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Original article

Types and Risk Factors of Male Infertility in Benghazi Teaching Hospital for Fertility and Assisted Reproduction: A Cross-Sectional Study

Amina Elsaid[1]*, Aynoor Eltajouri[2], Ali Ben–Ismail[2], Abaq Ellafi[2], Ahmed Ajaouda[2]

[1]*Department of Community Medicine, Faculty of Medicine, Libyan International Medical University, Benghazi, Libya*
[2]*Faculty of Medicine, Libyan International Medical University, Benghazi, Libya*
***Corresponding email**: amina.elsaid@limu.edu.ly*

Abstract
Male infertility is a significant global health concern, accounting for 40–50% of infertility cases in couples. Despite its prevalence, limited research has been conducted on the causes and risk factors of this condition in Libya. The aim is to determine the types of infertility in men as well as to determine the socio-demographic and behavioral risk factors in infertile men from Benghazi who have been referred to Benghazi Teaching Hospital for Fertility and Assisted Reproduction. A hospital-based cross-sectional study was conducted, including male patients who were referred to the hospital between 2022 and 2023. Among the 99 participants, 48.5% were aged 36–46 years, and 61% had primary infertility. Semen abnormalities were prevalent, with oligospermia (30.3%), asthenospermia (27.3%), and teratospermia (15.2%) as the most common. Smoking was reported by 52.5% of participants, obesity by 19.2%, and varicocele by 18.2. Semen abnormalities and modifiable risk factors, particularly varicocele, are major contributors to male infertility at Benghazi Hospital.
Keywords: Male infertility, Risk factors, Benghazi, Libya

Introduction

An increasing global concern, infertility affects 10–15% of couples of reproductive age [1]. Male infertility accounts for 40–50% of all instances; however, it is often underreported, even though both men and women can cause infertility. Male infertility is a complex disorder influenced by several factors, including genetics, health issues, lifestyle choices, and environmental exposure. Understanding the underlying causes and risk factors of male infertility is essential for providing effective diagnostic and therapeutic interventions in areas such as Libya, where health systems are improving [2]. One important facility in Benghazi devoted to the diagnosis and treatment of infertility is the Benghazi Teaching Hospital for Infertility and Assisted Reproduction. It offers specialized care in reproductive medicine and acts as a referral center for patients with infertility [4]. Despite the increasing number of male infertility cases referred to hospitals, there is limited research on the specific types and risk factors contributing to male infertility within this population [3].

Infertility is defined as the failure to conceive after 12 months of regular unprotected intercourse [1]. Globally, 17.5% of the global adult population, or one in six people, are affected according to the WHO. The prevalence of infertility is known to differ from place to place and region to region [5]. Infertility can be either primary or secondary. Primary infertility is when a pregnancy has never been achieved by a person, and secondary infertility is when at least one prior pregnancy has been achieved. The common causes of male infertility are primary hypogonadism (e.g., testicular, systemic, and genetic), secondary hypogonadism (e.g., hypothalamic, pituitary, medications, and genetics), and sperm transport disorders (e.g., obstructive azoospermia) [7]. The associated risk factors are smoking, alcohol intake, family history, testicular trauma, genetics, endocrinological disorders, past medical conditions (e.g., diabetes), and surgical history (e.g., testicular surgeries) [8]. Semen analysis remains the most basic and simple test for evaluation of male infertility [1]. This study aims to fill the gap in identifying and treating infertility among men in Benghazi, Libya, by classifying the types of male infertility and analyzing the sociodemographic and behavioral risk factors associated with infertility in men attending the Benghazi Teaching Hospital for Infertility and Assisted Reproduction. A thorough understanding of these factors is vital for developing targeted interventions and improving the quality of care for infertile men in this region.

Methodology

Study design

A cross-sectional study was conducted among 99 patients at the Benghazi Teaching Hospital for Infertility and Assisted Reproduction, a large public specialized institution for managing and treating infertility cases in Benghazi city.

