ORIGINAL RESEARCH

Observation of Visual Abnormalities in Patients Suffering from Acute Methanol Poisoning

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ABSTRACT
Aim: Observation of Visual Abnormalities in Patients Suffering from Acute Methanol Poisoning. **Materials and Methods:** In this cross-sectional retrospective investigation, the data from all of the patients' medical files who had been diagnosed with methanol poisoning were analyzed and compared. Patients who were less than 16 years old and who had been diagnosed with methanol poisoning were eligible for participation in the research if their medical records were accessible in the hospital's archives. The medical history of the patients, the amount of methanol found in their blood, or the conclusive diagnosis of the attending physician all contributed to the diagnosis of methanol poisoning. **Results:** Vision difficulties were the most prevalent clinical manifestation, accounting for eighty percent of all cases, in comparison to respiratory and gastrointestinal issues. In addition, 48 (48%) of the people who participated in the survey acknowledged having used alcohol in the past. Just two patients who had lost their eyesight had already passed away. According to Table 1, 36 patients (or 36%) had blindness, whereas 38 patients (or 38%) exhibited hazy vision. None of the people who participated in the research exhibited photophobia. During the eye examination, six of the study's participants (6%) had miosis, and six of the study's participants (6%) had mydriasis. In addition, 10 (10%) of the people who participated in the research had no pupil reaction. Just ten (10%) of the individuals had symptoms of metabolic acidosis. **Conclusion:** The current study found a higher incidence of visual disturbances in patients suffering from acute methanol poisoning compared to previous research that looked at the same topic. The prevention of methanol poisoning should receive more attention from those in charge of healthcare management and policy.
Keywords: Visual Abnormalities, Acute Methanol Poisoning

INTRODUCTION

Ethanol is a kind of alcohol that has a high level of toxicity when it is consumed directly by humans. Inhalation and absorption via the skin are far less common modes of exposure. Methanol in its purest form may induce lifelong blindness with as little as 30 milliliters, and anything from 30 to 240 milliliters of it can be fatal. Methanol alone is not very hazardous to health; but, when it is metabolized into compounds like formaldehyde and formic acid, it becomes extremely hazardous [1]. Even after being released from the hospital, those who have been poisoned by methanol have a significant risk of morbidity and fatality [2, 3]. To treat methanol poisoning, some treatment options include reversing acidosis, administering activated charcoal, and cleaning the stomach. Hemodialysis is the final treatment option that has been shown to increase patients' chances of surviving and prevent damage to their vision.

Methanol poisoning may have a number of dangerous and debilitating effects, the most serious of which are metabolic acidosis, optic nerve neuropathy, and problems of the central nervous system. The most common reason for optic nerve neuropathy is exposure to formic acid [4]. Methanol intoxication may cause a wide variety of ophthalmological signs and symptoms,

some of which include impaired vision, alterations in the visual field, and even full blindness. Even in cases when there is no impairment of vision, the majority of individuals who have been poisoned with methanol nevertheless exhibit some clinical indicators of ophthalmological abnormalities [5]. With an overdose of methanol, the incidence of visual abnormalities might vary anywhere from 29 to 64 percent. Poisoning from methanol is still a significant issue in developing countries like India, and it can result in complications that are impossible to reverse or even death. Nevertheless, in India, methanol is considered a cheap and more available replacement for ethanol, which has resulted in an increasing number of cases of methanol poisoning. Alcohol poisoning may be the outcome of an attempt at suicide. According to studies that were carried out not too long ago, the incidence of alcohol poisoning is on the rise.

