THE SCROTAL COLOUR DOPPLER ULTRASOUND FINDINGS IN INFERTILE MEN FROM 2014 TO 2017 IN SULAYMANIYAH/ IRAQ

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ABSTRACT

Background

Male factor infertility is an increasing clinical problem. The use of Colour Doppler Ultrasonography (CDUS) in a noninvasive imaging technique can help diagnose testicular and extra-testicular abnormalities, especially in patients presented; CDUS is one of the best imaging modality choices in infertility evaluation.

Objective

To determine the capability of the CDUS in identifying the cause of male infertility.

Methods

A cross-sectional study was performed on 309 infertile males referred from Infertility Center /Sulaimani City/ Iraq**;** the study extended from the year 2014 till the end of 2017. Colour Doppler Ultrasound of the scrotum and its contents was done for each participant in the study group to allocate the possible cause of infertility for each of them. Siemens Acuson X 300- 2010 Ultrasound machine was used for scrotal examination; the type of probe is a linear probe with frequency VF 10-5 MHz.

Results

The Colour Doppler Ultrasound of the scrotum detected the presence of abnormal findings in 266/309 (86%) of infertile men; six abnormalities were identified, these are in descending frequency: varicocele 143/309 (46%), thick epididymis in 99/309 (32%) of patients, testicular atrophy in 73/309 (23%) of patients, thick spermatic cord in 28/309 (9%), and cystic transformation of rete testes which was present in 17 (5.5 %) cases.

Conclusion

Scrotal Colour Doppler ultrasound is an effective, safe, and easy method to detect the leading causes of male factor infertility; it can detect varicocele, thick epididymis, thick spermatic cord, testicular atrophy, cystic transformation of rete testes, or undescended testicle. It would be very beneficial if all male patients with infertility undergo ultrasonic examination of their scrotum.

Keywords: *Doppler ultrasound, male infertility, scrotum, varicocele, testicular atrophy.*

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INTRODUCTION

Infertility is an increasing clinical problem, and despite the improvement in molecular diagnosis of male infertility, the causes of it are still unclear in nearly 50% of the patients [1]. The routine assessment of male infertility starts with history taking, physical examination, and then laboratory investigations. Imaging techniques are frequently utilized to assess the scrotum for the size of the testis and its morphology; these noninvasive imaging techniques can also help predict reversible pathology, like obstructive azoospermia [2].

The principal role of imaging techniques in male factor infertility is to detect the cause of infertility and assist in classifying it into obstructive and non-obstructive causes. In addition to being a diagnostic tool, it can guide some reproduction techniques like sperm aspiration from the epididymis or seminiferous tubules for in vitro fertilization or intra-cytoplasmic sperm injection [3]. Several imaging techniques are regularly used to assess the male reproductive system, including Ultrasound (US) and magnetic resonance imaging (MRI); invasive procedures such as vasography are also applied [4].

Scrotal ultrasonography is a perfect noninvasive imaging technique for evaluating scrotal anomalies, as it is a non-invasive, safe, inexpensive, and readily available imaging modality that does not involve ionizing radiation. Thus, it represents the first-line technique in male infertility assessment. It can determine the most important causes of infertility, whether testicular or extra-testicular abnormalities, and it is one of the best choices in infertility evaluation in patients with scrotal swelling [5]. The scrotal Colour Doppler Ultrasound (CDUS) uses a high-frequency linear array transducer, which provides excellent anatomic details of the testicles and surrounding structures while the patient is in the supine position. The routine assessment involves both transverse and longitudinal US of the testes. Thereby, abnormalities in the testes or the nearby structures can be demonstrated. In addition, vascular perfusion can be easily assessed using colour and spectral Doppler analysis [4].

The normal male testicle is an ovoid organ that has dimensions of 5×3×2 cm (length height breadth) with a homogeneous, intermediate echogenicity [6]. The epididymis is a comma-shaped, elongated structure located at the posterior border of the testicle and is divided into the head, tail, and body. The epididymal head overhangs the superior pole of the testicle and isoechoic or slightly hyperechoic to the adjacent testicular tissue. The epididymal body and tail are located behind and along the inferior pole of the testicle and are usually isoechoic to the testis [7].

In most cases, the combination of clinical history, physical examination, and information obtained with ultrasonography is crucial for the diagnosis of male infertility. This study aims to determine the capability of SCDU in identifying various scrotal and peri-scrotal lesions in men with infertility.