Data collection

A convenience sample included all male patients of all ages who were referred to the hospital and had complaints of infertility within the specified study period (2022-2023). Secondary data were collected from the patients' medical records at the hospital. The patient files provided information on types of infertility (e.g., primary or secondary), age, job, behavioral risk factors such as smoking, and medical history, including

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any relevant past medical and reproductive history (history of diabetes, hypertension, obesity, and varicocele). A structured data collection form was used to systematically extract relevant information.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS), and descriptive statistics (such as means, frequencies, and percentages) were calculated to describe the sociodemographic characteristics, types of infertility, and behavioral risk factors among the participants. Inferential statistics were employed to identify any significant associations between sociodemographic and behavioral risk factors and types of infertility. Tests such as chi-square tests were used, depending on the variable type and distribution, to evaluate associations. A p-value of less than 0.05 was considered significant.

Ethical Considerations

Ethical approval for this study was obtained from the Benghazi Teaching Hospital Authority and the Libyan International Medical University (LIMU) Ethics Committee.

Results

This study revealed that the majority of participants were between 36 and 46 years old (48.5%), followed by those aged 47-57 years (35.4%) and 25-35 years (14.1%). Approximately 61(61.6%) patients had primary infertility, and most of the patients were employed in office-based jobs 34 (34.3%) or were self-employed 36 (36.4%) (Table 1).

Table 1: Distribution of patients according to socio-demographic characteristics.

Variable	No.	%
Age		
25-35	14	14.1
36-46	48	48.5
47-57	35	35.4
> 57	2	2
Infertility Type		
Primary	61	61.6
Secondary	38	38.4
Job		
Teacher	4	4
Officer	34	34.3
Self-employment	36	36.4
Soldier	7	7.1
Policeman	7	7.1
Driver	3	3
Doctor	2	2
Others	6	6.1

Our study reported that health risk factors, such as smoking history (52 [52.5%] patients), diabetes (9 [9.1%] patients), and hypertension 7 [7.1%] patients), were relatively low among participants. Obesity was present in 19(19.2%) participants, and varicocele was reported by 82(18.2%) participants (Figure 1).

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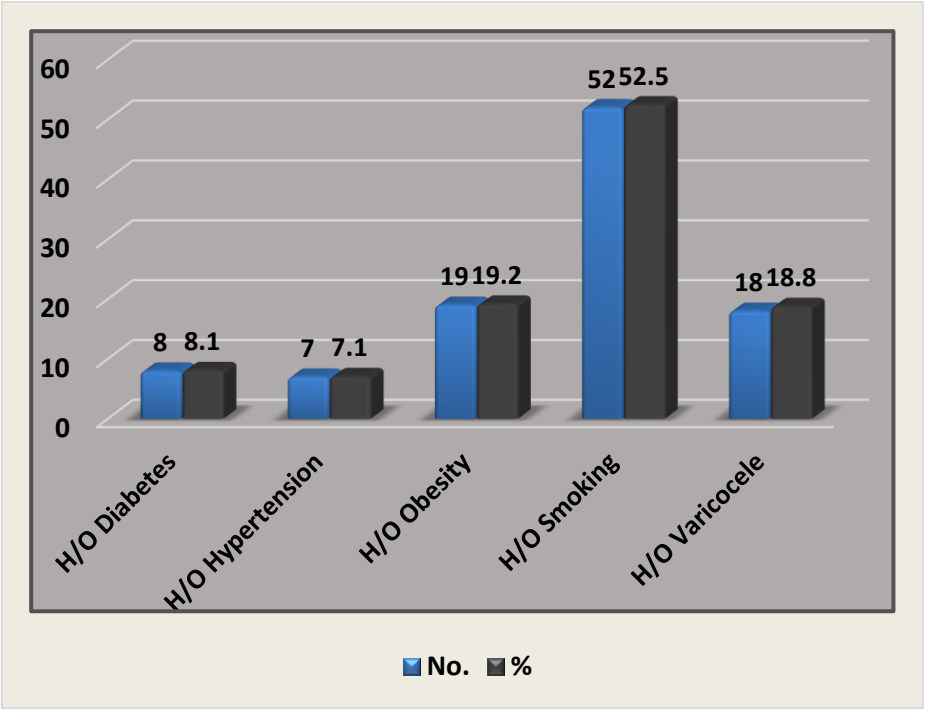

Figure 1: Distribution of patients according to history of diabetes, obesity, smoking, hypertension, and varicocele

