Morphology of Spermatozoa in Infertile Men with and without Varicocele

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This study was carried out to evaluate the morphology of spermatozoa in infertile men with and without varicocele. A series of 285 ejaculates were fully evaluated for seminal volume, sperm count, motility, and morphology, and classified into fertile (165 subjects), infertile without varicocele (93 subjects) and infertile with varicocele (27 subjects). Sperm morphology was classified by multiple entry criteria and recorded as normal, abnormal with head, midpiece, or tail single anomaly or abnormal with simultaneous multiple abnormalities.

Semen volume was almost identical in the three groups. Among the infertile men, sperm count was lower in those having a varicocele, but conversely those with varicocele had a higher percentage of motile spermatozoa, higher percentage of spermatozoa with forward movement and higher sperm velocity. There were higher proportions of spermatozoa with abnormal morphology, total number of anomalies, and multiple anomalies in infertile men, both with and without varicocele, than in fertile men. The percentage of abnormal spermatozoa was higher in infertile men with varicocele than in those without varicocele. The pattern of sperm morphology differed between the infertile and the fertile group, and with the presence or absence of varicocele. In the presence of varicocele, only the incidence of elongated (tapered) forms was significantly increased.

Key words: sperm morphology, semen analysis, varicocele, ogliozoospermia, athenospermia.

It is now accepted that varicocele can be an important factor in male infertility (Mac Leod, 1965; Brown et al, 1967; Mac Leod, 1969), and the association of a varicocele with low sperm count and poor semen quality has also been reported (Rodríguez-Rigau et al, 1978; Cockett et al, 1979). Increased numbers of tapered and amorphous spermatozoa were also found in cases of varicocele (Mac Leod, 1965), but this cytologic response is not reported to be specific to this condition. In fact, this pattern of seminal abnormality has also been observed in association with infectious diseases (Mac Leod, 1951), allergic reactions (Mac Leod, 1962) and other stresses (Mac Leod, 1964). French authors (Czyglik et al, 1973; David et al, 1975; Delecour et al, 1979) have reported a specific morphology pattern in men with varicocele. On the other hand, recent publications (Rodríguez-Rigau et al, 1981; Fariss et al, 1981) were unable to find differences in patterns of sperm morphology in the presence or absence of varicocele.

This controversy has prompted us to evaluate the morphology of spermatozoa from fertile and infertile men with and without varicocele, with a multiple entry classification that permitted us to compare not only the number of abnormal spermatozoa, but also the total number of anomalies.

Material and Methods

A series of 285 ejaculates were evaluated by sperm count, motility, and sperm morphology. Part of the series (165 ejaculates) was from male partners of previously infertile couples whose wives became pregnant within a year after specimen collection. No male factor was suspected in this group, which was considered as a fertile control, and therefore no physical examinations were performed on these patients.

On the other hand, 120 male patients were selected,

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on the basis of low sperm count (less than 40 millions/ml.), low motility (less than 60% motile spermatozoa), and low velocity (more than 2 seconds per 1/20 mm.) for the infertile group. In this "infertile" group no other explanation for the couples' infertility could be found. Ninety-three of the ejaculates had low sperm count, low motility, and low sperm velocity, with no varicocele found by examination of the patients in the standing position. On the other hand, 27 ejaculates were found to have low counts, low motility, and low velocity, and examination of the patients revealed a palpable varicocele. Semen specimens were obtained by masturbation after a 3 to 5 day continence period and were examined within 2 hours of collection; semen analyses were performed in duplicate for the infertile group. Spermatozoa were counted using a hemocytometer and recorded in millions per ml. Semen volume was measured using a graduated syringe. The percentage of motile spermatozoa was calculated as the percentage of motile spermatozoa among total spermatozoa counted in one ml. Among the motile spermatozoa, the percentage of spermatozoa demonstrating directional movement was also calculated. Sperm forward velocity was calculated in the central area of the hemocytometer and recorded as seconds per 1/20 mm (sec/ 1/20 mm). Values of velocity were means of ten fast spermatozoa. Sperm morphology was evaluated by microscopic examination of Papanicolaou stained smears with ×1000 magnification. In each smear, the same investigator evaluated and classified 100 spermatozoa according to the multiple entry criteria recommended by David et al (1975). With this method sperm morphology can be recorded as normal, abnormal with one anomaly, or abnormal with multiple anomalies, and therefore the total number of anomalies are usually not identical to the number of abnormal spermatozoa. Statistical evaluation of the data was performed by the Student *t* test.

