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Systematic Review

Role of Ultrasonography in Detection of Male Infertility

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ABSTRACT

Infertility is the inability of a couple of reproductive age to have conception even after one year without interruption of sexual activity. Young couples who are affected with infertility are 10-15% worldwide and 40-60 % are males. Approximately 80 million people are facing this problem. Azoospermia is the main presenting symptom of infertility. Various diseases such as varicocele, orchitis, and trauma are the most common causes of infertility. **Objective:** To investigate the effectiveness of scrotal ultrasonography in the diagnosis of causes of male infertility and to check the sonographic findings of the normal or pathological scrotum. **Methods:** Various search engines were used to perform a systemic literature review. Google scholar, NCBI, PubMed, and Medscape provide the articles for this systemic literature review. Male infertility, ultrasound, and causes are the main keywords that are used for searching articles related to this topic. **Results:** 45 articles were reviewed and 40 were included in this systematic review. The main finding of this review is that most of the infertile patients had azoospermia. The most common cause of male infertility is a varicocele and other causes include hydrocele, epididymal-orchitis, cysts of testes and epididymis, and trauma. For effective diagnosis and treatment of infertility sonographic scrotal evaluation must be included. **Conclusions:** The conclusion of this review is that measurement of the volume of testes and detection of varicocele by ultrasonography is very helpful for the physician for assessment of causes of male infertility.

INTRODUCTION

Inability to conceive after one year of uninterrupted sexual activity is described by the term infertility [1]. Primary and secondary infertility are two main types of infertility [2]. A couple who has never been capable to conceive is categorized under the term primary infertility [3]. A couple who have had at least one conception even though terminated as abortion are categorized under the term secondary infertility [4]. Various organs which may be internal or external organs form the male reproductive system and these organs work in coordination and in a very systematic way from production of sperms to transport of sperms for fertilization [5, 6]. Prenatally, male sex organs develop due to the testes of a fetus that secrete testosterone [7]. At puberty, the male secondary sex organs become functionally active [8]. The main organs that are used for the transport of sperms from their site of production to the site of fertilization include the epididymis, vas deferens, ductus ejaculatory, and urethra [9]. The nourishment of is done by seminal fluid which is secreted by seminal vesicles, and glands including, the bulbourethral and prostate gland (Figure 1) [10].

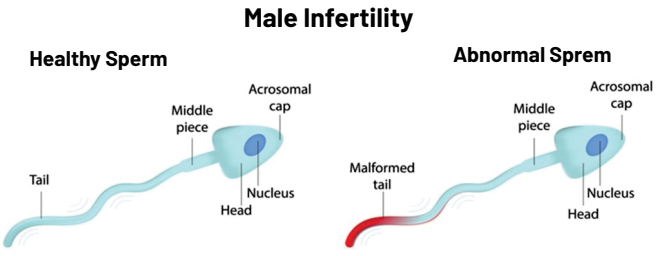

Figure 1: Normal and Abnormal Sperm

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Most infertile males have serious underlying medical diseases including adenomas of the pituitary gland, tumors which hormonally active, cancer of different organs (testes, liver, and kidneys), kidney failure, and cystic fibrosis [6, 11]. Azoospermia has both obstructive and non-obstructive causes [12]. Congenital or acquired disorders of the hypothalamus or pituitary gland result in pre-testicular causes of infertility [13]. Primary causes of male infertility include chromosomal anomalies, Varicocele, and cryptorchidism [14, 15]. Post-testicular causes include cystic fibrosis, congenitally or acquired blocked duct system, excessive use of cigarettes, or alcohol, retrograde ejaculation, uncontrolled chemotherapy or radiation therapy, and trauma [1]. The central main reproductive system organ is the testes and for assessment of testicular function, scrotal ultrasound, transrectal ultrasonography semen analysis, MRI, CT, vasography, and biopsy of the testis, are performed [16, 17]. Ultrasonography of the scrotum is a non-invasive procedure and harmless for both patient and clinician [18]. For assessment of the function of testes ultrasonography of scrotum has been standard imaging modality [19]. Testicular atrophy which is linked with varicocele, size, and position of testes is assessed with the use of ultrasonography of the scrotum [20]. Ultrasonography of the scrotum is also used to evaluate the volume of testes in the majority of infertile males [21]. Normal testes of the adult male are homogenous, oval-shaped, and hypo-echoic and measurements range in 3×2-4×3-5 cm with 12-19cc volume (Figure 2) [22, 23].

