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Review Paper

Predictors of Mortality in Methanol Poisoning: A Systematic Review and Meta-analysis

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ABSTRACT

Background: Today, methanol intoxication is increasing. Identifying mortality predictors has a significant correlation with poisoning progress. This meta-analysis study aimed to identify and evaluate mortality predictors for methanol poisoning.

Methods: In this study, we searched electronic databases for case-control and cohort studies related to methanol poisoning. The quality of the studies was evaluated using the STROBE checklist. Comprehensive meta-analysis 3 was used to calculate the odds ratio (OR) and 95% CI of the factors present, as well as to perform heterogeneity, sensitivity, and publication bias assessments.

Results: In this meta-analysis study, 14 out of 945 initial studies were included. The results identified 15 mortality predictors of methanol poisoning. The risk factors were ranked by the integrated OR values and included venous blood pH (OR=3.79, 95% CI, 2.42%, 5.19%), methanol concentration (OR=1.64, 95% CI, 1.05%, 2.55%), venous carbon dioxide pressure (PCO_2) (OR=9.993, 95% CI, 5.80%, 17.18%), base deficit (OR=2.943, 95% CI, 1.20%, 7.165%), hemodialysis time (OR=2.69, 95% CI, 1.35%, 5.35%), blood sugar (OR=9.84, 95% CI=3.86, 25.09), venous bicarbonate (HCO_3) (OR=2.97, 95% CI, 1.68%, 5.26%), creatinine (OR=13.10, 95% CI, 2.68%, 64.04%), potassium (K) (OR=3.51, 95% CI, 1.66%, 7.43%), alanine aminotransferase (OR=7.57, 95% CI, 1.03%, 55.57%), sodium (OR=6.69, 95% CI, 1.78%, 25.12%), white blood cells (OR=7.16, 95% CI, 1.42%, 36.16%), coma (OR=32.73, 95% CI, 18.59%, 56.70%), visual disturbances (OR=3.37, 95% CI, 1.59%, 7.16%), and gastrointestinal symptoms (OR=1.94, 95% CI, 1.16%, 3.22%).

Conclusion: Identifying mortality predictors and disease progression in methanol intoxication patients can help doctors diagnose patients at risk better and faster to provide effective treatment interventions for them.

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Introduction

Alcohol consumption is a significant obstacle within the field of public health in our nation, and this predicament has resulted in a substantial number of fatalities in recent years [1]. Methanol poisoning caused by illegal and homemade alcohol consumption is a major medical problem worldwide, and despite advances in diagnosis and treatment, the mortality rate is high [2-5]. Methanol is an organic, colorless, volatile, and slightly sweeter than alcohol solvent, achieved from wood fermentation, and is mainly used for industrial purposes [6]. Methanol is not toxic on its own; however, its metabolites, including formaldehyde and formic acid are the main responsible for toxicity in methanol poisoning [7]. Methanol poisoning epidemic has been reported in Iran and other countries in previous years, ranging from 0.8 to 17% in Iran and 16.5% in Sudan [8].

Patients can potentially be hospitalized at a medical facility due to various manifestations, including queasiness, regurgitation, impairments in visual perception, modified cognitive state, insufficient inhalation, rapid breathing, and discomfort in the thoracic region [7]. Methanol poisoning symptoms appear 12 to 24 hours after consumption because the toxic effects are due to the toxic metabolites of methanol. If there is a delay in hospitalization and treatment, severe metabolic acidosis occurs due to the conversion of methanol to toxic metabolites [9]. On the other hand, clinical symptoms, such as abdominal pain, dyspnea, hyperventilation, and visual disturbances may mimic the signs and symptoms of other diseases, which cause patients to die before reaching the hospital and methanol intoxication diagnosis [2, 4].

Researchers globally are looking for ways to quickly identify high-risk patients with poor prognosis. In previous studies, factors, such as delayed hospitalization after alcohol consumption, coma or seizures upon admission, severe metabolic acidosis, and inadequate hyperventilation have been identified as poor prognostic indicators in methanol poisoning [10-12]. Although various studies have investigated the prognostic indicators in cases of methanol intoxication, a comprehensive review of the subject has not yet been conducted. Due to the prevalence of alcohol consumption and the possibility of ethanol and methanol intoxication in alcoholic drinks, this meta-analysis study aimed to investigate methanol poisoning, risk factors, and complications, and identify the contributing factors that predict its consequences.

Materials and Methods

Study design

The present study was a systematic review and meta-analysis investigating the mortality predictors in methanol intoxication. The study was compiled based on the PRISMA checklist (Figure 1), and its protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) website (Code: CRD42023463298).

