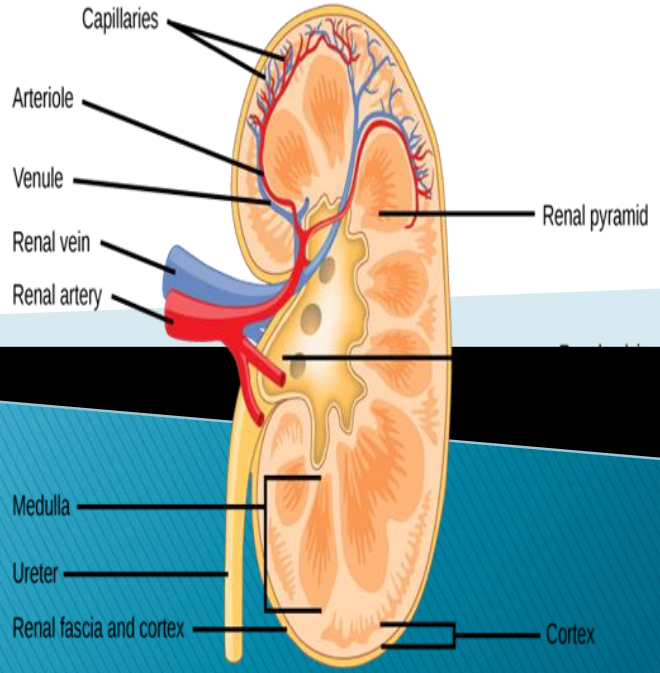
Al- Mustaqbal College University
kidney dialysis
Anatomy
2nd stage

BY:-
Dr.Roaa Nashat AL-Saffar

Innervation Of renal system



- The renal system is innervated by the renal plexus, a network of sympathetic and sensory nerve fibers that travel along the renal artery and vein into the kidney. The sympathetic nerves control functions like blood flow and renin secretion,
- while sensory nerves transmit signals about pain and kidney status. These nerves play a crucial role in regulating kidney function by influencing renal blood flow and tubular reabsorption.

Sympathetic (Efferent) Innervation

Source: Primarily from the sympathetic nervous system, receiving input from the celiac and aorti-corenal plexuses and the least splanchnic nerve.

Function:

Causes vasoconstriction of the afferent and efferent arterioles, which decreases renal blood flow and glomerular filtration rate.

Increases renin secretion from the juxtaglomerular cells.

Increases sodium reabsorption in the tubules.

The densest innervation is found in the afferent arterioles of the glomerulus.

Sensory (Afferent) Innervation

Source: Fibers that originate from the kidney and travel to the spinal cord.

Function:

Transmit signals from chemoreceptors in the renal pelvis, which are stimulated by hypoxia, ischemia, or changes in ion concentration (like high potassium or hydrogen ions).

Contribute to the feeling of pain, which is why kidney problems can cause flank pain, typically felt at the T10-T11 spinal cord level.

Role of Renal Nerves in Hypertension

The kidney is heavily innervated by the sympathetic nervous system (SNS). These renal nerves play a major role in regulating blood pressure (BP) through effects on:

- Renal hemodynamics
- Renin release
- Tubular sodium handling

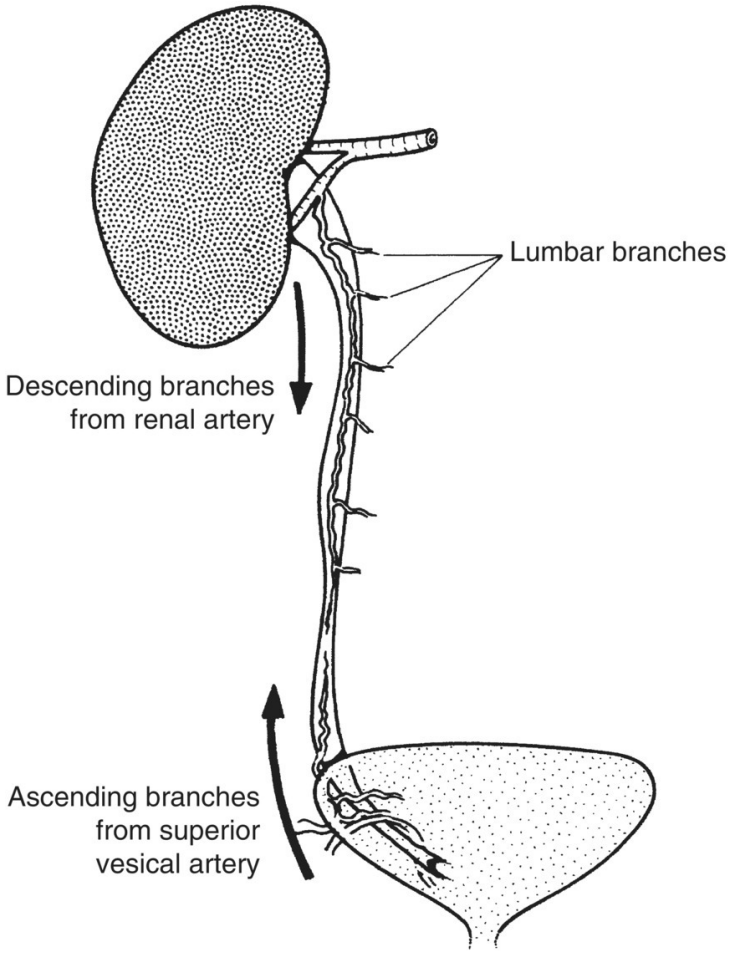
Elevations in renal sympathetic nerve activity (RSNA) increase renin release, tubular sodium reabsorption, and renal vascular resistance (RVR) thereby promoting water and sodium retention as well as arterial pressure rises depending on the physiological conditions