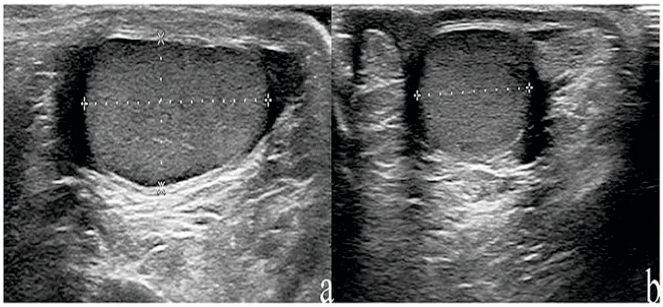

Figure 2: Referential Values of Testicular Volume Measured

Globally, approximately 80 million people are affected by infertility. The dysfunction of the reproductive system is presented with a sign of infertility [24]. 10-15 percent of the young population of the world is affected by infertility including 40-60% males [25]. Throughout the globe, the prevalence, and causes of male infertility vary from place to place, religion, and areas [26]. Couples who are facing this disorder, inability to conceive, have compromised their mental and emotional health, and are very depressed in their daily lives [27]. On this planet, infertility poses threat to the survival of humanity for a long duration [28]. This systemic review enabled the physician to accurately diagnose the causes of male infertility.

METHODS

Google Scholar, PubMed, and NCBI are the search engines that were used for this systematic review. Male infertility, causes, and scrotal ultrasonography were the keywords that were used for article searching from these search engines. These keywords were used and articles with unbiased searching were included in this systematic review. Articles, with inclusion criteria of the population especially males who were suffering from infertility, were reviewed in this systematic review article. Full journal articles were excluded. If raw data was not reported it was used for summary statistics (Figure 3).

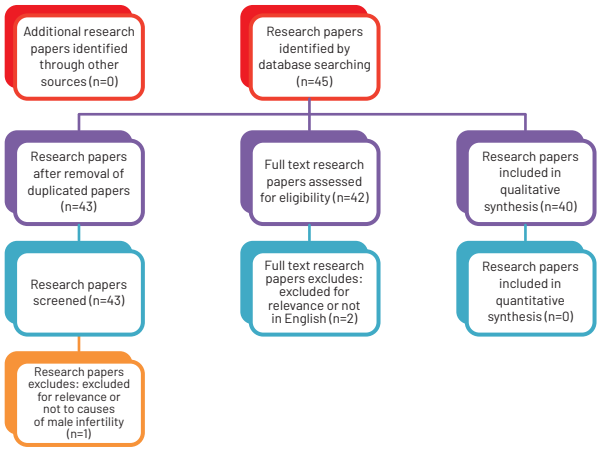

Figure 3: CONSORT diagram to illustrate the inclusion and exclusion criteria

RESULTS

The literature review of 45 articles and 40 met the inclusion criteria. It was found that azoospermia is a common finding in most infertile males. The incidence of male infertility was higher in males with varicocele, hydrocele, orchitis, and a history of trauma. Scrotal ultrasonographic evaluation was found effective in diagnosing the cause of male infertility.

DISCUSSION

45 articles were reviewed and 40 were included in this systematic review. The main finding of this review was that most of the infertile patients had azoospermia. The most common cause of male infertility was a varicocele and other causes included hydrocele, epididymal-orchitis, cysts of testes and epididymis, and trauma. For effective diagnosis and treatment of infertility sonographic scrotal evaluation must be included. Figure 4 shows Doppler examination of twenty five years infertile man with azoospermia.

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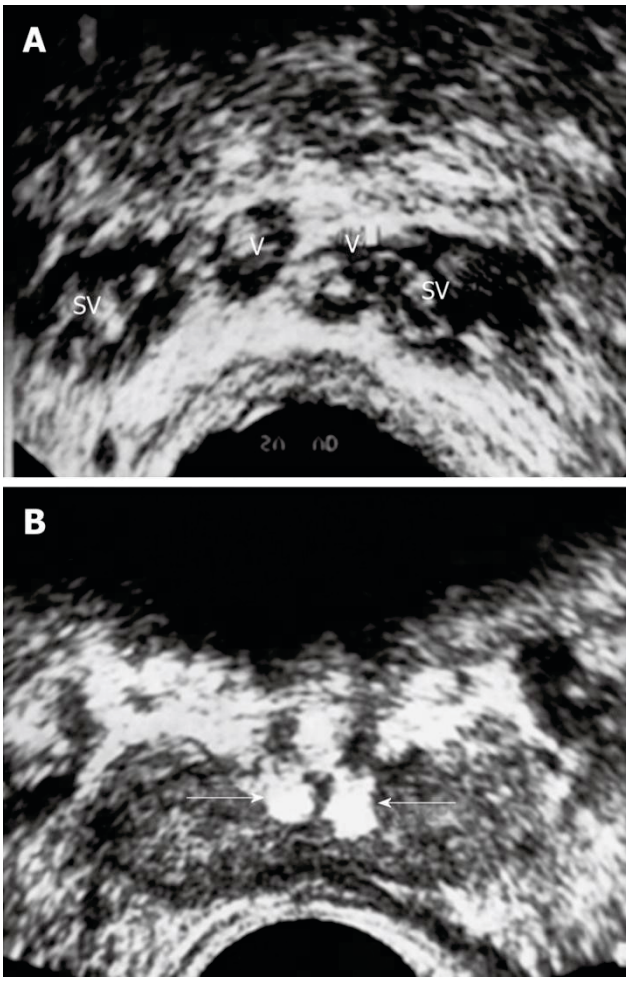

