ROLE OF COLORED DOPPLER IN ASSESMENT OF ORGANIC MALE IMPOTENCE

Thesis submitted for partial fulfillment of M.Sc.degree.
Radio-diagnosis

By
Dalia Saleh Mohamed Aly Hassan
(M.B.,B.CH.)

Under supervision :

PROF. MAMDOUH GHONIEM.
Prof .Radio-diagnosis,
Ain Shams University.

DR. OMAR MOHAMED ATEF SHARAF.
Lecturer .Radio-diagnosis.
Ain Shams University.

Faculty of medicine
Ain Shams University.

٢٠١٠

دور الموجات فوق الصوتية المزودة بالدوبلر الملون في تشخيص حالات الضعف العضوي الجنسي لدي الذكور

رسالة توطئه للحصول علي درجة الماجستير فى الأشعة التشخيصية

مقدمة من

داليا صالح محمد علي حسن

بكالوريوس الطب والجراحة –جامعة مصر للعلوم والتكنولوجيا

تحت إشراف

أ.د/ ممدوح أحمد غنيم

أستاذ الأشعة التشخيصية
كلية الطب-جامعة عين شمس

د/ عمر محمد عاطف شرف

مدرس الأشعة التشخيصية
كلية الطب-جامعة عين شمس

كلية الطب-جامعة عين شمس
٢٠١٠

Acknowledgements

Thanks are given to **ALLAH** the source of all knowledge, by whose abundant aid this work has come to fruition.

It has been a great honor to proceed this work under the supervision of **Prof Dr. MAMDOUH GHONEIM , Professor of radiology, Faculty of Medicine ,Ain Shams University.** I am greatly indebted to him for suggesting and planning the subject, supervising the whole work, reading and criticizing the manuscript. I will never forget his unlimited help, continuous support, kind encouragement, constructive criticism and wise guidance. To him words of praise are not sufficient and I am really greatly indebted to him.

I would like to express my deep obligation **Dr. OMAR MOHAMED ATEF ,Lecturer of Radiology department, Faculty of Medicine, Ain Shams University**, for his useful assistance and his enlightening supervision.

List of Abbreviations

CC	Corpora cavernosa
CCEMG	Electromyography of the corpus cavernosum
cGMP	Cyclic guanosine monophosphate
CS	Corpus spongiosum
DD	Color duplex doppler sonography
ED	Erectile dysfunction
EDV	End diastolic velocity
HDL	High density lipoproteins
ICI	Intracavernosal injection tests
IIEF	International index of erectile function
NOS	Nitric oxide synthase
NPT	Nocturnal penile tumescence
PDE-٥	Phosphodiesterase-٥
PDS	Penile Doppler ultrasound
PGE١	Prostaglandin e١
PSV	peak systolic velocity
RI	Resistive index
SHBG	Sex hormones binding globulin
SHIM	Sexual health inventory for men
SNPs	Single nucleotide polymorphisms

Contents

Introduction

Organic male impotence with normal endocrine balance and normal central nervous system may be due to scarring of the corpora cavernosa ,arterial deficit or venous leakage. color duplex sonography can be used to distinguish among these three causes of impotence .

Aim of the work

The aim of this work is to assess the value of color Doppler sonography i^n cases of organic male impotence.

Content

Chapter 2
ANATOMY OF THE PENIS

Anatomical background:

The penis is essentially a tripartite structure, with bilateral corpora cavernosa and the midline ventral corpus spongiosum/glans, all three of which are surrounded by loose subcutaneous tissue and skin that can be moved freely over the erect organ **(Fig ١).** The corpora cavernosa function as the main erectile bodies, while the corpus spongiosum contains the urethra***(Benson and Boileau, 1999).***

