

Pedophilia: a biological disorder?

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Abbreviations

ICD	impulse control disorder
5-HT ₂	type 2 serotonin
mCPP	m-chloro-phenylpiperazine

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Introduction

The sexual abuse of children (pedophilia) represents a remarkable proportion of about 25% of all sexual offences [1]. Between 100 000 and 500 000 children in the United States are thought to be sexually molested annually [2]. Pedophilia is one of the sexual deviation disorders, or paraphilias, which are diagnosable psychiatric syndromes characterized by recurrent fantasies about deviant sex, intense associated cravings, and stereotypic behavioral responses [3]. Pedophilia is a sexual disorder characterized by repetitive sexual arousal to prepubertal children [4]. Pedophilia has also been considered to be an impulse control disorder (ICD) [3,5]. Patients with paraphilias experience recurrent fantasies about deviant sex, intense associated cravings and arousal before committing the sexual act and they feel a release of tension after the act [5]. In addition, pedophiles use sexual aggression (persuasion, coercion or physical force) or sexual violence (may cause damage to the physical integrity of the victims) in their sexual assaults [5,6]. Although there is substantial evidence in the historical and anthropological record of pedophilia, and despite a large series of studies showing that paraphilias, aggression, violence and ICD are associated with alterations in monoaminergic turnover, there has been little research into the biological pathophysiology of pedophilia. Here I will review recent findings on the monoaminergic disturbances in paraphilias and pedophilia.

Paraphilias

It has been hypothesized that alterations in the metabolism of serotonin (5-HT) may play a role in the pathophysiology of paraphilias [7]. There are good indirect data suggesting that enhancing serotonin neurotransmission with selective serotonin reuptake inhibitors

can ameliorate paraphilic behavior and control arousal [8]. Also, alterations in the catecholaminergic pathways may be associated with criminal sexual behavior. The free and conjugated forms of plasma norepinephrine are significantly higher in patients with compulsive forms of paraphilia [9]. A state of deficiency in monoamine oxidase A, the enzyme that catabolizes catecholamines, and consequently, a disturbed monoamine metabolism, are associated with a behavioral phenotype characterized by impulsive aggression, attempted rape and exhibitionism [10].

Pedophilia

Recently, two publications showed that pedophilia may be accompanied by alterations in serotonin metabolism and catecholaminergic turnover. To examine the central serotonergic turnover, the baseline and m-chloro-phenylpiperazine (mCPP)-induced cortisol, prolactin and body temperature responses were measured in pedophiles versus normal controls; mCPP is the major metabolite of trazodone, a heterocyclic antidepressant. In psychiatric research, mCPP is now one of the agents most commonly employed to challenge the central serotonergic system. After challenge, mCPP rapidly crosses the blood brain barrier and stimulates serotonin postsynaptic receptors to secrete hormones such as prolactin and cortisol and to increase body temperature [11,12]. These effects are probably mediated through type 2 serotonin (5-HT₂) postsynaptic receptors [11,12]. It was found that the mCPP-induced cortisol responses are significantly greater in pedophiles than in normal men; and that baseline serum cortisol and prolactin are significantly lower and body temperature significantly higher in pedophiles than in matched controls [12]. The enhanced mCPP-induced hormonal responses in pedophilia probably reflect an upregulation of 5-HT₂ (5-HT_{2A} or 5-HT_{2C}) postsynaptic receptors. The findings that baseline serum cortisol and prolactin are significantly lower, whereas baseline body temperature is significantly higher in pedophiles than in controls may point towards a decreased presynaptic activity in the serotonergic neuron [12]. By inference, it may be hypothesized that pedophilia is accompanied by an upregulation of postsynaptic 5-HT₂ (5-HT_{2A} or 5-HT_{2C}) receptors which could be secondary to a decreased neurotransmission in the presynaptic serotonergic neuron [12]. A denervation of the serotonergic neuron, however, does not always induce 5-HT₂ receptor upregulation [13].