Search strategy

In this systematic review and meta-analysis study, all related studies were searched in SID, Magiran, ScienceDirect, Scopus, PubMed, ProQuest, Web of Science, and Google Scholar databases from initial to March 18, 2023. Keywords, including methanol, carbinol, wood alcohol, methyl alcohol, intoxication, poisoning, alcoholic intoxication, mortality, death, and fatality were used in the mentioned databases, and all combinations of these keywords were also searched. In the search process, all articles were obtained, and their information was transferred to EndNote software, version 20 (for Windows, Thomson Reuters) without any search restrictions. Also, to maximize the comprehensiveness of the search, the list of used references in related articles was manually checked.

PubMed search strategy was as follows: (Methanol [title/abstract]) OR (carbinol [title/abstract]) OR (wood alcohol [title/abstract]) OR (methyl alcohol [title/abstract]) AND (poisoning [title/abstract]) OR (intoxication [title/abstract]) OR (alcoholic intoxication [title/abstract]) AND (mortality [title/abstract]) OR (death [title/abstract]) OR (fatality [title/abstract]).

Population, intervention, comparison, and outcome (PICO) components

Patients: Methanol intoxication patients who died, intervention: Methanol, comparison: Survived methanol intoxication patients, and outcome: Mortality predictors.

Inclusion criteria

All observational studies (non-interventional studies), which had investigated the mortality predictors in methanol poisoning, were analyzed.

Exclusion criteria

Studies that did not have enough data for analysis, studies that examined factors that predict death in alcoholic patients other than methanol, studies that evaluated predictors other than mortality in methanol poisoning, studies for which the complete texts were not accessible, low-quality studies, and case report studies were excluded.

Qualitative assessment

We used the strengthening the reporting of observational studies in epidemiology (STROBE) guideline to assess the observational studies. It comprises 22 sections that encompass various aspects of a report. Within this checklist, the cumulative scores played a decisive role. Consequently, scores ranging from 1 to 15 denote inferior quality, scores ranging from 16 to 30 indicate moderate quality, and scores ranging from 31 to 44 signify exceptional quality. The present study's cut-off point for acceptability was set at 16 [13].

Data extraction

Initially, the duplicated articles acquired from various databases were eliminated. Subsequently, employing predetermined screening criteria to mitigate any potential bias, the titles and abstracts of the articles were independently scrutinized by two reviewers, who excluded irrelevant studies. Afterward, the complete text of the suitable articles was assessed by these two reviewers independently. A checklist, including the first author's name, study design, country, mean age, sample size, publication year, mortality predictors, and deaths or survived frequency was used to extract the required data. In cases of disagreement between the two reviewers, a third reviewer was assigned to assess the articles.

Statistical analysis

The odds ratio (OR) was employed to examine the predictors of mortality in patients suffering from methanol intoxication. The logarithm of the OR was utilized to pool the study outcomes, while the I^2 index and Cochran (Q) test were employed to investigate the heterogeneity between studies. Given the considerable heterogeneity observed in this study, the random-effects model was employed. The data analysis was carried out using comprehensive meta-analysis (version 3). The significance level for the tests was established at $P<0.05$.

Results

The preliminary investigation revealed a total of 945 studies. Subsequent to the elimination of duplicate studies, 265 were deemed ineligible. After the evaluation of the abstracts, 532 out of the remaining 680 studies were excluded as they did not satisfy the inclusion criteria, while 148 studies were considered for further examination. Following the examination for retrieval, 55 studies were excluded, leaving 93 studies to be assessed for eligibility. Ultimately, a total of 14 studies were included in the final review, whereas 79 studies were excluded based on the exclusion criteria.

The baseline characteristics of the included studies in this meta-analysis study are summarized in Table 1.

In total, 15 factors related to methanol poisoning mortality were extracted from three or more studies and included in the meta-analysis. The factors included serum methanol concentration, blood sugar, hemodialysis time, coma, visual disturbances, gastrointestinal symptoms, white blood cell count, sodium, creatinine, alanine aminotransferase (ALT) and potassium levels, levels, pH, base deficit (BE), and venous blood PCO_2.

Ten studies examined the impact of pH as a prognostic indicator for methanol poisoning mortality. According to the collective data analyzed using a random-effects model, the OR was determined to be 3.509 (95% CI, 2.00%, 6.14%, $P<0.001$), indicating a statistically significant association. However, notable heterogeneity ($I^2=54.67\%$) ($P<0.019$) was observed among the studies. A sensitivity analysis was performed, identifying the studies conducted by Ran et al. [18], Simani et al. [22], and Liu et al. [14] as potential outliers. Upon excluding these three studies, the OR became 3.79 (95% CI, 2.42%, 5.19%, $P<0.001$), resulting in a considerable reduction in heterogeneity ($I^2=0.0\%$) ($P=0.478$) (Figure 2). Therefore, it can be concluded that a low pH level is a weak predictor for methanol poisoning mortality.