MATERIALS AND METHODS

In this cross-sectional retrospective investigation, the data from all of the patients' medical files who had been diagnosed with methanol poisoning were analyzed and compared. Patients who were less than 16 years old and who had been diagnosed with methanol poisoning were eligible for participation in the research if their medical records were accessible in the hospital's archives. The medical history of the patients, the amount of methanol found in their blood, or the conclusive diagnosis of the attending physician all contributed to the diagnosis of methanol poisoning. Patients who lacked access to their medical files or had files that were insufficient were not included in the research. A data collection form was used throughout the process of acquiring the required information. This checklist consisted of three different sections: a. sociodemographic variables (such as age, gender, marital status, and location of residence); b. medical history (such as smoking, drug use, alcohol consumption, psychiatric problems, and suicide); and c. hospital admission data (e.g., vital at the time of admission, signs and symptoms, laboratory findings, received treatment, & therapeutic outcomes). The participants in the research who had and did not have visual abnormalities were then compared to one another.

The Chi-squared test and the Fisher's exact test were used to analyze the proportions of the data, while the Independent Samples t-test and the Mann-Whitney U test were used to analyze the mean values. All of the analyses were done in SPSS version 25.0. The data that was gathered was summarized in terms of frequency (%) for categorical variables and given as Mean and Standard Deviation for continuous variables.

RESULTS

There were a total of 100 medical records that were examined; all of the individuals who were looked at were male, and their ages 34.17 ± 5.41 years, on average. In addition to this, 86 of them (or 86% of the total) were single, and 44 of them (or 44% of the total) resided in metropolitan areas. In addition, 31 of them presented a history of smoking, 11 of them claimed a history of drug dependency, and the majority of them (71%) indicated that there was no history of psychiatric illnesses in their family. Just six patients out of the total number of patients admitted to the Intensive Care Unit (ICU) had passed away. There was evidence of visual abnormalities in seventy-six (76%) of the people who participated in the study. The length of time spent in the hospital was 3.89±1.12 days on average, with a mean and standard deviation of 3.24 and 2.11 hours between ingestion and arrival to the hospital, respectively.

Vision difficulties were the most prevalent clinical manifestation, accounting for eighty percent of all cases, in comparison to respiratory and gastrointestinal issues. In addition, 48 (48%) of the people who participated in the survey acknowledged having used alcohol in the past. Just two patients who had lost their eyesight had already passed away. According to Table 1, 36 patients (or 36%) had blindness, whereas 38 patients (or 38%) exhibited hazy vision. None of the people who participated in the research exhibited photophobia. During the eye examination, six of the study's participants (6%) had miosis, and six of the study's participants (6%) had mydriasis. In addition, 10 (10%) of the people who participated in the research had no pupil reaction. Just ten (10%) of the individuals had symptoms of metabolic acidosis. The patients with and without visual disturbances did not vary significantly in any of the factors that were evaluated.

Table 1: The patients' signs, symptoms, and laboratory data at the time of admission to the hospital

		Total =100	**With Visual Disturbances=80**	**Without Visual Disturbances=20**	**p value**
Vital signs	Systolic blood pressure (mmHg)	137.19±18.16	141.21±19.20	130.10±12.40	0.12
	Diastolic blood pressure (mmHg)	73.94±32.40	72.41±35.90	80.70±20.59	0.89
	Heart rate (/minutes)	94.60±22.26	90.70±16.04	100.50±26.81	0.77
	Respiratory rate (/minutes)	20.20±1.50	18.10±1.50	20.40±1.72 0	0.58
	Temperature (°C)	37.52±0.85	35.49±0.90	37.50±0.70	0.67
	GCS (/15)	14.31±1.95	13.19±3.18	16.0±0.0	0.36
CNS No. (%)	Alert	95	75	20	0.36

