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Commentary: Assessment of an assortment of factors on DNA damage veracity of human sperm

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Abstract
It is established that sperm DNA veracity is indispensable in fertilization and normal embryo and fetal growth. Custom semen analysis gives an estimated evaluation of the functional proficiency of spermatozoa, but does not always reproduce the quality of sperm DNA. Therefore, the assessment of sperm DNA integrity, in adding to routine sperm parameters, could add further in a row on the quality of spermatozoa and reproductive potential of males. The purpose of this study was to conclude the levels of sperm DNA damage in fertile and infertile males and its correlation with semen parameters and various related factors mentioned below. The data suggest that sperm DNA damages in infertile males is significantly higher than fertile males and sperms with abnormal morphology and low levels of motility has more abnormal DNA damages than motile and normal sperms.

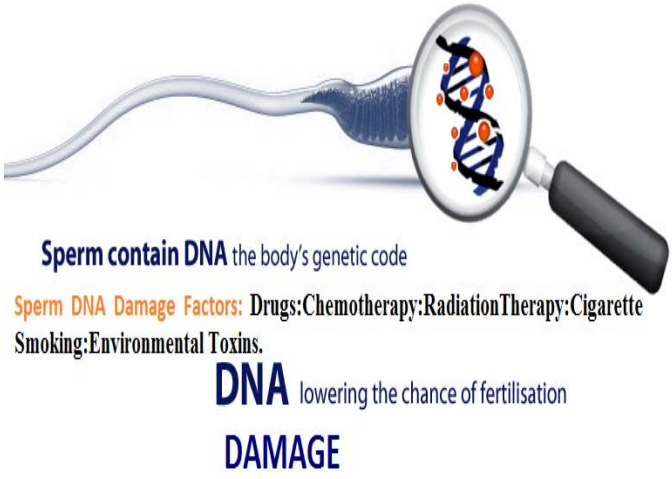
Keywords: DNA veracity, DNA Integrity, Infertility, Motility, Reproductive Potential

1. Introduction
It is established that sperm DNA quality is important in maintaining the reproductive potential of men. The fertilizing capacity of sperm rely not only on the functional competence of spermatozoa but also on sperm DNA integrity, Classical semen investigation, which consist of sperm concentration, motility and morphology gives an fairly accurate evaluation of the functional competence of spermatozoa, but does not always impart the quality of sperm DNA [2]. Men with normal sperm grams may still be infertile; the cause could be related to abnormal sperm DNA. Sperm DNA integrity has an important role not only for fertilization but also for normal embryo and fetal development [4]. Sperm with compromised DNA integrity, in spite of the extent of DNA damage, appear to have the capacity to fertilize oocytes at the same rate as normal sperm. However, the embryos produced by fertilization of an oocyte with DNA damaged sperm cannot develop normally [1]. Therefore, the assessment of sperm DNA veracity and integrity, in count to custom sperm parameters, could adjoin further information on the quality of spermatozoa and enhanced predictive and prognostic values could be achieved from validated sperm DNA fragmentation assays [3].
A suitable sperm DNA integrity evaluation relies not only on its discriminative power to predict fertilization failure but also on its capacity to help clinicians and Embryologist, in the selection of therapeutic procedures. A number of studies have explored and investigated the relationship between human sperm DNA damage and semen parameters, such as concentration, and motility morphology. In quite a few different study populations, by means of different assays to measure DNA damage [7].

