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Substance Abuse: Research and Treatment

Gasoline Abuse in a 10-Year-Old Child with Mental Retardation: A Case Report

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ABSTRACT: Inahalant abuse is of increasing interest in India. The age of onset is typically during adolescence. Gasoline inhalant use is rarely reported in adolescents with intellectual deficit. We report a case of petrol dependence in a 10-year-old child with mental retardation. Possible effect of petrol huffing on behavior and cognition is discussed.

KEYWORDS: petrol dependence, inhalant, mental retardation

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Introduction

Inhalant use disorder is of increasing interest in the current era, though Indian literature regarding the subject is scant. Inhalants are volatile substances that produce chemical vapors that can be inhaled to induce a psychoactive or mind-altering effect.[1] These inhalants are grouped into volatile solvents (gasoline, glue, paint thinner, nail polish remover), aerosols (spray paint, hair spray), gases (nitrous oxide, helium), and nitrites (amyl and butyl nitrites).[2] Inhalants most commonly used by American adolescents are glue, shoe polish, toluene, spray paints, gasoline, and lighter fluids.[3]

Inhalant use in India has been a problem for the last several decades.[4] Use of inhalants such as volatile petroleum products,[4–7] correcting fluids,[6–9] and adhesives[7] has been reported in India. Studies about inhalant use in India are scarce and are mostly case reports or series. Data regarding the most commonly abused inhalant by the Indian population vary. Petrol (gasoline) is a less likely abused inhalant (according to two studies, <5%).[7,10]

Review of literature suggests that the most common age of use is from 12 to 25 years, with the mean age of onset being 14 years. The use declines beyond the age of 18 years.[7,10–14] Rarely, onsets as early as 5–6 years have also been described.[13] About 0.4% of Americans aged 12–17 years have a pattern of use that meets the criteria for inhalant use disorder in the past 12 months.[11] In a review article published in a Canadian journal, inhalant abuse in an isolated native Indian population was found to occur at the rates of 10% of the total population and 25% of those aged 5–15.[15] The reasons for which adolescents frequently initiate the use of inhalants include experiencing a high, out of curiosity, peer pressure, as a fashion, and to forget problems in school. The most common reasons are out of curiosity and to experience a high.[7,10,12]

Inhalants have vapors that can be sniffed (through the nose) or huffed (deep breaths through the mouth) to experience the effects. This leads to transpulmonary absorption with very rapid drug access to the brain. The effects appear within five minutes and can last from 30 minutes to several hours, depending on the inhalant and dose. The acute effects resemble that of other central nervous system (CNS) depressants, notably alcohol. In small initial doses, inhalants can produce euphoria and pleasant floating sensations, the effects for which persons presumably use the drugs. High doses

cause fearfulness, illusion, auditory/visual hallucinations, and distortions of body size.[2]

Long-term use of petrol is associated with changes in the brain as well as neurobehavioral changes that include irritability, emotional lability, impaired memory, poor concentration, slurred speech, decreased speed of talking, hearing loss, peripheral neuropathy, headache, cerebellar signs, motor impairment, parkinsonism, and apathy. White matter changes on magnetic resonance imaging (MRI) have been associated with lower intelligence quotient (IQ). Verbal IQ is more impaired compared to performance IQ.[16] With regard to memory, working memory as well as executive functioning, including memory retrieval, is impaired significantly.[16,17] Long-term use of leaded petrol is associated with complications of lead poisoning, including lead palsy and lead encephalopathy. A history of lead encephalopathy and greater lead body burden is independently associated with more severe neurological impairments.[18–20] Also, the severity of abuse correlates with the extent of neurobehavioral impairment.[18] Subjects without history of lead encephalopathy, when they abstain from petrol use, have mild impaired recognition memory but all other functions return to normal. This evidence of neurobehavioral recovery in non-encephalopathic sniffers suggests that any disruption to the cortical and basal ganglia brain regions caused by chronic petrol sniffing is restored with abstinence.[19,20] Inhalants are associated with potentially serious effects, the most serious being death (resulting from respiratory depression, cardiac arrhythmias, asphyxiation, aspiration of vomitus, or accident or injury).[2]