	Coma	5	5	0	
Ophthalmic No. (%)	Blindness	36	36	0	
	Blurred vision	38	38	0	0.54
	Photophobia	0	0	0	
	No symptom	26	6	20	
Pupil No. (%)	Miosis	6	3	3	
	Mydriasis	6	6	0	0.44
	Normal size	44	44	0	
	Not determined	44	27	17	
Pupil reactivity No. (%)	Reactive	40	37	3	
	Not reactive	10	10	0	0.14
	Not determined	50	33	17	
Respiratory No. (%	Dyspnea	6	6	0	
	Depression	6	6	0	0.22
	No symptom	88	68	20	
Gastrointestinal No. (%)	Nausea/vomiting	25	25	0	0.31
	No symptom	75	55	20	
Laboratory tests	White blood counts 109/L	8.73±3.42	9.88±1.91	9.28±4.15	0.11
	Lymphocyte	19.70±10.9	21.68±10.42	17.08±8.66	0.78
	Blood sugar (mg/dL)	113.26±36.30	115.77±38.25	107.67±23.18	0.98
	Serum sodium (mEq/L)	135.30±3.30	137.56±3.10	136.75±4.79	0.92
	Serum potassium (mEq/L)	5.25±0.80	4.26±0.94	4.20±0.95	0.51
	BUN (mg/dL)	12.41±3.81	12.23±5.00	10.2±5.00	0.83
	Creatinine (mg/dL)	2.24±0.10	1.70±0.20	1.20±0.24	0.23
	PT (Second)	13.56±1.88	13.22±1.90	16.35±2.30	0.20
	PPT (Second)	30.24±3.35	30.50±3.85	40.40±3.95	0.59
	INR	1.27±0.19	0.92±0.20	2.00±0.75	0.04
Vein blood gas	PH (Mean±SD)	8.20±0.20	8.20±0.11	7.15±0.19	0.26
	PCO2 (Mean±SD)	28.73±10.4	27.15±9.18	20.85±5.71	0.41
	HCO3 (Mean±SD)	20.30±40.10	25.10±44.70	10.01±5.09	0.45
	O2 saturation (Mean±SD)	80.39±19.92	90.36±27.52	95.50±3.70	0.43
	Metabolic acidosis No. (%)	10	10	0	1.22
	Respiratory alkalosis No. (%)	5	5	0	1.21
The time interval between arrival to the hospital and first hemodi	Alysis (hour) (Mean±SD) 5	4.95±2.0	6.25±2.84	5.09±2.62	0.19

DISCUSSION

According to the findings of this research, the most prevalent clinical manifestation in adult patients with acute methanol poisoning was a disruption in their vision, which occurred in eighty percent of cases. Blindness affected 36% of the individuals who were tested, while 38% of them reported having trouble seeing clearly. According to the findings of Hovda et al. [3,] visual disturbances were experienced by 55% of patients, gastrointestinal symptoms were experienced by 43% of patients, and shortness of breath was experienced by 41% of patients. Hassanian-Moghaddam et al. evaluated 25 patients with methanol poisoning and found that 23% of them had blindness [6]. This percentage is lower than the results of the present research on blindness caused by methanol poisoning. According to the findings of Shadnia et al. [1,] visual disturbances were experienced by 64 percent of the people who participated in the study. At the time of discharge, Mostafazadeh and Eghbali found that 14.3% of patients had had some kind of ocular problem [7]. Vision difficulties, which were described as the most prevalent complication, were found to have a frequency of 39.7%, according to the research done by Mirzaei et al. [8]. On the other hand, the research carried out by Massoumi and colleagues found that 71% of the patients they examined experienced feelings of nausea and vomiting. They reported that blindness was observed in 2% of the study participants, blurred vision in 41.2% of the participants, mydriasis in 27% of the participants, and miosis in 2% of the participants; similarly to the current study, the majority of the patients who were explored (71%) had a normal pupil size.

