Methanol intoxication epidemiology

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Investigating the epidemiology of the methanol poisoning outbreaks in the third millennium: a scoping review protocol

SYSTEMATIC REVIEW PROTOCOL

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- Relevant studies from 2000 to 2020 regarding methanol poisoning outbreaks and map
  - Focus on the epidemiology and global burden of disease.
- Included databases (MEDLINE, Scopus, Embase, and Web of Science) and Google Scholar

Methanol poisoning outbreaks (MPOs)

- Methanol poisoning outbreaks (MPOs) definition:
  - Three victims within <48 to 72 hours will be considered as MPO.
- The most recent WHO fact sheet (July 2014) mentioned several MPOs in countries such as Iran, the Czech Republic, Estonia, Norway, Kenya, and Libya with outbreak sizes of 20 to 800 victims and a mortality rate of over 30% in some occasions.

SYSTEMATIC REVIEW PROTOCOL

LOGHMARI. Int Arch Subst Abuse Rehabil 2022, 4:016
DOI: 10.23937/2690-263X/1710016
Volume 4 | Issue 1
Open Access

International Archives of
Substance Abuse and Rehabilitation

ORIGINAL ARTICLE

Acute Methanol Poisoning in Tunisia: Clinical Features, Biological and Associated Factors for Mortality

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- Methanol (CH3OH), formerly, was known as woodalcohol because it was obtained by distillation of wood,now, is prepared by synthesis .
- Acute Methanol Poisoning (MP) is most often due to accidental ingestions due to distillation, fermentation errors

Acute Methanol Poisoning in Tunisia: Clinical Features, Biological and Associated Factors for Mortality

- **Population and Methods**

  Cases started consulting the Emergency Room (ER) on a festive day (1st day of Aid el Feter) corresponding to May 24, 2021.

- All of date were collected form admition

Result

- The study population consisted of 65 patients
- The majority of patients had a primary educational level (86.1%).
- The ingestion of methanol was associated to other substances in 46.1% of cases
  - Cannabis (15.3%)
  - Organochlorine (3%)
  - Parkizol(3%)
  - Ethanol (1.5%).
- The median delay between the ingestion of methanol and the medical consultation was 48.0 [24.0-50.0] hours
  - Minimum of 7 hours
  - Maximum of 72 hours

Clinical features characteristics

	Total n (%)
Headache	57 (87.6)
Dizziness	56 (86.1)
Dyspnea	4 (6.1)
Coma	7 (10.7)
Sleepiness	9 (13.8)
Isoreactive mydriasis	6 (9.3)
Reactive mydriasis	3 (4.6)
Seizures	8 (12.3)
Signs of shock	9 (13.8)

	Median [Q25–Q75]
SBP (mmHg)	12.0 [11.0-13.0]
DBP (mmHg)	70.0 [60.0-80.0]
HR (bpm)	90.0 [80.0-106.5]
RR (cpm)	20.0 [18.0-22.0]
SaO_2 (%)	98.0 [96.0-99.0]

Comparison of mortality rate between different studies.

Country	Year	n (%)
Canada [23]	1998	50 (36.0)
UNITED STATES [24]	2000	24 (33.3)
Norway [13]	2005	51 (17.6)
Iran [25]	2007	25 (48.0)
Tunisia [11]	2007	16 (19.0)
India [26]	2012	63 (31.7)
Iran [27]	2013	42 (40.5)
Czechia [7]	2014	121 (33.9)
Taiwan [16]	2014	32 (34.4)
Canada [12]	2015	55 (1.8)
Libya [28]	2016	1066 (9.5)
Kenya [28]	2016	467 (26.9)
Czechia [9]	2017	106 (21.7)
Uganda [6]	2017	15 (80.0)
Taiwan [18]	2018	50 (28.0)
China [8]	2019	52 (3.8)
Tunisia	2020	65 (12.3)

Discussion

- Despite the improvement in treatment, morbidity and mortality following MP remain high. This may be explained by the delay in diagnosis and therapeutic management
- The outcome was related to the degree of metabolic acidosis
- In a multicenter study of Paasma, et al. low pH (pH of 7) was also found to be among the strongest predictors of poor outcome

