Correlation between Color Doppler flow of transmediastinal arteries (TMA), hormonal assay and testicular volume in fertile and infertile men

Thesis
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List of Abbreviations

PSV = peak systolic velocity of transmediastinal artery (TMA).

EDV = End diastolic velocity of transmediastinal artery (TMA).

PI = pulsatility index of transmediastinal artery (TMA) = (PSV – EDV) / mean velocity.

RI = resistance index transmediastinal artery (TMA) = (PSV – EDV) / PSV.

S/D ratio = (peak systolic velocity / end diastolic velocity) ratio.

FSH = follicle stimulating hormone.

LH = luteinizing hormone.

PRL = prolactin.

TTE = testosterone.

NOA = Non – obstructive azoospermia.

TMA = Transmediastinal arteries.

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Abstract

The aim of the work is to study the relation between color Doppler flow parameters of the transmediastinal arteries, hormonal assay and testicular volume in fertile and infertile men and if it could be of value in differentiating different types of defective spermatogenesis, the study included, 43 patients who were repeatedly azoospermic with clinical examination suggestive of non-obstructive azoospermia (24 male) & obstructive azoospermia (19 male). Twenty one patients with oligozoospermia, twenty patients with asthenozoospermia, fifteen patients with oligoasthenozoospermia, and the last twenty one subjects were giving history of recent fertility within the last 2 years. Colour Doppler study of transmediastinal arteries, testicular volume and hormonal assay are useful in differentiating different types of defective spermatogenesis especially obstructive and non – obstructive azoospermia.

Keywords

Colour Doppler, transmediastinal arteries, hormonal assay, testicular volume, spermatogenesis, azoospermia.

Introduction

Infertility is defined as the inability to achieve pregnancy after one year of unprotected intercourse. An estimated 15% of couples meet this criterion and are considered infertile. Historically, the work-up for the infertile couple focused primarily on conditions of the female. Conditions of the male are estimated to account for nearly 30% of infertility cases and conditions of both the female and the male account for another 20%. Conditions of the male that affect fertility are still under-diagnosed and under-treated.

In general, causes of infertility in men can be explained by deficiencies in ejaculate volume, sperm concentration or too few sperm (oligozoospermia), complete absence of sperm in the ejaculate (azoospermia), sperm motility (asthenozoospermia), or sperm morphology (teratozoospermia).

Nearly 70% of conditions causing infertility in men can be diagnosed by history, physical examination, testicular volume estimation, and hormonal and semen analysis. A rational approach is necessary to perform the appropriate work-up and to choose the best treatment options for the couple (***Schoor et. al., 2003***).

One of the recent methods to detect different degrees of defective spermatogenesis is the color doppler assessment of the testicular vascularity. In ***1997, Atilla*** reported that the arterial impedance of undescended testes in adults may have predictive value and provide more accurate information about histology than the testicular volume. The latter is inversely correlated with the pulsatility index (PI) of the transmediastinal artery, which has higher resistances in

azoospermic than in oligoasthenospermic and normospermic men (***Battaglia et. al., 2000***). The intratesticular arterial blood flow and maximum blood flow velocity were significantly lower in patients with germ cell hypoplasia or maturation arrest (***Omori et. al., 2000***). The PI of the transmediastinal artery was significantly higher in men with obstructive azoospermia (OA) than in those with unobstructive azoospermia (UOA) (***Battaglia et. al., 2001***). A colour Doppler semiquantitative score has been used to distinguish OA from UOA affected by primary testicular pathology (***Foresta et. al., 1998***). These authors concluded that spectral echo-colour Doppler traces from the testicular arteries may be related to the amount of spermatogenesis and therefore of help in distinguishing OA from UOA.

The detection of significant differences among the various types of defective spermatogenesis is not sufficient alone to conclude that spectral trace values are related to the amount of spermatogenesis, as the relationship should be confirmed by regression analysis (***Lison L. et. al., 2000***). The cited studies did not compare echo-colour Doppler spectral traces and the first-line tests (i.e. FSH serum levels and testicular volume) to differentiate OA from UOA. This diagnosis is often difficult and is associated with different surgical approaches (***Silber et. al., 2000***), different success rates in the recovery of spermatozoa to be used in intracellular sperm injection (ICSI), and different results of *in vitro* fertilization (IVF) or of implantation rates after ICSI (***DeCroo et. al., 2000***). Thus we assessed the relationship between FSH, testicular volume or the results from echo colour Doppler spectral traces and the amount of spermatogenesis, and evaluated the efficiency of these tests in the differential diagnosis of the different forms of defective spermatogenesis.

