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Original Research Article

Insight into epidemiology of male infertility in central India

Ayushi Agarwal[1]*, Aviral Srivastava[2], Farheen Fathima[1], Bharti Lodhi[1]

[1]Department of Obstetrics and Gynaecology and Reproductive medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India
[2]Department of Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

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***Correspondence:**
Dr. Ayushi Agarwal,
E-mail: Ayushibrettlee@gmail.com

ABSTRACT

Background: Approximately 10% to 15% of couples in developing countries are infertile. Male infertility is responsible for 20-43% of infertility cases and contributes to another 12-20% of cases. Azoospermia, oligozoospermia, asthenozoospermia, teratozoospermia, and oligoasthenoteratozoospermia are abnormal sperm parameters causing male infertility. Male infertility is often poorly responsive to primary treatment and often requires supportive secondary measures. The understanding of causes and modifiable risk factors for male infertility would enable their prevention and primary treatment. Aims and objectives of current study was to analyze the epidemiology and clinical factors of male infertility in Central India and identify its risk factors.
Methods: 100 male patients attending outpatient for treatment of infertility were evaluated using a questionnaire. Semen samples were collected and spermatozoa were assessed according to WHO 2021 data for semen analysis. The results were tabulated and analyzed.
Results: Amongst patients were semen abnormalities, the majority (34%) of patients had oligoasthenoteratozoospermia. All semen abnormalities were most common in the age group 35-45 years and in patients with 5-10 years duration of infertility. All semen abnormalities except azoospermia were most common in people with a monthly income of >2,000-5,000. The majority of the patients had a past history of urogenital tract infection, except oligoasthenospermic males in whom the majority had varicocele. All semen abnormalities were more common among businessmen and also more prevalent among smokers.
Conclusions: Couples should be educated about infertility causes and the contribution of male infertility to it. Multifactorial analysis along with clinicopathological analysis should contribute to accurate diagnosis of the cause of male infertility and proposal of adequate measures.

Keywords: Male infertility, Infertility, Epidemiology, Semen analysis, Central India

INTRODUCTION

As per WHO, infertility is defined as the inability to conceive after at least 12 months of unprotected and regular sexual intercourse. 8-12% of couples worldwide are estimated to be affected. Male infertility is primarily responsible in 20-42% of cases and is contributory to other 10-20% of subjects.[1,2] Infertility is causative of major psychological and social distress also affecting patients and health care systems economically. The factors responsible for male infertility primarily impair spermatogenesis and post-testicular obstructive factors contribute to remaining cases. Early diagnosis of these factors, their prevention, and appropriate management can minimize the burden significantly. Male fertility can also have an adverse association with a number of health

conditions.[2] This highlights the need for a thorough medical evaluation to swiftly identify treatable and reversible factors. Glazer et al reported a significantly higher risk of mortality among men with male factor infertility as compared to men who were fertile.[1] Male infertility has also been reportedly associated with a higher incidence of cancer.[3,4] Therefore, early diagnosis of male infertility helps in the identification and treatment of medical conditions affecting not only fertility but also the general health of the patients. Inadequate numbers (oligospermia/azoospermia), impaired motility, and defective morphology of spermatozoa have been reported as leading causes of male infertility.[1-5] Semen analysis is mainstay in the evaluation of male infertility. Additionally, advanced diagnostic tests to investigate sperm quality are on a rise and can improve diagnosis and management.[2] Male infertility is often poorly responsive to primary treatment and is frequently tackled using secondary measures like intra-uterine insemination, in vitro fertilization, intra-cytoplasmic sperm transfer, and child adoption.[5-7] This study was undertaken to help understand the causes and risk factors responsible for male infertility thereby enabling the identification of effective methods for its primary treatment.

