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Original Research Article

Role of semen analysis in diagnosing male infertility

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Abstract

Introduction: Infertility affects 13% to 15% of couples worldwide, with male factor infertility playing a significant role. Semen analysis is a key diagnostic tool for evaluating male fertility, as abnormalities in semen parameters can indicate reproductive challenges.
Aim and Objectives: 1. To assess the role of semen analysis in diagnosing male infertility; 2. To determine the prevalence of abnormal semen parameters in a tertiary care hospital.
Materials and Methods: This retrospective study included 72 male patients diagnosed with infertility at a tertiary care hospital between January 2018 and December 2020. Semen samples were collected following a three-day abstinence period and analyzed for volume, viscosity, sperm concentration, motility, and morphology based on WHO 2021 guidelines.
Results: The participants were aged 27 to 48 years. Semen analysis revealed that 28 individuals (38.8%) had an ejaculation volume below 1.5 ml, while 18 (25%) had sperm concentrations below 15 million/ml. Azoospermia was identified in 4 cases (5.5%). Additionally, 21 cases (29.2%) exhibited total motility below 42%, with 2 cases showing 100% immotile sperm.
Conclusion: A significant proportion of patients had abnormal semen parameters, emphasizing the importance of semen analysis in diagnosing male infertility. Early detection can aid in targeted interventions to improve reproductive outcomes. Further large-scale studies are recommended to explore contributing factors and optimize management strategies.

Keywords: Infertility, Semen analysis, Sperm concentration, Azoospermia, Oligospermia.

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1. Introduction

Infertility is a frequently encountered concern in clinical practice, defined as the inability of a couple to achieve conception after one year of regular, unprotected intercourse. It can be classified as primary and secondary infertility. Primary infertility is the inability to conceive after 12 months or more of regular unprotected sexual intercourse in a couple who have never achieved a pregnancy. Secondary infertility is the inability to conceive after 12 months or more of regular unprotected sexual intercourse in a couple who have previously conceived at least once.[1,2]

It affects approximately 13% to 15% of couples globally and is recognized as a significant public health issue. Beyond impacting the lives of couples, infertility also places a burden on healthcare systems and has social implications.[1] Studies indicate that male factors alone account for around 20% of infertility cases, with an additional 30% to 40% of cases involving both male and female factors.[2]

Semen quality is a key indicator of male fertility, and variations in semen parameters can reflect reproductive potential. Semen analysis is considered the initial diagnostic tool for evaluating male fertility in couples facing infertility issues.[3]

Despite its limitations, semen analysis continues to be widely conducted in laboratories worldwide. It is a fundamental and straightforward test that evaluates sperm development, maturation, and interaction with seminal fluid, offering valuable insights into both sperm production and

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quality.[4,5] Semen analysis plays a vital role in assessing male fertility potential, particularly in relation to age-related factors.[6]

The current study aims to analyse the semen characteristics of men presenting to our tertiary care hospital, regardless of whether they present with primary or secondary infertility.

2. Aim and Objectives

1. To evaluate the significance of semen analysis as a diagnostic tool in assessing male infertility.
2. To determine the prevalence of abnormal semen parameters in a tertiary care hospital.

3. Materials and Methods

It is an observational study conducted retrospectively from January 2018 to December 2020. In this study we included all the clinically diagnosed infertility cases based on history reported to our tertiary care hospital within the study period, following the approval from the Institutional Ethics Committee.

3.1. Inclusion criteria

All cases of clinically diagnosed infertility reported to our tertiary care hospital.

3.2. Exclusion criteria

All the cases with a history of conditions or surgeries known to you impact reproductive function, such as varicocele, cryptorchidism, epididymitis, mumps, vasectomy, or vasectomy reversal.

Semen samples were collected after informing the patients and ensuring a mandatory abstinence period of three days. The samples were delivered to the laboratory within 30 minutes of collection. Each sample was obtained through masturbation using a sterile, wide-mouthed plastic container provided by the laboratory, which was properly labelled with the patient's name, registration number, and the time and date of collection.

The collected semen samples were analyzed for key parameters, including volume, viscosity, sperm concentration, motility, and morphology, in accordance with the 2021 World Health Organization (WHO) guidelines.[18] Light microscopy was used for the examination of samples. Sperm motility was categorized based on the sperm progression grading system:

A: Rapid forward progressive motility
B: Slow or sluggish progressive motility
C: Non-progressive motility
D: Immobile sperm

4. Results

This study included 72 male subjects aged between 27 and 48 years. The highest proportion of cases (34.7%) fell within the age group of 31–35 years, with the mean age calculated as 34.8±2.4 years (**Figure 1**). A majority (64%) experienced infertility for less than five years, while 21% reported infertility lasting between 5 to 10 years, and 15% had infertility for over a decade.