Oligospermia (Low Sperm Count) had the highest prevalence, accounting for more than 30%, indicating that it is a leading cause of male infertility in the population studied. Asthenospermia (Reduced Sperm Motility) is similarly prevalent to oligospermia, with approximately 30%. This suggests that motility issues are significant contributors to infertility. Teratospermia (Abnormal Sperm Shape) occurs in approximately 15-20% of cases. Highlights a notable proportion of infertility linked to sperm morphology issues. The prevalence of oligoasthenospermia (low sperm count and reduced motility) is approximately 10-15%, suggesting a combined impact of sperm count and motility on fertility. Azoospermia (No Sperm Production) is the least common, with a prevalence of less than 10 %. It represents a complete absence of sperm in the ejaculate and is typically more severe than Oligozoospermia. The prevalence of asthenoteratospermia (Reduced Motility + Abnormal Shape) is very low, indicating that it is relatively rare compared to other conditions (Figure 2).

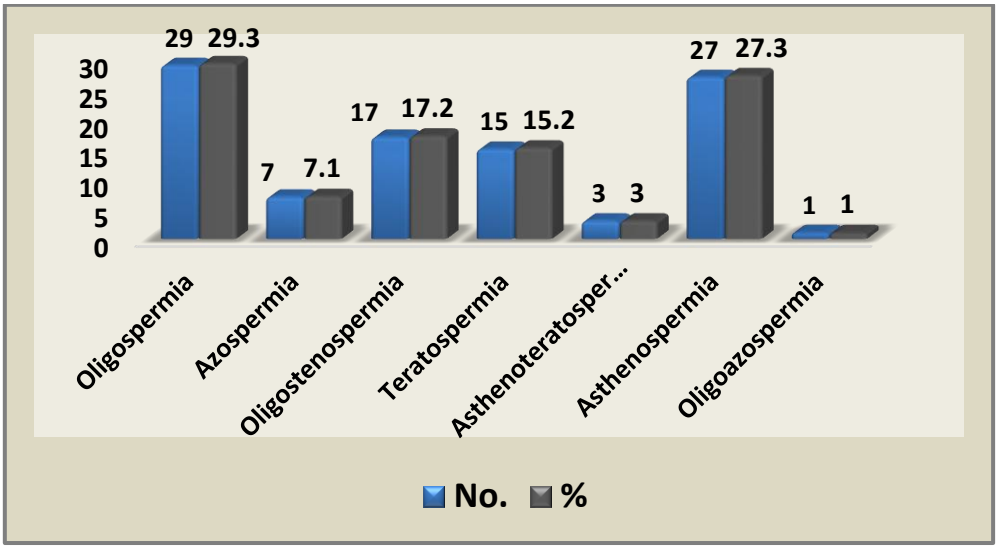

Figure 2: Distribution of patients according to semen analyses.

Our study concluded that the sample distribution suggests that male infertility is more commonly reported in middle-aged men than in younger men. However, the difference between age groups and types of infertility (primary vs. secondary) was not statistically significant. p = 0.489, indicating that age may not be a decisive factor for the type of infertility. Although job type was investigated as a potential risk factor, it showed no significant association, p = 0.374, with infertility type (Figure 3).

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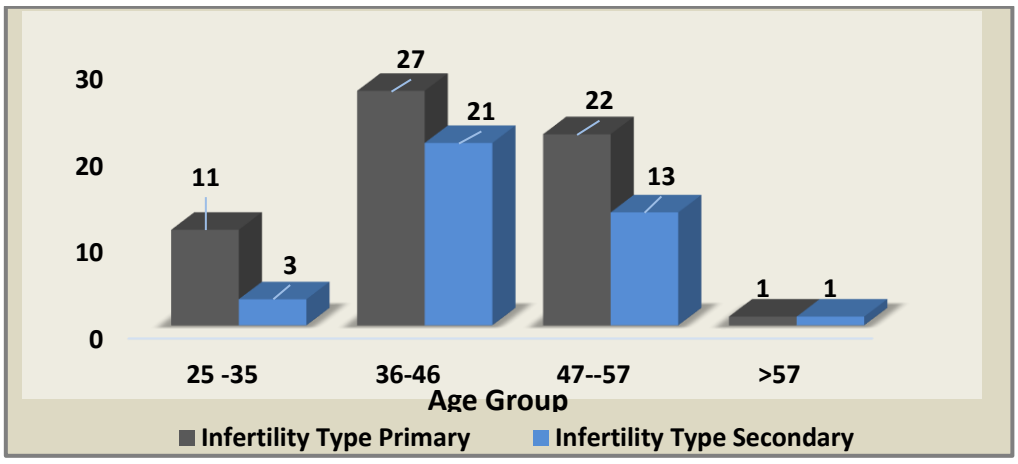

Figure 3: Differences between age groups and types of infertility.

