ORIGINAL RESEARCH

Exploring the Complexities of Male Infertility: Insights from Oligoasthenozoospermia, Asthenoteratozoospermia, and Oligoasthenoteratozoospermia

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Abstract

Background: Male infertility accounts for about 50% of infertility cases and can result from a range of factors including anatomical anomalies, hormonal imbalances, lifestyle habits like tobacco and alcohol use, stress, and environmental exposure. Common contributors to male infertility include low sperm concentration, reduced motility, and abnormal sperm morphology.The aim of this study was to provide insight into three distinct categories of sperm abnormalities; oligoasthenozoospermia, asthenoteratozoospermia, and oligoasthenoteratozoospermia.

Methods: A retrospective investigation examined medical records of men visiting an infertility clinic. Various parameters from semen analysis, encompassing factors such as semen volume, pH, viscosity, sperm concentration, motility, morphology, and white blood cell counts were analysed.The reference thresholds established by the World Health Organization were used for the analysis.

Results: The study included medical records of 54 patients with a mean age of 33.1years (n=52). Majority of the patients (65.4%) were aged>30 years. Mean duration of infertility was 4.2 years. Primary infertility was observed in 94.4%. Varicocele was observed in 11 patients. Abnormalities in sperm count, motility, and morphology were prevalent.Among the patients, 81.5% exhibited an atypical sperm count whilethe mean abnormal total motility was observed in 87% of the patients.Abnormal progressive motility was observed among all of the patients (100%) while abnormal non-progressive motility was observed among 98.1% of the patients.Abnormal total motile sperm count was observed among 92.6% patients whereas abnormal sperm morphology was observed among 55.5% of patients.

Conclusion: Among infertile males oligoasthenozoospermia is a majorly contributing condition followed by asthenoteratozoospermia.

Key words: oligoasthenozoospermia, as thenotera to zoospermia, sperm motility, oligoasthenoteratozoospermia

Introduction

Infertility has emerged as a majorly concerning issue. Statistics indicate that around one in every six individuals within the reproductive age range globally will encounter issues of infertility at some point in their lives.On an average, approximately 10% of all couples encounter challenges in starting a family, leading to a profound sense of individual disappointment. This issue is particularly significant in India, where religious and socio-economic factors have created considerable barriers, making it considerably difficult for everyone to achieve parenthood.[1]According to world health organization, infertility is defined as a medical condition that affects either the male or female reproductive system. It is characterized by the inability to achieve a pregnancy even after engaging in regular unprotected sexual intercourse for a period of 12

months or longer.Male factor is found responsible among 50% of all cases of infertility approximately.[2,3]Male infertility can arise from a spectrum of factors, encompassing anatomical anomalies in the male reproductive tract, dysregulation of endocrine pathways impacting spermatogenesis, testicular insufficiency, abnormal sperm functional attributes and morphological characteristics, as well as the lifestyle factors such as tobacco consumption, elevated psychological stress, immoderate alcohol consumption, adiposity, and exposure to environmental pollutants. These multifaceted contributors can collectively exert detrimental effects on sperm vitality and motility, consequently affecting upon male reproductive fertility. [4,5]Male fertility can be influenced by both genetic factors, as well as infections. These factors can result in disruptions to the production of sperm cells, their transportation, and sexual behaviors, ultimately culminating in infertility.[6] The most significant conditions contributing to male infertility include low concentration of sperm (oligozoospermia), reduced sperm motility (asthenozoospermia), and abnormal sperm shape (teratozoospermia).[7]Oligo-astheno-teratozoospermia (OAT) is a commonly observed condition in men belonging to infertile couples. The underlying causes of OAT often remain unidentified, and a diverse range of factors can contribute to the development of this syndrome.[8] This retrospective study was aimed to shed light on the three specific subtypes of sperm abnormalities: oligoasthenozoospermia, asthenoteratozoospermia, and oligoasthenoteratozoospermia in the infertile couples by assessing key parameters such as sperm count, motility, morphology, and other relevant factors.

Materials and methods

Study design and setting: This was a retrospective study conducted at tertiary care hospital. The medical records of men attending OPD for infertility and underwent semen analysis for the same were analysed.This study was conducted in accordance with ethical principles that are consistent with the Declaration of Helsinki.The study protocol was approved by the Institutional Review Board/Ethics Committee.

