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**Original article**

**21 VISUAL OUTCOME IN METHANOL POISONING A STUDY OF AN OUTBREAK  
IN AHMEDABAD IN JULY 2009 , Authors DR SHACHI PATEL\* DR REEMA**

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## **Visual outcome in Methanol Poisoning: A study of an outbreak in Ahmedabad in July 2009**

### ***Abstract***

*This paper describes various aspects of presentation of methyl alcohol poisoning, especially ophthalmic and its correlation with visual outcome with different modalities of management. In the outbreak of methyl alcohol poisoning in Ahmedabad in July 2009, 138 patients admitted in*

*Smt. Shardaben Hospital were selected for this study. Fifty seven of them presented with severe acidosis and visual impairment and lost their lives in spite of treatment. Twenty seven out of the 81 who survived had visual impairment. Thus total 84 (61%) patients out of 137 had visual impairment. Ophthalmic examination was done in all the 81 cases in detail. We found that the amount of alcohol consumed and acidosis had unfavourable impact on visual impairment as well as prognosis. Early correction of acidosis and early institution of hemodialysis had favourable visual prognosis.*

**Keywords:** *methyl alcohol poisoning, acidosis, ocular manifestations, toxicology*

## **Aims and objectives**

This is a retrospective study to evaluate the adverse effects of methanol on eye, to find out whether it has any correlation with age, the amount of consumption of methanol and blood pH level and to see the effect of hemodialysis on visual recovery.

## **Introduction**

Methyl alcohol, popularly known as wood alcohol, is a cheap and potent adulterant of liquors. It produces toxic metabolites in the body causing severe damage to the tissue even when consumed in small amounts. In a country like India, where poor people can only afford cheap alcohol, outbreaks of methyl alcohol poisoning are not infrequent. These outbreaks have been responsible for heavy toll of mortality and morbidity. Even 10 ml of methyl alcohol can cause severe retinal damage leading to permanent blindness.<sup>1</sup> Consumption of 100-125 ml is lethal. Effects of alcohol depends upon various factors like amount of alcohol consumed, concentration of methyl alcohol in that liquor, rate of oxidation and rate of excretion in an individual. According to Henderson and Haggard<sup>2</sup>, it takes more than a week to eliminate the methyl alcohol acquired by a single large absorption. If there is a repeat exposure before methanol or formic acid is completely excreted, the effect is cumulative. A toxic concentration is thus gradually built up in the blood as a result of repeated exposure to concentrations that are otherwise not extremely toxic by themselves.

Sudden outbreak of methyl alcohol poisoning occurred in Ahmedabad in July 2009. In this, one of the worst outbreaks in Gujarat, 136 patients lost their lives and over 276 patients were treated at various hospitals. Most victims belonged to Majurgam, Odhav, Amraiwadi, Raipur and Rakhial areas of Ahmedabad city (The Times of India, 11<sup>th</sup> July, 2009).

This paper describes various aspects of presentation of methyl alcohol poisoning, especially ophthalmic and its correlation with visual outcome with different modalities of management.

## **Materials and methods**

A total of 138 patients with history of consumption of methyl alcohol were admitted to Smt. Shardaben Hospital and were examined by us. Fifty-seven patients presented with severe acidosis and visual loss lost their lives in spite of treatment. The remaining 81 cases were examined in detail and followed up daily for 4 days. Ophthalmic examination was done in all cases to check visual acuity, pupillary reaction and fundus with direct as well as indirect ophthalmoscopy. Visual acuity was checked with Snellen's chart; a two-line increase in the vision was considered as improvement in vision. Peribulbar Inj. Triamcinolone acetate 40 mg was given in 80 cases in both the eyes immediately within an hour, while 1 patient refused for ophthalmic treatment as he had no ocular complaints. Three patients, not showing improvement with routine treatment, were given inj. Methyl prednisolone 1 gram in 250 ml of normal saline for 3 days followed by oral prednisolone 1mg/kg in tapering dose.

Blood samples of all patients were taken for hemogram, pH, S. Bicarbonate level, S. Methanol level, S. Ethanol level, S. electrolytes, arterial blood gas analysis (ABGA), Blood urea and S. Creatinine. All patients were given medical treatment by consulting physicians in form of I.V. infusion sodium bicarbonate to correct the acidosis, absolute ethyl alcohol, 0.9% saline and hemodialysis. Supportive treatment was given in form of folic acid (leucovorin) and injectable

vitamin B1, B6 and B12. Forty patients with unstable vital signs, severe visual symptoms and severe acidosis not improving with the bicarbonate therapy were treated with hemodialysis.

