

Seminal Volume in the Investigation of Male Infertility

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ABSTRACT

Objective: To determine the seminal volume among infertile males and the frequency distribution of hypospermic and hyperspermic patients in infertile males.

Study Design: Cross-sectional observational study.

Place and Duration of Study: Department of Reproductive Physiology/Health, Public Health Laboratories Division, National Institute of Health, Islamabad, from 2002 to 2009.

Methodology: Semen examinations of infertile male were carried out according to the standardized method of the World Health Organization. Seminal volume of 2-6 ml were considered normal, while volumes less than 2 ml and higher than 6 ml were considered hypospermic and hyperspermic respectively.

Results: Out of 1521 patients, 355 were hypospermic (23.34%), 1046 were normospermic (68.78%) while 120 were hyperspermic (7.88%). In the hypospermic cases, 57 out of 355 (16.05%) had a volume of less than 1 ml. Of those 57 patients, 34 were found to be azoospermic, 12 were asthenozoospermic, one each were terato and polyzoospermic, while 6 had normal counts. Among the hyperspermic patients (n=120), 3 were azoospermic, 24 were oligozoospermic and 19 cases (15.84%) had count within the normal range, while 1 patient was polyzoospermic. Significant differences ($p < 0.05$) were observed among azoospermic, oligoasthenozoospermic and teratozoospermic groups when comparing hypo and hyperspermic patients.

Conclusion: Seminal volume is an important parameter for assessment of infertility investigation and its abnormalities constitute a valuable index of problems with the male partner, even if the count and motility are well within the acceptable limits.

Key words: Seminal volume. Male infertility. Sperm count.

INTRODUCTION

Infertility is defined as the inability to conceive after one year of unprotected sexual interaction.¹ It has been reported that it effects about 15% of couples as whole and a male factor alone is responsible in about 50% of cases.² The term infertility has got great social implications in certain societies of the world particularly in Pakistani community. Lower sexual and poor personal quality of life has been reported to be responsible in male infertile patients.³ Similarly, male with an age of above 30 years, having 3-6 years of infertility duration are risk factors for marital dissatisfaction.⁴ Besides this, there are some other risk factors leading to defective spermatogenesis and hence male infertility which include varicocele, cryptorchidism, infections, obstructive lesions, cystic fibrosis, trauma and oxidative stress.⁵

Human semen is a mixture of components produced by several different glands, incompletely mixed during

ejaculation. The initial ejaculate is not an entirely homogeneous mixture. The first portion of the ejaculate, about 5% is made up of secretions from the Cowper and Littre glands. The second portion is derived from the prostate and contributes about 15-30% to ejaculate. There follow small contributions of the ampulla and epididymis and, finally of the seminal vesicles, which contribute the remainder and majority of the ejaculate, thus totalling to almost 4-6 ml.^{6,7}

The volume of the human ejaculate has been extensively studied. Normal seminal volume ranges from 2-6 ml. It was found that seminal volume during coitus was significantly higher (4.99 ml) as compared to masturbation (3.92 ml).⁸

Keeping these in mind, the present study was conducted to determine seminal volume among the infertile males, the frequency distribution of hypospermic and hyperspermic patients on the basis of seminal volume.

METHODOLOGY

The present study was carried out in the Department of Reproductive Physiology / Health, Public Health Laboratories Division, National Institute of Health, Islamabad. A total of 2000 subjects were referred for analysis from different Infertility Clinics, to the Reproductive Physiology / Health, National Institute of Health, Islamabad in 7 years period from 2002 to 2009.

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Out of them, 1521 subjects were analyzed and included in the study, along with 97 proven fathers as control, while the rest were unable to fulfill the criteria.

After approval from ethical committee of the institution and taking informed consent, the subjects were then divided into three groups on the basis of seminal volume. Seminal volume of 2-6 ml was considered normal, while volume less than 2 ml and higher than 6 ml were considered hypospermic and hyperspermic respectively. Out of the 1521 patients, hypospermic were 355, normospermic were 1046, while hyperspermic were 120.

Semen examination of the patients visiting the Reproductive Physiology / Health Laboratories of the National Institute of Health, Islamabad, Pakistan, was carried out according to the standardised method of the World Health Organisation.^{9,10}

Males with primary and secondary infertility without treatment were included in the study. Semen samples were obtained through masturbation and were ejaculated into clean wide mouthed plastic containers, which had already been confirmed to be non-toxic to

spermatozoa. Those subjects, who had undergone pelvic surgery or hernia repair, patients with diseases such as diabetes mellitus, thyroid disease and subjects who were drug addicts, and on vitamins and mineral supplements were excluded from this study.