2. Causes of sperm DNA damage
The causes of sperm DNA damage, much analogous to those of male infertility, have a set of factors and may be attributed to intra-or extra testicular factors. Sperm DNA damage is clearly associated with male infertility (and abnormal spermatogenesis), but a minute fraction of spermatozoa from fertile men also possesses detectable levels of DNA damage [8].
An important subset of infertile men (about 5%–15%), but not of fertile men, possess a complete protamine deficiency. Studies on transgenic animal models with targeted protamine deficiency suggest a link connecting protamine deficiency, sperm DNA damage and reduced fertilizing capability during in vitro fertilization (IVF). A single case report indicated that a febrile illness can cause a transient increase in the nuclear histone: protamine ratio and associated abnormalities of sperm chromatin structure[5]. This relationship between sperm DNA damage and protamine deficiency suggests that the damage may be due to a defect in spermiogenesis Sperm DNA damage has been associated with high levels of reactive oxygen

species, increased intensity of which have been noticed in the semen of 25% of infertile men. Although low levels of reactive oxygen species are necessary for normal sperm function, increased levels are produced by defective spermatozoa and by semen leukocytes, which effects in sperm malfunction. The association between sperm DNA damage and sperm-derived reactive oxygen species suggests that DNA damage may be caused by a defect in spermiogenesis, whereas the association between sperm DNA damage and leukocyte-derived reactive oxygen species suggests that the DNA damage may be caused by a post-testicular defect [6].

Sperm DNA damage may be due to apoptosis (programmed cell death), even though this theory has been confronted. Apoptosis during normal spermatogenesis results in the destruction of up to 75% of potential spermatozoa. The selective apoptosis of these premature germ cells avoids over proliferation of the cells and selectively aborts abnormal sperm forms. Advancing age and gonadotoxins have been associated with reduced levels of germ cell apoptosis in the testicle and an increased percentage of ejaculated spermatozoa with DNA damage, which recommends that in these men mutually spermatogenesis and apoptosis have been interrupted [9].



3. Various Related Factors for Sperm DNA Damage

Drugs, chemotherapy and radiation therapy

Young men with cancer (e.g., Hodgkin's lymphoma and testicular cancer) usually have poor semen quality and sperm DNA damage, even previous to cancer therapy [11].

Cigarette smoking

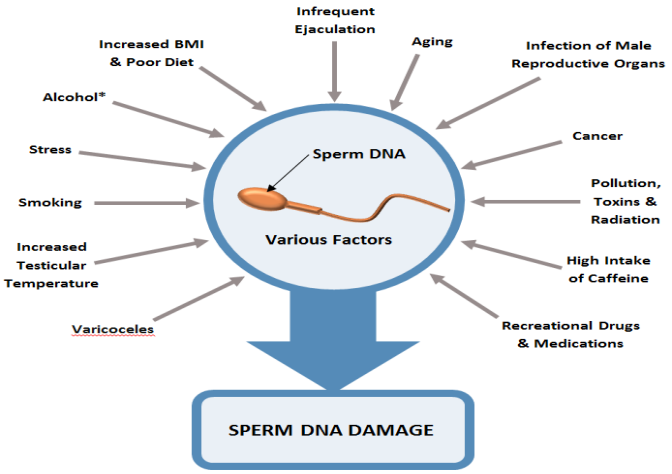
Studies have shown that cigarette smoking is associated with a decrease in sperm counts and motility and an increase in abnormal sperm forms and sperm DNA damage. It is asumed that smoking causes increased production of leukocyte-derived reactive oxygen species, which has undesirable consequences on mature sperm [13].

Environmental toxins

Exposure to pesticides (organophosphates) and air pollution has also been associated with increased levels of sperm DNA damage.

Genital tract inflammation

Post-testicular genital tract infection and inflammation (e.g., combined inflammation of the epididymis and testis or of the prostate gland) result in leukocytospermia and have been associated with increased levels of reactive oxygen species and subsequent sperm DNA damage.



Testicular hyperthermia

A febrile illness has been shown to cause an increase in the histone: protamine ratio and DNA damage in ejaculated spermatozoa. Testicular hyperthermia directly associated has also been shown to cause these effects. Certain behaviors' have been associated with increased scrotal temperatures. Although the specific effects on sperm parameters or pregnancy outcomes have not been demonstrated, certain line of work has been associated with poorer sperm quality. Farmers, painters and mine workers have been shown to have an increased likelihood of decreased sperm counts, while metal welders have been shown to have decreased sperm motility. Corroborative studies on sperm DNA damage are still lacking [12].