Results

Volume of the ejaculates, sperm counts, percentage of motile spermatozoa, percentage of forward motility, and sperm velocity of the 285 men with and without varicocele are presented in Table 1. The mean semen volumes of the groups (fertile, infertile without varicocele, infertile with varicocele) have no statistically significant differences. Among men with poor seminal characteristics, those with varicocele have lower mean sperm counts ($p < 0.01$), higher percentages of motile spermatozoa ($p < 0.05$), higher percentages of spermatozoa with forward movement ($p > 0.05$), and higher sperm velocity ($p < 0.01$).

Sperm morphology of the fertile and infertile (with and without varicocele) groups is presented in Table 2. The percentage of normal spermatozoa was 54.37 ± 13.27 in the fertile group, 35.92 ± 15.75 (infertile group without varicocele) and 29.22 ± 10.08 (infertile group with varicocele). These differences were statistically significant ($p < 0.01$). Furthermore, the mean number of spermatozoa with multiple anomalies and the mean number of sperm abnormalities were lower ($p < 0.01$) in fertile men than in infertile men. In the groups with poor seminal characteristics, the mean frequency of normal spermatozoa from men with varicocele was lower ($p < 0.01$) than from men without varicocele. However, the mean number of anomalies and the mean number of spermatozoa with multiple anomalies (Table 2) did not differ significantly ($p > 0.05$) according to presence or absence of varicocele.

The patterns of sperm morphology differed between the infertile and fertile group (Table 3), and in the presence or absence of varicocele. Only the elongated (tapered forms) were significantly higher in the presence of varicocele ($p < 0.01$, Table 3).

TABLE 1. Sperm Counts, Percentage of Motile Spermatozoa, Percentage of Spermatozoa Moving Forward and Sperm Velocity in 285 Men With and Without Varicocele*

Group	Number of Subjects	Volume of Ejaculates	Sperm Count (10^6 ml)	Percentage of Motile Spermatozoa	Percentage of Spermatozoa Moving Forward	Sperm Forward Velocity (sec/1/20 mm)
Fertile	165	3.19 ± 1.49	47.70 ± 33.43	52.78 ± 16.06	68.63 ± 19.50	1.83 ± 0.63
Low seminal quality (infertile) without varicocele	93	3.38 ± 1.59	15.76 ± 10.66	23.49 ± 12.37	33.86 ± 22.28	3.69 ± 1.13
Low seminal Quality (infertile) with varicocele	27	3.59 ± 1.44	7.65 ± 5.04	28.38 ± 10.83	41.33 ± 24.38	3.14 ± 0.90

* Values are means ± standard deviation.

TABLE 2. Normal Spermatozoa, Abnormal Spermatozoa, Total Number of Anomalies, Spermatozoa with Multiple Anomalies, and Immature Cells in 285 Men With and Without Varicocele*

Group	Number of Subjects	Percentage of Normal Spermatozoa	Percentage of Abnormal Spermatozoa	Total Number of Anomalies	Number of Spermatozoa With Multiple Anomalies	Immature Cells
Fertile	165	54.37 ± 13.27	45.63 ± 13.27	52.55 ± 16.26	6.30 ± 4.51	1.33 ± 2.03
Low seminal quality (Infertile) without varicocele	93	35.92 ± 15.75	64.08 ± 15.75	79.28 ± 24.15	14.38 ± 9.93	5.09 ± 1.73
Low seminal quality (infertile) with varicocele	27	29.22 ± 10.08	70.78 ± 10.08	89.09 ± 24.34	18.18 ± 12.22	4.96 ± 3.48

* Values are means ± standard deviation.