Six studies evaluated the effect of methanol concentration as a mortality predictor of methanol poisoning. The pooled data by the random-effects model showed an OR of 3.719 (95% CI, 1.68%, 8.18%, $P<0.001$), with significant heterogeneity ($I^2=86.21\%$) ($P<0.001$). Sensitivity analysis showed that the studies by Hovda et al. [2], Drangsholt et al. [19], could be outlier. After removing these three studies, the OR was 1.641 (95% CI, 1.05%, 2.55%, $P=0.001$), and heterogeneity was significantly reduced ($I^2=0.0\%$) ($P<0.001$) (Figure 3). High metha-

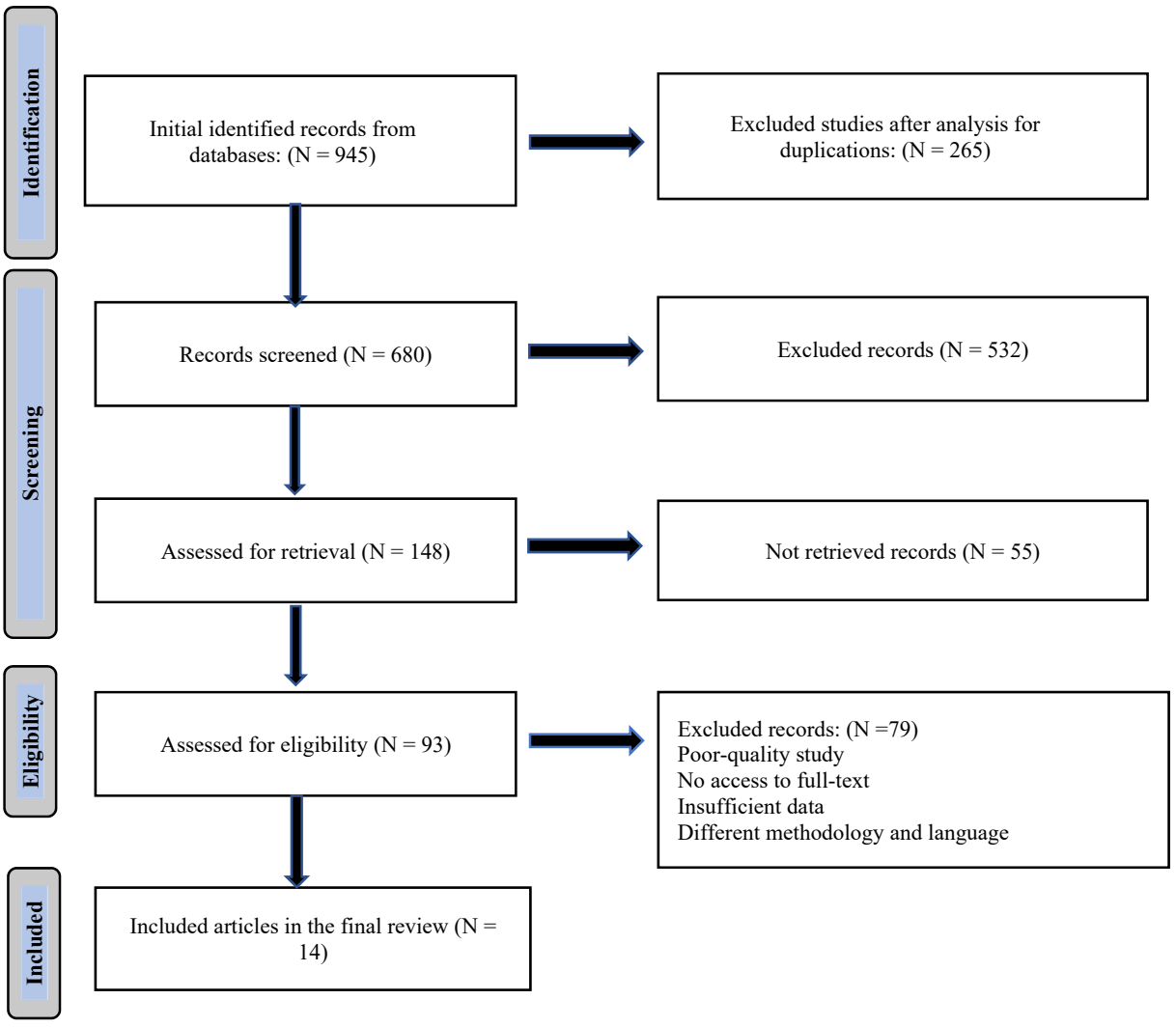

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Figure 1. The four-phase PRISMA diagram

nol concentration was found to be a weak predictor for methanol poisoning mortality.