METHODS

This study was conducted in the department of obstetrics, gynaecology, and reproductive medicine at Gandhi medical college, Bhopal, from August 1, 2021, to July 31, 2022. 100 male patients attending outpatient for treatment of infertility were evaluated using a pre-formed questionnaire. The majority (83%) of semen samples were collected through masturbation in a sterile container while the remaining were collected by coïtus interruptus. The mean length of sexual abstinence before sample collection was 5.8 days (range 2-7 days). The results were tabulated and analyzed. Semen analysis was performed according to WHO 2021 data for semen analysis.[8]

RESULTS

The distribution of patients according to abnormalities in semen parameters is shown in (Table 1). The majority (34%) of patients had oligoasthenoteratozoospermia (OAT). The second most common abnormality was azoospermia (26%) followed by oligoasthenospermia (24%), the least common abnormality being oligospermia in 8% of cases. Meanwhile, 8% of males did not have any semen abnormalities. The distribution of patients according to age group is shown in (Table 2). The mean age of patients was 38.89 years, the minimum age was 21 years and the maximum age was 50 years. Maximum i.e., 59% of patients were in the age group 35 to 45 years, 30% of patients were in the age group 25 to 35 years, and the least patients (4%) were below the age of 25 years. The distribution of seminal abnormalities in different age groups is shown in (Table 3). In this study, out of 92 patients with semen abnormalities, the majority of azoospermia patients (46.15%) were of age 35-45 years, an age group which also contributed to the majority of oligospermia (50%), oligoasthenospermics (66.66%) and oligoasthenoteratospermics (67.66%).

Table 1: Distribution of patients according to abnormalities in seminogram (n=100).

Type of seminal abnormality	N	%
Oligospermia	8	8
Oligoasthenoteratospermia	34	34
Oligoasthenospermia	24	24
Azoospermia	26	26
Normal	8	8

Table 2: Distribution of patients according to age (n=100).

Age (years)	N	%
<25	4	4
25-35	30	30
>35-45	59	59
>45-55	7	7

The 25 to 35-year age group had the second-highest occurrence of these abnormalities. The distribution of all patients according to infertility duration is shown in (Table 4). The mean duration of infertility was 8.95 years, the minimum being 2 years and the maximum duration was 15 years. 49% of patients had infertility for more than 5 years but less than 10 years, 30% of patients had infertility for more than 10 years and 21% of patients had infertility for less than 5 years. The distribution of seminal abnormalities with the duration of infertility is highlighted in (Table 5). Amongst 92 patients with semen abnormalities, the majority (53.84%) of azoospermia patients had infertility for 5 to 10 years, 15.38% had for less than 5 years, while 30.76% had for more than 10 years. 25% of oligospermia patients had infertility for less than 5 years, and 37.5% had for 5 to 10 years and more than 10 years each. The majority (50%) of the oligoasthenospermia patients had infertility for 5 to 10 years, while 16.66% had for less than 5 years, and 33.33% for more than 10 years. Majority (50%) of oligoasthenoteratozoospermia cases were infertile for 5 to 10 years, while 20.58% had infertility for less than 5 years, and 29.41% had for more than 10 years. The distribution of patients according to their monthly income is depicted in (Table 6). The majority (42%) of patients had a monthly income of less than 10,000 INR. The majority (53.84%) of azoospermia patients had a monthly income of 10,000-15,000, while 30.76% of patients had less than 10,000 and 15.38% had more than 15,000 (Table 7). The majority (50%) of oligoasthenoterato-spermic males had a monthly income of less than 10,000, 29.41% had between 10,000-15,000, and 20.58% had an income above 15,000. Majority of the oligoastheno-spermia (50%) and oligospermia patients (50%) had an income less than 10,000 followed by those who had an income between 10,000-15,000.

Table 3: Distribution of the seminal abnormalities in different age groups.

Age (years)	AZO (N=26)		OAT (N=34)		OA (N=24)		OLI (N=8)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
< 25	1	3.84	–	–	1	4.16	–	–
25-35	11	42.32	7	20.58	6	25	4	50
>35-45	12	46.15	23	67.66	16	66.66	4	50
>45-55	2	7.69	4	11.76	1	4.16	–	–

AZO: Azoospermia; OAT: Oligoasthenoteratospermia; OA: Oligoasthenospermia; OLI: Oligosper

Table 4: Distribution according to the duration of infertility (n=100).

Duration of infertility (years)	N	%
<5	21	21
>5-10	49	49
>10	30	30

Table 5: Distribution of the seminal abnormalities with the duration of infertility.