Discussion

Sperm count and motility have been the two classical seminal factors for evaluating male fertility (Eliasson, 1971). In agreement with the results reported by Rodríguez-Rigau et al (1981), sperm count was lower in infertile men with varicocele. We do not have a good explanation for the higher percentage of motile spermatozoa, higher percentage of spermatozoa with forward movement, and higher sperm velocity found in infertile men with varicocele, since these results are different from other published studies (Rodríguez-Rigau et al, 1978; Cockett et al, 1979). Differences in the populations studied, and different grades of varicocele, might explain the discrepancies. Although very low and very high semen volumes may be factors associated with male infertility, in the present study there is no statistical difference in volumes between fertile and infertile groups.

As has been stressed by many investigators (Mac Leod, 1964; David et al, 1975; Eliasson, 1975; Amelar and Dubin, 1977), the number of spermatozoa with normal morphology is higher in fertile

TABLE 3. Patterns of Sperm Morphology in 285 Fertile and Infertile Ejaculates

	Fertile (N = 165)		Infertile (N = 120)			
			Without Varicocele (N = 93)		With Varicocele (N = 27)	
Patterns of Sperm Morphology	Number of Anomalies*	SD†	Number of Anomalies*	SD	Number of Anomalies*	SD
Head						
Elongated (tapered)	6.85‡	6.80	14.06‡	13.14	21.54‡	13.32
Thin	4.93	5.39	5.69	4.83	6.66	5.16
Small	7.29	4.35	7.45	5.72	5.88	5.22
Large	5.84	3.95	6.04	4.36	5.59	5.67
Amorphous	6.66‡	4.72	12.42‡	12.89	10.40	5.04
Bicephalic	0.53	1.03	0.84	1.46	1.44	2.11
Lysed	0.69	1.12	1.77	2.69	1.92	2.35
Intermediate piece						
Cytoplasmic droplet	4.40	3.43	8.66	5.84	9.81	6.22
Angulated	3.80	2.97	7.14	4.23	8.40	7.74
Tail						
Missing	2.77	2.97	5.60	5.25	6.00	5.00
Short	2.86	3.13	3.81	3.27	4.11	3.77
Coiled	5.42	5.25	5.46	5.56	7.11	5.87
Double	0.32	1.77	0.30	0.76	0.17	0.48
TOTAL	52.55	16.26	79.28	24.15	89.09	24.34

* Values are means of anomalies per 100 spermatozoa screened ± standard deviation.
† Standard deviation.
‡ $p < 0.01$.

than in infertile men, and therefore morphology should be considered as a crucial factor in evaluating male fertility. Among the infertile men, the number of spermatozoa with normal morphology is lower in the presence of varicocele, our results agreeing with Czyglik et al, 1973; David et al, 1975; Delecour et al, 1979. However, recent papers (Rodríguez-Rigau et al, 1981; Fariss et al, 1981) have reported that the patterns of sperm morphology were not different in men with and without varicocele. The results of our study shows that elongated (tapered) and amorphous spermatozoa were seen more frequently ($p < 0.01$) in the infertile men and, in this group, those with varicocele had a significantly higher ($p < 0.01$) number of tapered forms. Recent publications (Rodríguez-Rigau, 1981) have reported that abnormal sperm morphology appears to be associated with decreased sperm count and motility, regardless of the presence or absence of a varicocele. Our results suggest that a high rate of tapered spermatozoa in any ejaculate with low sperm count, low motility, and low velocity may indicate the presence of a varicocele. Therefore any ejaculate with low count, low motility and low velocity should be examined carefully for high rates of elongated forms, and if excessive numbers are found, varicocele should be ruled out.

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