WIKIPEDIA
The Free Encyclopedia

List of methanol poisoning incidents

- Outbreaks of methanol poisoning have occurred when methanol is used to adulterate moonshine

WHO Model List of Essential Medicines

- If as little as 10 ml of pure methanol is ingested can cause permanent blindness by destruction of the optic nerve, and 30 ml is potentially fatal

Vale A (2007). "Methanol". *Medicine*. **3**

WIKIPEDIA
The Free Encyclopedia

List of methanol poisoning incidents

- **Australia**
  In 2013 three people died and one suffered partial blindness
  In 1997 two people from Central Australia died
- **Brazil**
  In 1999, 35 people died, in ten cities of the state of Bahia
- **Cambodia**
  In 2012, 49 people died, and more than 300 people were hospitalized
  Costa Rica
  25 persons died in August 2019 due to methanol poisoning

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List of methanol poisoning incidents

- **Czech Republic**
  Over the course of several days, 38 people in the Czech Republic and 4 people in Poland died as a result of methanol poisoning and several tens of others were taken to hospital

- **El Salvador**
  as many as 122 people died in 2000 as a result of drinking low quality liquors sold in unauthorized shops
- **Estonia**
  September 2001, when 68 people died and 43 were left disabled

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List of methanol poisoning incidents

- **India**

India has a thriving moonshine industry, and methanol-tainted batches have killed over 2,000 people in the last 3 decades, including:

- 1976: 100 people died in Gujarat
- 2008: 148 people in Karnataka & Tamil Nadu
- 2019: In February 2019, just days after the Uttar Pradesh and Uttarakhand deaths (above),156 people (mostly tea plantation workers) died in Assam state. see 2019 Assam alcohol poisonings
- 2022: 2022 Gujarat Toxic Liquor deaths

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List of methanol poisoning incidents

- **Iran**
  - In 2013, as a result of methanol mass poisoning in Iran 694 people were hospitalised in the city of Rafsanjan. 8 people were reported
  - During the COVID-19 pandemic in Iran, nearly 300 people died and over a thousand became ill from drinking methanol in the belief that drinking it can kill the virus in the body
- **Ireland**
- Two men were killed in a methanol poisoning incident near to Burtonport

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List of methanol poisoning incidents

- **Madagascar**

The Madagascar methanol mass poisoning occurred in 1998 when 200 people died

Malaysia
From September until October 2018, 45 people have been reported died
Mexico
during the COVID-19 pandemic may have exacerbated Reportedly, 35 people died in 2020 in just one mass poisoning incident due to methanol tainted drinks

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List of methanol poisoning incidents

- **Norway**

  Between September 2002 and December 2004, 51 people were admitted to hospital with symptoms of methanol poisoning, of whom 9 died.
  A further 8 people who died outside hospital were found to have died from methanol poisoning following autopsy

- The liquor responsible for all of the cases contained 20% methanol and 80% ethanol and probably came from the same source in southern Europe

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List of methanol poisoning incidents

- **Russia**

  In December 2016, 72 people died

  In October 2021, in Orenburg, 35 people died

  in October 2021 18 people died a

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List of methanol poisoning incidents

- **Turkey**

2004 - 21 deaths in Istanbul

2005 - 23 deaths in Istanbul

2011 - 5 Russian tourists died in the Turkish Riviera

2015 - 32 deaths in Istanbul,3 deaths in Izmir

2020 - At least 44 deaths from bootleg drink made with methanol around the country

2021 - 22 deaths in Istanbul.

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The Free Encyclopedia

List of methanol poisoning incidents

- **United States**

  In December 1963, a rash of 31 deaths

  In January 2016 two Tennessee high school students

  In April 2018, a Massachusetts man died

What happened after methanol ingestion

International Journal of
Medical Toxicology & Forensic Medicine
Summer 2021, Volume 11, Number 3

Research Paper: Visual Disturbances in Patients With Acute Methanol Poisoning: A Cross-sectional Study.