Varicoceles

Varicoceles have been associated with sperm DNA damage. The level of sperm DNA damage is related to the high levels of oxidative stress found in the semen of infertile men with this condition. Current studies have revealed that Varicoceles are associated with the abnormal retention of sperm cytoplasmic droplets (a morphologic feature associated with high levels of reactive oxygen species) and that these retained droplets are correlated with sperm DNA damage in infertile men. Furthermore, sperm DNA integrity has been shown to improve after varicocele repair.

Hormonal factors

Experimental evidence has demonstrated that hormonal deficiency can cause sperm chromatin defects. Compared with wild-type mice, follicle – stimulating – hormone – receptor knockout mice have been found to have lower levels of sperm nuclear protamines and lower testosterone, impaired fertility and higher levels of DNA damage [10].

4. Conclusion

Sperm DNA damage is noteworthy increased in men with idiopathic and male factor infertility and in men who failed to commence a pregnancy after assisted reproductive techniques. Such amplification may be linked to high levels addiction and mentioned above factors.

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6. Footnotes

Inference for medical institution / practice/ health policy/ /research/embryologist/: The paper is helpful for the gynecologists in developing countries to deem sperm DNA Damage as an important root of infertility.

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10. Reference

1. Armstrong JS, Rajasekaran M, Chamulitrat W, Gatti P, Hellstrom WJ, Sikka SC. Characterization of reactive oxygen species induced effects on human spermatozoa movement and energy metabolism. Free Radic Biol Med 1999; 26:869-80.
2. Aitken RJ, Krausz C. Oxidative stress, DNA damage and the Y chromosome. Reproduction 2001; 122:497-506.
3. Duru NK, Morshedi M, Oehninger S. Effects of hydrogen peroxide on DNA and plasma membrane integrity of human spermatozoa. Fertil Steril 2000; 74:1200-7.
4. Genesca A, Caballin MR, Miro R, Benet J, Germa JR, Egozcue J. Repair of human sperm chromosome aberrations in the hamster egg. Hum Genet 1992; 89:181-6.
5. Ahmadi A, Ng SC. Fertilizing ability of DNA-damaged spermatozoa. J Exp Zool 1999; 284:696-704.
6. Haaf T, Ward DC. Higher order nuclear structure in mammalian sperm revealed by in situ hybridization and extended chromatin fibers. Exp Cell Res 1995; 219:604-11.
7. Sakkas D, Mariethoz E, Manicardi G, Bizzaro D, Bianchi P, Bianchi U. Origin of DNA damage in ejaculated human spermatozoa. Rev Reprod 1999; 4:31-7.
8. Larson KL, DeJonge CJ, Barnes AM, Jost LK, Evenson DP. Sperm chromatin structure assay parameters as predictors of failed pregnancy following assisted reproductive techniques. Hum Reprod 2000; 15:1717-22.
9. Rajesh KT, Doreswamy K, Shrilatha B, Muralidhara M. Oxidative stress associated DNA damage in testis of mice: induction of abnormal sperms and effects on fertility. Mutat Res 2002; 513:103-11.
10. Shen HM, Chia SE, Ong CN. Evaluation of oxidative DNA damage in human sperm and its association with male infertility. J Androl 1999; 20:718-23.
11. Barroso G, Morshedi M, Oehninger S. Analysis of DNA fragmentation, plasma membrane translocation of phosphatidylserine and oxidative stress in human spermatozoa. Hum Reprod 2000; 15:1338-44.
12. Kodama H, Yamaguchi R, Fukuda J, Kasai H, Tanaka T. Increased oxidative deoxyribonucleic acid damage in the spermatozoa of infertile male patients. Fertil Steril 1997; 65:519-24.
13. Lopes S, Jurisicova A, Sun J, Casper RF. Reactive oxygen species: a potential cause for DNA fragmentation in human spermatozoa. Hum Reprod 1998; 13:896-900.