The Aim of The Work

The aim of the work is to study the relation between color Doppler flow parameters of the transmediastinal arteries, hormonal assay and testicular volume in fertile and infertile men and if it could be of value in differentiating different types of defective spermatogenesis specially obstructive and non-obstructive azoospermia.

ANATOMY OF THE SCROTUM

A. The testes and epididymes:

The testes, the primary male reproductive organs or gonads, are suspended in the scrotum by scrotal tissues including the non-striated dartos muscles and the spermatic cords, the-left testis usually being about 1 cm lower than the right. Average testicular dimensions are 4-5 cm in length, 2.5 cm in breadth and 3 cm in antero-posterior diameter, their weight varies from 10.5 -14 grams. Each testis, ellipsoidal and compressed laterally, is obliquely set in the scrotum, its upper pole tilted antero-laterally. Anterior, medial and lateral surfaces and both poles are convex, smooth and covered by the visceral layer of the serosal tunica vaginalis which separates them from the parietal layer and the scrotal tissues external to this. The posterior aspect is nearly straight, with the spermatic cord attached to it. The posterior aspect is only partly covered by tunica serosa; the epididymis adjoins its lateral part ***(Williams and Dyson, 1989; Chan and Hermo, 2004)***.

The epididymis, a tortuous canal and the first part of the efferent route from the testis, is much folded and tightly packed to form a long, narrow mass attached postero-laterally to the testis. It has a central body, a superior enlarged head and an inferior pointed tail. The head is connected to the upper testicular pole by efferent ductules and the tail to the lower pole by areolar tissue and the reflected tunica vaginalis. Laterally the head and tail are covered by the tunica and are here free. The body is also so invested, except on its posterior aspect.

The tunica vaginalis Is recessed between the epididymal body and the lateral surface of the testis, forming the sinus of the epididymis ***(Williams and Dyson, 1989; Refkin and Cochlin, 2002)***.

Testicular and epididymal appendices*:* At the upper pole of the testis, just inferior to the epididymal head, is a minute, oval, sessile structure; the appendix of the testis, a remnant of the upper end of the para-mesonephric duct. On the epididymal head is a small, stalked, appendage (sometimes double), and the appendix of the epididymis, usually considered a mesonephric vestige ***(Williams and Dyson, 1989; Dewbury, 2000)***.

Testicular coats: The testis is invested by three coats from outside inwards: the tunica vaginalis, tunica albuginea and tunica vasculosa ***(Chan and Hermo, 2004)***.