METHODS

All the men were referred from an infertility centre in Sulaimani City/Iraq, and their chief complaint was infertility. The total number of infertile males enrolled in this study was 309, and the duration of sample collection was from 2014 till the end of 2017. Before the US examination, the infertile patients had their seminal fluid analysis (SFA) done in the international hospital in Sulaimani City/Iraq.

The ultrasound scans were done in a private Sulaimani City/ Iraq clinic using a Siemens Acuson X 300 2010 Ultrasound machine. The type of probe is a linear probe with a frequency VF 10-5 MHz.

The US examination was done supine; the testicles and scrotum were elevated and supported with a towel placed underneath the scrotum. The patient asked to hold another towel to retract and cover the penis. Then, the ultrasonic gel was applied in a completely private situation, and the Valsalva manoeuvre and standing positions were used when needed. The findings were reported and saved, while the pathological findings were printed as a document on thermal laser printer paper.

Each testicle was measured consecutively in two dimensions (length and height). Evaluation of the epididymis includes longitudinal and transverse images of the head, body, and tail. Spectral waveforms, including arterial and venous flow, were documented for each side.

Veins of the pampiniform plexus should be specifically evaluated as to diameter and augmentation with either the Valsalva manoeuvre or the upright positioning of the patient.

RESULTS

Both primary and secondary infertile patients were enrolled in the study. The patients' ages ranged between 21 and 62 years, and their mean age was 42 years. Their seminal fluid analysis revealed azoospermia in 228/309 (73.8%), oligoasthenospermia in 62/309 (20.1%), and oligospermia in 19/309 (6.1%), as shown in Figure (1).

The azoospermic cases were associated with abnormal US findings in 200/228 (87.7%) cases; the varicocele was reported in 98/200 (43%) of the azoospermic subgroup. The patients with oligoasthenospermia have abnormal US features in a frequency of 53/62 (85.5%) while only 9/62 (14.5%) had normal US; in this oligoasthenospermia patients the varicocele was found in 34/62 (54.8%). The US features of the oligospermia patients (n=19/309) were abnormal in 13 (68%) vs 6 (32%) with normal scrotal US image; the US findings revealed that 11/19 patients (57.9%) of this subgroup had varicocele; the above findings are shown in Tables 1and 2.

From a total of 309 cases have been examined, only 43 (14%) had normal US scan examination (Figure 3&4). In contrast, the rest of the cases [n=266 (86%)] had abnormal findings, which are in descending order: varicocele, thick epididymis, thick spermatic cord, testicular atrophy, a cystic transformation of rete testes (CTRT) and undescended testes. The prevalence of anomalies diagnosed by the US is illustrated in Figure (4).

The results of each abnormal finding are mentioned separately and according to the most common to fewer ones, percentage, and degree of severity, either unilateral or bilateral for each.

Varicocele

The varicocele was identified in 143/309 (46%) cases, of which 123/143 (86%) have unilateral varicocele, while bilateral varicocele was only found in 20 (14%) cases. Most of the varicocele cases [n=116/143; (81%)] have left-sided varicocele, while only 27/143 (19%) have right-sided varicocele. The degree of varicocele is mild in the majority [113/143, (79%)] of cases, while 25 (17.5%) cases have a moderate degree and only 5 (3.5%) cases have marked varicocele, Figure (5).

Thick epididymis (chronic epididymitis)

99/309 (32%) patients in the US had thick epididymis, which is a feature of chronic epididymitis, Figure 6 (Aand B).

Testicular atrophy

The US identified testicular atrophy in 73/309 (23%) patients, the bilateral cases were diagnosed in 53/73 (72.6%), while 20 (28%) cases had unilateral testicular atrophy (right testicle= six vs left testicle= 14 cases). Testicular atrophy ranges from mild to severe degrees, either primary or secondary testicular atrophy, and results from different aetiologies, as illustrated in Figures (7,8, and 9).

Thick spermatic cord

Only 28/309 (9%) men in the study group were diagnosed with thick spermatic cord, of which most of them (25/28) were suffering from bilateral features, and a few cases (3/28) had unilateral thick spermatic cord, Figures (10, and 11).

Cystic transformation of rete testes (CTRT)

CTRT was present in 17 (5.5 %) cases. It was either unilateral or bilateral, ranging from mild to marked changes, and CTRT is one of the causes of obstructive azoospermia, Figure (12).