According to the 2021 WHO criteria, a normal semen volume is considered to be 1.4 ml or more. Among the 72 participants, 44 individuals (60.2%) had an ejaculation volume of 1.5 ml or higher, whereas 28 participants (38.8%) had a volume below 1.5 ml (**Figure 2**).

Sperm concentration serves as a key indicator of fertility potential. In this study, sperm counts ranged from 0 to 94 million per ml. A total of 18 cases (25%) had a sperm concentration lower than 15 million/ml, while 69.5% of the participants fell within the normal range. Azoospermia, defined as the absence of sperm in the ejaculate, was observed in 4 cases (5.5%) (**Table 1**).

In addition to sperm concentration, motility is a crucial factor in assessing male fertility. Sperm motility should ideally be evaluated within 60 minutes of sample collection for accurate results. As per the latest WHO guidelines (2021), the threshold for total sperm motility is 42%, with progressive motility greater than 30% considered normal. In this study, 21 cases (29.2%) exhibited total motility below 42%, while the remaining 51 cases (70.8%) met the criteria with more than 30% showing progressive movement. Among the 21 cases with low motility, 2 individuals were found to have 100% immotile sperm at the time of analysis (**Figure 3**).

Sperm morphology was assessed using fixed stained smears of semen samples. Azoospermia was confirmed in 4 cases (5.5%). One participant with a sperm concentration of 4 million/ml exhibited 90% abnormal sperm morphology (teratospermia). Abnormal morphology was determined based on defects affecting the sperm head, neck, midpiece, or tail.(**Table 2**)

Table 1: Distribution of cases according to sperm concentration (in millions per ml).

Sperm concentration (million/ml)	No of patients	Percentage
Azoospermia	04	05.5%
<14	18	25.0%
15-30	10	13.8%
31-50	14	19.5%
51-70	18	25.0%
>70	08	11.2%
Total	72	100%

Table 2: Abnormalities in semen analysis.

Abnormality	No of patients	Percentage
Oligozoospermia	13	42.0%
Oligoasthenozoospermia	10	32.2%
Azoospermia	04	13.0%
Aspermia	01	03.2%
Nacrospermia	02	06.4%
Teratozoospermia	01	03.2%
Total	31	100%

Table 3: Comparison of duration of infertility in years with other studies (in percentage).

Studies	< 5 years	5-10years	>10years
Jajoo et al[4] (N=100)	62%	32%	6%
Jain et al[9] (N=109)	66%	20%	14%
Present study (N=72)	64%	21%	15%

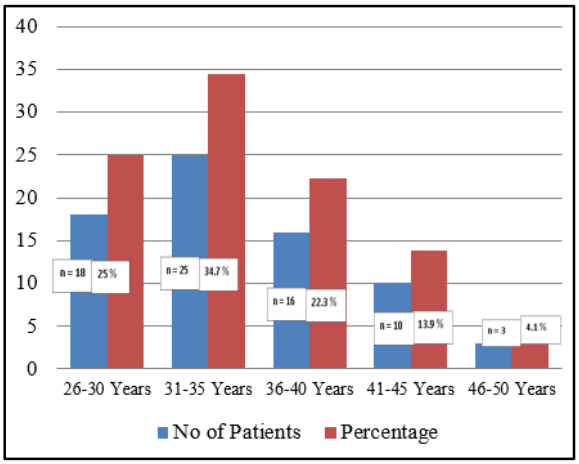

Figure 1: Age wise distribution of all the cases.

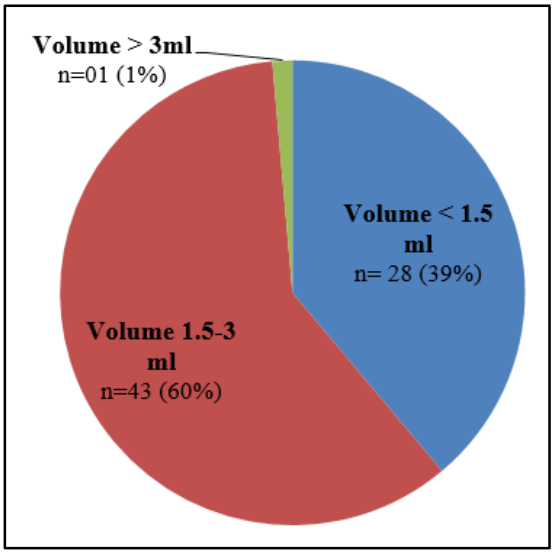

Figure 2: Distribution of cases according to volume of semen.