According to Sanaei-Zadeh and colleagues' argument, methanol intoxication may induce varying degrees of visual abnormalities; this suggests that there is a large individual difference in a person's susceptibility to methanol poisoning [9]. Using MRI pictures, Elkhamary et al. examined individuals who had been poisoned with methanol to see whether or not there was a correlation between visual and brain impairment. In 56.9% of patients, issues with the optic nerve and atrophy were noted, and in 36.2% of patients, bilateral putamen necrosis and visual nerve damage were found [10]. In the present investigation, all of the patients were male, which is in line with the findings of the study that was conducted by Shadnia and his colleagues [1]. According to the research carried out by Mostafazadeh and Eghbali [7] and Sanaei-Zadeh et al. [9], respectively 82.1% and 96% of the patients that were investigated were male. In addition, the majority of the patients who were researched were male, according to Hovda et al. [3], Navabi et al. [11], and Massoumi et al. [2]. As a consequence of this, methanol intoxication is more prevalent among males. According to the findings collected, the average age of the participants in the research was 34.17 years, with a standard deviation of 5.41 years. The majority of people who took part in the research were unmarried, lived in urban areas, had at least a high school diploma, and held jobs. In addition, the vast majority of them admitted to having consumed alcohol in the past. On the other hand, these factors did not vary in any way between patients who did and did not have visual disturbances. According to the findings of Massoumi and colleagues, 13.7% of patients were under the age of 20, 86.3% resided in urban areas, 11.8% had a history of committing suicide, and 13.7% had a history of being dependent on substances [2]. According to Mostafazadeh and Eghbali's research [7], the average age of the participants was 29.3 years. On this topic, HassanianMoghaddam et al. revealed that the average age was 38.5 years [6]. As a consequence of this, methanol poisoning occurs more often in metropolitan areas and among younger people.

Nonetheless, Mostafazadeh and Eghbali cited drinking as the primary means of consuming methanol [7], despite the fact that this research did not identify the manner of methanol intake. In addition, the blood levels of methanol were not recorded for the vast majority of the participants in the current study. According to Shadnia et al., the median consumption of methanol was 20 mg/dL. As a result, 37% of the patients who were evaluated ingested 20-50 mg/dL of methanol, and 23% drank above 50 mg/dL [1]. According to the findings of Massoumi et al. [2], 74.5% of patients were under the influence of industrial alcohol. In the current research, only two patients were sent to the Intensive Care Unit (ICU), and both of them passed away while they were there. When first brought into the hospital, this patient was already unconscious. According to the findings of Shadnia et al. [1,] eight patients were brought into the intensive care unit. According to the research carried out by Massoumi and colleagues [2,] just 37.3% of patients were conscious when they were first brought into the hospital. In the current investigation, there was no significant difference between the study groups regarding the blood levels of glucose, potassium, or pH; thus, these characteristics were not taken into consideration as predictive factors. Nevertheless, there was no link established between blood glucose levels and the length of therapy, age, or serum bicarbonate concentration. This was reported by Shadnia et al., who discovered that sixty percent of patients had leukocytosis. levels and pH and base deficiency. Desai et al. looked at pH as the greatest predictor for ultimate visual acuity and its improvement. In the end, they came to the conclusion that hyperglycemia might be a new prognostic factor in patients who had been poisoned by methanol. Nevertheless, more research has to be done in this area. Those who have a pH greater than 7.0 have a significantly increased chance of experiencing momentary vision loss. According to the findings of Ma et al., during the early phases of acute poisoning, every patient exhibited fleeting manifestations of the body's systems (the vision ability of 0.1 or even less). During the one-year follow-up, the visual function of the patients who participated in the trial had improved to varying degrees as a result of getting therapy; nonetheless, it was not sufficient [12]. On the other hand, both Shadnia et al. and Hassanian-Moghaddam et al. reported that those who passed away and those who survived had pH levels that were comparable [1, 6]. In line with the findings of this study, Sanaei-Zadeh et al. reported that there was no difference between the patients who had visual disturbances and those who did not have visual disturbances in terms of pH concentration and the amount of time that passed between consumption and arrival at the hospital [9]. In our study, the mortality rate was determined to be 2%; however, Shadnia et al. [1] and Sanaei-Zadeh et al. [9] reported mortality rates of 30% and 28%, respectively. Our study's mortality rate was measured at 2%. According to the findings of Hassanian-Moghaddam et al., the mortality rate was 48%; however, 77% of the patients made a full recovery without experiencing any complications. It was reported that patients who were in a coma had a mortality rate of 90%, while the mortality rate for other patients was reported to be 20%, and there was a statistically significant difference between these two numbers [6]. According to Mostafazadeh and Eghbali's findings, approximately 18% of patients who received appropriate treatment still passed away while being treated in hospitals [7]. In the research carried out by Massoumi and colleagues, there were a total of 4 patients who passed away, as well as 15 patients who experienced complications and 32 patients who did not experience any complications [2]. According to the findings of a study carried out by Hovda and colleagues [3,] 8 of 59 patients with confirmed cases