Undescended testes

12/309 (3.8%) patients were found to have undescended testes; unilateral undescended testicle was identified in 9 patients (right-sided in 3 cases (25%) and left-sided in 6 cases; the bilateral undescended testicles were present in only 3/12 (25%) cases. 11/12 cases had atrophic testicles, while only 1/12 was normal after Orchidopexy.

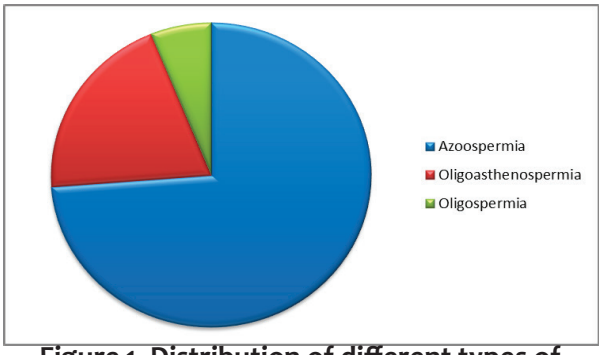


Figure 1. Distribution of different types of abnormal sperm count

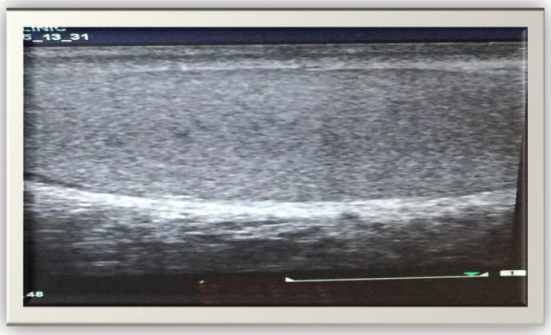


Figure 2. Ultrasound image of Normal testis.

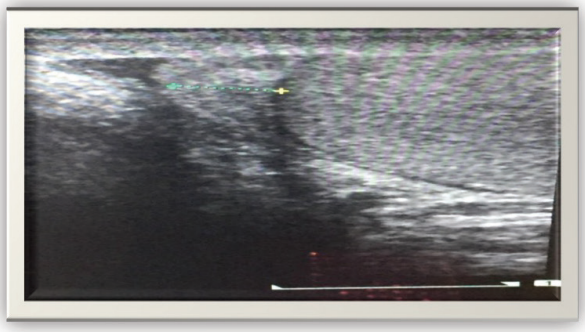


Figure 3. Ultrasound image of Normal epididymal head.

Table 1. The distribution of normal and abnormal US findings among infertile patients

Infertile patients	Ultrasound examination	
	Normal	Abnormal
Azoospermia (n=228/309)	28/228 (12.3%)	200/228 (87.7%)
Oligoasthenospermia (n=62/309)	9/62 (14.5%)	53/62 (85.5%)
Oligospermia (n=19/309)	6/19 (32%)	13/19 (68%)
Total (n=309)	43 (14%)	266 (86%)

Table 2. The presence of varicocele as diagnosed by US findings among study group.

Infertile patients	Varicocele	
Azoospermia (n=228/309)	98/228 (43%)	130/228 (57%)
Oligoasthenospermia (n=62/309)	34/62 (54.8%)	28/62 (45.2.6%)
Oligospermia (n=19/309)	11/19 (57.9%)	8/19 (42.1%)
Total (n=309)	143 (46.7%)	166 (54.3%)