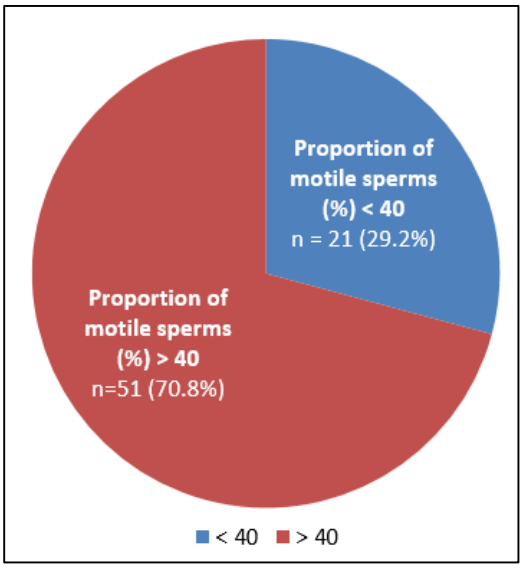

Figure 3: Distribution of cases on the basis of total motility.

5. Discussion

Semen analysis is one of the most commonly performed yet often under-interpreted tests in the assessment of male infertility. It is widely utilized and, in many cases, serves as the primary and sometimes the only diagnostic test for evaluating male reproductive health.[7] Patterns of male fertility can vary significantly across different regions and even among various cultural or religious groups. Several factors, including lifestyle habits such as smoking, environmental influences, and genetic predispositions, are believed to contribute to these variations.[8] As this was a retrospective study we could not analyze these factors in our study.

A majority (64%) experienced infertility for less than five years, while 21% reported infertility lasting between 5 to 10 years, and 15% had infertility for over a decade. These findings are comparable with previous studies conducted by Jajoo et al.[4] and Jain et al.(**Table 3**)[9]

Sperm concentration is considered a crucial indicator of fertility potential. Recent studies have highlighted a global decline in sperm concentration.[13] In this study, oligospermia (sperm count <15 million/ml) was observed in 25% of cases, aligning with findings from studies by Khan et al.,[14] Shaikh et al.,[15] and Owolabi et al.,[16] which reported similar rates (23.2%, 32%, and 25.6%, respectively). Azoospermia was detected in 5.5% of participants, which is consistent with a study by Jairajpuri et al.[7] reporting a prevalence of 9%.

In the current study, 38.8% of participants had an ejaculation volume below 1.5ml. This finding is comparable to research by Jajoo et al.,[4] which reported 22% of males with semen volumes below 2ml, and Jairajpuri et al.,[7] who found a similar prevalence of 23%. Accurate volume measurement is essential in semen analysis as it aids in determining the total sperm and non-sperm cell count in the ejaculate. A reduced semen volume may indicate ejaculatory duct

obstruction or congenital absence of the vas deferens, while inadequate collection techniques may also contribute to lower volumes. Conversely, increased semen volume might suggest active inflammation of accessory glands.[17]

Evaluating sperm motility is critical since sperm must travel through the female reproductive tract to fertilize an oocyte, which is essential for achieving pregnancy. According to WHO 2021 guidelines, a normal semen sample should contain at least 42% motile sperm, with a minimum of 30% demonstrating progressive motility.[18] In this study, 70.8% of participants had sperm motility above the reference level, with progressive motility exceeding 32%. These results are in agreement with the 77.9% motility rate reported by Jairajpuri et al.[7]

The study has certain limitations, including a relatively small sample size and the lack of a comprehensive medical history and contributory factors for participants. Additionally, chromosomal analysis was not available in our setup.

6. Conclusions

This study highlights the significance of semen analysis in diagnosing male infertility, revealing a notable prevalence of abnormal semen parameters among the study population. The findings underscore the necessity of semen analysis as a fundamental diagnostic tool in assessing male reproductive health. Early identification of semen abnormalities allows for timely medical interventions, improving fertility outcomes. Further large-scale studies are recommended to investigate potential contributing factors and enhance treatment strategies for male infertility.

7. Source of Funding

None.

8. Conflict of Interest

None.

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