Razieh Sadat Mousavi-Roknabadi[1,2], Mahdi Alibeigi[1,3*], Mehrdad Sharifi[1,2], Reyhaneh Sadat Mousavi-Roknabadi[4], Zahra Beizavi[5]

- This study aimed to evaluate the incidence of visual disturbances in patients with acute methanol poisoning in the south of Iran
- This retrospective cross-sectional study (from 21/ March/2014 to 21/March/2019)
-

Results

Variables		Total	With Visual Disturbances (n=15)	Without Visual Disturbances (n=5)	P
Age (y) (Mean±SD)		33.15±10.4	33.47±9.92	32.20±12.76	0.788
Gender No. (%)	Men	20 (100)	15 (100)	5 (100)	-
	Women	0 (0)	0 (0)	0 (0)	
Marital status No. (%)	Single	17 (85)	13 (86.7)	4 (80)	0.468
	Married	2 (10)	1 (6.7)	1 (20)	
	Not determined	1 (5)	1 (6.7)	0 (0)	
Place of live No. (%)	Urban	9 (45)	6 (40)	3 (60)	0.585
	Rural	7 (35)	6 (40)	1 (20)	
	Not determined	4 (20)	3 (20)	1 (20)	
Educational level No. (%)	Illiterate	1 (5)	1 (6.7)	0 (0)	0.712
	Primary	1 (5)	1 (6.7)	0 (0)	
	Middle school	2 (10)	2 (13.4)	0 (0)	
	Diploma	6 (30)	5 (33.3)	1 (20)	
	Not determined	10 (50)	6 (40)	4 (80)	

Results

Variables		Total	With Visual Disturbances (n=15)	Without Visual Disturbances (n=5)	P
History of addiction No. (%)	Yes	2 (10)	2 (13.4)	0 (0)	1.0
	No	12 (60)	8 (53.3)	4 (80)	
	Not determined	6 (30)	5 (33.3)	1 (20)	
History of psychological diseases	No. (%)				
	Yes	1 (5)	1 (6.7)	0 (0)	1.0
	No	14 (70)	11 (73.3)	3 (60)	
	Not determined	5 (25)	3 (20)	2 (40)	
History of suicide No. (%)	Yes	0 (0)	0 (0)	0 (0)	-
	No	13 (65)	10 (66.7)	3 (60)	
	Not determined	7 (35)	5 (33.3)	2 (40)	
Transfer to hospital No. (%)	By himself	4 (20)	4 (26.6)	0 (0)	0.679
	Individual acquaintances	10 (50)	7 (46.6)	3 (60)	
	Emergency medical service	2 (10)	2 (13.4)	0 (0)	
	Not determined	4 (20)	2 (13.4)	2 (40)	
Duration between consumption	and arrival to the hospital (hour) (Mean±SD)	3.13±2.85	3.28±3.04	2.0±0.1	0.429
Duration of hospitalization (day)	(Mean±SD)	3.94±3.98	4.29±4.61	3.0±0.71	0.094
Outcome No. (%)	Discharged	19 (95)	14 (93.3)	5 (100)	1.0
	Death	1 (5)	1 (6.7)	0 (0)	

Table 2.. The patients' signs, symptoms, and laboratory data at the time of admission to the hospital

Variables		Total	With Visual Disturbances (n=15)	Without Visual Disturbances (n=5)	P
Vital signs (Mean±SD)	Systolic blood pressure (mmHg)	138.20±17.16	140.20±18.18	132.20±13.50	0.102
	Diastolic blood pressure (mmHg)	74.95±31.41	73.40±34.92	79.60±19.58	0.875
	Heart rate (/minutes)	96.80±20.28	92.60±17.05	109.40±25.91	0.783
	Respiratory rate (/minutes)	19.21±1.51	19.13±1.51	19.50±1.73	0.580
	Temperature (°C)	36.53±0.86	36.52±0.94	36.57±0.67	0.674
	GCS (/15)	14.41±2.65	14.15±3.17	15.0±0.0	0.357
CNS No. (%)	Alert	19 (95)	14 (93.3)	5 (100)	1.0
	Coma	1 (5)	1 (6.7)	0 (0)	
Ophthalmic No. (%)	Blindness	7 (35)	7 (46.6)	0 (0)	0<0.001*
	Blurred vision	8 (40)	8 (53.3)	0 (0)	
	Photophobia	0 (0)	0 (0)	0 (0)	
	No symptom	5 (25)	0 (0)	5 (100)	
Treatment No. (%)	Gastric lavage	0 (0)	0 (0)	0 (0)	-
	Active charcoal	1 (5)	1 (6.7)	0 (0)	1.0
	Hemodialysis	17 (85)	12 (80)	5 (100)	0.539
	Sodium bicarbonate	12 (60)	10 (66.7)	2 (40)	0.347
	Folic acid folinate	16 (80)	12 (80)	4 (80)	1.0
	Fompizol	0 (0)	0 (0)	0 (0)	-