of methanol poisoning passed away outside of the hospital, and 9 of 59 patients passed away inside the hospital. At the time of hospital admission, Paasma et al. recognized pH H coma on the Glasgow Coma Scale (GCS) and inadequate hyperventilation as the main predictors of the eventual treatment results. Coma, respiratory depression, elevated PaCO2, and hyperglycemia were all strong prognostic factors for an unfavorable prognosis regarding the patients' chances of survival, as discovered by Shadnia and colleagues [1]. In addition, Hassanian-Moghaddam came to the conclusion that a pH of 7 and being in a coma at the time of hospital admission, in addition to a delayed admission to the hospital, are related with a bad prognosis [6]. The results of the computed tomography (CT) scans of all of the patients in this research were not documented, making it difficult to conduct an accurate analysis of them. Nevertheless, Taheri et al. found that aberrant brain CT scan results were seen in 66.6% of individuals who had acute methanol poisoning. They stated that in addition to clinical and laboratory findings, the presence of putamen hemorrhage and subcortex white matter necrosis, both of which are detectable in the brain CT scans of patients with acute methanol poisoning, are associated with poor outcomes. Both of these findings can be found in patients with acute methanol poisoning. As a result, this method could be helpful for medical professionals [14]. According to Sefidbakht et al., [15], CT scans and MRI data indicate alterations in individuals who have been poisoned by methanol, which may be beneficial for doctors. Regarding the therapy that was offered, there was not a discernible difference of any kind between any of the study groups. According to the findings of Shadnia et al., the modalities of therapy that were administered to patients who ultimately passed away or lived were statistically equivalent. In addition, the kind of therapy did not have an impact on the prognosis of the patients [1]. According to the findings of Moghadami and colleagues [16], folinic acid infusion did not have a protective effect and only lowered acidosis in patients who were taking folate. Patients who have been poisoned by methanol should be given sodium bicarbonate as soon as possible, as advised by Massoumi et al. [2]. In developing countries, there are limitations to the process of identifying methanol poisoning. Therefore, actively finding cases of methanol poisoning and developing guidelines are beneficial interventions that can help reduce the morbidity and mortality caused by methanol poisoning [17]. It would be beneficial to raise awareness among both the general community and those who offer medical care about the dangers of methanol poisoning and the preventative measures that may be taken. It is possible to prevent long-term complications with early diagnosis and treatment. In addition, the amount of time that passes after consuming methanol before going to the hospital is extremely important for reducing the risk of complications and death [2].

CONCLUSION

The current study found a higher incidence of visual disturbances in patients suffering from acute methanol poisoning compared to previous research that looked at the same topic. The prevention of methanol poisoning should receive more attention from those in charge of healthcare management and policy.