The results obtained were subjected to statistical analysis by using Statistical Package for Social Sciences (SPSS) version 14.0 The results of frequency distribution of various groups of hypospermic and hyperspermic patients was compared by applying Chi-square test, while the seminal count (mean ± SD) in hypospermic and hyperspermic groups were compared with control by applying “t-test” and the level of significance was determined. P-value < 0.05 was considered significant.

RESULTS

The results of the study are tabulated in Tables I – IV. The mean age of the males were 31.72±0.44, 35.40±0.42, 34.62±0.26, 34.20±0.43, 35.57±0.82, 33.03±0.39 and 32.15±0.85 years in azoo-, oligo-, astheno-, oligoastheno-, terato-, normo- and polyzoospermic groups respectively. The duration of infertility ranged from 1-10 years.

Out of the 1521 patients, there were 355 hypospermic (23.34%); 1046 were normospermic (68.78%) and 120 were hyperspermic (7.88%). In the hypospermic cases, 57 out of 355 (16.05%) had a volume of less than 1 ml. Of those 57 patients, 34 were found to be azoospermic,

Table I: Distribution of patients on the basis of volume.

Group	n	percentage
Hypo (Hypospermic)	355	23.34%
Normo (Normospermic)	1046	68.78%
Hyper (Hyperspermic)	120	7.88%
Total	1521	100%

Table II: Comparison of hypospermic (n=355) and hyperspermic (n=120) patients, on the basis of semen concentration, motility and morphology.

Group	Age	SD	Hypospermic patients (n = 355)		Hyperspermic patients (n = 120)		Chi-square test
			n	Percentage	n	Percentage	p-value
Azoospermic	31.72±	0.44	74	20.84	03	2.5	0.000 (Sig)
Oligozoospermic (< 20 million/ml)	35.40±	0.42	97	27.32	24	20.0	0.111 (ns)
Polyzoospermic (> 250 million/ml)	32.15±	0.85	3	0.84	01	0.8	0.990 (ns)
Count within normal range (20-250 million/ml)	33.03±	0.39	24	6.76	19	15.8	0.003 (Sig)
Asthenozoospermic (Active motility < 30%)	34.62±	0.26	89	25.1	49	40.9	0.001 (Sig)
Oligoasthenozoospermic (< 20 million/ml & active motility < 30%)	34.20±	0.43	57	16.05	24	20.0	0.39 (ns)
Teratozoospermic (normal morphology < 30%)	35.57±	0.82	11	3.09	00	00	0.03 (Sig)

Table III: Frequency distribution of hypospermic (n=355) and hyperspermic (n=120) patients, on the basis of semen volume.

Hypospermic (n=355) patients			Hyperspermic (n=120) patients		
Group	n	Percentage	Group	n	Percentage
Volume < than 0.5 ml	09	2.54%	Volume > 6.0 but ≤ 7.0 ml	95	79.17%
Volume exactly 0.5 ml	17	4.78%	Volume > 7.0 but ≤ 8.0 ml	07	5.83%
Volume > 0.5 but < 1.0 ml	31	8.74%	Volume > 8.0 but ≤ 9.0 ml	01	0.83%
Volume exactly 1.0 ml	69	19.44%	Volume > 9.0 but ≤ 10.0 ml	04	3.34%
Volume > 1.0 but < 1.5 ml	10	2.82%	Volume > 10.0 but ≤ 11.0 ml	00	0.00%
Volume exactly 1.5 ml	174	49.01%	Volume > 11.0 but ≤ 12.0 ml	13	10.83%
Volume > 1.5 but < 2.0 ml	45	12.67%	Volume > 12.0 ml	00	0.00%
Total	355	100	Total	120	100

Table IV: Seminal concentration on the basis of volume.

Group	n	Semen concentration (m/ml)	"t"test
Hypo (Hypospermic)	355	56.50 ± 10.50	p < 0.001
Hyper (Hyperspermic)	120	62.20 ± 14.50	
Control (Proven Father)	120	102.12 ± 1.34	

12 were asthenozoospermic, one each were terato and polyzoospermic, while 6 had counts well over the required normal value of 20 million/ml. Among the hyperspermic patients (n=120), the greatest volume observed was between 11 - 12 ml. Regarding hyperspermic patients, analysis on the basis of count revealed that 3 patients were azoospermic, 24 were oligozoospermic and 19 (15.84%) had count within the normal range of 20-250 million/ml, while 1 patient was polyzoospermic. Significant differences were observed among azoospermic ($p < 0.001$), asthenozoospermic ($p < 0.001$) and teratozoospermic ($p < 0.03$) groups when compared to hypo- and hyperspermic patients, however, no significant differences were observed among the oligo-, oligoastheno- and polyzoospermic groups.

