Short Communication

# The effects of bacterial infection on sperm DNA integrity, nuclear protamine, sperm quality and ICSI outcome: A Short Communication

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## Introduction:

Infertility is a clinical and social problem. About 15% of couples cannot conceive. The male factor is associated with up to 40% of this problem, where they suffered abnormal sperm parameters according to WHO criteria (WHO, 2010). Bacteriospermia had associated with about 35% of male infertility.

## Aim:

The purpose of this study was to detect the effects of bacterial infection on human sperm nuclear protamines, DNA fragmentation and ICSI outcome.

## Material & Methods:

In this study 120 semen samples were collected from unselected male partners of couples consulting in infertility and obstetrics clinic. All the samples were screened bacteriologically according to World Health Organization guidelines as well as sperm parameters and DNA fragmentation was evaluated. The protamines P1 and P2 concentrations were quantified using acid urea acrylamide gel electrophoresis. 84 couples underwent for ICSI treatment.

The Effects of Bacterial Infection on Sperm Parameters

The presence of bacteria might alter the sperm quality. Microbial infections have been reported to reduce sperm viability. Microorganisms might affect the male reproductive function in different ways: 1) Some pathogenic bacterial strains present in semen may act directly on sperm cells causing the agglutination of motile sperm, reducing the ability for the acrosome reaction, and also causing alterations in cell morphology. For example E. coli strains are known for their ability to immobilize and damage the morphology of spermatozoa by direct contact, mediated by attachment organelles such as pili or type-1 fimbriae (projections) and mannose receptor-dependent interactions. Also, the sperm surface is rich in glycoproteins and is therefore susceptible to the nitration of bacteria such as E. coli, C. trachomatis, U. urealyticum, Staphylococcus haemolyticus and Bacteroides ureolyticus with spermatozoa leading to the loss of sperm motility and normal morphology (1). Some researchers were isolated the spermagglutination factor from S. aureus, which showed spermagglutinating and spermicidal properties in vitro. 2) Microorganisms trigger a local inflammatory reaction. The inflammatory response of the genitourinary tract to the invasion of microorganisms and inflammation is considered to be extremely similar to the reaction observed in other sites of the body. This physiological response activates leukocytes and inflammatory mediators such as cytokines and reactiveoxygen species (ROS) which are known to play important roles in sperm DNA fragmentation and male infertility. The inflammatory process caused by pathogenic bacteria in the genital tract may lead to a deterioration of spermatogenesis and obstruction of the seminal tract. The induction all of the inflammatory reactions in the seminal tract through the activation of neutrophils and macrophages may indirectly exert a deleterious effect on male fertility, where most of the leukocytes attracted to the semen during bacterial semen infection are phagocytic cells such as polymorphonuclear granulocytes (PMNs) and macrophages. The tight adhesion of neutrophils, and macrophages to the surface of the sperm results in phagocytic process (1) (Figure 1). The sperm abnormal form associated with elongation and reduced acrosomal inducibility have been found in men with inflammatory chronic prostatitis and these changes were attributed to leukocytes. 3) Induction of sperm autoantibodies 4) Some microbial pathogens may affect the sperm, resulting in the expression of some surface virulent factors such as lipopolysaccharides (LPS), cytotoxic necrotising factor, □-haemolysins and ß-haemolysins, and from the release of soluble spermatotoxic factors such as sperm immobilisation factor (SIF). A single incubation with E. faecalis, E. coli and S. aureus induced apoptosis in human sperm with two possible, putative mechanisms: a direct cytotoxic activity of bacterial toxins and the contact with pili and flagella. It has also been demonstrated that E. coli can start the apoptotic process by activating several caspases, proteases responsible for mitochondrial changes, alterations in membrane symmetry, and DNA fragmentation. Other study revealed that the E. coli showed a significant increase in apoptosis in sperm, and the bacterial infection of male genital tract decrease the motility and increase in non-viable sperm, as well as causing sperm DNA fragmentation. Escherichia is the most extensively studied microorganism in relation to infertility as a result of interaction with spermatozoa. It is also the primary bacteria associated with prostatitis and epididymitis. E. coli has a passive effect on sperm motility and acrosomal function. Several authors were

described spermagglutination and immobilization by E. coli. In rats, infection with uropathogenic E. coli (UPEC) results in severely impaired spermatogenesis, characterized by, for example hypospermatogenesis, germ cell loss and reduced sperm number. Kaur and Prabha isolated Sperm agglutination factor from S. aureus which showed sperm agglutinating and spermicidal properties in vitro. In human, E. coli and S. aureus are the predominant flora in infertile men. Other authors reported that these species of bacteria can cause a significant decrease in sperm motility. Emokpae et al studied the contribution of seminal tract infection to sperm density, asthenozoospermia and teratozoospermia, where they observed S. aureus as the causative organism accounting for 68.2% of seminal infections. S. aureus is known to produce various toxins and enzymes that may exert a damaging effect on human sperm. The increased prevalence of genital tract infections caused by E. faecalis is associated with a deterioration of semen quality in terms of sperm concentration and morphology. Also the presence of micrococci and alphahaemolytic streptococci does not appear to exert any detrimental effect on sperm quality. Although no significant depressor effect of enterococci on sperm motility was observed, some researchers described, in an in vitro study, a negative influence on membrane integrity of human sperm head, neck and mid-piece, probably mediated by haemolysin, a wellknown virulence factor of enterococci. 5) Infection treatment with antibiotics In spite of the sperm parameters being improved after the treatment of UTIs (84), antibiotics have negative effects on sperm motility and morphology.

## Results:

Out of a total number of 120 sample, 36 (30%) of them were infected with bacteria. Nine species of bacteria belonging to five genera, Staphylococcus, Escherichia, Streptococcus, Enterococcus and Klebsiella, were identified. The comparison between infected (36) and non-infected (84) samples appeared the negative impact of bacterial infection on sperm parameters and P1/P2 ratios. The percentages of P1/P2 ratio abnormality were significantly higher in infected patients. Sperm concentration, motility, progression and chromatin condensation were significantly lower in infected patients ($P<0.010$). Moreover, high DNA fragmentation with low P1 and P2 concentrations were noticed in the infected patients in comparing to the non-infected patient put no significant. Also the fertilization rate decreased significantly ($p<0.05$) with infected patients.

## Conclusion:

Sperm bacterial infections affects significantly sperm quality and fertilization rate in patients undergoing ICSI treatment.

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