Six articles explored the influence of PCO_2 as a prognostic indicator for the mortality caused by methanol poisoning. Based on the comprehensive data analyzed utilizing a random-effects model, the OR was identified to be 7.932 (95% CI, 4.04%, 15.56%, P<0.001), signifying a statistically significant connection. Nevertheless, notable heterogeneity (I^2=71.17%) (P<0.001) was detected among the articles. An examination of sensitivity was conducted, pinpointing the investigations carried out by Ran et al. [18], Shadnia et al. [12], and Sanaei Zadeh et al. [16] as possible outliers. By excluding these three investigations, the OR was 9.993 (95% CI, 5.80%, 17.18%, P=0.001), leading to a substantial reduction in heterogeneity (I^2=0.0%) (P=0.757) (Figure 4). Consequently, it can be deduced that a high PCO_2 level is a weak predictor for the mortality caused by methanol poisoning.

Four studies examined the impact of the base deficit as a prognostic indicator for mortality resulting from methanol poisoning. Based on the comprehensive analysis of the data using a random-effects model, the OR was determined to be 4.724 (95% CI, 1.62%, 13.47%, P=0.004), indicating a statistically significant association. However, there was considerable heterogeneity (I^2=85.70%) (P<0.001) among the studies. A sensitivity analysis was performed, identifying the investigations conducted by Ran et al. [18] as potential outliers. After excluding this study, the OR changed to 2.943 (95% CI, 1.20%, 7.165%, P<0.001), resulting in a substantial reduction in heterogeneity (I^2=77.49%) (P=0.012) (Figure 5). Therefore, it can be inferred that a severe base deficit

Table 1. The characteristics of included studies in this meta-analysis

Authors	Publication (y)	Country	Study Design	Mean Age (y)	Sample Size	No. (%)		Factors	Quality
						Died	Survived		
Liu et al. [14]	1998	Canada	Retrospective review	39	50	18(36)	32(64)	pH-methanol	Desirable
Hovda et al. [2]	2005	Norway	Combined prospective and retrospective case series	52-57	51	9(18)	42(82)	pH-methanol concentration/ethanol concentration/base deficit/PCO_2/time of hemodialysis/coma	Desirable
Hassanian et al. [15]	2007	Iran	Prospective cross-sectional	38.5	25	12(48)	13(52)	pH-methanol concentration/ethanol concentration/coma/respiratory arrest/time from intake to admission	Desirable
Sanaei-Zadeh et al. [16]	2011	Iran	Retrospective	31.6±14.3	95	27(28)	68 (72)	pH-methanol/ethanol concentration/base deficit/ PCO_2/coma/seizure/elapsed time to treatment/blood glucose/ HCO_3	Desirable
Shadnia et al. [12]	2013	Iran	Retrospective	31±14	30	9(30)	21(70)	pH-methanol/ PCO_2/coma/blood glucose/K/HCO_3WBC/time of hemodialysis/gastrointestinal symptoms/visual disturbances	Desirable
Zakharov et al. [3]	2014	Czech	Prospective and retrospective case series	53	121	80(79.2)	21(20.8)	Gastrointestinal symptoms/visual disturbances/coma/chest pain/respiratory arrest/dyspnea	Desirable
Zakharov et al. [17]	2015	Norway	Prospective	51	38	32(84.3)	6(15.7)	Gastrointestinal symptoms/visual disturbances/coma/chest pain/respiratory arrest/dyspnea	Desirable
Ran et al. [18]	2019	China	Retrospective	47.67±12.13	52	2(3.8)	50(96.2)	pH/base deficit/ PCO_2/blood glucose /HCO_3/K/Na/WBC/Cr/LDH/AST/ALT/no hemodialysis/coma/dyspnea	Desirable
Gulen et al. [7]	2020	Turkey	Retrospective observational case series	>18	67	18(36.7)	49(73.3)	pH/ base deficit/time of hemodialysis/ HCO_3/K/Na/WBCCr/AST/ALTgastrointestinal symptoms/visual disturbances/chest pain/respiratory arrest/dyspnea	Desirable
Drangsholt et al. [19]	2018	Czech	Observational	NA	35	4(11.4)	31(88.6)	pH/ methanol/PCO_2	Desirable
Arslan et al. [20]	2021	Turkey	Retrospective cohort	45±11	42	9(21)	33(79)	Gastrointestinal symptoms/visual disturbances/chest pain/coma	Desirable

Authors	Publication (y)	Country	Study Design	Mean Age (y)	Sample Size	No. (%)		Factors	Quality
						Died	Survived		
Navabi et al. [21]	2018		Retro-spective descriptive-analytic	NA	188	24(12.5)	168(87.5)	pH/PCO_2/blood glucose/HCO_3/ time of hemodialysis K/Na/LDH/Cr/AST/ALT /visual disturbances/ coma	Desirable
Simani et al. [22]	2022	Iran	Retrospec-tive	40.6±13.5	516	22(55)	18(45)	pH-methanol/HCO_3 /LDH/Cr/AST/ALT	Desirable
Mahdavi et al. [23]	2022	Iran	Cross-sectional	19-91	796	84(10.5)	711(89.5)	Coma	Desirable

NA: Not available.