Duration of infertility (years)	AZO (N=26)		OAT (N=34)		OA (N=24)		OLI (N=8)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
<5	4	15.38	7	20.58	4	16.66	2	25
>5-10	14	53.84	17	50	12	50	3	37.5
>10	8	30.76	10	29.41	8	33.33	3	37.5

Table 6: Distribution of the patients according to the monthly income (n=100).

Monthly income (Rs)	N	%
<10,000	42	42
>10,000-15,0000	36	36
>15,000	22	22

Table 7: Distribution of the seminal abnormalities with monthly income.

Monthly income (INR)	AZO (N=26)		OAT (N=34)		OA (N=24)		OLI (N=8)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
<10,000	8	30.76	17	50	12	50	4	50
>10,000-15,0000	14	53.84	10	29.41	8	33.33	2	25
>15,000	4	15.38	7	20.58	4	16.66	2	25

Table 8: Distribution of the patients according to pathologies in the past medical history (n=83).

Pathology	N	%
Urogenital tract infection	36	43.37
Varicocele	32	38.55
Testicular trauma	13	18.07
Hydrocoele	2	2.40

The distribution of patients according to past medical pathologies contributing to infertility is depicted in (Table 8). 83% of patients had a significant past history, out of which 43.37% had urogenital tract infection and 38.55% had varicocele in past. The distribution of seminal abnormalities according to past pathologies is described in (Table 9). Out of 8 cases with normal seminogram, 50% had a history of varicocele and 25% had a urogenital infection, while 25% had no significant past medical history. In 26% of cases with azoospermia, the majority (38.64%) had a history of urogenital infection, 26.92% had varicocele, and 19.23% had testicular trauma, while 11.53% cases had no significant history in the past. The majority (38.46%) of oligoasthenoteratospermia cases had a history of urogenital infection, followed by 32.35% who had varicocele. However, the majority (33.33%) of oligoasthenospermia males had a history of varicocele followed by urogenital infection (25%), and 41.66% had no significant history. Oligospermic males had an equal

number of cases (25%) with a history of urogenital infection, varicocele, and traumatism each.

Table 9: Distribution of the seminal abnormalities according to pathologies in the past medical history.

Pathology	Normal (N=8)		AZO (N=26)		OAT (N=34)		OA (N=24)		OLI (N=8)	
	N	%	N	%	N	%	N	%	N	%
Urogenital infection (N=36)	2	25	10	38.46	16	47.05	6	25	2	25
Varicocele (N=32)	4	50	7	26.92	11	32.35	8	33.33	2	25
Testicular killing (N=13)	0	0	5	19.23	6	17.64	0	0	2	25
Hydrocoele (N=2)	0	0	1	3.84	1	2.94	0	0	0	0
None (=17)	2	25	3	11.53	0	0	10	41.66	2	25

Table 10: Distribution of seminogram in various occupational groups.

Occupation	N	Normal semen parameters (N=8)		OLI (N=8)		OAT (N=34)		OA (N=24)		AZO (N=26)	
		N	%	N	%	N	%	N	%	N	%
Businessmen	38	5	62.5	3	37.5	12	35.29	9	37.5	7	26.92
Banker	5	–	–	–	–	1	2.94	–	–	4	15.38
Driver	13	–	–	1	12.5	6	17.64	3	12.5	3	11.53
Factory labourer	12	–	–	–	–	3	8.82	4	16.67	5	19.23
Farmer	10	–	–	2	25	5	14.7	3	12.5	1	3.84
Government employee	7	1	12.5	–	–	3	8.82	2	8.33	1	3.84
Labourer	2	1	12.5	1	12.5	1	2.94	–	–	–	–
Painter	6	–	–	1	12.5	2	5.88	–	-	3	11.53
Mechanic/welder	1	–	–	–	–	1	2.94	–	-	0	–
Teaching job	6	1	12.5	–	–	–	–	3	12.5	2	7.69

Table 11: Distribution of the seminal parameters in smokers and nonsmokers.