Conclusion

- In the present study, the incidence of visual disturbances in patients with acute methanol poisoning was higher than that in similar studies.
- Healthcare managers and policymakers should pay more attention to preventing methanol poisoning

Neurology Perspectives 3 (2023) 100114

NEUROLOGY PERSPECTIVES

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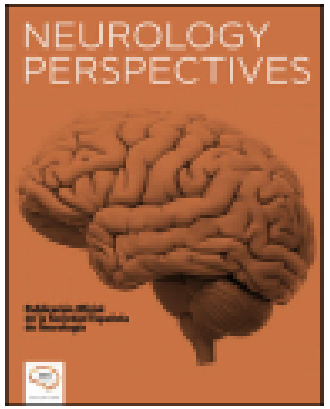

SCIENTIFIC LETTER

Multifocal neuraxial involvement in acute methanol intoxication: A series of two patients from rural India

Afectación multifocal del neuroeje en la intoxicación aguda por metanol: una serie de dos pacientes procedentes de la India rural

erythrocyte sedimentation rate, and moderately increased transaminases and gamma-glutamyl transferase. A serum creatine phosphokinase level was raised (1080 UI/L). Arterial blood gas analysis revealed high-anion gap metabolic acidosis (HAGMA). Visual evoked potential (VEP) showed prolonged P100 latency involving both eyes (right more than left). A nerve conduction study revealed a sensorimotor (sensory more than motor) polyneuropathy (lower limbs more than upper limbs). Magnetic resonance imaging (MRI) of the brain on day five of admission revealed bilaterally symmetrical hyperintense lesions on T2-weighted imaging and FLAIR sequences involving lentiform nucleus and hypointense

Case study report

- Report two patients with multifocal neuraxial involvement after acute methanol intoxication
- Case 1: A 22-year-old previously healthy man
- Case 2: A 31-year-old man from rural West Bengal (India)
  - Presented with an acute-onset painless diminution of vision (DOV) for the last day
  - MRI of the brain on day five of admission revealed bilaterally symmetrical hyperintense lesions on T2-weighted imaging