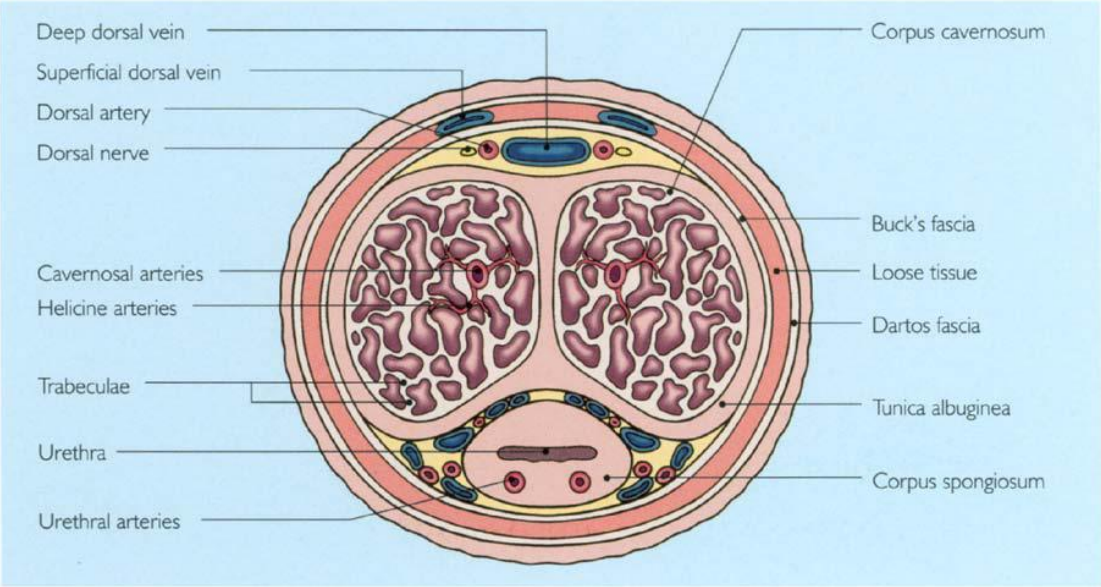

Fig ١ : Cross-sectional anatomy of the penis. Used with permission from the American Urological Association from AUA Update Series, vol ١٣, lesson ٢, ١٩٩٤.

There are two fascial layers. The more superficial is the dartos fascia, continuous with Scarpa's fascia of the abdomen. It continues caudally as the dartos fascial layer of the scrotum and Colles' fascia in the perineum. The deeper fascial layer is Buck's fascia, which covers the corpora cavernosa and the corpus spongiosum in separate compartments, including coverage of the deep dorsal vein as well as the dorsal

neurovascular bundles. Buck's fascia attaches to the perineal membrane proximally and to the coronal sulcus distally, where it fuses with the tips of the corpora. The fundiform and suspensory ligaments attach to the pubic symphysis and Buck's fascia, and allow the erect penis to achieve a horizontal or greater angle.

The corpora are surrounded by tunica albuginea, a strong structure of heterogenous thickness and anatomy, the purpose of which is to both provide rigidity of the erectile bodies as well as to function in the venoocclusive mechanism. The tunica albuginea consists of two layers, the outer of which is oriented longitudinally and the inner layer consisting of circular fibers. The inner layer contains struts that course the cavernosal space and serve to augment the support provided by the intracavernosal septum. The corpus spongiosum lacks both the outer layer as well as the struts***(Hsu et al. 1994).***

The paired corpora cavernosa originate separately underneath the ischiopubic rami, then merge as they pass under the pubic arch. The septum between them is incomplete in humans, although complete in some other species. They are supported by several fibrous structures, including the surrounding tunica albuginea, the intracavernous struts radiating from the inner layer of tunica albuginea, and perineural/ periarterial fibrous sheaths. The spongy inner portion of the corpora consists mainly of interconnected sinusoids separated by smooth muscle trabeculae, which are surrounded by collagen and elastic fibers. These sinusoids are larger centrally and smaller towards the periphery.

The corpus spongiosum and its distal termination in the glans penis are similar in internal structure to the corpora cavernosa except that the sinusoids are larger, and there is a lack of outer layer of tunica albuginea that is absent in the glans***(Breza J et al,1989)*** **.**

The paired internal pudendal arteries are the principal blood supply to the penis. These vessels arise from the internal iliac (hypogastric) artery and form the penile arteries, which, in turn, divide into three main branches. The bulbourethral artery supplies the CS, and the dorsal artery of the penis nourishes the penile skin and glans **(Fig ٢،٣)**. The paired cavernous arteries, coursing through the center of the CC, are the principal blood supply to the erectile tissue and are important for corporal engogement. It should be noted that there could be considerable variation in the penile arterial supply. The principal venous drainage of the CC is the subtunical and emissary veins, which drain into the deep dorsal vein, while the superficial dorsal vein provides for cutaneous drainage of the penis. The other major venous drainage system is the cavernous and crural veins, which form the pudendal vein. The venous drainage of the penis is also complex and variable **(Fig ٤).*(Bensonand Boileau,1999)***.