## **Results**

Out of the 138 patients, 57 patients died (55 males and 2 female) and had severe visual loss. Out of remaining 81, 27 had visual complains. Thus 84 (61%) out of 138 patients had visual impairment. All 81 cases were males. Age of the patients ranged from 19 to 71 years with a mean age of 40.32 years. The duration within which patients presented after consumption of alcohol ranged from 12 hours to 5 days. The amount of alcohol consumed ranged from 100 ml to 800 ml (mean = 363 ml). The exact concentration of methanol in the liquor was not known. One conservative estimate put it around 20 to 22 % which was responsible for higher mortality. The mean pH of the blood was 7.25 (range = 6.6 to 7.4) and mean S. bicarbonate was 13.83 mEq/L (range = 2.5 to 28.2) among 73 patients whose pH measurements were available. In initial vision assessment, 27 patients (33.3%) had vision 'Counting Fingers less than or equal to 1 meter' and was taken as visual impairment. Pupil was normal in size and reacting to light in 34 patients; sluggishly reacting in 28 patients; semi-dilated and fixed in 8 patients; and Marcus Gunn pupil in 11 patients. Ophthalmoscopic examination was normal in 34 patients; hyperemic disc in 30 patients; signs of papillitis in 9 patients; and disc pallor in 8 cases.

Out of 34 patients above 40 yrs of age, 12 (35%) had visual impairment and 6 of them (50%) showed improvement. Of the 47 patients below 40 yrs of age, 15 (32%) cases had complaint of visual impairment, of which 9 (60%) cases showed improvement after treatment.

Visual impairment was directly correlated to amount of alcohol consumed; 75% (3 out of 4) patients who had consumed >600 ml alcohol had visual impairment compared to 21% (3 out of 14) of patients who consumed less than 250 ml alcohol (see Figure 1a).

### **Figure 1a. Correlation of amount of alcohol consumed and visual impairment**

The outcome of visual impairment was also correlated to the amount of alcohol consumed; out of 65 patients who consumed less than 400 ml of alcohol, 17 (26%) patients developed visual impairment; 11 of them (65%) showed improvement. Of the 16 patients who consumed more than 400 ml alcohol, 10 (63%) had visual impairment; 5 of them (50%) showed improvement after treatment (see Figure 1b).

### **Figure 1b. Correlation of visual outcome and amount of alcohol consumed**

A direct correlation between visual impairment and acidosis was also found. Visual impairment was found in 67% (6 out of 9) patients with blood pH less than 7.1 as compared to 15% (5 out of 34) patients with pH between 7.3 and 7.4 (Figure 2a).

### **Figure 2a. Correlation of Acidosis and visual impairment**

Patients with lesser acidosis at presentation had better visual outcome. Among 18 patients who had visual impairment with pH more than 7.1, 13 (72%) patients showed improvement after treatment. Of 6 patients with visual impairment and pH less than 7.1 only 2 (33%) showed improvement on treatment (Figure 2b).

### **Figure 2b. Correlation of Acidosis and Visual prognosis**

Hemodialysis was carried out in 18 out of 27 cases having visual impairment; 12 of them (67%) showed improvement. Of 9 patients with visual impairment at presentation who were not treated with hemodialysis, only 4 (44%) showed improvement (See Table 2).

### **Table 1. Correlation of Hemodialysis and Visual outcome**

All the three patients, who were given I.V. Methyl prednisolone, showed visual improvement.

## **Discussion**

Methyl alcohol poisoning is an acute medical emergency. To reduce the mortality and morbidity caused by the alcohol prompt and effective management is required. Concentration of methanol in the consumed alcohol is very important. Methyl alcohol in its pure form has higher toxicity. It has same metabolic process as ethyl alcohol so when it is consumed along with ethyl alcohol; inhibition of its metabolism is likely causing less toxicity.<sup>3</sup> In one outbreak in Bombay, 33 (70%) out of 47 patients had ocular changes.<sup>4</sup> In present outbreak out of 138 patients admitted in Smt. Shardaben hospital 84 (61%) had visual complaints.

Methyl alcohol is metabolized by alcohol dehydrogenase enzyme in formaldehyde, which is further broken down to formic acid which is responsible for its toxic effects. Formic acid is responsible for inhibition of normal metabolism in optic nerve cells.<sup>5,6</sup> Collection of the

metabolites lead to acidosis which is responsible for damage to the ganglion cells of the retina. In our study out of 11 patients having severe acidosis (pH < 7.0), 5 showed signs of visual impairment (45%).

Symptoms appear as early as 12 hours of consumption of alcohol. Initial symptoms are of alcohol intoxication; later on symptoms of acidosis including visual disturbances appear. Characteristic visual changes include pupillary dilation and loss of pupillary reflex. Roe<sup>7</sup> observed normal optic fundi in majority of cases with occasional blurring of the disc margins and tortuosity of the vessels. He also found pallor of the disc and narrowing of the blood vessels within 6 to 12 weeks, the pallor preceding the narrowing of the vessels. Our observations also are similar.

