CASE-REPORT

Acute Tubular Necrosis in Organophosphorus Poisoning: An Atypical Complication

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ABSTRACT

All the different manner in poisoning cases are more common in India than in Western countries owing to the easy availability of poisonous substances due to non-stringent application of the laws of the land. Accidental poisoning is also on an increase because of the greater use of chemicals for agro-industry and domestic purposes. Organophosphorus poisoning is the most commonly encountered agro-poison. OP compounds are widely used as insecticides in our agricultural setting. They are easily available, and no real care is taken while handling these compounds which have also been used for the purposes of suicides in developing countries. Acute tubular Necrosis has been seen in OP poisoning very rarely and only a few cases have been reported in medical literature. Furthermore, the main mechanism by which Organophosphates can cause acute tubular necrosis has been debated. Different mechanisms have been suggested that can cause acute tubular necrosis. Organophosphates might also cause oxidative stress, direct damage to the renal tubules, rhabdomyolysis, and hypovolemia due to dehydration. This is a case of organophosphorus poisoning with clear findings of the rare complication, acute tubular necrosis in the histopathology.

INTRODUCTION

Organophosphorus (OP) compounds are the most common insecticides used in India which is mainly due to their low cost, easy accessibility and availability.[1] According to the World Health Organization there are more than 3 million cases of OP poisoning annually.[2] The manner of poisoning can be correlated, up to certain extent, with the age of the victim. Children and infants usually present with accidental exposure, whereas teenagers and adults are usually involved with suicidal intents.[3] Acetylcholine a neurotransmitter is present in the peripheral and central nervous systems at the neuromuscular junctions and its action is hydrolyzed by Acetylcholinesterase (AChE) which

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render it inactive. This action of Acetylcholinesterase is inactivated by OP compounds through phosphorylation and leads to accumulation of acetylcholine resulting in overstimulation at neuromuscular junctions in both central and peripheral nervous system.[4] The exposure to the organophosphorous compounds may cause acute signs of cholinergic crisis and some late complications involving respiratory, neurologic, and cardiac systems. Acute kidney injury (AKI) is not listed among those and is an underestimated complication.[5]According to the literature, AKI in OP poisoning cases is associated with high morbidity, mortality and a risk of long-term dialysis.[6]Here, we report a case of organophosphorus poisoning with clear findings of the rare complication i.e. acute tubular necrosis (ATN) in the histopathological examination.

CASE REPORT

A dead body of a 5-year-old male child was brought to the mortuary for post-mortem examination with alleged history of consumption or inhalation of unknown substance while playing near the wastage dump site of a local factory. There were symptoms of nausea, vomiting, sweating and loss of consciousness. The deceased child was rushed to a nearby hospital where he was declared brought dead. The whole survival period from starting of symptoms to death was about 5-6 hours. Autopsy findings: There were no injuries or atypical findings present on external examination of the dead body. On opening of the body all the internal organs were found to be congested. Stomach contained about 200ml of yellow coloured semi-digested food material and the mucosa was congested and hyperaemic. Stomach along with its contents and required viscera was sent for chemical analysis. Necessary internal organs were preserved for histopathological examination. In the crime scene investigation done by the investigating authorities, it was revealed that there is indeed a milk factory which releases its chemical wastes into a dumpsite which is near the fields and home of the decedent. Investigating personnel collected soil and water from the field and sent for chemical analysis along with the viscera for identification and comparison of poisonous substances if any. The chemical analysis report of viscera received from the Forensic Science Laboratory revealed detection of Organophosphorus compounds in the viscera and the water sample obtained from the fields and the histopathology of the viscera showed there was finding of acute tubular necrosis in the kidneys with features of congestion in rest of the viscera. Histopathology findings: Sections of lungs showed oedema and congestion. Sections of kidneys examined were depicted in photomicrograph Figures 1 and 2. These sections were prepared by using H&E staining method.

Figure 1: Photomicrograph of Kidney (H&E; 100X).

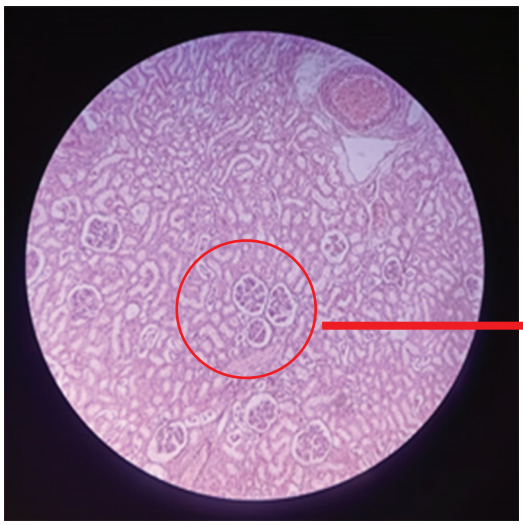
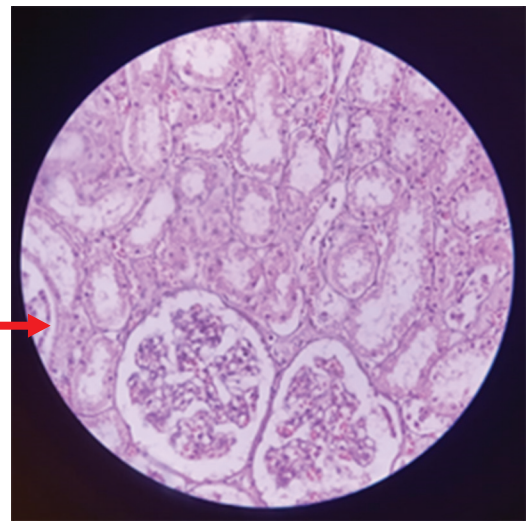