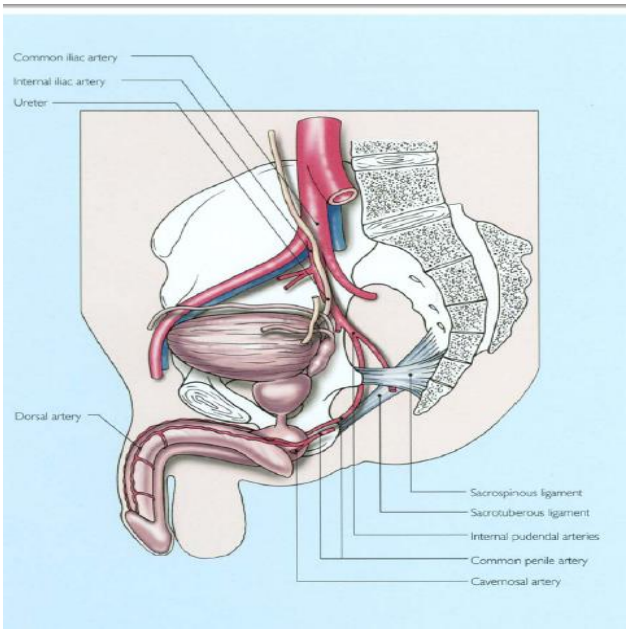

Fig ٢ ; Blood supply to each corpus cavernosum is derived from the internal iliac artery, a branch of the common iliac artery; the internal pudendal artery is one of the terminal branches of the internal iliac**(Humana, New Jersey,٢٠٠٦)**

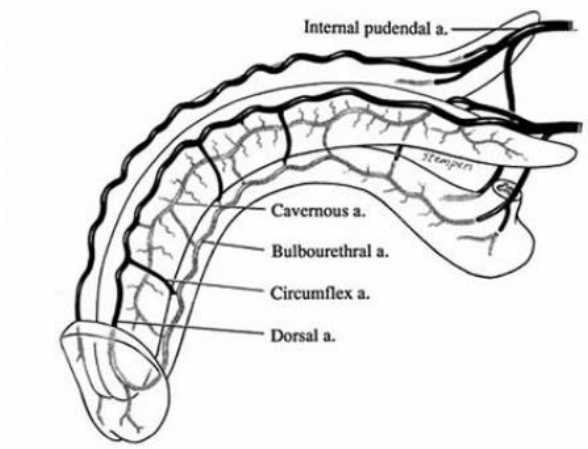

Fig ٣: Arterial anatomy of the penis ,quoted from male sexual function, ٢nd edition, ed. Mulcahy (Humana, New Jersey,٢٠٠٦)

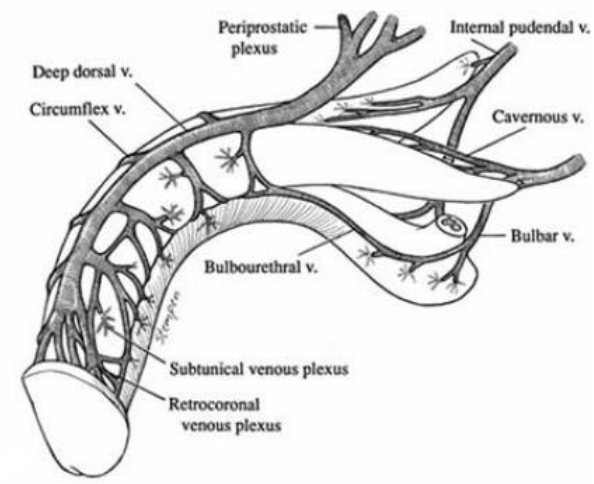

fig ٤ **Venous anatomy of the penis ,quoted from male sexual function, ٢nd edition, ed. Mulcahy (Humana, New Jersey,٢٠٠٦)**