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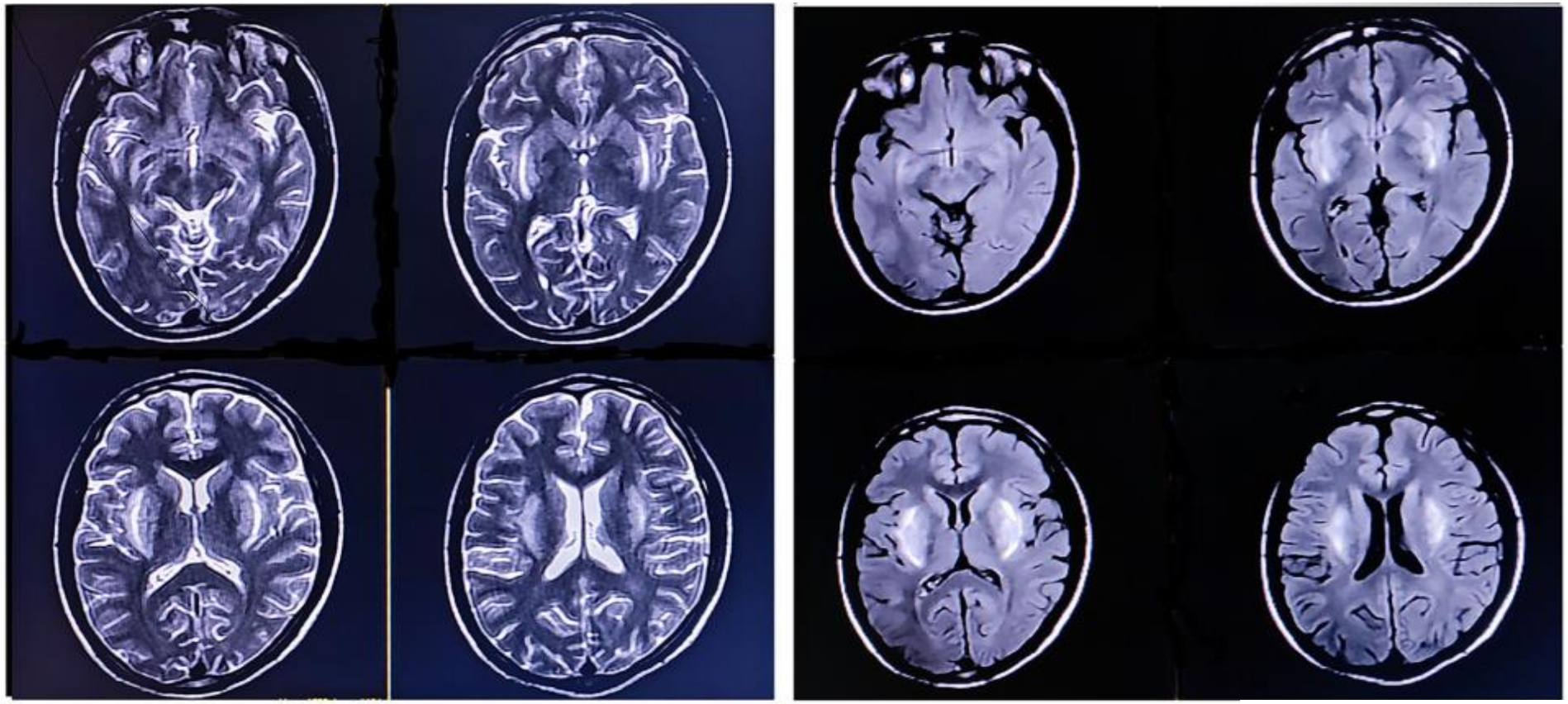
MRI of the brain on day five of admission revealed bilaterally symmetrical hyperintense lesions on T2-weighted imaging



A B

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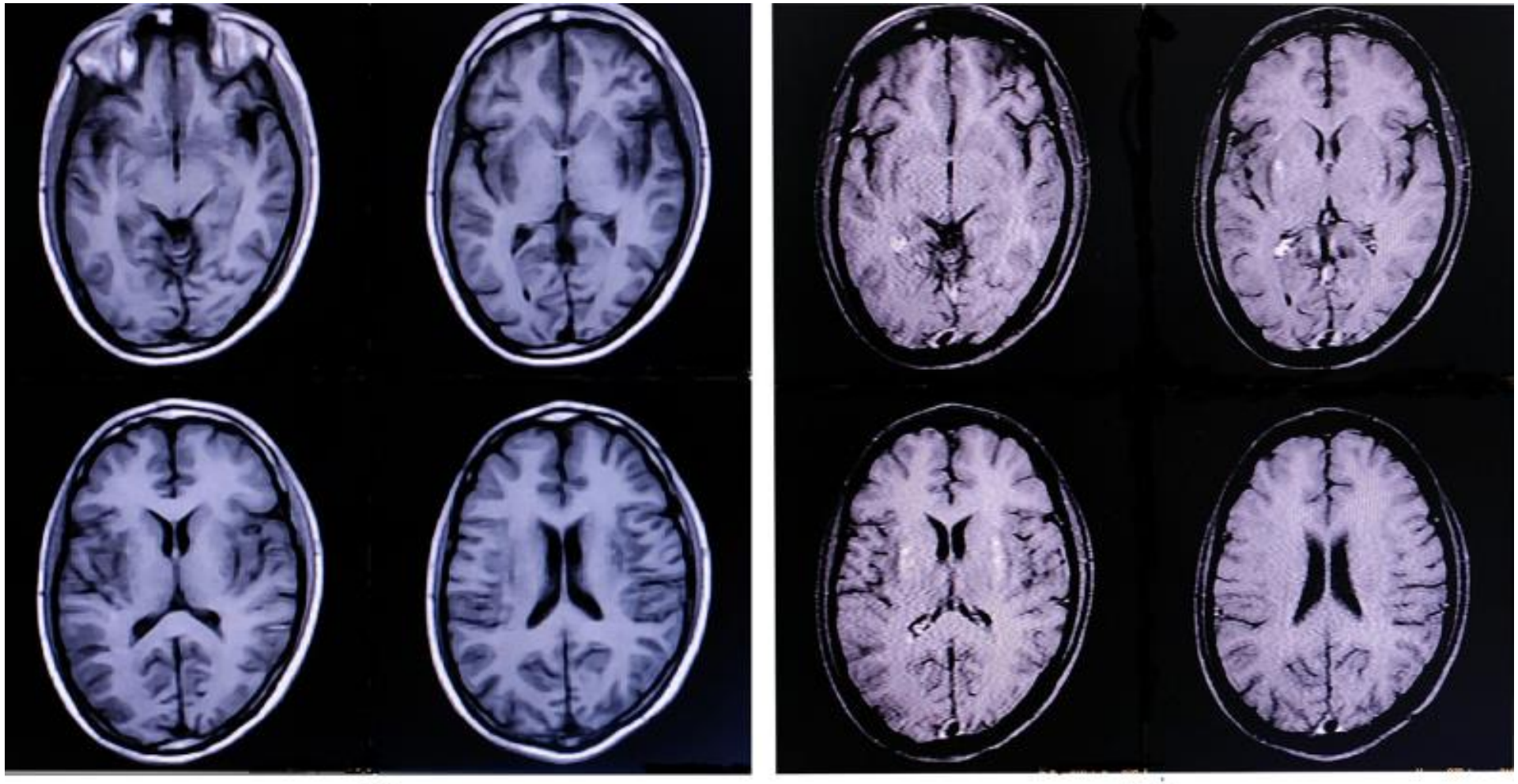
MRI of the brain on day five of admission revealed bilaterally symmetrical hyperintense lesions on T2-weighted imaging