This study showed that there was no significant difference between age groups in semen analysis results (p=0.506). Middle-aged groups (36–46 and 47–57 years) showed the highest prevalence of most conditions, particularly oligospermia, asthenospermia, and teratospermia. Young adults (25–35 years) generally show a lower prevalence across all conditions, indicating fewer fertility issues at a younger age. Older adults (>57 years) show moderate prevalence, with a noticeable decrease in complex conditions such as teratospermia and oligospermia. See figure 4

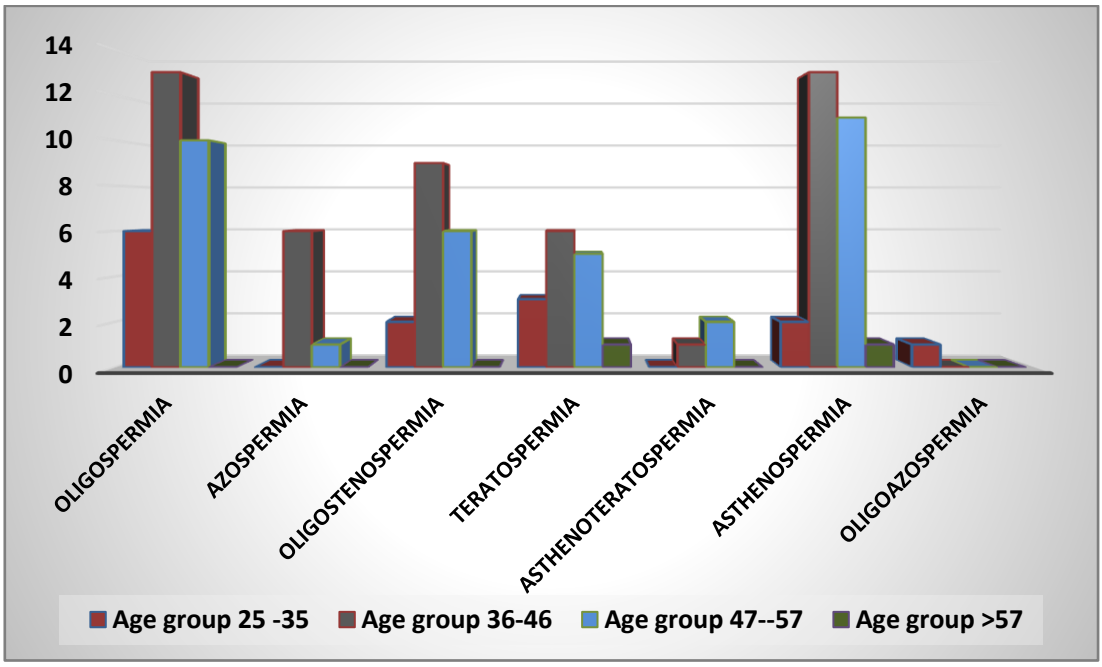

Figure 4: Prevalence of male infertility conditions by age group

The study reported that the type of semen abnormality was not significantly associated (p = 0.068) with the type of infertility, either primary or secondary.

Table 2: Differences between semen analysis results and type of infertility.

Semen Analysis	Infertility Type		Total
	Primary	Secondary	
Oligospermia	19	11	30
Azoospermia	6	1	7
Oligoasthenospermia	6	11	17
Teratospermia	13	2	15
Asthenoteratospermia	2	1	3
Asthenospermia	15	12	27
Total	61	38	99

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Diabetes and Hypertension were relatively low among participants (9% and 7.1%, respectively), suggesting that they may not be major contributors to infertility in this group. While smoking was prevalent, with 52.5% of the patients reporting a smoking history, this could contribute to their infertility. The study finding reported that 18[18.2%] of patients had varicocele, which is consistent with its known contribution to male infertility; Notably, statistical analysis did not find a significant association (p = 0.818) with specific types of infertility or semen abnormalities (Figure 5).