Figure 4: Twenty five years infertile man with azoospermia. A: Multiple calculi within the SV and V; B: Bilateral echogenic calculi impacted within the ejaculatory ducts (arrows)

The population of reproductive age experience infertility of approximately 5-20 percent, with 40-60 percent of male factor [29]. For evaluation of male infertility imaging modalities are very effective, particularly for the identification of obstructive causes of infertility. For accurate diagnosis and treatment of infertile patients scrotal and doppler ultrasonographic findings are very helpful for clinicians [17, 23]. It is just a myth that females are responsible for infertility, male infertility is very complicated and its diagnosis is very complex, various health problems are related male infertility. Extra testicular varicocele is the most common pathology that was seen in infertile males. Reports in the literature described varicocele as the most commonly detected disease in infertile males during ultrasonographic evaluation and its prevalence is 20-49 % in all infertile male [30, 31]. In comparison of primary to secondary infertility there is an apparent difference in testicular volume, sperm count, and FSH. A positive statistical correlation between sperm count and volume of testes and a negative statistical correlation between FSH and volume of testes is observed [32, 33, 17]. Most infertile male patients had azoospermia, most of them are workers. Hydrocele, chronic epididymal-orchitis, microlithiasis, and calcifications are other sonographic findings that are detected by ultrasonographic examination [11, 34]. Dilatation of pampiniform plexus is seen in the case of varicocele on greyscale and flow reversal in Doppler evaluation. Doppler examination is very helpful in grading the degree of flow reversal in varicocele (Figure 5) [35, 36].

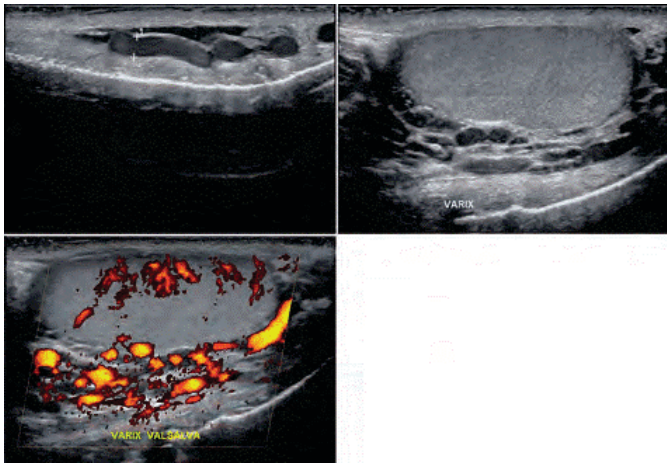

Figure 5: Typical ultrasound appearance of a left-sided grade 3 varicocele

Hydrocele is the second most common cause of male infertility and sonographically presented as an anechoic fluid collection. On Doppler examination, hydrocele presented as avascular (Figure 6) [37, 38].

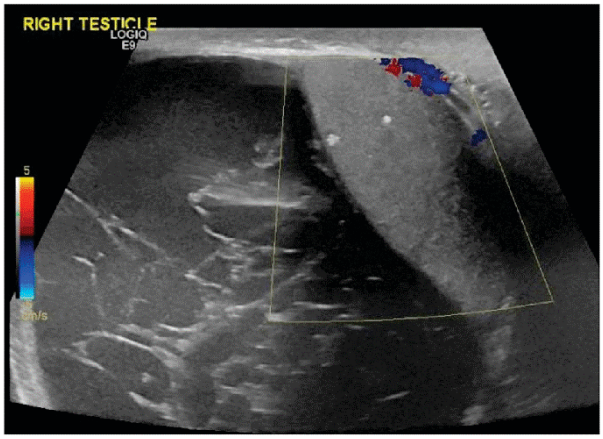

Figure 6: Right testis surrounded by right-sided septated hydrocele with Microlithiasis measuring 9.9×6.5×6.7 cm

Hypoechoic testes and epididymis enlargement is seen in the case of orchitis and epididymis respectively on greyscale and Doppler examination blood flow is increased [39]. On greyscale microlithiasis appear as Hyperechoic foci with a small diameter of 1-3mm within the parenchyma of testes distributed very uniformly. Anechoic structure with posterior acoustic enhancement is visualized in an

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epididymal or testicular cyst which is well-circumscribed in shape [39-41].

CONCLUSIONS

It was found that azoospermia is a common finding in most infertile males. The incidence of male infertility was higher in males with varicocele, hydrocele, orchitis, and a history of trauma. Scrotal ultrasonographic evaluation was effective in diagnosing the cause of male infertility. Measurement of the volume of testes, size of testes, and detection of varicocele by ultrasonography are very helpful for the physician for assessment of causes of male infertility. In conclusion, Scrotal US is a valuable tool in the evaluation of infertile men.

Authors Contribution

Conceptualization: KB
Methodology: KB, NA
Formal analysis: KB, NA
Writing-review and editing: KB, NA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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