C D

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Why optic nerve?

- There is no clear explanation for why formic acid affects the retina, optic nerve, and basal ganglia (putamen) but does not involve other brain areas
- Accumulating formic acid in high amounts in these areas has been suggested to lead to damage
- A possible explanation for this may be the expression of aquaporins, especially 1, 3, and 4, which are essential for the water and osmotic balance of brain cells and the optic nerve

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Acute methanol intoxication should be suspected

- When facing a patient with
  - Bilateral putaminal necrosis
  - Optic neuropathy
  - Polyneuropathy
  - Parkinsonism
  - Unexplained HAGMA
- Even in the absence of suggestive medical history.

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The treatment of acute methanol intoxication

- The elimination of methanol and prevent complications
- Ethanol and fomepizole competitively inhibit alcohol dehydrogenase
- Folic acid and folinic acid metabolize toxic formic acid to non-toxic carbon dioxide and water.
- Because folic acid may decrease cobalamin reserves, treatment with vitamins B6 and B12 is recommended for up to one month.
- Hemodialysis is used ultimately when other therapeutic measures fail

Neurology Perspectives 3 (2023) 100114

Acute Medicine & Surgery 2021;**8**:e715 doi: 10.1002/ams2.715

Original Article

Prevalence of clinical and radiologic features in methanol-poisoned patients with and without COVID-19 infection

Nasim Zamani,[1,2] Farzad Gheshlaghi,[3] Maryam Haghighi-Morad,[4] Hooman Bahrami-Motlagh,[4] Ilad Alavi Darazam,[5] Seyed Kaveh Hadeiy,[1] Rebecca McDonald,[6] and Hossein Hassanian-Moghaddam[1,2]

- In Iran, an outbreak of methanol poisoning was triggered by the coronavirus disease (COVID-19) pandemic in early March 2020
- The outbreak was found to be so huge when it was announced that the death toll due to methanol poisoning surpassed the deaths due to COVID-19 in Khuzestan