DISCUSSION

Semen analysis is the first and key step to investigate male infertility.¹¹ It can label a patient as normospermic, oligozoospermic, asthenozoospermic, teratozoospermic, polyzoospermic and azoospermic or combinations of these. It has been reported that patients with varicocele have significant oligoasthenozoospermia and varicocelectomy improves sperm volume, concentration and active motility.^{12,13} Similarly, testicular inflammation leads to decreased testicular volume and oligospermia.¹⁴

Infertility due to volume disturbance has not been given due consideration. That is why only few studies have been reported during the last three decades. The present study is the first of its kind in the region. Variation in the frequency of incidence of volume disturbances can be attributed to the difference in sexual activities of the populations. In a study conducted by the WHO, it has been shown that suppression of spermatogenesis through testosterone enanthate injections varies on the basis of ethnic compositions of the population's studied.¹⁵

Results of this study were divided into different groups on the basis of volume and are presented in Table I. These were classified into hypospermic, normospermic and hyperspermic groups. Hypospermic were 23.34%, normospermic were 68.78% while hyperspermic were 7.88%.

In the hypospermic cases, (16.05%) had a volume of less than 1 ml. Of these 57 patients, 34 were found to be azoospermic, 12 were asthenozoospermic, one each were terato- and polyzoospermic, while 6 had counts well over the required normal value of 20 million/ml.

Regarding hyperspermic patients only 15.84% had count within the normal range of 20-250 million/ml. Among the hyperspermic patients, the greatest volume ranged between 11 - 12 ml.

In the present study, the overall frequency of hyperspermia was 7.88%, with 23.33% of these having counts outside the WHO's permissible level. Only one of the patients had sperm concentrations exceeding the upper level of 250 million/ml. A study carried out in Australia, examined the semen of 4223 men, and found 229 men (5.42%) as hyperspermic.¹⁶ Of them, 49.3% were found to have a sperm concentration of less than the WHO recommended minimal level of 20 million/ml. Similarly, a study carried out in South Africa, where 70% patients had possible contribution to male factor for infertility, reported hypospermia in 45% and hyperspermia in 9% of the patients studied.¹⁷ A Belgian study found hypospermia in only 0.16% patients over 5 years.¹⁸ In contrast, an East German study found the incidence of hypospermia to be 21.53%.¹⁹ This high variation in the incidence rates of hypospermia between 0.16% in Belgium and 45% in South Africa, suggests that the magnitude of the problem varies with the population under study.

In two European studies,^{18,19} no case of hyperspermia was observed in contrast to the Australian¹⁶ and South African¹⁷ studies, as seen in the present study. This can be attributed to the geographical location of the 5 countries, with Australia, South Africa and Pakistan falling in the tropical region and the two European countries belonging to a comparatively colder temperate zone. Since the Australian study was specifically carried out to measure the upper range of semen volume of the population, it was more likely to show hyperspermia.¹⁶

In this study on volume disturbances, revealed incidence of low ejaculatory volume in 23.34% and high volume in 7.88% of the males. The mean seminal concentrations were within normal range for both low (56.50 ± 10.50) and high ejaculatory volume groups (62.20 ± 14.50) but were significantly lower than the control group (102.12 ± 1.34, Table IV). Impaired motility was seen in both the groups with volume disturbances. Among the low volume (hypospermic) group, 47.88% had normal count, while in the high volume (hyperspermic) group, 76.66% had normal count. If the volume factor was ignored, nearly 68.78% men with ejaculatory volume disorder would not qualify for male factor fertility problem, and the remaining would be categorised as oligozoospermic or merely azoospermic. Taking into consideration the percentages of hypospermic and hyperspermic men having sperm concentrations within permissible limits,²⁰ 31.22% patients of the total would be, erroneously, considered to be free from any male factor infertility condition. The available literature contains very little information on ejaculatory volume.¹⁶⁻¹⁹

This paucity itself is evidence of the fact that volume has not been given the true importance as a male fertility limiting factor.

CONCLUSION

Seminal volume is an important parameter for assessment of infertility investigation and it should not be ignored, as its abnormalities constitute a valuable index of problems with the male partner, even if the count and motility are well within the normal limits.

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