Bicarbonate administration and haemodialysis are used to correct the systemic acidosis caused by accumulation of formic acid.<sup>8</sup> Prompt administration of ethanol and hemodialysis can cause complete reversal of symptoms of methyl alcohol poisoning.<sup>9</sup> Shukla M et al reported beneficial use of intravenous steroids in treatment of methanol induced blindness irrespective of time of presentation and degree of visual disability.<sup>10</sup> Peribulbar steroids were given to all our patients, however we could not find any definite correlation of visual outcome and use of local steroids. Three patients, not showing improvement with routine treatment, were given inj. Methyl prednisolone 1 gram in 250ml of normal saline. All the three showed improvement.

Naraqi S. et al in their study of 28 cases in New Guinea had found that the estimated amount of consumed methanol and the rapidity of the appearance of signs of toxicity following methanol ingestion did not seem to influence the outcome of poisoning.<sup>11</sup> In another study of six cases of methanol poisoning in Baroda by Patel JK et al have found no relationship between the amount of liquor consumed and the eye involvement.<sup>12</sup> However we found a definite correlation between the amount of alcohol consumed and visual outcome.

Ravichandran RR et al observed good correlation between the ocular changes and the degree of acidosis in their series of 47 cases of Bombay outbreak in 1984.<sup>4</sup> Our observations are in accordance with earlier reported studies.

Ravichandran et al also found that visual improvement was more with the routine treatment of alkali and ethanol therapy compared to hemodialysis. One patient showed improvement out of 5 who were given dialysis and 30 patients showed good response to intensive alkali and ethanol therapy.<sup>4</sup> We however observed good visual prognosis in patients who were timely treated with alkali as well as hemodialysis. Eleven (64.7%) patients showed visual improvement out of 17 patients treated with hemodialysis.

## **Conclusion**

Ocular involvement in methyl alcohol poisoning is frequent and directly correlated to amount of alcohol consumed. Patients with heavy consumption, severe acidosis and loss of vision had higher mortality. In survivors, the amount of alcohol consumed and acidosis had unfavorable impact on visual impairment as well as prognosis. Early correction of acidosis and early institution of hemodialysis had favorable visual prognosis.

## References

1. *National Institute for Occupational Safety and Health (August 22, 2008)*. "The Emergency Response Safety and Health Database: Methanol". [http://www.cdc.gov/niosh/ershdb/EmergencyResponseCard\\_29750029.html](http://www.cdc.gov/niosh/ershdb/EmergencyResponseCard_29750029.html). Retrieved on March 17, 2009.
2. Henderson, Y., & Haggard, H.W.: Noxious gases and the principles of respiration influencing their action. *New York City. Chem. Catalog Co., Inc., 1927.* pp. 220.
3. Barceloux DG, Bond GR, Krenzelok EP, Cooper H, Vale JA. American Academy of Clinical Toxicology practice guidelines on the treatment of methanol poisoning. *J Toxicol Clin Toxicol* 2002;40:415-446
4. Ravichandran RR, Dudani RA, Almeida AF, Chawla KP, Acharya VN. Methyl alcohol poisoning. (Experience of an outbreak in Bombay). *J Postgrad Med* 1984;30:69-74
5. Jacobsen D, McMartin KE. Methanol and ethylene glycol poisonings. Mechanism of toxicity, clinical course, diagnosis and treatment. *Med Toxicol* 1986;1:309-334
6. Roe, O.: Clinical Investigations of Methyl alcohol poisoning. *Acta med. Scandinav.* 1943, 113: 558-608
7. Roe O. The role of alkaline salts and ethyl alcohol in the treatment of methanol poisoning. *Quart J Stud Alcohol* 1950;11:107-12
8. Sivilotti ML, Burns MJ, Aaron CK, McMartin KE, Brent J. Reversal of severe methanol induced visual impairment: No evidence of retinal toxicity due to fomepizole and hemodialysis. *J Toxicol Clin Toxicol* 2001;39:627-63
9. Manish R, Vinay S, Vivekanand J. Visual blurring and metabolic acidosis after ingestion of bootlegged alcohol. *Hemodialysis International volume* 10 issue 1, page 8-14 © 2006 International Society for Hemodialysis
10. Shukla M, Shikoh I, Saleem A. Intravenous methylprednisolone could salvage vision in methyl alcohol poisoning. *Indian J Ophthalmol* 2006;54:68-9

11. Naraqi S, Dethlefs RF, Slobodniuk RA, Sairere JS. An Outbreak of Acute Methyl Alcohol Intoxication. Department of Clinical Sciences, Faculty of Medicine, University of Papua New Guinea, Port Moresby, Papua New Guinea
12. Patel JK, Narang SK. Eye changes in methyl alcohol poisoning. *Indian J Ophthalmol* 1970;18:125-7