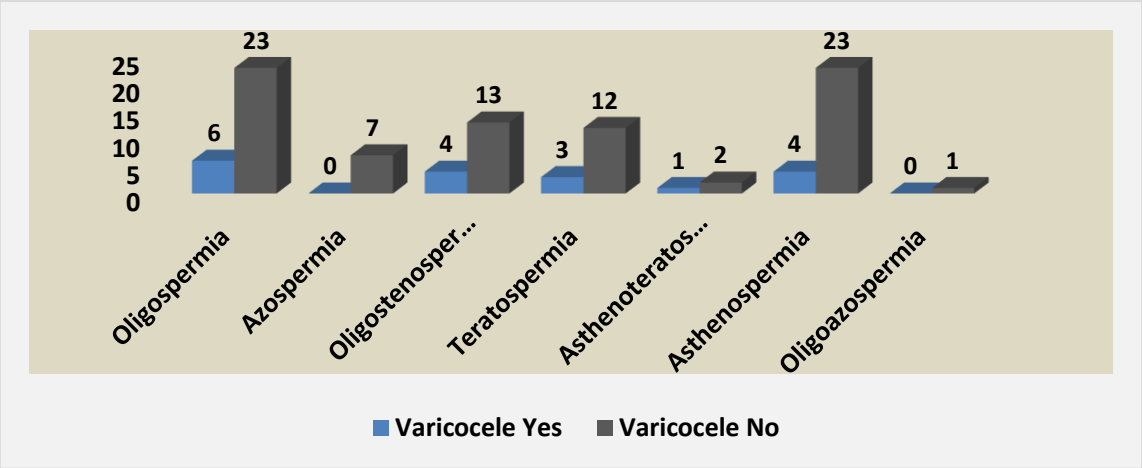

Figure 5: Association between varicocele and semen analysis

Discussion

Infertility due to male factors in Libya (approximately 70%) is very high compared to data from other regions of the world [7]. To better inform the prevention and primary treatment of male infertility, this study aimed to identify the likely types and risk factors of male infertility among patients referred to the Benghazi Teaching Hospital for Fertility and Assisted Reproduction from 2022 to 2023. based on previously reported data. Additionally, we propose new research directions and interventions.

Approximately 61.6% of participants had primary infertility, similar to a previous study conducted in Morocco (61.8 %) [9], Pakistan (62.7 %) [10], and Iran (69.5 %) [11], while it was much lower than estimates in a previous Libyan study, where primary infertility was 95.2% [7]. However, in Saudi Arabia, primary infertility was 80.5% [12]. while a lower estimation in Northern Tanzania showed that primary infertility was 37.1% [13].

Evidence indicates that some of the major behavioral and lifestyle risk factors for male infertility include alcohol consumption, cigarette or tobacco smoking, and being overweight or obese [14, 15]. Four major themes, biological/physiological reasons, behavioral/lifestyle risk factors, environmental risk factors, and socio-demographic risk factors, were used to present the causes and risk factors of male infertility as found in the examined studies [14].

Many previous studies have reported that cigarette smoking lowers sperm quality and that there is a relationship between smoking and male infertility [16]. Most studies have reported that smoking significantly decreases sperm production [17] and decreases sperm motility and normal forms [17,18], and that this decreases correlates with the number of cigarettes smoked per day [6]. Lower sperm concentrations have been observed in heavy smokers [18]. Moreover, men who smoke before or during attempts to conceive are at a higher risk of decreased fertility (OR 1.6) than non-smokers. Men who smoke tend to have a decrease in total sperm count, density, motility, normal morphology, semen volume, and fertilizing capacity [8], and sperm fertilizing capacity through increased seminal oxidative stress and DNA damage [17]. Our study revealed that more than half, 52.5%, of patients were smokers.