Figure 2: Photomicrograph of kidney showing mild interstitial inflammatory infiltrate (H&E; 400X)



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DISCUSSION

Organophosphorus compounds are the popular pesticides, used particularly in the Third World Countries.[7]Exposure to OP compounds results in accumulation of acetylcholine at the neuromuscular synapses as a result of inhibition of acetylcholinesterase activity.[8] The signs and symptoms of OP poisoning in children were well reported. It affects central nervous system resulting in a decrease level of consciousness. The cholinergic and muscarinic effects include increased secretions, sweating, rhinorrhea, miosis, vomiting and nicotinic effects manifest as muscle weakness.[9] Acute poisoning manifests as cholinergic crisis and respiratory failure. Intermediate syndrome or delayed neuropathy may develop at later stages. The involvement of other systems such as kidneys, although rare, may worsen the clinical presentation and prognosis.[10]Lee, et al. in 2015 reported that OP poisoning was associated with 6.17-fold increase in acute kidney injury.[11]Involvement of renal system is rare but is more frequent in severe cases of OP poisoning. Non oliguric renal dysfunction, acute tubular necrosis, and acute renal failure (ARF) have been previously reported and were related to mortality in almost all the cases reported.[12] The most debated issue is the main mechanism by which OPs can cause AKI. Different theories have been suggested and attributed. These include direct damage to the renal tubules, oxidative stress, rhabdomyolysis, and hypovolemia due to dehydration.[13] Rhabdomyolysis which is associated with acute renal failure and myoglobinuria may result from seizures and muscle fasciculation. The oxidative stress from poisoning targets many organs including kidneys.[14] It was revealed that higher concentrations of OPs were founds in kidneys and fat tissue when compared to blood from postmortem analysis.[15] Renal elimination half-life for OP compounds was calculated to be 3.3 hours and there is a secondary rise in plasma level which we should be aware of while treating the cases of OP poisoning. [16] There is truly little information in the literature about the involvement of renal system in OP poisoning and all the information available is mainly based on case reports, case series and animal studies. Betrosian, et al. in 1995 reported a case of 68-year-old man who developed multiple system organ failure, including AKI after ingestion of OP compounds with suicidal intent. The diagnosis of ATN was confirmed by histopathology report obtained after autopsy, which showed extensive tubular destruction.[12] Shobha, et al. in 2000, published a study of 23 patients in which glucosuria was detected in patients with OP poisoning and was described to be evidence for oxidative stress which resulted in renal tubular damage.[17] Gokel, et al. in 2002 reported two cases of acute renal failure in cases of OP poisoning with features of rhabdomyolysis.[18]Similarly, another case was reported by Agostini and Bianchin, et al. in 2003 of suicidal OP poisoning complicated with acute renal failure and multiple organ dysfunction syndrome and inferred that high intratubular concentrations of OP compounds along with hypovolemia might be the culprit behind the AKI.[13] In a survey conducted by Faiz, et al.in 2011on 300 patients of OP poisoning in an intensive care unit and reported that 1.66% of them developed acute renal failure as a complication. [19] Again in 2013, Cavari, et al. reported a case of young patient who developed renal failure following OP poisoning and proposed that direct parenchymal intoxication, secondary to hemodynamic instability, or seizure-induced rhabdomyolysis might be the reason for the renal involvement.[5] These finding were substantiated by Arefi, et al. in 2014when they investigated 1500 patients of OP poisoning and indicated that rhabdomyolysis was a strong risk factor for renal failure.[20]

CONCLUSION

Organophosphate poisoning is very commonly encountered in our day-to-day practice. Hence, it is better to have knowledge of all the atypical presentations and expected complications of its toxicity. With the increasing number of OP poisoning cases the chance to come across a rare complication such as AKI increases. So, there is need to identify these potential cases and a thorough research and studies are needed to discover the main mechanisms behind the involvement of renal system. Therefore, patients of OP poisoning should be treated and considered as potential candidates for renal failure.

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