Study investigation: Semen analysis plays a crucial role in assessment of male partner of a couple facing infertility challenges. The data from the semen analysis were documented, including measurements of the amount of seminal fluid, pH level, viscosity of the fluid, overall sperm concentration and count, both progressive and non-progressive movement of the sperm, overall sperm mobility, the shape of the sperm, the count of actively moving sperm, and the presence of white blood cells (WBCs) or pus/epithelial cells. The World Health Organization (WHO) has established certain minimum standards for semen analysis as follows: the volume of seminal fluid should be a minimum of 1.5 mL; the concentration of sperm should be at least 15 million spermatozoa per mL; the total sperm count in one ejaculation should be at least 39 million; there should be at least 4% of morphologically normal shaped sperm; the forward movement of sperm (progressive motility) should be no less than 32%, and the overall movement of sperm (combining both progressive and non-progressive motility) should be at least 40%.

Moreover, the duration for semen liquefaction should not exceed 30 minutes, the consistency of the semen should be below 2 mL, the presence of white blood cells (WBCs) or pus cells/epithelial cells should be at a minimum of 6 million, the quantity of total motile sperm should be at least 20 million, and the proportion of sperm with non-progressive movement should be equal to or exceed 40%.

Data collection: The social background of the patient, along with demographic information, clinical observations, and results from semen analysis, were documented. The data analysis was done with the Statistical Package for the Social Sciences (SPSS) version 23 and Microsoft excel 2019. Categorical variables were summarized using frequencies and percentages, while continuous variables were presented as both mean and standard deviation (SD), as well as median and range. Furthermore, relationships between normal and abnormal total sperm count and factors such as age, duration of infertility, type of infertility, smoking or tobacco use, alcohol consumption, and the presence of erectile dysfunction were examined using the chi-square test. A significance level of $p<0.05$ was deemed appropriate.

Results:

Medical records of 54 patients were assessed. The mean age of patients was 33.1 years with majority (65.4%) of the study population were of age >30 years. The mean duration of infertility was 1.9 years; 59.3% of the patients had infertility for <5 years and 40.7% of the patients had infertility for ≥5 years. Majority (96.3%) had collected semen sample through masturbation. Primary infertility was observed in most (94.4%) of the patients. Thirty five percent of patients had history of tobacco consumption and smoking and 13% of patients were consuming alcohol. Varicocele was reported in 20.4% of patients while 7.4% of patients had erectile dysfunction. [Table 1] Whole semen sample was collected for majority (96.3%) of patients. The mean duration between sample collection and testing was 42.1 minutes. Liquefaction was normal among majority of patients (87%). The seminal fluid volume was normal in 87% of patients and the mean pH was 8.

Normal viscosity was observed among majority of the population (92.6%). The median sperm concentration was 10 mL while the median sperm count was 18.8 million/mL.Abnormal sperm count was observed among 81.5% of the patients whereas normal sperm count was observed in 18.5% of the patients. [Table 2] The mean total motility was 25%, and the mean abnormal total motility was observed in 87% of the patients. Abnormal progressive motility was observed among all of the patients (100%) while abnormal non-progressive motility was observed among 98.1% of the patients. The median total motile sperm count observed was 1.7 million and abnormal total motile sperm count was observed among 92.6% of the patients. The mean immotile sperm count was 76.4%. Abnormal pus cells were reported in 4 patients (7.4%) only. Normal sperm morphology exhibited in 24 (44.4%) patients whereas abnormal sperm morphology was observed among 30 (55.5%) patients. [Table 3] On analyzing medical records of their female partners respectively, irregular menstrual cycle was observed among 2 females, polycystic ovarian disease in one female and fibroid in one female. One female had history tubectomy reversal. The mean abstinence period was 3 days among the study population. According to the semen analysis report 25 patients (46.29%) had Oligoasthenozoospermia, 20 patients (37.03%) had Asthenoteratozoospermia and 9 patients (16.66%) had Oligoasthenoteratozoospermia. [Table 4]

Table 1: Demographic characteristics

Parameter	Number of patients (N=54)
Age (years), mean (SD), (n=52)	33.1 (6.3)
Age groups (years), (n=52)	
<30	18 (34.6)
>30	34 (65.4)
Duration of infertility (years), mean (SD)	4.2 (1.9)
Duration of infertility (years)	
<5	32 (59.3)
≥5	22 (40.7)
Mode of collection	
Masturbation	52 (96.3)
Coitus interrupts	2 (3.7)
Infertility	
Primary	51 (94.4)
Secondary	3 (5.6)
Anatomical abnormality	1 (1.9)
Smoking/tobacco consumption	19 (35.2)
Alcohol consumption	7 (13)
Erectile dysfunction	4 (7.4)
Varicocele	11 (20.4)
Data presented as (%), unless otherwise specified. SD, standard deviation.	

