



Abstract

A man is impotent when he fails to achieve and/or maintain an erection of sufficient rigidity and duration to allow satisfactory vaginal intromission. Erection is a complex interplay of psychogenic, hormonal, arterial, venous and sinusoidal factors. Dysfunction can occur with any or all of the above factors.

Incidence

- I. 1% of men at age 40, rising to 25% of men 65 or older.
- II. In 50% or more, there is an underlying organic cause as the dominant factor, the percentage rises with age.

Anatomy

I. Arterial

Internal pudendal artery is the main blood supply.

Penile artery divides into several branches: the dorsal artery supplies the glans penis, the penile skin and subcutaneous tissues; the cavernous artery enters the corpus cavernosum in the penile hilum and is the main source of blood to the erectile bodies; the bulbourethral artery supplies blood to the urethra.

In the flaccid state blood flows through the cavernous artery at only several cc/minute, a rate that supplies adequate nutrients only.

II. Venous - 3 systems

Superficial - drains the skin to the superficial saphenous system.

Intermediate - drains the proximal 2/3 of the cavernous bodies through the emissary and circumflex veins to the deep dorsal vein of the penis which in turn to the periprostatic plexus.

Deep - drains the proximal third of the penis through the cavernous and crural veins to the internal pudendal veins.

III. Neurologic

A. Central - the hypothalamic centers are:

1. Medial preoptic area (MPOA) - erection and libido.

2. Paraventricular area - seminal emission, important for fertility.
3. Receptors - Adrenergic, dopaminergic, serotonergic.

B. Peripheral nervous system - Penile nerves:

1. Pudendal nerve - somatic sensory and motor
 - a. Dorsal nerve - responsible for penile sensation.
 - b. Perineal nerve - to the accessory muscles of erection: the ischiocavernosus and bulbospongiosus, these muscles contract during sexual activity and compress the proximal corpora cavernosa. These contractions increase the intracorporal pressure to several times that of the systolic pressure.
2. Cavernous nerves - autonomic
 - a. Sympathetic stimulation causes detumescence
 - b. Parasympathetic stimulation results in erection. Enter, the penis in the penile hilum with the cavernous arteries, can be damaged during pelvic surgery such as radical prostatectomy for prostate cancer or surgery for colorectal cancer resulting in neurogenic impotence.

C. Neurotransmitters

1. Tumescence is parasympathetically mediated : Nitric oxide is the main transmitter. Acetylcholine and VIP are co-transmitters.
 2. Detumescence is sympathetically mediated.
 - a. Probable transmitter - norepinephrine
 - b. Possible alternative transmitters
 - neuropeptide Y (NPY)
 - endothelin
- I. Initiation - due to appropriate neurologic stimulus which can be psychogenic, tactile or more commonly both in origin.
 - II. Sinusoidal relaxation - under the influence of parasympathetic neurotransmitter the smooth muscle relaxes resulting in a large potential space for blood pooling.
 - III. Arterial dilation - in response to or simultaneous with the sinusoidal dilation the arteries dilate, increase their blood flow to more than 100 cc/min and blood fills the dilated sinusoidal spaces.
 - IV. Venous occlusion - the sinusoids are drained by small venules that come together to form many plexus of venules beneath the tunica albugenia. These subtunica venules then pierce the tunica and drain into circumflex veins which join the deep dorsalsalvein in the midline. During erection expansion of the sinusoids compresses the subtunica venular plexus against the less-distensible tunica, reducing the venous outflow.

Diagnosis - Patient goal-directed: least invasive tests first

- Medical and sexual history, past medical and surgical illness, medications and substance abuse.
- Physical examination: aiming at detecting signs of vascular, endocrine and neurologic deficit.
- Laboratory: routine CBC, SMAC, testosterone and prolactin, others when indicated.

Tests for differential diagnosis of various types of impotence:

I. Nocturnal Penile Tumescence testing

- A. Normal males have penile erection 3-5 times /night during REM sleep
- B. Electronic monitoring of rigidity and tumescence differentiates organic from functional (psychogenic) impotence

II. Combined injection & Stimulation (CIS) Test

- A. Use of direct injection of vasodilators intracavernously to bypass neural mechanism and genital self stimulation to enhance the response
- B. Intravenous agents in use today: Papaverine Phentolamine Prostaglandin E

III. Duplex/color ultrasonography - direct test of arterial function

- A. Two ultrasound heads, one is used to image and direct the placement of the second ultrasound beam directly over the cavernous artery. The second head then is used to measure the velocity blood flow through the cavernous vessel.
- B. Non invasive way to examine adequacy of arterial flow

IV. Arteriography

- A. Invasive way to examine adequacy of arteries
- B. Aim: detect proximal lesions of internal pudendal artery amenable to ballon dilation or surgery

V. Cavernosometry/Cavernosography

- A. Test of veno-occlusive mechanism
- B. Performed in the presence of intracavernous vasodilators which activate the vaso-occlusive mechanism
- C. Cavernosometry measures intracorporal pressure rise as a function of filling with saline under pressure. With venous leak pressure rise is limited and pressure falls rapidly when filling is halted.
- D. Cavernosography - radiographic contrast infused to pinpoint location of leakage

Treatment - patient goal-oriented, trial of less invasive therapy first

- I. Psychogenic impotence - Causes: anxiety, fear, religion, depression, marital conflict, lack of attraction, lack of knowledge of normal aging changes.
 - A. Characterized by acute onset, situational nature, related to specific partner or event.
 - B. Therapy of choice is psychosexualtherapy.
 - C. Adjunct:
 - 1. Intracavernous injection (ICI) - patients learn to self-inject vasodilators prior to intercourse.
 - 2. Vacuum Constriction Device (VCD) - Negative pressure generated to stretch sinusoids and pull in blood. Blood trapped in penis by elastic band.
 - D. Alternative penile prosthesis - destroys native erectile tissue.

- II. Neurogenic - Causes: Spinal (trauma, tumor, congenital deformity, surgery, multiple sclerosis). Peripheral (colorectal & prostate surgery, trauma, diabetes, alcoholism)
 - A. First choice: ICI, VCD
 - B. Alternative - Penile prosthesis

- III. Hormonal
 - A. Hyperprolactinemia: pituitary ablation or bromocryptine
 - B. Hypergonadotropic hypogonadism: i.m. testosterone
 - C. Hypogonadotropic hypogonadism: pituitary causes (refer to endocrinologist)
 - D. Thyroid, adrenal: refer to endocrinologist

- IV. Arteriogenic - Causes: atherosclerosis, hyperlipidemia, diabetes, hypertension, long distance biking, straddle injury, pelvic injury
 - A. Proximal artery - balloon dilation or surgery
 - B. Distal
 - 1. Traumatic in origin and localized, may be treated with arterial bypass
 - 2. Generalized - ICI, VCD
 - C. Alternative - Penile prosthesis

- V. Venogenic Impotence - Causes: mostly unknown (traumatic, aging, end organ disease)
 - A. Mild to moderate-ICI &/or VCD
 - B. Severe-venous ligation and excision, penile prosthesis

- VI. Sinusoidal fibrosis - Causes: post-priapism, blunt injury (penile fracture), scleroderma
 - A. Mild - ICI, VCD
 - B. Severe - penile prosthesis

VII. Drug-induced - Causes: antidepressant, anti hypertensive, antiandrogen, estrogen, cimetidine, cigarette smoking, alcoholism, marijuana, cocaine. Treatment: discontinue or change medication. If not feasible - ICI or VCD.