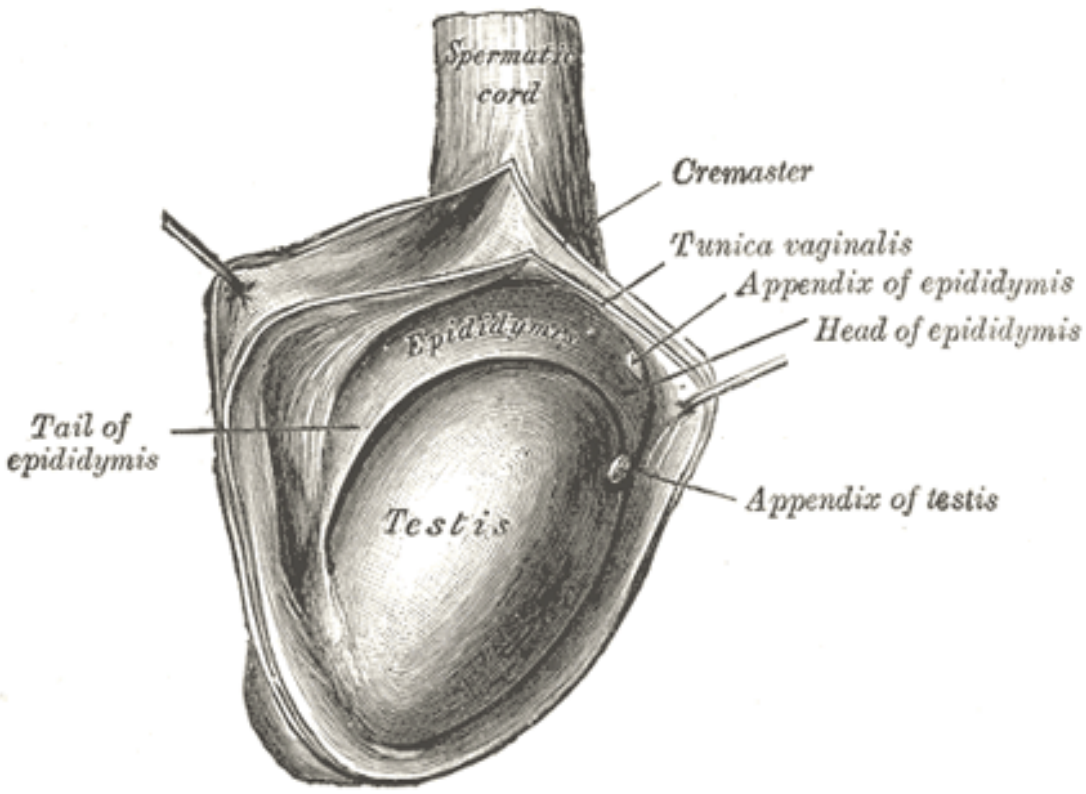

Figure (1): showing the testis and its coverings **(Refkin and Cochlin, 2002)**.

The tunica vaginalis: is the lower end of the peritoneal processus vaginalis, which precedes the descent of the fetal testis from abdomen to scrotum. After this migration, the tunica's proximal part, from the internal inguinal ring almost to the testis, contracts and obliterates, leaving a closed distal sac invaginated by the testis and reflected to the internal scrotal surface, thus forming the visceral and parietal layers of the tunica ***(Refkin and Cochlin, 2002)***.

The *visceral layer:* it covers all aspects of the testis except the posterior border. Postero-medially it is reflected forwards as the parietal layer. Postero-laterally it passes to the medial aspect of the epididymis, lining its sinus, and then laterally to its posterior border where it is reflected forwards into the parietal layer. The Visceral and parietal layers are also continuous at both poles but at the upper pole the visceral layer surmounts the head of the epididymis before reflection *(**Williams and Dyson, 1989**)*.

The parietal layer: is more extensive than the visceral reaches below the testis and ascends in front of and medial to the spermatic cord. Internally the tunica vaginalis has a smooth, moist mesothelium, the potential space between its visceral and parietal layers being its cavity ***(Williams and Dyson, 1989; Refkin and Cochlin, 2002)***.

The obliterated part of the processus vaginalis: it is often seen as a fibrous thread in the anterior part of the spermatic cord, extending from the internal end of inguinal canal and connected here to peritoneum. Sometimes it disappears in the cord or its proximal part remains patent to the peritoneal cavity then communicating with the tunica, or the proximal processus may persist, although shut off distally from the

tunica. Occasionally its cavity may persist at an intermediate level as a cyst ***(Williams and Dyson, 1989)***.

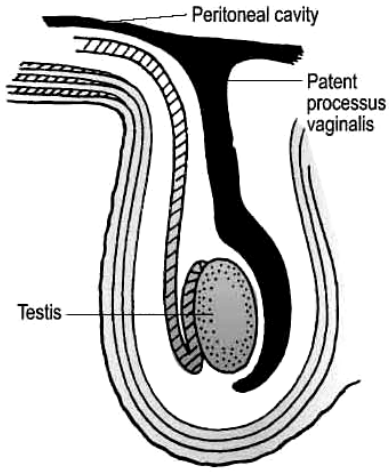

Figure (2): showing patent processus vaginalis

(*Arregui M E and Nagan R. F., 1994*)

The tunica albuginea: it is a dense, bluish-white covering for the testis, composed mainly of interlacing bundles of collagen fibers, covered externally by the visceral layer of the tunica vaginalis, except at the epididymal head and tail and the posterior testicular aspect, where vessels and nerves enter the testis. It covers the tunica vasculosa and, at the posterior border of the testis, projects into it as a thick, vertical but incomplete septum, the ***mediastinum testis***. This extends from the upper almost to the lower end of the testis and is wider above than below *(Williams and Dyson, 1989).* Septa radiate from the mediastinum and attach to the inner surface of the tunica albuginea to form 200 to 300 cone-shaped lobules, each containing -one or more convoluted seminiferous tubules ***(Brooks, 1998; Chan and Hermo, 2004)***.