Table 2: Pattems of semen analysis among the study subjects

Parameter	Number of patients (N=54)
Semen sample collected	
Whole	52 (96.3)
Partial	2 (3.7)
Duration between collection and testing (minutes), mean (SD)	42.1 (15.6)
Liquefaction	
Normal (≤30 minute)	47 (87)
Abnormal (>30 minute)	7 (13)
Seminal fluid (mL), mean (SD)	2.2 (1.1)
Seminal fluid	
Normal (>1.5 mL)	47 (87)
Abnormal (≤1.5 mL)	7 (13)
PH, mean (SD)	8 (0.2)
Viscosity,	
Normal (<2 mL)	50 (92.6)
Abnormal (>2 mL)	4 (7.4)
Total sperm concentration (mL), median (range)	10 (0-85)
Total sperm concentration	
Normal (≥15 mL)	10 (18.5)
Abnormal (<15 mL)	44 (81.5)
Total sperm count (%), median (range)	18.8 (0.1-209)
Total sperm count	
Normal (≥39%)	10 (18.5)
Abnormal (<39%)	44 (81.5)
Data presented as (%), unless otherwise specified. SD, standard deviation.	

Table 3: Morphological characteristics

Parameter	Number of patients (N=54)
Progressive motility	
Abnormal (<32%)	54 (100)
Non-progressive motility	
Normal (≥40%)	1 (1.9)
Abnormal (<40%)	53 (98.1)
Total motility (%), mean (SD)	25 (0-58)
Total motility	
Normal (≥40%)	7 (13)
Abnormal (<40%)	47 (87)
Immotile sperm (%), mean (SD)	76.4 (15.2)
Sperm morphology	
Normal (≥4%)	24 (44.4)
Abnormal (<4%)	30 (55.6)
Total motile sperm (million), median (range)	1.7 (0-60.6)
Total motile sperm	
Normal (>20million)	4 (7.4)
Abnormal (<20million)	50 (92.6)
WBC (pus/epithelial cells)	
Normal (≥6 pus cell)	50 (92.6)
Abnormal (<6 pus cell)	4 (7.4)
Data presented as (%), unless otherwise specified. SD, standard deviation; WBC, white blood cell.	

Table 4: Distribution of cases according to semen analysis report

Characteristics	Number of patients (N=54)
Oligoasthenozoospermia	25 (46.29)
Asthenoteratozoospermia	9 (37.03)
Oligoasthenoteratozoospermia	20 (16.66)
Data presented as n (%).	