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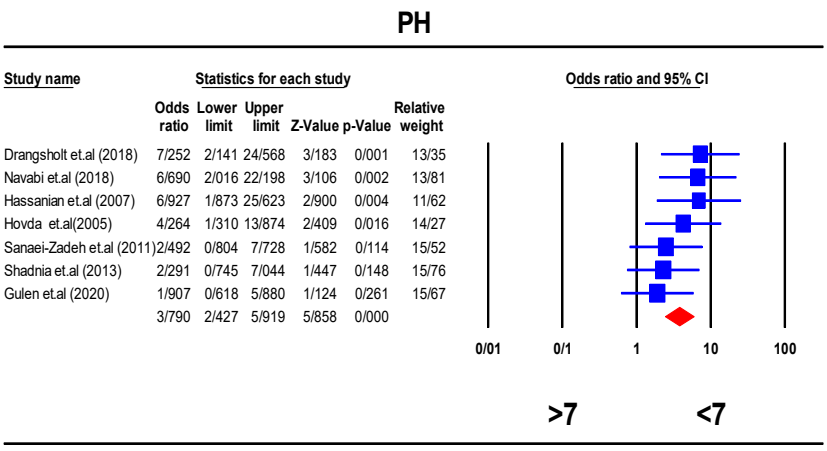

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Figure 2. pH forest plot to predict mortality in methanol poisoning patients

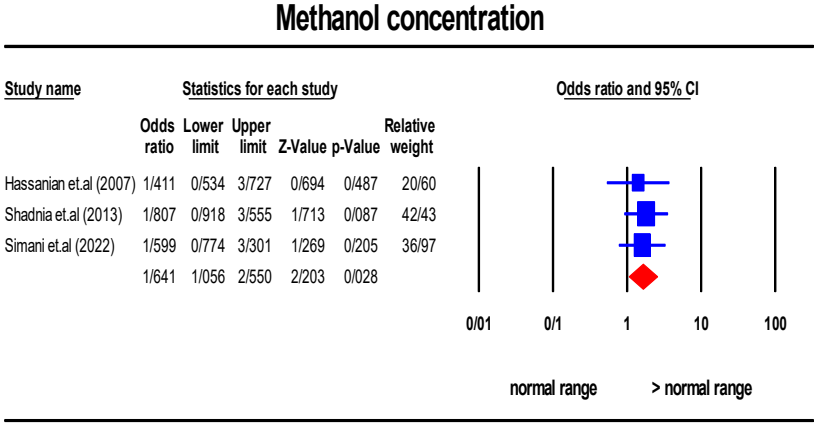

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Figure 3. Methanol concentration forest plot to predict mortality of methanol intoxication patients

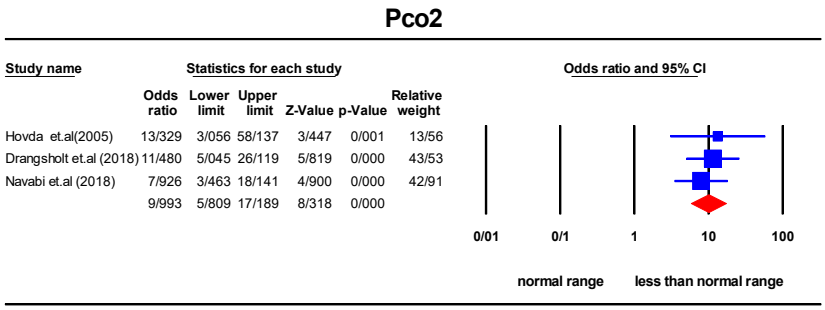

Figure 4. PCO_2 forest plot to predict mortality of methanol intoxication patients

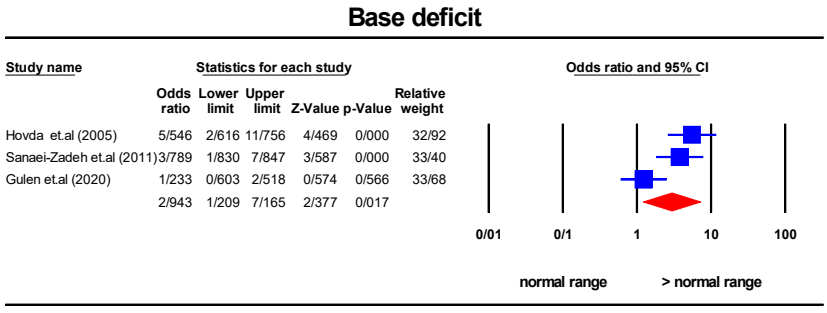

Figure 5. Base deficit forest plot to predict mortality of methanol intoxication patients