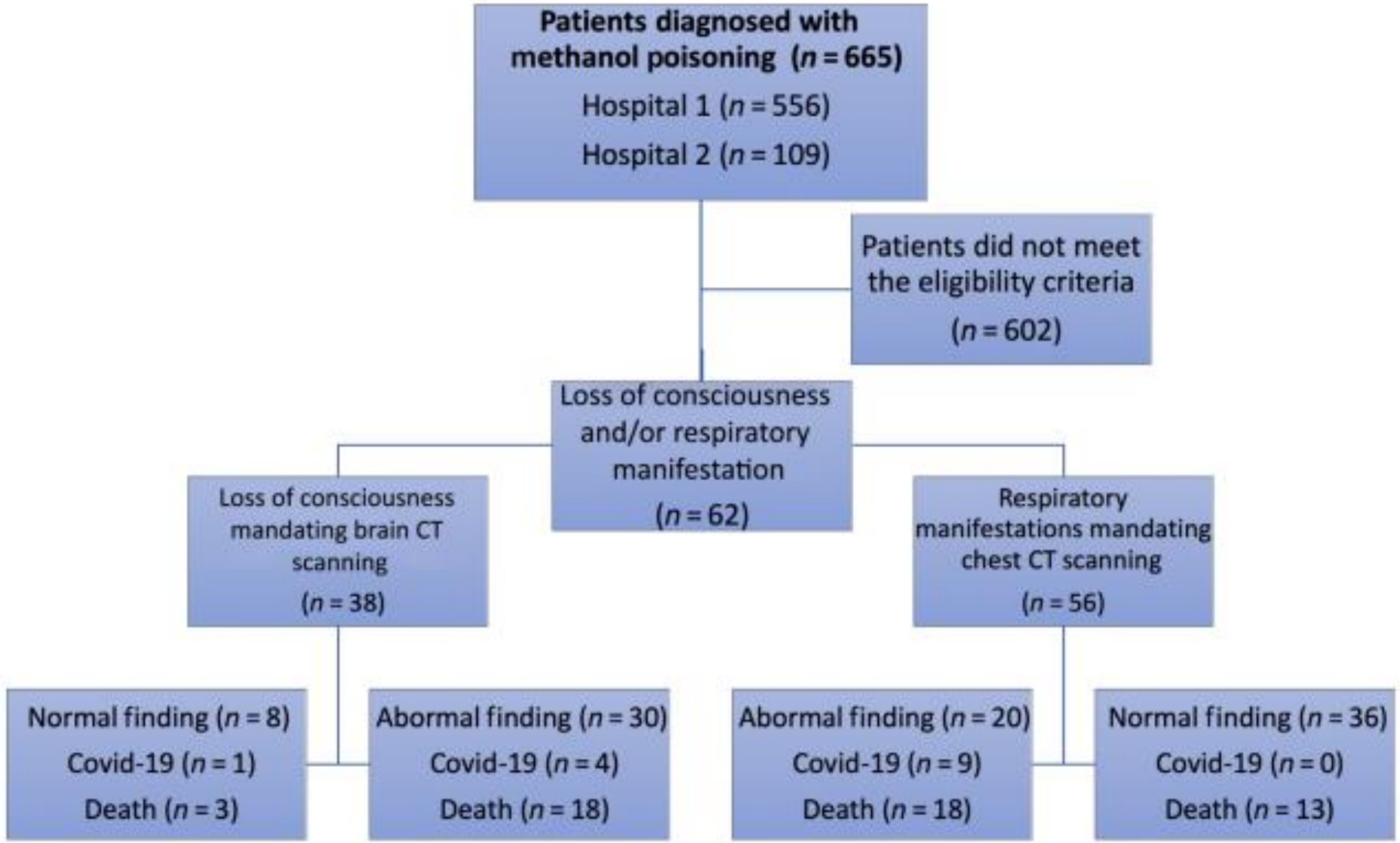
Study design and setting

- Retrospectively undertaken between March and June 2020
- The data were gathered from patients admitted to two toxicology referral centers in Iran
  - Loghman Hakim Hospital in Tehran
  - Alzahra Hospital in Isfahan.
- Inclusion criteria
- Confirm COVID-19 disease by PCR or chest CT

Data collection

- Questionnaire and by evaluation of the patients
- Electronic records
- laboratory data
- Radiologic work-up

Selection algorithm of 62 cases of methanol poisoning



RESULTS

- 62 confirmed methanol poisoning were enrolled into the study
  - Sixty patients (96.8%) had ingested alcoholic liquids
  - Three (4.8%) mentioned that they had consumed alcohol to disinfect themselves