The withdrawal syndrome does not occur frequently; when it does, it can be characterized by sleep disturbances, irritability, jitteriness, sweating, nausea, vomiting, tachycardia, craving for the inhalants, restlessness, tingling, headache, poor concentration, and body ache, and (sometimes) delusions and hallucinations.[2,7,21]

Literature about use of inhalants among the mentally retarded is sparse. There is a single case report of use and inhalant dependence in a child with a background of mental retardation. The case report described severe cognitive impairment occurring secondary to long-term inhalation of gasoline in a 19-year-old person having mild mental retardation prior to onset of gasoline use. This suggests that chronic use of gasoline leads to worsening of intellectual functioning.[22] A study conducted in a clinic in South India reported that 16% of the population group using inhalant had subnormal intelligence and 60% had impulsivity, hyperactivity, and conduct symptoms. The level of intellectual functioning was not reported, and whether the above symptoms were present before the use of the inhalant or developed later was also not specified.[10]

We report a case of petrol dependence in a 10-year-old child with mental retardation and attention deficit hyperactivity disorder (ADHD) with onset of petrol dependence at least two years earlier. Written consent for this publication was provided by the parents of the child.

Case Report

A 10-year-old boy, living in a village near the Kota district of Rajasthan in India, presented to the psychiatric outpatient department with his parents.

The parents reported that the child was a full-term normal delivery and had no antepartum/peripartum complication. At the age of one month, he had a single episode of febrile generalized tonic-clonic seizure. Later, the child had delayed developmental milestones. He started speaking at the age of three years in monosyllables such as mama and papa. At five years of age, he started speaking two to three words with no further development until presentation at our department at age 10 years. His speech was not clear and was difficult to comprehend even by his parents. His social judgment and skills were also not appropriate for his chronological age. His motor milestones were appropriate for his age.

At the age of approximately 5 years, the parents noted the child being increasingly restless, running the whole day, playing, and having difficulty keeping calm and being seated. He would repeatedly break anything that came to his hands. As he grew up, the parents noted that he would not be attentive and would not listen to any instructions, and would be always on the go and roaming around. He would not continue with a single task, and would get distracted easily and keep on changing his games. If restrained, he would become fidgety, shout, scream, throw or pound, and destroy things, and would climb or jump. No one could control him, though he would sleep adequately and quietly at night. He was also observed putting non-edible things into his mouth, such as marbles, sand, or clothes, or he would bite his own hands and suck his thumb if he did not get anything else to put into his mouth. These features were continuously present throughout, and his hyperactivity increased with age.

At the age of approximately eight years, one of the neighbors reported that the child was seen huffing petrol from the tank of a vehicle. The parents became more concerned and started monitoring the child. He was observed huffing petrol from the tanks of vehicles regularly two to three times a day. After huffing petrol, there would be remarkable changes in the child's behavior; his restlessness and hyperactivity would reduce for two to three hours. After this, the child would again grow restless and become hyperactive. His father noticed that when occasionally he huffed petrol for longer durations, his eyes would roll up and he would become drowsy, and he would walk with a drunken gait for a duration of 10–15 minutes. Initially, he used to sniff or huff three to four times a day, which increased gradually over two years to seven to eight times a day. Whenever he did not get petrol and was restricted by the parents, he would become more restless and irritable than before, would start beating the parents and break things, and would shout, scream, and have difficulty even falling asleep. This would subside after he had inhaled petrol. Often, he ran away from the house, hiding from his parents, in search of petrol. The parents tried their

conventional household techniques to control the child and to train him, but it did not work much. He was also treated by the general physicians at the local government hospital, but his parents were not satisfied by the treatment and ultimately they brought the child to our psychiatric outpatient department, which is a part of a higher medical center.

On presentation to our clinic, the child was restless, did not sit quietly, threw his legs onto the table, stood and jumped on the cot, kept running, sucked his thumb, spoke repeatedly in non-comprehensible short words, and followed simple commands with difficulty. There were bite marks over his thumb. His IQ was initially assessed by a clinical psychologist using Seguin Form Board (SFB) Test. The score was in the range of 40–45, categorized as moderate mental retardation (moderate intellectual disability as per Diagnostic and Statistical manual 5th edition (DSM 5)). Conners ADHD parent version revised short form questionnaire was completed by the parents, with a score of about 64 out of 81. His serum lead levels were investigated to rule out lead toxicity associated with use of leaded petrol and eating of other non-edible items like sand. Lead levels as measured by LeadCare II Analyzer were less than 3.3 µg/dL, ie, within normal range.