Discussion

Male infertility, a significant but often overlooked element in couples' infertility assessments, emphasizes the need for comprehensive diagnosis. Seminal analysis holds a pivotal role in identifying potential causes and guiding suitable treatments for male factor infertility. Thus, this research aims to examine semen analysis patterns and pinpoint potential contributors to fertility challenges. The noteworthy findings from the study were: 1) majority of the study population was aged >30 years. 2) most (94.4%) of the patients had primary infertility. 3) history of tobacco consumption and smoking was present in 35% of the patients. 4) 20.4% patients had varicocele while 7.4% patients had erectile dysfunction. 5) the liquefaction and seminal fluid volume were normal among most of the patients with mean pH of 8. 6) Among the patients, 81.5% exhibited an atypical sperm count. 7) The average abnormal total motility was detected in 87% of the patientswhile all patients (100%) exhibited abnormal progressive motility, and 98.1% showed abnormal non-progressive motility.8) the total motile sperm count was abnormal among majority of the patients (92.6%). 9) Among the patients, 24 (44.4%) displayed normal sperm morphology, while 30 (55.5%) exhibited abnormal sperm morphology. 10) Oligoasthenozoospermia was present in 25 patients (46.29%), Asthenoteratozoospermia in 20 patients (37.03%), and Oligoasthenoteratozoospermia in 9 patients (16.66%). The mean age of the participants in the current study was 33.1 years, with the majority being over the age of 30. Similarly, in research by Shagufta Khan et al. [9], the predominant age range for men was between 30 and 39 years.In the present study, primary infertility was detected in 94.04% of the patients. Correspondingly, similar trends were observed in other investigations, where primary infertility rates were reported as 90.70% [9], 83.00% [10], and 77.00% [11] among male patients.The current study identified varicocele in 7.4% of cases, while erectile dysfunction was evident in 7.4% of the patients. Another study reported the presence of varicocele in approximately 25% of the patients,[9] and in contrast to our study erectile dysfunction was present in 2.6% of the patients. Factors like smoking, alcohol and tobacco consumption affects male fertility.[9]In our study 35% of the patients had history of smoking and tobacco consumption and 7% patients were consuming alcohol. Findings from a study by Gaur DS et al. showed that alcohol consumption appears to affect the structure and production of sperm, while toxins from smoking mainly impact sperm movement and the quality of seminal fluid. The gradual decline in semen quality is linked to higher levels of alcohol consumption and cigarette smoking.[12] The assessment of semen pH holds significance in diagnosing male factor infertility, given that acidic pH levels are linked to potential blockages in the ejaculatory duct. In this study the mean pH of semen was observed as 8 which is more than the reference range given by WHO [13]. Abnormal sperm viscosity was observed in 4 patients, a finding consistent with a study by Chitturi Ramya et al., was observed in 12 out of 159 cases.[13]Male infertility resulting from sperm hyper viscosity is mainly attributed to factors such as decreased sperm motility and compromised semen quality.In this study, abnormal total sperm count was noted in 81.5% and abnormal total sperm concentration in 81.5%. Similarly, another study by Chitturi Ramya [13]revealed abnormal sperm count in 63 out of 159 male patients. In a separate study by Atul Jain et al., the sperm count was below 20 million/mL in the majority of the population (70%)[14] The average overall motility was 25%, with approximately 87% of patients exhibiting abnormal total motility.Another study found that 94% of patients had less than 50% of their sperm exhibiting motility, with 46% having less than 25% motile sperms.[14]The median total motile sperm count observed was 1.7 million and abnormal total motile sperm count was observed among 92.6% of the patients. A study by Ahmad M et al reported that infertile patients had a significantly lower median total motile sperm count compared to fertile patients (37.5 vs. 83 million/ejaculate, $p<0.001$).[15]A study carried out in South India over a span of 13 years revealed that there was a decrease of 30.31% in sperm count, and at the same time, sperm motility and morphology experienced declines of 22.92% and 51.25%, respectively.[16] The mean immotile sperm count was 76.4%. along with abnormal sperm morphology in 30 (55.5%) patients. A study conducted by Ali A. et al in Sudan reported that the average count of immotile sperm was recorded as (56.3±12.9) million per milliliter, and there was an associated abnormal sperm morphology rate of 40.7%.[17]As per the semen analysis report, Oligoasthenozoospermia was identified in 25 patients (46.29%), Asthenoteratozoospermia in 20 patients

(37.03%), and Oligoasthenoteratozoospermia in 9 patients (16.66%). In another study oligoasthenozoospermia was reported in 7.1 % of the patients, Asthenoteratozoospermia in 13.8% of the patients and Oligoasthenoteratozoospermia in 5.2% of the patients.[17] In a study on Bulgarian infertile men the presence of oligoasthenozoospermia was reported among 9.8% of the patients[18]study documented the occurrence of Asthenoteratozoospermia at a rate of 1.08%. [19]Other studies indicated the prevalence of oligoasthenoteratospermia to be 9.09%[20] and 11%[21] respectively. Findings from a study by Kumar N et al.reported in their study that prevalence of asthenoteratozoospermia was slightly elevated, approximately at 19.35%, and exhibited a rising trend over the past decade. [22] Study limitations include the exclusion of various factors that can influence sperm parameters, like environmental elements (heat, chemicals), lifestyle factors (diet, intercourse frequency), and stress (both emotional and physical). Additionally, factors such as insomnia, tight underwear, and hot tub usage, known to impact semen quality, were not considered in this study.

Conclusion

This study comments on distinct subtypes ofsperm abnormalities, specifically oligoasthenozoospermia, asthenoteratozoospermia, and oligoasthenoteratozoospermia, within couples experiencing infertility. Through a comprehensive assessment of pivotal parameters including sperm count, motility, morphology, and additional relevant factors, this research contributes to a more profound understanding of male infertility.