In another study, to assess catecholaminergic turnover, plasma epinephrine and norepinephrine were assayed in the serum of pedophiles and matched controls [14]. Pedophiles had significantly increased baseline plasma concentrations of both norepinephrine and epinephrine [14]. Since there is no predominance in the increase of any of the two catecholamines measured in pedophilia, the findings are less likely to reflect increased emotional stress because the latter is characterized by a more selective increase in epinephrine concentrations. There is also evidence that the peripheral sympathoadrenal and central catecholaminergic activity may be regulated in parallel. Thus, the major brainstem catecholaminergic cell groups (A6, A7, A5 and A1) contribute to (1) descending projections in the spinal cord and have widespread connections with preganglionic neurons, which innervate sympathetic ganglia and adrenal medulla [15,16] and (2) ascending projections which give off terminations in, amongst others, hypothalamic sites [15]. The impulses in the sympathoadrenal system depend upon descending impulses from sympathetic regulatory centers in the pons, medulla oblongata and hypothalamus [16,17]. Under many conditions there is a significant positive relationship between central catecholaminergic activity and peripheral sympathoadrenal system activation [18]. Thus, our results suggest that pedophilia may be characterized by increased sympathoadrenal system activity which could point towards increased central catecholaminergic inputs. In accordance with the above, Maes *et al.* (unpublished data) found that pedophiles rate significantly higher at feeling active, elated and excited and significantly lower at feeling sleepy, calm, and relaxed than normal men. These findings suggest that the activity and arousal levels are significantly higher in pedophiles than normal men. Since the catecholaminergic system has a global modulating function in enhancing arousal and orientation to threatening stimuli [19], the findings of Maes *et al.* suggest that the increased activity and arousal state in pedophilia may be related to increased sympathoadrenal system or central catecholaminergic activity.

It is also possible that alterations in the interplay between serotonin and catecholamines are involved in the pathophysiology of pedophilia. In this respect, it was reported that mCPP has a significant suppressant effect on plasma epinephrine concentrations in pedophiles, but not in normal men [14]. There are many reports showing that there are major serotonin-norepinephrine interactions in various brain areas, such as the raphe dorsalis and the locus coeruleus [20]. The norepinephrine system of the locus coeruleus is stimulated by type 1A serotonin receptor activation and inhibited by 5-HT₂ receptors [20]. 5-HT₂ receptor activation inhibits noradrenergic neurons in the locus coeruleus and the hippocampus [21,22]. Since pedophiles may have an increased number

or increased activity of postsynaptic 5-HT_{2A} or 5-HT_{2C} receptors, activation of these receptors by mCPP may have diminished the catecholaminergic turnover (by inhibiting noradrenergic neurons in the locus coeruleus and the hippocampus) more in pedophiles than in matched normal controls.

Further views

Clinical and animal studies have shown important factors in the underlying pathology of ICD and aggression or violence to be (1) disorders in the serotonergic neuron and hence a lowered synthesis of serotonin, (2) lowered reuptake of serotonin and increased numbers of 5-HT_{2A} receptor sites (on platelets) and (3) a slight activation of the central and peripheral catecholaminergic system [23,24]. As to how pedophilia is related to violence or aggression and ICD, the serotonergic and catecholaminergic findings in pedophilia are in agreement with previous reports that disorders in serotonin metabolism and increased sympathoadrenal system activity are related to aggression or violence and ICD. There is also some evidence that serotonin exerts an inhibitory effect on aggressive or violent and impulsive behavior [25–28] and that lowered presynaptic serotonin neurotransmission may diminish these inhibitory effects, thus, increasing impulsivity and aggression or violence [29,30].

It could be hypothesized that disorders in the serotonergic neuron and increased catecholaminergic turnover may not be specific characteristics of pedophilia but rather of paraphilia or of aggression or violence and impaired impulse control in general. By inference, pedophilia could be regarded as one of the clinical expressions of the above monoaminergic disturbances, which characterize aggression or violence and deviant impulse control in general.

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