The child was presented to us at age of 10 years. Considering that petrol has alcohol-like CNS depressant properties and carbamazepine had property of reducing impulsive behavior, the child was prescribed clonazepam (a benzodiazepine) 0.5 mg thrice daily and carbamazepine 100 mg thrice daily. Parents reported gradual reduction of petrol use, and the child was fully abstinent after three months. He no longer seeks petrol as earlier. However, his activity level and his improvement in behavior though better have not reached to the level prior to the petrol use. Conners ADHD parent version revised short form questionnaire was again filled after three months, and the score was 60. Thus, there was minimal improvement in ADHD features.

Discussion

Inhalant dependence is now increasingly reported as a substance use disorder among adolescents, who are always curious about experiencing new things. However, study of substance use among children younger than 10 years is an unusual scenario. There are no studies on inhalant use in children having mental retardation.

The child here had an unusually early onset before eight years, compared to the usual onset at around 14 years. Though literature reports onset even at five to six years of age, details of its pattern are not reported in the available literature.[2,7,10,12,13,23]

Reports of increased use of substance among ADHD patients are well known.[24] The child had a history of hyperactivity prior to substance use, as was assessed clinically from the history available from parents and observation during clinical interview. This hyperactivity worsened after onset of petrol use. Though DSM 5 does not describe any withdrawal features, some case reports/series have described some physical withdrawal features such as irritability, psychomotor retardation, anhedonia, dry mouth, sleep disturbances, craving, and increased lacrimation.[21] Withdrawal features such as restlessness, irritability, inattention, sleep disturbance, and craving (difficulty in preventing child to remain away from substance use) were observed in this child. The presence of restlessness, inattention, and irritability even before petrol use was reported. Thus, it was difficult to conclude that they were because of petrol use. However, these features definitely worsened after use of petrol, and the worsening though reduced after petrol abstinence did not fully resolve, suggesting possibility of some behavioral change by chronic petrol use.

A calming effect with the petrol use was reported by the parents. Gasoline acts as a CNS depressant,[2] which calms the hyperactivity and gives the child a pleasurable effect. This in turn led to development of dependence. The child with moderate mental retardation was not able to understand the potentially hazardous consequences of gasoline use. Apparently, the child started using substance in exploration or as experimenting and became dependent. Thus, the common pattern of use among adolescents in response to peer pressure or for fun was not observed in this child. The self-medication hypothesis cannot be commented on, as the child was having intellectual disability and he was not able to understand the nature of self-medication.

The craving was difficult to manage by parents. Treating withdrawal with benzodiazepines and carbamazepine significantly reduced the craving, and gradually, the child was off the substance. Carbamazepine acted by reducing the impulsivity.[25,26] Classical conditioning behavior might not be developed in this child as seen by complete abstinence from substance spontaneously with minimal effort by parents and not using gasoline even when available. Thus, the child became easily abstinent with minimal pharmacological and behavioral management.

Conclusion

The presence of hyperactivity before onset of substance use and increase in the same after petrol use complicates the picture and makes it difficult for the clinician to judge the course of illness. This also suggests that substance dependence should also be thought of as a part of a complex presentation in a child. ADHD and mental retardation (MR) could be predictors of early onset of substance use. Use of substances in ADHD is more likely because of the impulsivity phenomenon, suggesting that the role of impulsiveness in use of substances including gasoline needs further exploration and evidence-based studies.

Author Contributions

Conceived and observed the case: MJ, GKV. Analyzed the data: MJ, GKV. Wrote the first draft of the manuscript: MJ. Agreed

with manuscript conclusions: MJ, GKV. Jointly developed the structure and arguments for the paper: MJ, GKV. Made critical revisions and approved the final version: MJ, GKV. Both authors reviewed and approved of the final manuscript.

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