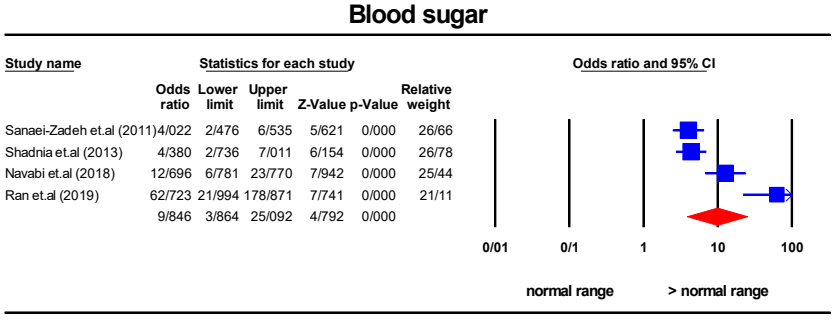

Figure 6. Blood sugar forest plot to predict mortality of methanol intoxication patients

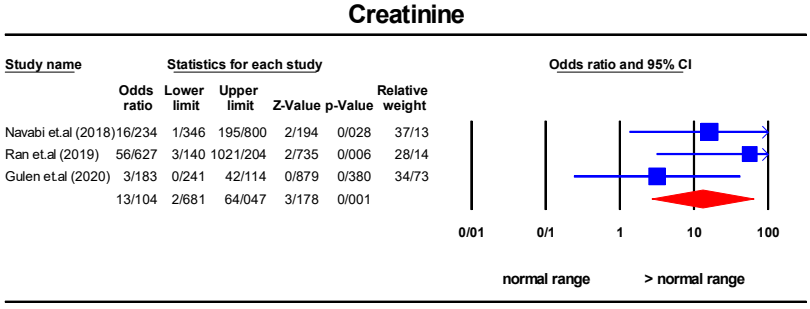

Figure 7. Creatinine forest plot to predict mortality of methanol intoxication patients

is an inadequate predictor for mortality caused by methanol poisoning.

The report discusses four studies that reported the effect of high blood sugar on the mortality predictor of methanol poisoning. The combined data under a random-effects model showed an OR of 9.846 3.86%, 25.09%, P=0.047) with significant heterogeneity (I^2=89.58%) (P<0.001) (Figure 6). Thus, high blood sugar is a risk factor with weak pre-notification in methanol poisoning.

The effect of creatinine on the mortality predictor of methanol poisoning was assessed in four studies. The combined data under a random-effects model showed an OR of 9.846 (95% CI, 3.86%-25.09%, P=0.047) with significant heterogeneity (I^2=48.44%) (P<0.001) (Figure 6). Sensitivity analysis showed that one study was an outlier. After removing this study, the OR was 13.10 (2.68-64.04, P=0.001), and heterogeneity was significantly reduced (I^2=7.63%) (P=0.339) (Figure 7). We conclude that a high concentration of creatinine is a strong risk factor in predicting mortality from methanol intoxication.

The impact of HCO_3 concentration on the mortality predictor of methanol poisoning was assessed in four different studies. The polled data, analyzed using a random-effects model, demonstrated an OR of 1.925 (95% CI, 0.97%, 3.18%, P=0.060) with significant heterogeneity (I^2=56.78%) (P<0.001). Upon conducting a sensitivity analysis, it was observed that one study was an outlier. Upon exclusion of these studies, the OR increased to 2.977 (95% CI, 1.68%, 5.26%, P<0.001), and heterogeneity was significantly diminished (I^2=0.00%) (P=0.415) (Figure 8). Consequently, we concluded that a high concentration of HCO_3 is a risk factor associated with weak mortality prediction in cases of methanol poisoning.

The effect of ALT on the mortality prediction of methanol poisoning was investigated in four different studies. Using a random-effects model, the pooled data revealed an OR of 7.573 (95% CI, 1.68%, 8.18%, P=0.047), accompanied by a considerable amount of heterogeneity (I^2=97.14%), (P<0.001) (Figure 9). Therefore, we concluded that a high ALT level is a weak risk factor for predicting methanol poisoning mortality.

In four studies, the effect of potassium concentration on mortality prediction of methanol poisoning was reported. The pooled data under a random-effects model showed an OR of 6.025 (95% CI, 1.94%, 18.66%, P=0.002) with substantial heterogeneity (I^2=63.21%) (P<0.001). Sensitivity analysis showed that the study by Ran et al. [18] could be a possible outlier. After removing this study, the OR was 3.516 (95% CI, 1.66%, 7.43%, P=0.001) with reduced heterogeneity (I^2=0.0%) (P=0.438) (Figure 10). High K concentration was a risk factor with weak predictor power in methanol poisoning [18].

In three studies, the effect of white blood cell count on the prediction of methanol intoxication was reported. The combined data under a random-effects model showed an OR of 10.935 (95% CI, 1.42%, 36.16%, P=0.017) with substantial heterogeneity (I^2=89.58%) (P<0.001) (Figure 11). High white blood cell count was a poor predictive risk factor for methanol poisoning.