Innervation of the ureter

Nerve Supply: The ureters receive their innervation from the autonomic nervous system, specifically through the sympathetic and parasympathetic fibers.

Sympathetic Innervation: Arises from the thoracolumbar region (T11-L2) and travels via the renal plexus and aortic plexus to the ureters. This innervation is involved in regulating peristalsis and blood flow.

Parasympathetic Innervation: Comes from the pelvic splanchnic nerves (S2-S4), which stimulate peristalsis and promote urine transpor


Lumbar branches
Descending branches
from renal artery
Ascending branches
from superior
vesical artery

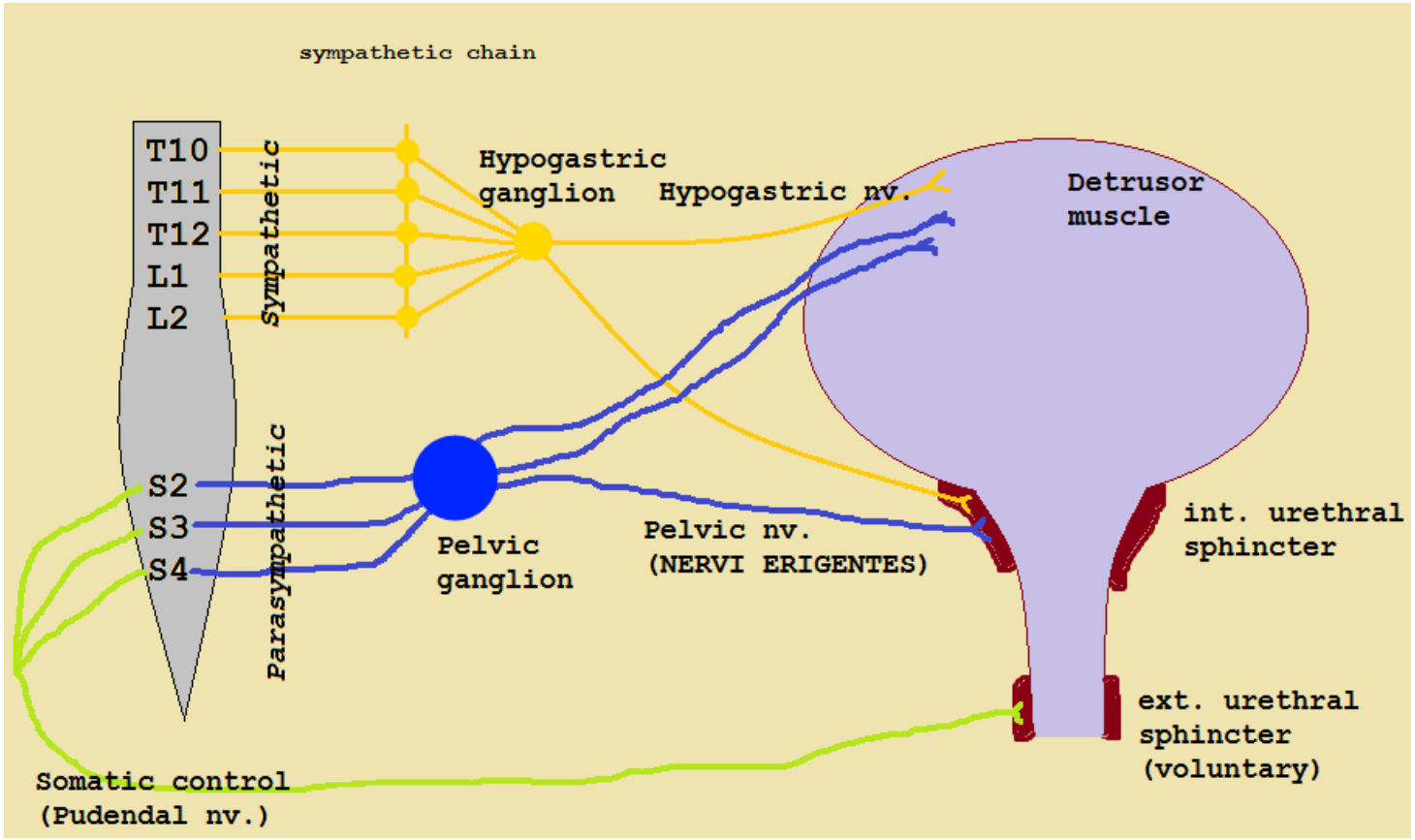
Nerve supply of the bladder

Neurological control is complex, with the bladder receiving input from both the autonomic (sympathetic and parasympathetic) and somatic arms of the nervous system:

Sympathetic – hypogastric nerve (T12 – L2). It causes relaxation of the detrusor muscle, promoting urine retention.