Smoking addiction		Normal (N=8)	Azoospermia (N=26)	OAT (N=34)	OA (N=24)	Oligospermia (N=8)
Non-smokers	Frequency	5	15	12	10	2
	%	62.5	57.69	35.29	41.66	25
Smokers	Frequency	3	11	22	14	6
	%	37.5	42.30	64.70	58.33	75

The distribution of patients according to occupation is shown in (Table 10). In the study, out of subjects who had normal seminogram, 62.5% were businessmen, and 12.5% were government servants, laborers, and teachers each. Amongst those who had oligospermia, 37.5% were businessmen and 25% were farmers. Similarly, the majority of oligoasthenoteratospermia (35.29%), oligoasthenospermia (37.5%), and azoospermia (26.92%) patients were businessmen. The distribution of the seminal parameters in smokers and nonsmokers is shown in (Table 11). In 8% cases who had normal seminogram, 62.5% were non-smokers whereas 37.5% were smokers. 57.69% of azoospermia patients were non-smokers whereas 42.30% were smokers. On the other hand, the majority of oligoasthenoteratospermic (64.70%), oligoasthenospermic (58.33%), and oligospermia males (75%) were smokers.

DISCUSSION

Identifying causative factors, establishing an association with male infertility, and bringing about behavioural changes can help in prevention. The most common semen abnormality found in the patients in this study was oligoasthenoteratozoospermia is shown in (Table 1). In the study by Mama & Diallo, 76.2% of the patients presented with necrozoospermia, 74.4% with low motility, and leucocytospermia was seen in 57.8% of the samples. Oligozoospermia was seen in more than one-third of the patients and sperm count was under 5 million for almost 27.7% of the patients. Only 19.1% of the spermocytogramms presented normal forms after evaluation of the morphology and 14.5% of patients presented with azoospermia.[9] Muhammed et al found that out of the 300 patients, 77.7% were recorded with normal semen quality, whereas 13.3% were recorded with

oligozoospermia, 4% with azoospermia, 4.3% with asthenozoospermia and 0.7% with oligoasthenozoospemia.[10] As shown in (Table 2), the majority (59%) of the patients in this study were in the age group 35-45 years as compared to those in the age group of 25-35 years or less than 25 years, thus concluding that infertility is more common among the elderly population. Analogous to the present study, Kumar et al showed that the majority (43.64%) belonged to the age group 36-42 years, 36.91% belonged to the age group 29-35 years, 14.76% of patients were 43 years and above and 4.6% patients belonged to the age group 21-28 years.[11] In the study by Mama & Diallo, the mean age of the patients was 38.0±7.1 years.[9] In reference to (Table 3), all semen abnormalities were most common in the age group >35-45 years. Thus, it was inferred that the chances of having semen abnormalities increased with advancing age. Umashankar et al reported that free testosterone and serum testosterone levels decrease by 1.2 and 0.4% per year respectively after the age of 50 years. This may be attributed to a decrease in Leydig cells due to lesser perfusion and reduced mitochondrial steroid supply. Also, age-related changes in seminal vesicles, epididymis, and prostate lead to reductions in seminal volume, percentage of sperm cells, and sperm cell motility.[12] Kumar et al also stated that aging affects semen parameters adversely leading to lower fertility potential.[11]