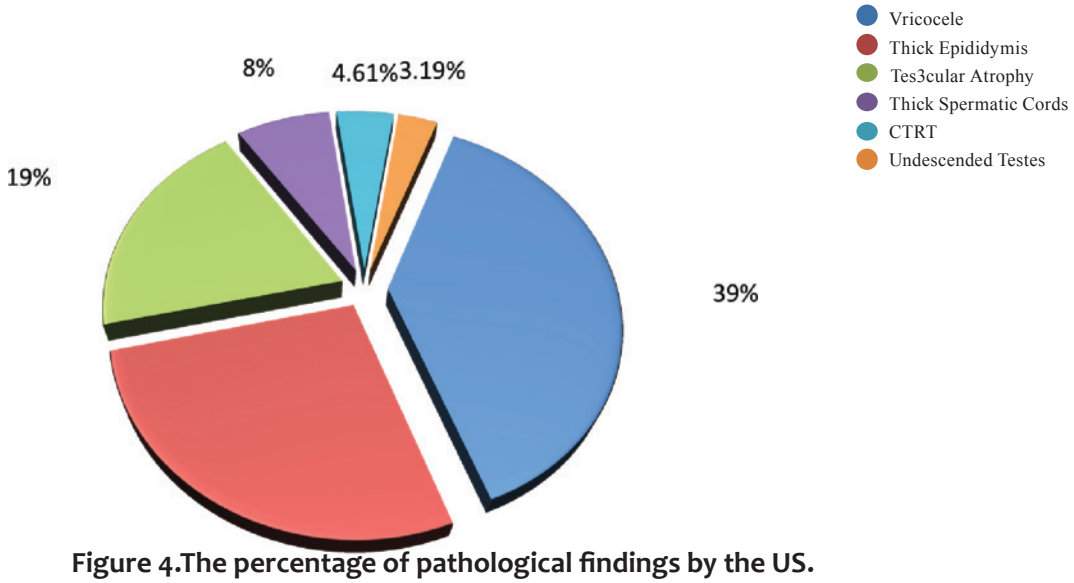
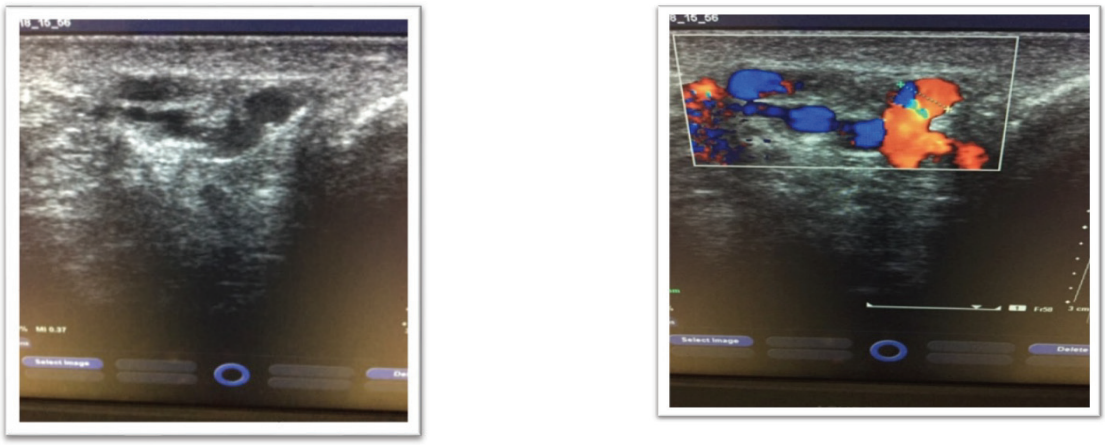
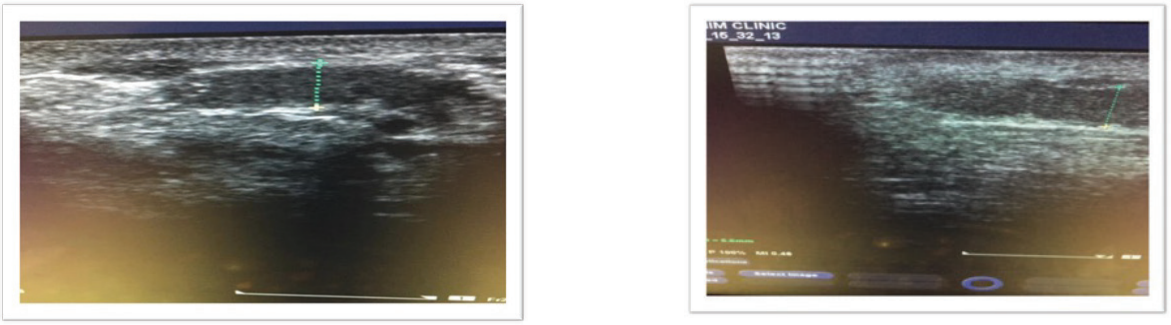


Figure 4.The percentage of pathological findings by the US.



A **B**

Figure 5. Varicocele: A- grey scale US shows dilated veins, B- Colour Doppler shows venous reflux during Valsalva.



A B

Figure 6. Ultrasound images (A) and(B) of thick epididymis of 2 different patients.

