ORIGINAL ARTICLE

A STUDY OF SPERM DEFORMITY INDEX AT ISLAMABAD

Mohammad Owais Ahmad, Muhammad Tariq
Department of Physiology, Kabir Medical College, Peshawar

Background: The aim of this study was to determine the sperm deformity index (SDI) of proven fertile males and compare this with that of infertile males. **Methods:** The study was carried out at Islamic International Medical College Rawalpindi and Islamabad Clinic Serving Infertile Couples, Islamabad, from July 2005 to July 2006. It was a cross-sectional comparative study. Fifty healthy fertile males were selected, another 50 infertile males were inducted as controls. The sampling technique was convenience non-probability. Their sperm morphology was determined according to Tygerberg's strict criteria and the SDI was calculated. Inclusion criterion for proven fertile males was pregnancy achieved within 1 year of marriage with successful coituses. In case of infertile males it was failure to achieve pregnancy without the use of assisted reproductive techniques, with no infertility factors in the female partner. The semen samples were obtained at the laboratory after 3 to 4 days of sexual abstinence with clear written and oral instructions given to the subjects. **Results:** The infertile group was found to be significantly older than the proven fertile group (36.60±6.28 versus 31.32±6.10 years, $p<0.000$). SDI was significantly less in the proven fertile group ($p<0.007$). SDI ranged from 1.20 to 2.07 in the proven fertile group and from 0 to 2.28 in infertile group. **Conclusion:** SDI was significantly less in fertile men. It is suggested that SDI should also be used to differentiate between fertile and infertile males in addition to other semen parameters as it can be useful in identifying potential infertile males.

Keywords: Sperm morphology, Strict criteria, Fertile males, SDI

INTRODUCTION

The sperm concentration, motility and morphology evaluation is the mainstay of the assessment of male reproductive health.[1] Decreased sperm concentration has been associated with decreased fertility.[2] Sperm motility has also been associated with the fertiliy.[3]

More uniform and rigid criteria for examination of sperm morphology however, has improved impartiality and decreased intra-laboratory variability. The WHO also recommends that strict criteria should be applied in assessing the morphological normality of the spermatozoon. This has led to the establishment of lower threshold levels for normality.[1]

The sperm deformity index (SDI) score is a novel expression of the quality of sperm morphology, which has been shown to be a more powerful predictor of male fertility and of *in vitro* fertilization outcome compared with the assessment of the proportion of sperm with normal morphology.[4]

It is now customary to record the number of defects divided by total number of sperms, called sperm deformity index. Previously when multiple defects were present only one defect was recorded.[1]

SDI is a manifestation of sperm morphological assessment by the Tygerberg's strict criteria for normal sperm morphology that was reported to correlate with fertilisation rates by the 1999 WHO manual. SDI is useful in the analysis and identification of fertile and infertile semen, and is more reliable than the multiple anomalies index, which involves the assessment of only abnormal sperms.[5]

Morphologically abnormal spermatozoa often have multiple defects. Following categories of defects are usually found: [1,6,7]

Head defects: Large, small, tapered, pyriform, round and amorphous heads. Vacuolated heads (>20% of head area occupied by unstained vacuolar areas) or those with small acrosomal cap (<40% of head area) and double heads or combination of above are head defects.

Neck and mid-piece defects: Bent, asymmetrical insertion of mid-piece into the head, thick or irregular shaped mid-piece, abnormally thin mid-piece (i.e., no mitochondrial sheath), or any combination of these are considered as mid-piece defects. Normally neck/mid-piece and tail should form an angle of 90^{o} to the horizontal axis of head. Cytoplasmic droplets which are usually located in the mid-piece should not be greater than one-half of a normal sperm head.

Tail defects: Short, multiple, hairpin, broken, bent tails, irregular width, coiled tails or any combination of these are the defects found in sperms.

For a spermatozoon to be classified as normal the size and shape must be within normal limits.[8] Since no local data of SDI is available and very few studies have been conducted elsewhere in which the SDI has been calculated. Moreover, SDI is not routinely calculated in semen analysis.

The aim of the present study was to determine the SDI of proven fertile males and compare this with that of infertile males at Islamabad.

MATERIAL AND METHODS

The study was done at the Islamic International Medical College, Rawalpindi and Islamabad Clinic Serving Infertile Couples, Islamabad, from July 2005 to July 2006. It was a convenience non probability sample comparing a fertile population with an infertile group in a cross-sectional comparative study. We took 100 subjects and divided them into 2 groups each containing 50 subjects. Husbands of 50 pregnant women attending the antenatal clinic at Railway Hospital, Rawalpindi were requested to participate in the study whose semen were collected for analysis. Another 50 infertile men were recruited into the study as a control group when they came for the consultation at the Islamabad Clinic Serving Infertile Couples, Islamabad. Proforma was completed and an informed consent was obtained. We included all fertile males whose wives achieved pregnancy within 1 year of marriage with successful coituses. For infertile males the inclusion criteria was their wives' failure to achieve pregnancy (without the use of assisted reproductive techniques), with no infertility factors in the female partner. All factors like high grade fever, tuberculosis, mumps, orchitis or any chronic debilitating illness, vericoceole, sexually transmitted diseases, any drug affecting male fertility, e.g., beta-blockers, anti-neoplastic agents etc. were excluded from the study**.**