Lymphatics of the prepuce and penile shaft converge dorsally, and then drain into both right and left sided superficial inguinal lymph nodes via channels alongside superfi cial external pudendal vessels. Lymphatics of the glans and penile urethra pass deep to Buck's fascia and drain into both superficial and deep inguinal nodes **(Fig٥)** ***(Hsu et al. 1994).***

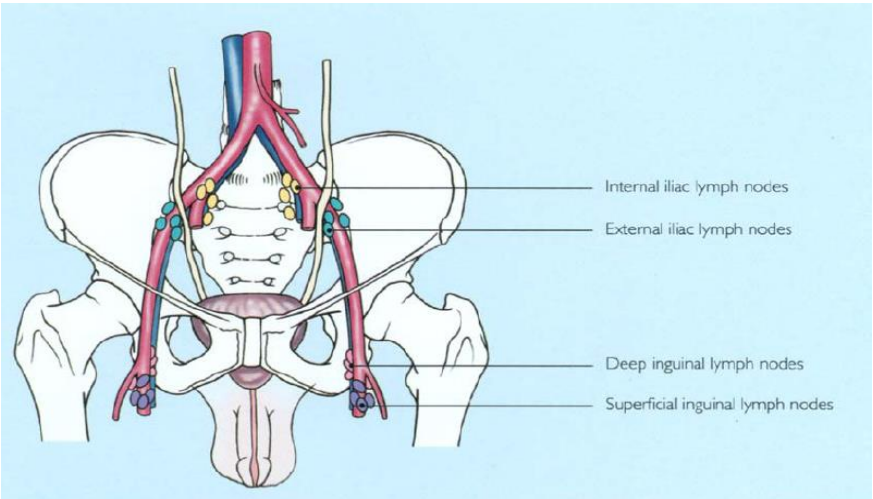

Figure ٥ Lymphatic drainage of the penis is accomplished by the superficial and deep inguinal nodes which, in turn, drain to the iliac and para-aortic lymph nodes Quoted from **An atlas of erectile dysfunction/Roger S.Kirby٢٠٠٥; ٢nd ed.**

The penis receives both somatic and autonomic (sympathetic and parasympathetic) innervations. The somatic component (S٢ to S٤) is the dorsal nerve of the penis, a terminal branch of the pudendal nerve carrying penile sensory afferent fibers. Sympathetic (T١٠ to L٢) and parasympathetic (S٢ toS٤) fibers form the pelvic plexus and cavernosal nerves.

These fibers run posterior and lateral to the tips of the seminal vesicles and prostate, and penetrate the genitourinary diaphragm at the ٣ and ٩ o'clock positions. The nerves are located at the ١ and ١١ o'clock position relative to the bulbar urethra before entering the CC. Cholinergic parasympathetic fibers are the primary neuronal system involved in the erectile process and are involved in both tactile and psychogenic erection. The role of the sympathetic nervous system is less defined. It is generally agreed that adrenergic stimulation results in penile detumescence; however, sympathetic fibers may have a role in psychic erection **(Fig. ٧,٨)** ***(Benson and Boileau, ١٩٩٩)***.

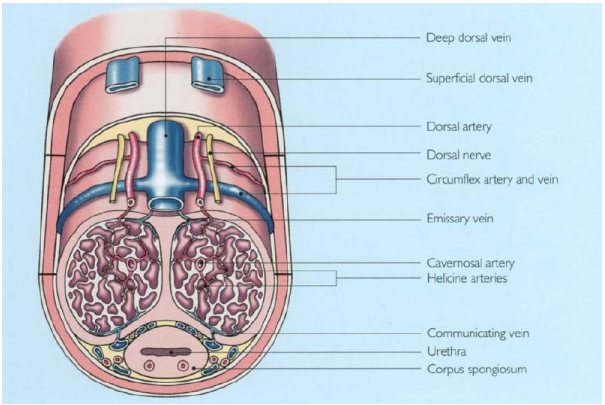

Figure ٦; Cross-section of the penis showing the locations of the paired dorsal arteries and cavernosal arteries. Note the helicine arteries, which supply arterial blood to the lacunar spaces Quoted from An atlas of erectile dysfunction/Roger S.Kirby٢٠٠٥; ٢nd ed.

