SMOKING DURING PREGNANCY CAUSES DOUBLE-STRAND DNA BREAK DAMAGE TO THE PLACENTA, WHICH IS COMPLETELY REVERSED AFTER FOUR WEEKS OF CESSATION

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Despite the adverse effects of smoking, many pregnancies are exposed to tobacco smoke. Recent studies have investigated whether smoking damages placental DNA by measuring DNA adducts. This study investigated whether a more severe lesion, double-strand DNA breaks, was also present in the tobacco smoke exposed placenta. Term placentae from women who smoked during their entire pregnancies (n = 52), from those who had ceased smoking for at least 4 weeks before delivery (previous smokers, n = 34), and from non-smoking women (n = 150) were examined using the DNA double-strand break marker phosphorylated γ H2AX. The extent of DNA damage was assessed according to cell type and additional markers applied, cell fate (apoptosis and DNA repair), and functional markers (human chorionic gonadotropin, human placental lactogen, and glucose transporter 1), to characterize the effect of the DNA damage on placental integrity. Marked phosphorylated γ H2AX–positive cells occurred in the villous syncytiotrophoblast and syncytial knot nuclei in placentae from smokers (P < 0.001). Phosphorylated γ H2AX foci did not co-localize with the DNA repair protein 53BP1, and damaged nuclei had a marked reduction in expression of human chorionic gonadotropin, human placental lactogen, and glucose transporter 1. Minimal DNA damage, similar to non-smokers, was present in previous smokers including those that had ceased smoking for just over 4 weeks before delivery. In summary, smoking during pregnancy was associated with marked double-strand DNA break damage to the syncytiotrophoblast. We suggest that smoking cessation is important to prevent additional DNA damage and to facilitate DNA repair, particularly because the damage is reversible!