Cigarette Smoking is Associated with Abnormal Histone-to-Protamine Transition in Human Sperm

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OBJECTIVE: To investigate the association between smoking, semen quality, and the histone-to-protamine transition ratio in mature sperm.

DESIGN: Biochemical and molecular analysis in human samples and a cell line.

SETTING: Andrology laboratory in a university-affiliated hospital.

PATIENT(S): Semen samples from 147 heavy smokers and 175 nonsmokers receiving infertility treatment.

INTERVENTION(S): None.

MAIN OUTCOME MEASURE(S): Basic semen parameters, histone-to-protamine ratios, and number of sperm cells with abnormal histone transition were calculated. The relative messenger RNA (mRNA) expression levels of protamine 1 and protamine 2 were assayed in human sperm and in TM3 cells exposed to cigarette smoke condensate. T tests, Spearman tests, and nonparametric Mann-Whitney U tests were used to detect significant differences.

RESULT(S): Normozoospermic smokers had significantly higher abnormalities than their nonsmoking counterparts. Sperm histone replacement abnormalities were found to be closely correlated with sperm motility, viability, concentration, counts, and cotinine levels. The ratios of protamine 1 to protamine 2 mRNA expression significantly increased in heavy smokers and in TM3 cells treated with cigarette smoke condensate.

CONCLUSION(S): Smoking is strongly associated with abnormalities in histone-to-protamine transition and with alteration of protamine mRNA expression in human sperm.