The obesity epidemic has recently become a serious issue, particularly in industrialized nations, and obesity can significantly affect male and female fertility [8]. Our study findings showed that 19.2% of patients reported obesity, and obese men were three times more likely to exhibit a reduction in semen quality than men of normal weight. Several studies have shown that higher BMI is associated with lower sperm concentration and motility. Overweight men have also been found to have increased DNA damage in their sperm [8]. Abnormal (low and elevated) body mass index (BMI) has been identified in many studies as a significant risk factor for male infertility [19-23]. Semen volume, sperm count, and poor sperm motility were significantly lower in obese men than in men with normal weight [19,23]. In a study conducted in Iran, obese men were 3.5 times more likely to have oligospermia than men with a normal BMI [20]. Men with a BMI > 25 had a significant reduction in the number of normal motile sperm [6].

In this study, about 18.2% of patients had a varicocele. Varicocele is characterized by increased scrotal temperature, possibly due to the reflux of warm blood from the abdominal cavity. However, the mechanism by which temperature influences spermatogenesis remains unclear. According to one theory, it is caused by thermal damage to the DNA and proteins in the nucleus of spermatic tubule cells and/or Leydig cells [24].

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The prevalence among infertile men varies between different studies from 17% and 41%. For many years, varicocele has been considered an important cause of male infertility, as numerous studies have shown improvement (30% to 60%) in semen parameters after varicocelectomy [24]. Varicocele is considered the most common correctable cause of male infertility [6, 14, 25,9].

Our study findings revealed that oligospermia and asthenospermia had the highest prevalence, at approximately 30%, indicating that they could be the leading causes of male infertility in the population under study. In the western region of Libya, a study found that 31% of men had asthenospermia and 22.9% had oligospermia [7]. Azoospermia (No Sperm Production) is the least common, with less than 10% among patients, representing a complete absence of sperm in the ejaculate, typically more severe, nearby the study done in Morocco (16%) [9]. Teratospermia (Abnormal Sperm Shape) occurs in approximately 20% of cases. A notable proportion of infertility is linked to sperm morphology; however, a study in the western region of Libya found that 36.4% of patients had teratospermia [7].

Our study concluded that the sample distribution suggests that male infertility is more commonly reported in middle-aged men than in younger men, that 48.5% with 36- 46 age group. However, the difference between age groups and types of infertility (primary vs. secondary) was not statistically significant, indicating that age may not be a decisive factor for the type of infertility. An Indian study reported that the risk of infertility doubled in men over 35 years of age [6]. There is a significant decrease in sperm concentration with age [26]. A higher percentage of semen abnormalities was found in men aged ≥ 40 years [27]. The aged groups (36–46 and 47–57 years) showed the highest prevalence of most conditions, particularly oligospermia, asthenospermia, and teratospermia, while young adults (25–35 years) generally showed a lower prevalence across all conditions, indicating fewer fertility issues at a younger age. Older adults (>57 years) show moderate prevalence, with a noticeable decrease in complex conditions such as teratospermia and oligospermia. However, this study tested the significant relationship using chi-square, which was unable to detect and disaggregate the magnitude of the relationship by category. Primary infertility was more common among patients with oligospermia and teratospermia, whereas secondary infertility was frequently observed in patients with asthenospermia. No significant statistical associations were found between infertility type and comorbidities such as diabetes, obesity, or hypertension, indicating that these conditions were not major risk factors for infertility in this study population.

Limitations of the Study

Relying on existing medical records introduces limitations due to incomplete or inconsistent data. Missing information in patient files, particularly regarding lifestyle factors such as smoking frequency, alcohol consumption, or detailed occupational exposures, restricted the depth of analysis.

Conclusion

The study concluded that the main type of infertility in men is primary infertility, most abnormalities of semen are oligospermia, asthenospermia, and teratospermia, and varicocele is the major risk factor that contributes to male infertility in Benghazi Hospital.

Recommendation

Prospective studies with larger and more diverse samples are necessary to validate these findings. Incorporating detailed environmental exposure assessments could provide insights into unexplored risk factors. Additionally, Longitudinal studies tracking the outcomes of interventions, such as lifestyle modifications and varicocele surgery, would provide valuable insights into effective management strategies. By addressing these challenges, healthcare providers can improve the diagnosis, treatment, and prevention of male infertility, ultimately enhancing reproductive health outcomes for affected individuals and their families.

Conflict of interest. Nil

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