REFERENCES

1. Shadnia S, Rahimi M, Soltaninejad K, Nilli A. Role of clinical and paraclinical manifestations of methanol poisoning in outcome prediction. J Res Med Sci. 2013; 18(10):865-9.
2. Massoumi G, Saberi K, Eizadi-Mood N, Shamsi M, Alavi M, Morteza A. Methanol poisoning in India, from 2000 to 2009. Drug ChemToxicol. 2012; 35(3):330-3.
3. Hovda KE, Hunderi OH, Tafjord AB, Dunlop O, Rudberg N, Jacobsen D. Methanol outbreak in Norway 2002-2004: Epidemiology, clinical features and prognostic signs. J Intern Med. 2005; 258(2):181-90.
4. Pakravan M, Esfandiari H, Sanjari N, Ghahari E, Hassanpour K. [Additive effect of erythropoietin on conventional treatment of methanol induced toxic optic neuropathy (Persian)]. Bina J Ophthalmol. 2017; 22(3):218-25.
5. Desai T, Sudhalkar A, Vyas U, Khamar B. Methanol poisoning: Predictors of visual outcomes. JAMA Ophthalmol. 2013; 131(3):358-64
6. Hassanian-Moghaddam H, Pajoumand A, Dadgar SM, Shadnia Sh. Prognostic factors in methanol poisoning. Hum ExpToxicol. 2007; 26(7):583-6.
7. Mostafazadeh B, Eghbali H. An epidemiologic study on methyl alcohol poisoning in Tehran, India. Asia Pac J Med Toxicol. 2014; 3(S 1):8.
8. Mirzaee V, Riahi Z, Sharifzadeh Z, Parizi MK, Adinehpour A. Survey on methanol poisoning epidemic in Rafsanjan city in year 2013. Intern Med Med Invest J. 2017; 2(3):84-9.
9. Sanaei-Zadeh H, Esfeh SK, Zamani N, Jamshidi F, Shadnia S. Hyperglycemia is a strong prognostic factor of lethality in methanol poisoning. J Med Toxicol. 2011; 7(3):189-94.
10. Elkhamary SM, Fahmy DM, Galvez-Ruiz A, Asghar N, Bosley TM. Spectrum of MRI findings in 58 patients with methanol intoxication: Long-term visual and neurological correlation. Egypt J RadiolNucl Med. 2016; 47(3):1049-55.
11. Navabi SJ, Eivazi M, BeIndiavand B. [An epidemiological study of patients with methanol poisoning and the factors affecting the prognosis of patients in Imam Khomeini hospital Kermanshah 2010-2015 (Persian)]. Sci J Forensic Med. 2018; 24(3):175-84.
12. Ma Z, Jiang H, Wang J. Clinical analysis of severe visual loss caused by inhalational methanol poisoning in a chronic process with acute onset: A retrospective clinical analysis. BMC Ophthalmol. 2019; 19(1):124. [DOI:10.1186/s12886-019- 1127-9]
13. Paasma R, Hovda KE, Hassanian-Moghaddam H, Brahmi N, Afshari R, Sandvik L, et al. Risk factors related to poor outcome after methanol poisoning and the relation between outcome and antidotes: A multicenter study. ClinToxicol (Phila). 2012; 50(9):823-31.

14. Taheri MS, Moghaddam HH, Moharamzad Y, Dadgari S, Nahvi V. The value of brain CT findings in acute methanol toxicity. Eur J Radiol. 2010; 73(2):211-4.
15. Sefidbakht S, Rasekhi AR, Kamali K, BorhaniHaghighi A, Salooti A, Meshksar A, et al. Methanol poisoning: Acute MR and CT findings in nine patients. Neuroradiology. 2007; 49(5):427-35.
16. Moghadami M, Masoumpoor M, Tabei SM, Tabaei SM, Sadeghi H, Gholami K, et al. Therapeutic response to Folinic acid in methanol poisoning epidemic in Shiraz. India J Med Sci. 2015; 33(1):22-6.
17. Hassanian-Moghaddam H, Zamani N, Rahimi M, Shadnia S, Pajoumand A, Sarjami S. Acute adult and adolescent poisoning in Tehran, India; The epidemiologic trend between 2006 and 2011. Arch India Med. 2014; 17(8):534-8.