The semen samples were obtained at the laboratory after 3–4 days of sexual abstinence, and the subjects were given clear written and oral instructions to wash their genitals thoroughly and dry them, not to use any lubricant, i.e., any soap or oil as they damage the sperms and once the sample is produced, put the cap on very tightly and place the container in the accompanied plastic bag and seal the bag. The sample was collected in the privacy of a room/bathroom within the laboratory. Sperm morphology was assessed by strict criteria by preparing a stained slide of sperms from the ejaculate after liquefaction.[5] A clean dry glass slide was labelled with patient's number and a 5–10 µl drop of ejaculate was placed on the slide and a thin smear was made using edge of another glass slide or a cover slip, the smear was dried in air and fixed by spraying ethyl alcohol. The slide was dipped in the Giemsa stain for 3–5 minutes and washed under running tap water and then dried in air. Sperm morphology was assessed under oil immersion at ×100 magnification of microscope using ocular micrometer [ocular micrometer was calibrated with stage micrometer to measure the exact size]. The sperm head, mid-piece or tail was brought over the micrometer to measure the exact size. One hundred sperms were counted at random measuring carefully their head, mid-piece and tail size. At least 2 observations were taken. Sperm deformity index (SDI) was calculated by the formula:[1]

$$\text{SDI} = \frac{\text{Total No. of defects}}{\text{No. of sperms with defects}}$$

The following is an example of the calculation of SDI:

Number of sperms counted =	200
Number of normal sperms =	10
Percentage of Normal sperms =	5%
Number of sperms with defects (200-10) =	190 (95%)
Number of sperms with head defects =	180 (90%)
Number of sperms with mid-piece defects =	34 (17%)
Number of sperms with tail defects =	24 (12%)
Total number of defects (180+34+24) =	238
Sperm deformity index:	
(No. of defects/No. of sperms counted) = 238/200= 1.19	

Results were entered into SPSS-10.0. Descriptive statistics were used to calculate means and standard deviations for numerical data. These were compared using *t*-tests at a confidence level of 95%.

RESULTS

Table-1 shows Mean±SD of weight and age of the proven fertile and infertile groups. The difference is significant in both of these ($p<0.000$). These results suggest the possible role of weight and age in the fertility potential of males. When the ages of the subjects in both the groups were compared, the infertile group was found to be statistically significantly older then the proven fertile group, i.e., (36.60 versus 31.32 years).

Table-2 presents Mean±SD sperm deformity index in proven fertile and infertile group. SDI was significantly less in the proven fertile group ($p<0.007$). SDI ranged from 1.20 to 2.07 in the proven male group, and from 0 to 2.28 in the infertile group.

Table-1: Demographic Data of Proven Fertile and Infertile Group

Group	Weight (Kg) (Mean±SD)	Age (Years) (Mean±SD)
Proven Fertile (n=50)	74.26 ± 6.49	31.32 ± 6.10
Infertile (n=50)	81.58 ± 4.03	36.60 ± 6.28
***p*-Value**	<0.000*	<0.000*

*p=Significant

Table-2: Sperm Deformity Index of Proven Fertile and Infertile Group

Group	Sperm Deformity Index (Mean±SD)
Proven Fertile (n=50)	1.58±0.19
Infertile (n=50)	1.81±0.57
***p*-Value**	< 0.007*

*p=Significant

DISCUSSION

To be of clinical value, the methods used for semen analysis should be standardised and threshold values for fertility and infertility should be calculated for various parameters used in standard semen analysis. Since there are so many different methods for semen evaluation, especially sperm morphology that it would be difficult to standardise the methods used for semen analysis. The

two classifications most widely accepted are the WHO (1987 and 1992), and the Tygerberg strict criteria.[1,9] Inconsistency between different methods of sperm morphology assessment has been identified by Ombelet *et al*[10] and others[11,12] who suggested that the semen analysis methodologies should be standardised. This could be achieved by calculating multiple sperm defects and especially the SDI, as it may be a useful tool in identifying potential infertile males.[5]

A significant positive correlation was observed between sperm reactive oxygen species production and the proportion of sperm with abnormal morphology characterized by high SDI scores.[13]

An SDI of 1.6 is the threshold for failure of fertilization *in vitro*.[4] In a study by Said *et al*[5] almost all patients undergoing infertility screening had an SDI >1.6, despite the presence of equivocal sperm concentration and motility. In another study by Aziz *et al*[14] the non-apoptotic sperm subpopulation had morphologically superior quality sperms compared with apoptotic sperm as reflected by significantly lower SDI scores, i.e., 1.34 as compared to 1.72 in apoptotic sperm fraction.

The results of our study were consistent with the above mentioned studies as in our study an SDI value of 1.58 was calculated in the proven fertile group as compared to an SDI score of 1.81 in the infertile group.

CONCLUSION

SDI was significantly less in fertile men. It is suggested that SDI should also be used to differentiate between fertile and infertile males in addition to other semen parameters as it can be useful in identifying potential infertile males.

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Address for Correspondence:

Dr. Muhammad Owais Ahmad, Department of Physiology, Kabir Medical College, Peshawar, Pakistan.
Email: drmowais@hotmail.com