Four studies reported the effect of hemodialysis time on the prediction of mortality of methanol intoxication. The combined data under the random effects model showed an OR of 2.694 (95% CI, 1.35%, 5.35%, P=0.005), without significant heterogeneity (I^2=0%, P=0.600) (Figure 12). Hemodialysis time was a risk factor with weak predicting power for methanol intoxication.

The effect of sodium concentration on predicting mortality from methanol poisoning was reported in three studies. The polled data under the random effects model showed an OR of 6.69 (95% CI, 1.78%-25.12%, P=0.005), with significant heterogeneity (I^2=91.32%) (P<0.001, Figure 13). High sodium concentration was a risk factor with weak predicting power for methanol intoxication mortality.

In eight studies, the effect of coma on predicting mortality from methanol poisoning was reported. The pooled data under the random-effects model showed an OR of 7.252 (95% CI, 2.78%, 18.09%, P<0.001), with significant heterogeneity (I^2=92.13%) (P<0.001, Figure 14). Sensitivity analysis showed that five studies were outliers. With the removal of these studies, the OR was 32.73 (95% CI, 18.59%, 56.70%, P<0.001), and heterogeneity was greatly reduced (I^2=0.0%) (P=0.698). Coma was a risk factor with strong predictor power in methanol intoxication.

Data related to visual disturbance was extracted from five studies. The combined data under a random-effects model showed an OR of 0.991 (95% CI, 0.30%-3.28%, P=0.989), with significant heterogeneity (I^2=95.27%) (P<0.001). Sensitivity analysis showed that the studies by Zakharov et al. [3] and Gulen et al. [7] could be potential outliers. After removing these two studies, the OR was 3.379 (95% CI, 1.59%-7.16%, P=0.001), and heterogeneity decreased (I^2=76.31%) (P=0.015) (Figure

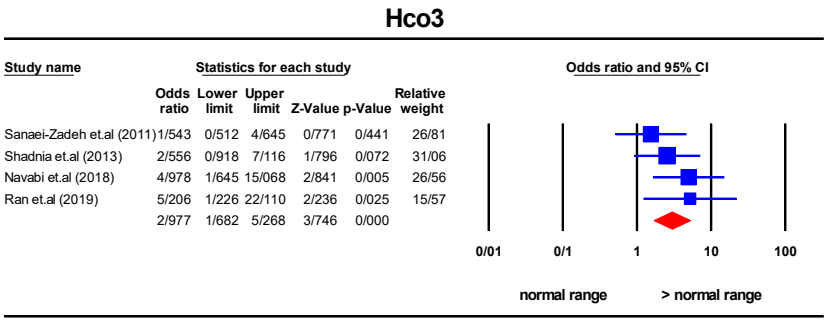

Figure 8. HCO_3 forest plot to predict mortality of methanol intoxication patients

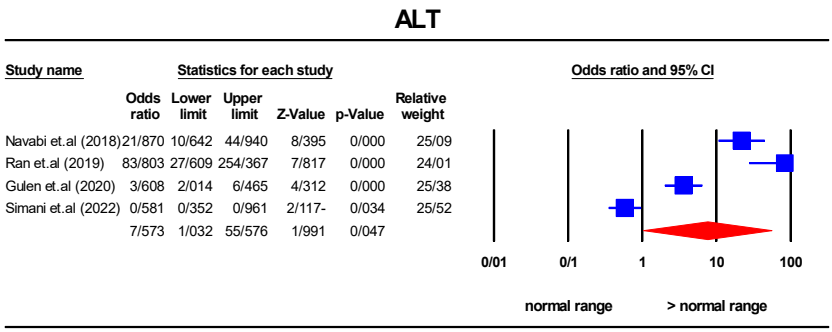

Figure 9. ALT forest plot to predict the mortality of methanol intoxication patients

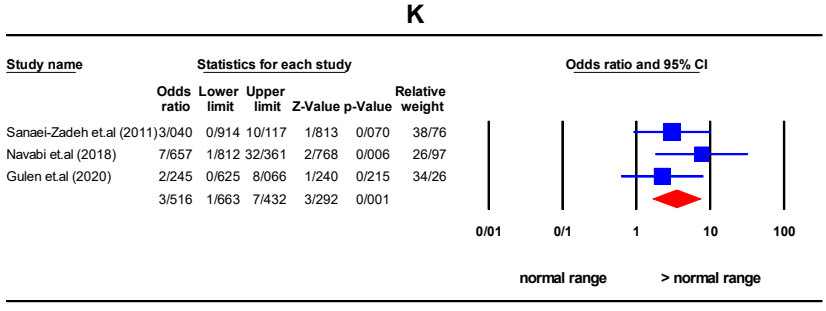

Figure 10. Potassium forest plot to predict the mortality of methanol intoxication patients