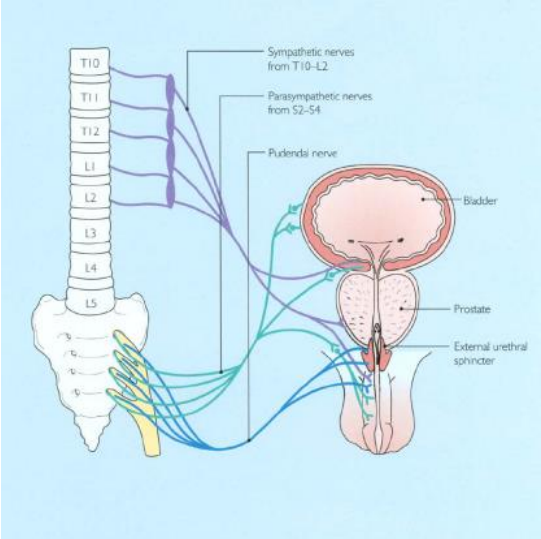

Fig ٧ ;Three sets of peripheral nerves are involved in penile erection: two are autonomic and one is somatic. Parasympathetic nerves stem from the second to the fourth sacral segments (S^{2}–S^{4}), whereas sympathetic nerves have their preganglionic cell bodies in the intermediolateral cell columns of the thoracolumbar (T^{10}–L^{2}) segments. Somatic fibers travel in the pudendal nerves and their cell bodies are situated in the S^{2}–S^{4} segments

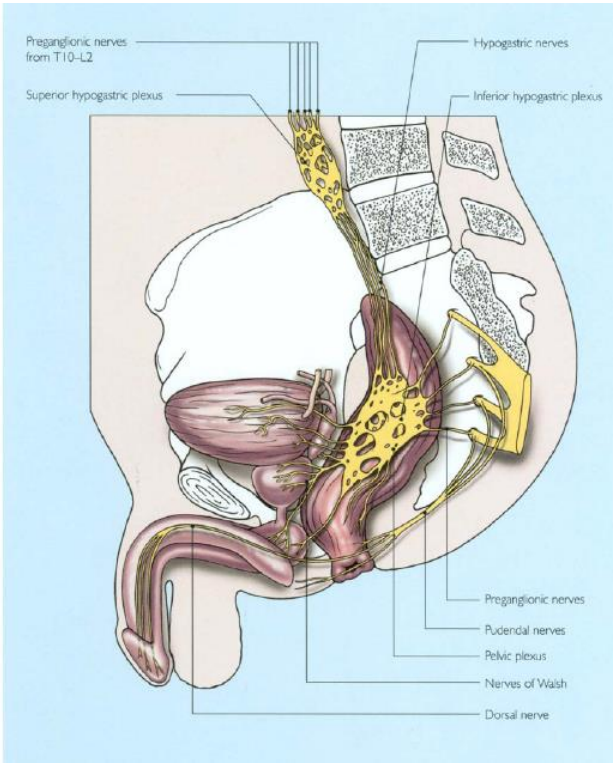

Figure ٨; The hypogastric nerves are vulnerable during retroperitoneal lymph node dissection. Both sympathetic and parasympathetic nerves merge in the pelvic plexus and pass posterolateral to the prostate gland in the so-called neurovascular bundles of Walsh, where they may be damaged during radical prostatectomy and cystoprostatectomy Quoted **from An atlas of erectile dysfunction/Roger S.Kirby٢٠٠٥; ٢nd ed.**

Recent evidence also points to the presence of noncholinergic, non-adrenergic neurons in the CC that cause penile tumescence through Tissue concentration of cGMP is regulated by the rates of both synthesis and degradation via phosphodiesterases release of an endothelium-derived relaxation factor, nitric oxide. This compound, which is also released in response to cholinergic stimulation, is believed to be the principal mediator of CC smooth muscle relaxation. Nitric oxide appears to exert its effect through increased intracellular levels of cyclic guanosine monophosphate (GMP). With cavernosal artery smooth muscle relaxation, blood engorges the sinusoids resulting in tumescence. To maintain an erection, the corporal venous outflow has to be occluded. When the CC engorges with blood, they enlarge and stretch the surrounding tunica albuginea. This, in turn, compresses the small venules running through the tunica and blocks the venous outflow of the penis. Corporal smooth muscle constriction and the opening of venous channels allows for drainage of corporal blood resulting in detumescence ***(Carrier et al., 1993)***.