renal lymphatic flow can increase significantly.
- By treating thoracic, ribcage, abdominal and pelvic somatic dysfunctions, the effectiveness and efficiency of pressure gradients, and hence the body's ability to assist in lymphatic and venous fluid return, is improved.
The Respiratory-Circulatory Model

• Osteopathic manipulative treatment is directed first at the thoracic inlet
• Somatic dysfunction in this region can affect the efficiency and capacity of lymph drainage
• Once the inlet has been opened, the thoracic spine, rib cage, and diaphragm can be treated
• Abdominal and pelvic somatic dysfunction should be treated next
• Finally, lymphatic pumps can be used to mobilize fluids once these treatments have been completed
Metabolic - Energetic
The Metabolic-Energetic Model

• Fatigue can be a major symptom of patients with renal disease
• The kidneys receive approximately 25% of cardiac output
• They are partially responsible for elimination of waste products of metabolism, acid-base balance, formation of blood, electrolyte balance, and vitamin D metabolism
• Any one of these essential processes can become disrupted by kidney disease
• As kidney function declines, the ability of the kidneys to perform these tasks diminishes
• Anemia, subtherapeutic vitamin D levels, increases in blood urea nitrogen, and electrolyte imbalance can occur with either elevated levels or depleted levels of electrolytes. Acidosis can occur if hydrogen ions are not able to be excreted effectively
• Any of these changes can lead to a change in a patient's strength and energy
The Metabolic-Energetic Model

- The acidotic patient has an increased respiratory rate for compensation.
- This stresses the body, and any underlying somatic dysfunction will be exaggerated.
- Add underlying anemia and increasing blood urea nitrogen and the effect can worsen.
- These patients consume more resources to maintain homeostasis and therefore fewer resources are available to maintain well-being and perform activities of daily living.
- Patients may complain of fatigue, pain, swelling, or dyspnea.
The Metabolic-Energetic Model

• Allostatic load is the total summation of all the stressors on a patient
• These stressors can be physical, metabolic, emotional, and musculoskeletal
• This is mediated through the hypothalamic-pituitary axis
• Hypersympathetic states along with elevated cortisol and neuroendocrine levels occur
• These changes in our immune status have consequences regarding life expectancy, morbidity, and pathology
The Metabolic-Energetic Model

• The DO can not only treat the underlying disease process but can also address somatic dysfunction and thereby improve efficiency of the musculoskeletal system and decrease overall allostatic load

• This can help preserve patients' resources and affect the ability of our patients to both maintain quality of life and improve overall well-being
The Biopsychosocial Model
The Biopsychosocial Model

• Changes in emotional states have well-documented psychological impact on the body at large
• This has been demonstrated through the concept of allostatic load, which has been mentioned previously
• Through these mechanisms, emotional stress can cause vasoconstriction of renal blood flow and this leads to decreased urine production and output
The Biopsychosocial Model

• Studies have examined the relationship between renal disease and depression and have found increased prevalence of depression in patients even in the early stages of kidney disease

• Research has shown that as many as 40% of patients with chronic kidney disease and 50% of patients with end-stage renal disease have major depression

• Patients with depression and kidney disease have higher morbidity and overall worse outcomes
The Biopsychosocial Model

• Depression can have both somatic and cognitive features that mimic the findings of uremia—anorexia, sleep disturbances, abdominal pain other pain issues, and fatigue

• The DO can intervene with screening, pharmacologic intervention, and the use of osteopathic manipulation.

• Through the application of osteopathic principles, the practitioner is able to decrease somatic dysfunction throughout the body and decrease both segmental and central facilitation, thereby decreasing the musculoskeletal contribution to the allostatic load
In addition, the autonomic milieu can change from one of hypersympathetic state to parasympathetic state, which has many documented positive benefits.

There have been a few pilot studies that examined the treatment of depression using manipulation, and these have shown a positive effect in treated patients.

There is at least this evidence and rationale to include osteopathic manipulative treatment as a possible intervention to offer these patient
Further Reading


Thank You!