Parasympathetic – pelvic nerve (S2-S4). Increased signals from this nerve causes contraction of the detrusor muscle, stimulating micturition.

Somatic – pudendal nerve (S2-4). It innervates the external urethral sphincter, providing voluntary control over micturition


sympathetic chain
T10
T11
T12
L1
L2
Sympathetic
Hypogastric ganglion
Hypogastric nv.
Detrusor muscle
S2
S3
S4
Parasympathetic
Pelvic ganglion
Pelvic nv.
(NERVI ERIGENTES)
int. urethral sphincter
ext. urethral sphincter (voluntary)
Somatic control
(Pudendal nv.)

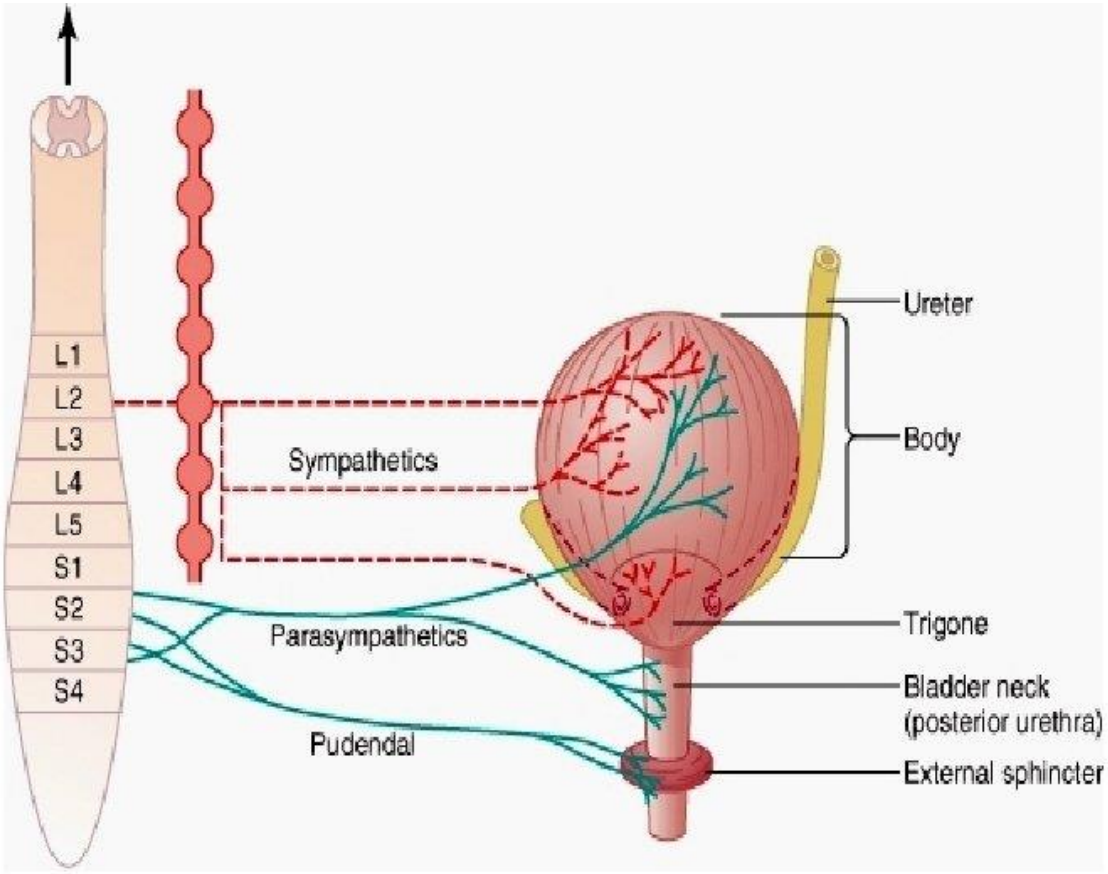
Innervation of urethra

The urethral sphincter complex receives both somatic and autonomic innervation. These supply its voluntary and involuntary components, respectively.

The smooth muscle fibers of the internal urethral sphincter receive both sympathetic and parasympathetic innervation.

Sympathetic supply arises from the lower thoracic and upper lumbar (T11 - L2) segments of the spinal cord. These nerves maintain tonic contraction of the internal urethral sphincter, thereby preventing urine outflow from the bladder into the urethra

the parasympathetic supply arises from sacral levels S2 - S4 (spinal micturition center). It acts to “inhibit” the internal sphincter muscle, thereby relaxing it and allowing urine to pass from the bladder into the urethra.



The external urethral sphincter is innervated by the pudendal nerve (S2–S4), which provides somatic motor innervation. This innervation allows for voluntary control of the sphincter, playing a crucial role in urinary continence.