Variables with significant group difference in methanol poisoned patients (COVID-19-infected vs. noninfected cases

	p-value[a]	Odds ratio	95% confidence interval	
Comorbidities	0.024	8.500	1.500	50.000
History of alcohol consumption	0.036	0.741	0.593	0.926
Abnormal chest CT scan	<0.001	4.300	2.500	7.200
Urea (<40 mg/dL)	0.004	0.050	0.010	0.480
Delay in first dialysis (<13.5 h)	<0.001	0.013	0.001	0.179
Delay in second dialysis (>20.5 h)	0.001	6.300	2.200	17.900
Duration of taking maintenance ethanol (>17 h)	0.007	3.500	1.800	6.900

Table 2. Chest computed tomography results in methanol-poisoned patients in Iran with and without COVID-19 infection

Radiologic pattern/frequency	COVID-19 patients (*n* = 9)	Non-COVID-19 patients (*n* = 47)	*p*-value	OR (95% CI)
Ground glass opacity	9 (100.0)	2 (4.1)	<0.001	23.50 (6.10, 91.20)
Crazy paving	0 (0.0)	0 (0.0)	–	–
Consolidation	4 (44.4)	7 (14.9)	0.063	–
Reticulation	0 (0.0)	0 (0.0)	–	–
Nodular infiltration	1 (11.1)	1 (2.0)	0.298	–
Reverse halo	0 (0.0)	0 (0.0)	–	–
Lymphadenopathy	0 (0.0)	0 (0.0)	–	–
Pleural effusion	0 (0.0)	1 (2.0)	0.999	–
Peripheral/subpleural	6 (66.7)	1 (2.0)	<0.001	0.01 (0.01, 0.12)
Central/ peribronchovascular	2 (22.2)	0 (0.0)	0.023	0.78 (0.55, 1.10)
Unilateral left	0 (0.0)	0 (0.0)	–	–
Unilateral right	1 (11.1)	1 (2.0)	0.289	–
Bilateral	6 (66.7)	9 (19.1)	0.008	0.12 (0.02, 0.57)

Note: Data are shown as *n* (%).
Abbreviations: –, not applicable; CI, confidence interval; OR, odds ratio.

Table 3. Brain computed tomography results in methanol-poisoned patients in Iran

	Involvement		
	Unilateral	Bilateral	None
Putaminal hypodensity	1 (2.6)	23 (60.5)	14 (36.8)
Putaminal hemorrhage	2 (5.3)	10 (26.3)	26 (68.4)
Subcortical WM hypodensity	0 (0.0)	15 (39.5)	23 (60.5)
ICH	2 (5.3)	2 (5.3)	34 (89.4)
IVH	4 (10.5); 1 (2.6) lateral ventricle; 1 (2.6) 4th ventricle; 2 (5.3) with hemorrhage in all brain ventricles		34 (89.5)
Diffuse cerebral edema	12 (31.6)		26 (68.4)
Cerebellar hypodensity	0 (0.0)	1 (2.6)	37 (97.4)

Note: Data are shown as *n* (%).
Abbreviations: ICH, intracranial hemorrhage; IVH, intraventricular hemorrhage; WM, white matter.

Variables with significant group difference (survivors vs. nonsurvivors) among methanol-poisoned patient

	p-value	Odds ratio	95% confidence interval	
			Lower	Upper
Need for second dialysis	0.030	3.611	1.109	11.763
Receiving loading ethanol	0.007	0.488	0.360	0.663
Receiving maintenance ethanol	0.007	0.488	0.360	0.663
GCS (<12/15)	0.000	10.900	2.600	45.600
Blood pressure (<120 mmHg)	0.019	4.000	1.200	13.400
Creatinine (>1.45 mg/dL)	0.004	5.600	1.700	18.600
pH (<7.08)	0.001	7.400	2.200	24.000
HCO_3 (<8.9 mEq/L)	<0.001	10.800	3.000	39.200
Base deficit/excess (<−22.150)	0.002	11.300	2.300	54.500
Duration of hospitalization (>3 days)	0.003	8.700	2.000	37.800
Diffuse cerebral edema on brain CT	0.003	16.000	1.797	142.438

CONCLUSION

- Could influence their outcome
  - Concurrent methanol poisoning and COVID-19
  - Higher urea level
  - Delayed medical care
- Among patients with methanol poisoning, specific attention should be paid
  - Elevated creatinine
  - Loss of consciousness
  - Severe acidosis

شاد و خرم باشید