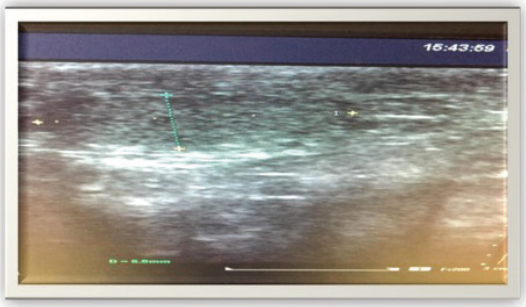


Figure 7. Unilateral severe testicular atrophy, size 15*6.8 mm

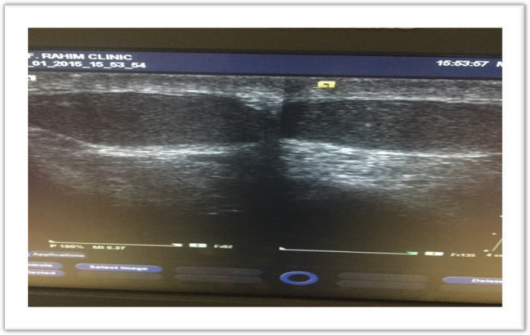


Figure 8. Bilateral testicular atrophy, Small 20*5 mm, smooth outline in tall bald patient, Klinefelter syndrome.

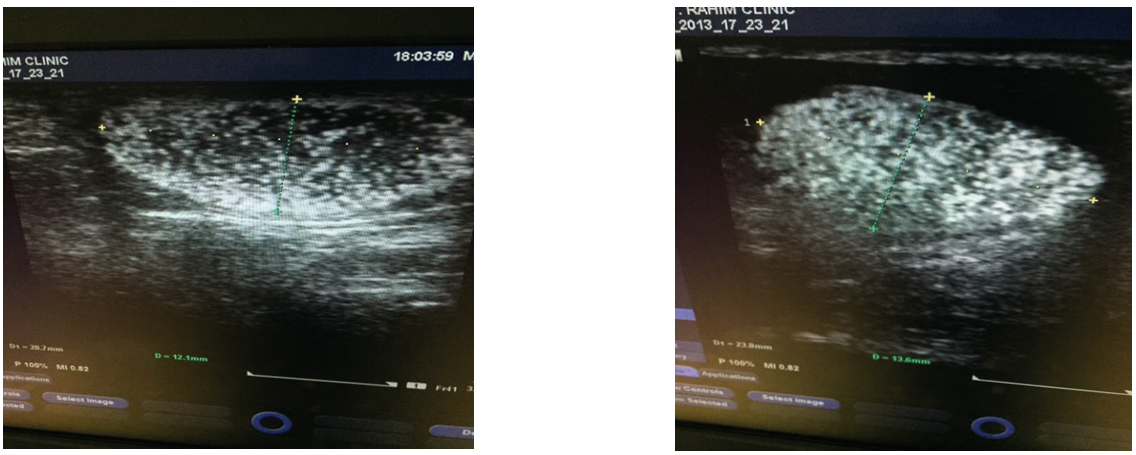


Figure 9. Bilateral Testicular Atrophy with heavy Micro-calcification.

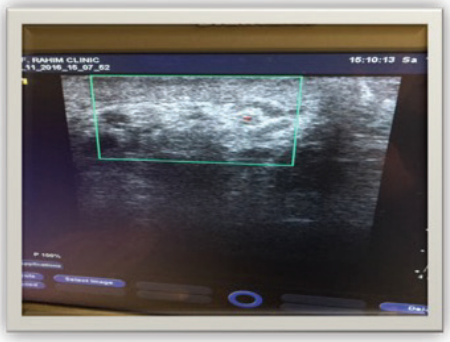


Figure 10. Thick Spermatic Cord, unilateral.

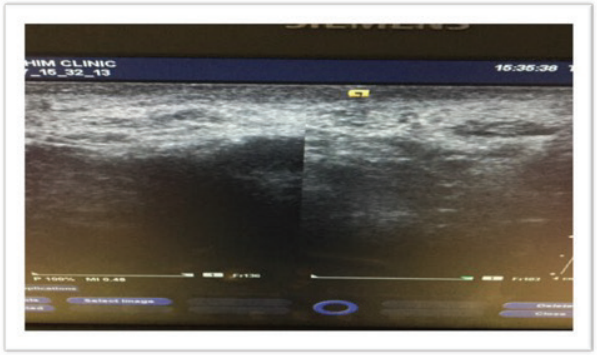


Figure 11. Bilateral thick spermatic cord.