Most of the subjects (49%) had marital life of 5-10 years and the least (21%) had less than 5 years, thus concluding that chances of infertility increase with increasing duration of marital life (Table 4). The increasing age with increasing duration of marital life was also thought to play a role. Contrary to the present study, Muhammed et al found that 63% of patients had a married life of 5 years and less, 29.7% between 6-10 years, and 7.3% had a married life of 11 years and above.[10] Mama et al found the mean duration of infertility to be 5.3 years.[9] In our study all the semen abnormalities were most common in the males with a duration of infertility of 5-10 years (Table 5). Muhammed et al found a significant association between semen parameters and marriage duration, whereby 20.8% of patients who had abnormal semen parameters had been married for more than 11 years as compared to those who had normal semen parameters in which only 3% had been married for more than 11 years.[10] The duration of marriage was found to be an important determinant of semen quality, which significantly deteriorates with an increase in the marital period.[10,11] Majority (42%) of subjects had income between >2,000-5,000 and all semen abnormalities except azoospermia were most common in people with a monthly income of >2,000-5,000 (Table 6-7). Thus, it was concluded that semen abnormalities were more common in males with meager livelihood, a finding supported by studies in past. Muhamad et al found that 47% of the subjects belonged to a household income of less than RM 4,000, 50% of the subjects belonged to a household income range of RM 500 0–RM9000, while only 3% of the subjects were found to have a household income of above RM10,000.[10] In reference to (Table 8-9), the majority of cases presented with a significant past pathology related to infertility, the commonest being urogenital tract infection. Table 9 shows that most of the oligoasthenospermia patients had a history of varicocele (33.33%), while 41.2% had no significant past history. Among rest of the patients with semen abnormalities, the majority had a history of urogenital tract infection. In the study by Mama and Diallo, 113 patients presented with a pathology in the past that could be related to infertility. Among them, 48 of them were treated for an infection of the genital tract and 46 of them were followed for varicocele.[9] Clinically significant varicocele (grade 2/3) is associated with an increase in testicular temperature and vasoconstriction resulting in seminiferous tubular damage. In reference to (Table 10), the majority of subjects in the present study were businessmen (36%). All semen abnormalities were most prevalent among businessmen. Muhamed et al stated that the majority of the subjects were found to have occupations related to management (26.3%), followed by professionals (21.7%), and the least were employed in service and as sales workers (5.7%).[10] Kenkel et al demonstrated that farmers and painters had reduced sperm counts and concentrations out of all infertile men; also, more farmers presented with maldescended testes. Welders/metal workers presented with reduced sperm motility, which might have been due to increased exposure to heat and toxins at the workplace. Poor semen parameters of varnishers/painters could be caused by exposure to toxins. This may also be applicable to the farmers (fertilizers, herbicides); also, the increased rate of maldescended testes may be due to increased exposure to toxins during prenatal development.[11-13] Okonofua et al reported that semen abnormalities were more common among civil servants as compared to other professions. This might be attributed to social activities like smoking and excessive alcohol consumption.[5] Lopez et al found that heavy metals interfere with endocrine functions thereby affecting male fertility adversely.[14] Thus we see that certain occupations predispose males to deteriorated semen parameters. In subjects who had normal seminogram, a majority (62.5%) were non-smokers (Table 11). All semen abnormalities were seen more commonly among smokers than non-smokers. This helps in establishing a significant association between smoking and semen abnormalities. Rehman et al found in their study that the normal sperm morphology was 1.29% lower among smokers as compared to non-smokers. Smoking has a significant effect on fertility, specifically sperm count and morphology. This effect might be due to oxidative stress produced by smoking, which has devastating effects on semen parameters thus adversely affecting male fertility.[15] Bundhun et al in their meta-analysis of sixteen studies concluded that oligozoospermia was significantly higher in smokers. It was also seen that morphological defect of spermatozoa was higher in smokers whereby significant head, neck,

and tail defects were observed. However, smoking did not affect the pH and motility of spermatozoa.[16]

Cigarette smoking affects sperm quality adversely (count and abnormal morphology). Cigarette smoke contains substances like nicotine, alkaloids, and nitrosamines which generate free radicals damaging the spermatozoa. Smoking also interferes with sperm DNA synthesis as evidenced by the increased level of 8-oxo-deoxyguanosine. Also, infertile smokers showed higher levels of oligospermia than infertile non-smokers.[12] Thus, it is recommended that infertile patients should quit smoking. This study has some limitations due to its small sample size, absence of genetic analysis, and lack of insight into response to factor modification.

CONCLUSION

Male infertility is becoming a modern plague in couples' lives. Age, occupation, and behavioural habits, coupled with stress and lack of timely medical help, have a remarkable effect on semen quality and quantity. Modifiable factors like healthy lifestyle, smoking and alcohol cessation, exposure to toxins and chemicals, diseases, and diet modification can have a considerable contribution in improving semen parameters and help in infertility management. Couple education on factors in both sexes causing infertility, and curability by modifiable and medical manoeuvres should be promoted.

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