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Deficits in plasma oxytocin responses and increased negative affect, stress, and blood pressure in mothers with cocaine exposure during pregnancy

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Abstract

In animals, oxytocin enhances maternal behavior and lowers blood pressure (BP) and negative affect, while parturitional cocaine disrupts oxytocin activity and increases maternal neglect and aggression. Thus, we compared oxytocin, BP, maternal behavior, and affect in mothers of infants who used cocaine (cocaine, $n=10$) or did not (no drug, $n=25$) during pregnancy. Laboratory BP and circulating oxytocin, catecholamines, and cortisol were examined before and during a speech stressor on 2 days, with vs. without prestress baby holding. Ambulatory monitoring assessed BP, urinary norepinephrine, and cortisol for 24 h at home. The cocaine group had lower oxytocin levels, greater hostility and depressed mood, less support from others and mastery over life events, higher BP during all events of testing without the baby, and higher ambulatory BP and urinary norepinephrine at home, while cortisol and epinephrine responses were blunted. Although they tended to hold their babies less often at home, baby holding in the laboratory led to decreased BP in cocaine mothers who then did not differ from no-drug mothers in BP or observed affect.

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1. Introduction

As primary caregivers, mothers who abuse drugs during pregnancy are at high risk for problems in parenting skills (Lawson & Wilson, 1980). A history of substance abuse has been associated with poor maternal–infant interactions (Bauman & Dougherty, 1983; Bays, 1990; Howard, Beckwith, Espinosa, & Tyler, 1995; Johnson & Rosen, 1990), as well as inadequate social support systems and low self-esteem and maternal ego development (Fineman, Beckwith, Howard, & Espinosa, 1997; Williams-Petersen et al., 1994). Specifically, maternal cocaine abuse during pregnancy has been correlated with a greater incidence of maternal neglect (Kelly, Walsh, & Thompson, 1992), problems with maternal–infant bonding (Burns, Chethik, Burns, & Clark, 1991), and child abuse in the human population (Murphy et al., 1991). A relatively recent study found that women who had taken cocaine during pregnancy had more difficulty interacting with their infants and expressed subtle hostility during feeding and play periods as compared to nondrug-abusing women (Goldman-Fraser, 1997).

In an animal model of maternal neglect, it was found that exposure to cocaine in pregnant rats decreases their subsequent maternal behavior and increases inappropriate and non-adaptive aggressive behavior. Specifically, rats given a moderate dose of cocaine either acutely during the postpartum period or chronically during pregnancy display increased maternal neglect of offspring (less feeding, licking, and nestbuilding) and either compulsive nonadaptive aggressive behavior (after chronic gestational treatment) or nonprotective behavior (after acute cocaine postpartum treatment) in the presence of an intruder (Johns et al., 1998; Johns, Noonan, Zimmerman, Li, & Pedersen, 1994). Continuing exposure to postpartum cocaine may result in somewhat different patterns of disruptions in maternal behavior or aggression depending on dose and frequency of use during pregnancy (Johns, Lubin, Walker, Meter, & Mason, 1997; Johns, Noonan, Zimmerman, Li, & Pedersen, 1997; Johns et al., 2002; Nelson, Meter, Walker, Ayers, & Johns, 1998). These abnormal maternal behaviors appeared to be at least partially mediated by cocaine-induced changes in oxytocin activity (Elliott, Lubin, & Johns, 2001; Johns, Lubin et al., 1997; Lubin, Elliott, Black, & Johns, 2003).

The neuropeptide, oxytocin, is linked in animal models to both initiation and perhaps early maintenance of maternal behaviors, including licking and nursing (Champagne & Meaney, 2001; Johns, Lubin et al., 1997; Pedersen, Caldwell, Walker, Ayers, & Mason, 1994), and to antistress and blood pressure (BP) lowering effects (Knox & Uvnas-Moberg, 1998; Petersson, Alster, Lundeberg, & Uvnas-Moberg, 1996). Oxytocin administration to female sheep will induce them to adopt and nurse orphan lambs, demonstrating oxytocin's role in maternal–offspring bonding (Keverne & Kendrick, 1992). In rats, exogenous oxytocin or endogenous oxytocin activity elicited by stroking gives rise to antistress effects [e.g., decreases in activity of the hypothalamic–pituitary–adrenal (HPA) axis and BP, but greater stress analgesia] after repeated administration (Holst, Uvnas-Moberg, & Petersson, 2002; Petersson, Uvnas-Moberg, Erhardt, & Engberg, 1998; Robinson et al., 2002). Preliminary evidence from human mothers suggests that oxytocin helps modulate their affective state, and this may, in turn, influence their stress responses. In mothers who both breast- and bottle-feed their infants, the act of breast-feeding (which typically elicits greater rises in plasma oxytocin) is

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