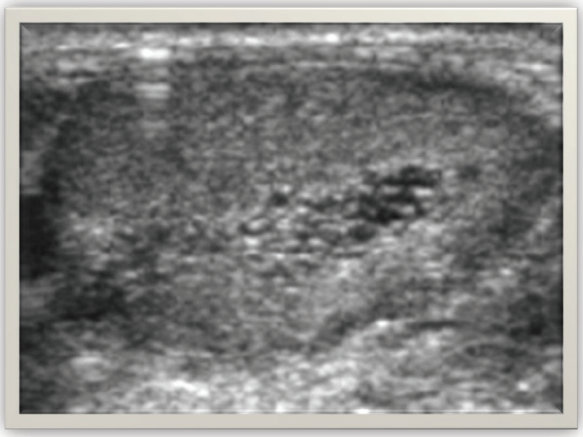


Figure 12. Ultrasound image of Cystic transformation of rete testes

DISCUSSION

The scrotal US can help find signs of obstruction or features of testicular abnormalities [8]. The CDUS added more specificity to the diagnosis of male factor infertility by detecting testicular ischemia, testicular infections, and testicular trauma [9].

Varicocele is a common finding in male factor infertility; it is found in nearly 20% of adolescents and adults, and it is present in approximately 40% of infertile men [10], which is close to our results as CDUS detects varicocele in 46% of the infertile men in the current study. In addition to physical examination, CDUS can help in the diagnosis of varicocele as it can confirm the diagnosis and can identify the impalpable and asymptomatic varicocele, which will be the only diagnostic tool which can assist in planning for varicocelectomy, which would reverse the normal function of the testis [11]. The best images of varicocele are best seen with CDUS, and the change in venous diameter after the Valsalva manoeuvre, compared to rest, can improve the diagnosis

[12]. Thick and enlarged epididymis by CDUS usually features epididymitis, a common cause of scrotal pain in adolescents and adults; this inflammation is mostly due to bacterial infection. The CDUS is an excellent technique for the diagnosis of epididymitis [4]; 32% of the infertile men in our study had epididymitis, which represents a high frequency among infertile males, similar findings of high prevalence were mentioned previously [13]; the incidence of it was estimated by Nicholson *et al.* as ~2.5–6.5/100 000 person-years [14].

Testicular atrophy is presented as reduced testicular size; it was common in the current study, as reported by CDUS, in 23% of the infertile males. Testicular atrophy has many aetiologies like endocrine diseases, such as pituitary adenoma, primary testicular failure, iatrogenic (steroid abuse), and chromosomal disorders such as Klinefelter's syndrome. In this study, one of

the cases was Klinefelter's syndrome with testicular atrophy. The testicular atrophy usually appears on CDUS as a change in the echo texture of the testis, while the epididymis is usually normal [4].

A thick spermatic cord was recorded in 9% of the infertile males in this study, which is a relatively high prevalence; the thick spermatic cord, also called funiculitis, is an inflammation of the spermatic cord mostly due to infectious or autoimmune causes [15]. This is the first report on the prevalence of funiculitis in Iraq; the CDUS technique is an excellent tool for the detection of thick spermatic cords.

The CDUS reported Cystic transformation of rete testes (CTRT) in 17 (5.5 %) cases, which is a relatively high percentage when compared to the few previous studies [16]. The mediastinum testis in CDUS appears as hypo-echoic areas.

In our paper, the undescended testis was diagnosed in 3.8% of infertile men by CDUS. In newborns, the prevalence of undescended testis is 1-4.5% [17], which decreases by one year to 0.8-1.2% [18]. The higher percentage of undescended testes in the current study is due to different study population, which is restricted to infertile males in this study.

The detection of undescended testis is of significant importance as it helps identify an irreversible cause of male factor infertility as the spermatogonia cells in the testes become atrophic and disappear from the seminiferous tubules usually by the age of 2 years. So, an adult undescended testis does not contribute sperm to the semen. However, if the diagnosis is made before the age of 2 years, Orchidopexy could help in return the normal function of the testis and reduce the risk of infertility, preventing the possible testicular cancer, and help in detecting and treating the risk of accompanying inguinal hernia [19].

In conclusion, we could conclude that scrotal Doppler ultrasound is a practical, cheap, safe, and easy method to detect the main testicular pathologies leading to male factor infertility. Overall, we could see from this paper that the leading causes of male infertility identified by scrotal ultrasonic were varicocele, epididymal obstruction, and testicular atrophy. For the reasons mentioned above, it would be very beneficial if all male patients with infertility undergo an ultrasonic examination of their scrotum.

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