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References

1. Sharma A. Male infertility; evidences, risk factors, causes, diagnosis and management in human. Ann Clin Lab Res. 2017;5(3):188.
2. Öztekin Ü, Caniklioğlu M, Sarı S, Selmi V, Gürel A, Işıkay L. Evaluation of male infertility prevalence with clinical outcomes in middle Anatolian region. Cureus.10;11(7).
3. Turchi P. Prevalence, definition, and classification of infertility. InClinical management of male infertility 2014:(5-11).
4. World Health Organization. WHO fact sheet on infertility. Global Reproductive Health. 2021;6(1):e52.
5. Purkayastha N, Sharma H. Prevalence and potential determinants of primary infertility in India: Evidence from Indian demographic health survey. Clinical Epidemiology and Global Health. 2021;9:162-70.
6. Abebe MS, Afework M, Abaynew Y. Primary and secondary infertility in Africa: systematic review with meta-analysis. Fertility research and Practice. 2020;6:1-1.
7. Okonofua FE, Ntoimo LFC, Omonkhua A, Ayodeji O, Olafusi C, Unuabonah E, et al. Causes and Risk Factors for Male Infertility: A Scoping Review of Published Studies. Int J Gen Med. 2022;15:5985-97.
8. Colpi GM, Francavilla S, Haidl G, Link K, Behre HM, Goulis DG, et al. European Academy of Andrology guideline Management of oligo-astheno-teratozoospermia. Andrology. 2018;6(4):513-24.
9. Khan SA, Kulkarni VR, Shah RS, Gokral JS, Meherji PK, Vadigoppula AD, et al. Clinical Presentations and Semen Characteristics of Men Attending the Secondary Referral Infertility Clinic at Mumbai, India. J Hum Reprod Sci. 2021;14(4):356-64.
10. Kaushal R, Gurnani N, Kumar M, Dada R, Kumar R. Male infertility in India: Demographics, aetiology and outcomes of standard clinical practice. Natl Med J India. 2020;33(6):340-43.
11. Baranwal A, Chattopadhyay A. Proposition of Belief and Practice Theory for Men Undergoing Infertility Treatment: A Hospital Based Study in Mumbai, India. Front Sociol. 2020;28;5:43.
12. Gaur DS, Talekar MS, Pathak VP. Alcohol intake and cigarette smoking: impact of two major lifestyle factors on male fertility. Indian J PatholMicrobiol. 2010;53(1):35-40.
13. Chitturi R, IV Renuka, Premalatha P, Madhavi K. Patterns of semen analysis in male partners of infertile couples at a tertiary care hospital. IJPO. 2017;4(4):536-9.
14. Jain A, Ambrish PI, Hoogar MB, Dhar R, Wani A, Agrwal S. Role of semen analysis in the diagnosis of infertility at a tertiary care centre in Western India: a prospective study. IJRCOG 2016;5(7):2389-92.
15. Majzoub A, Arafa M, El Ansari W, Mahdi M, Agarwal A, Al-Said S, et al. Correlation of oxidation reduction potential and total motile sperm count: its utility in the evaluation of male fertility potential. Asian J Androl. 2020;22(3):317-22.
16. Adiga SK, Jayaraman V, Kalthur G, Upadhya D, Kumar P. Declining semen quality among South Indian infertile men: A retrospective study. J Hum Reprod Sci. 2008;1:15–8
17. Ali AF, Modawe G, Rida MA, Abdrabo AA. Prevalence of Abnormal Semen Parameters among Male Patients Attending the Fertility Center in Khartoum, Sudan. J Med Life Sci 2022;4(1):1-8.
18. Yovinska S, Belemezova K, Hristova-Savova M, Milachich T, Andreeva P, Veleva L, et al. Correlation between Cytogenetic Findings and Spermatogenic Failure in Bulgarian Infertile Men. Life. 2022;12(11):1840.
19. Jequier AM. Semen analysis: a new manual and itsapplication to the understanding of semen and itspathology. Asian J Androl, 2010;12:11-3.
20. Rikhasor RM, Rathi SL, Jelbani MF, Pirzada ZA, Abassi SA Semen analysis of infertile men plasma levels of LH, FSH and testosterone inoligospermia. Med. Channel. (2001). 72: 30-32.
21. Subhan F, Tahir F, Ahmed R, Khan ZU .Oligospermia and its relation with hormonal profile. J Pak MedAssoc 1995; 45: 246-7.

22. Kumar N, Choudhari AR, Singh AK. Prevalence of male factor infertility in last ten years at a rural tertiary care centre of central India: a retrospective analysis. Indian J ObstetGynecol Res. 2015;2(3):132-6.