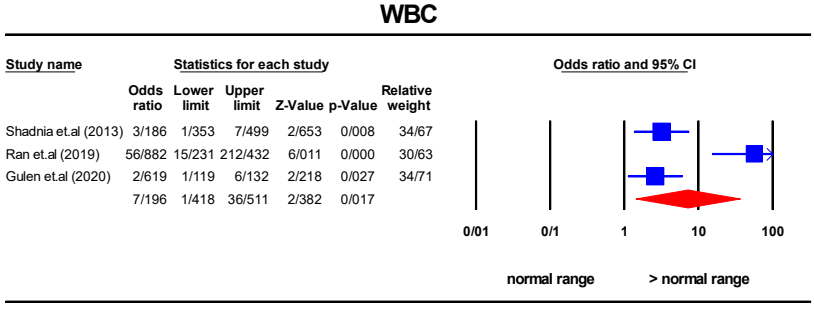

Figure 11. White blood cell count forest plot to predict the mortality of methanol intoxication patients

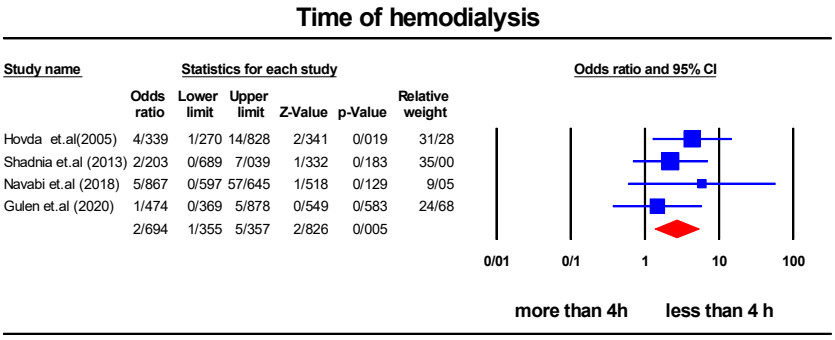

Figure 12. Hemodialysis time forest plot to predict the mortality of methanol intoxication

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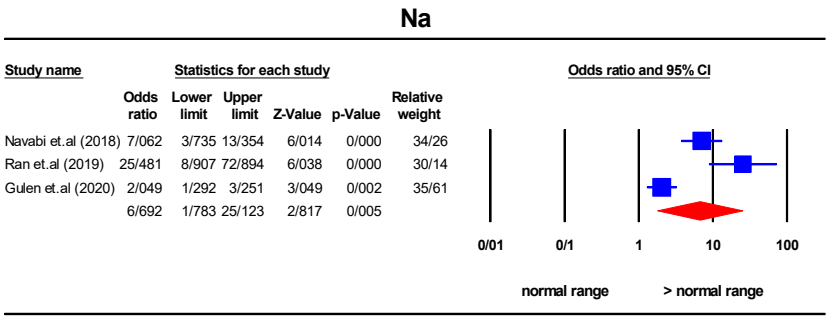

Figure 13. Sodium forest plot to predict mortality of methanol intoxication patients

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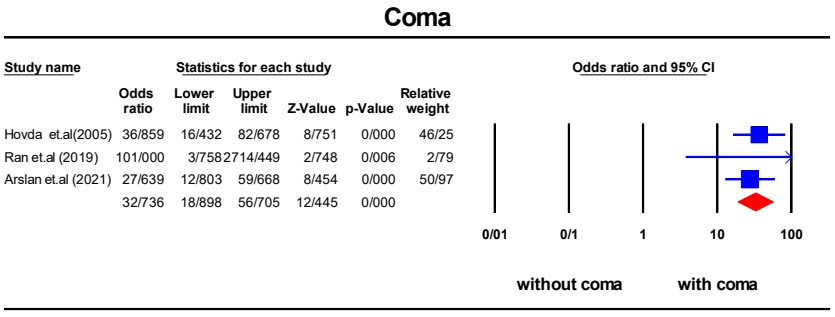

Figure 14. Coma forest plot to predict the mortality of methanol intoxication patients

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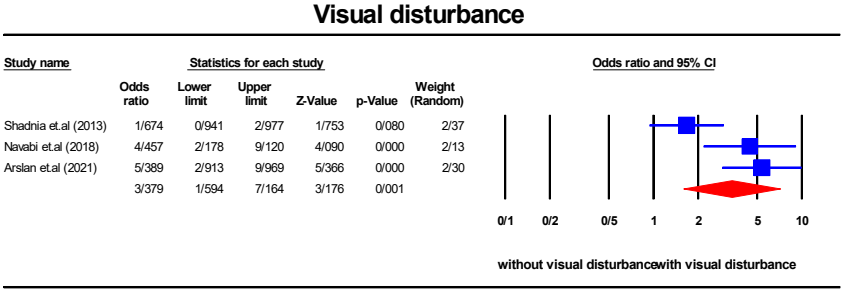

Figure 15. Visual disturbance forest plot to predict the mortality of methanol intoxication

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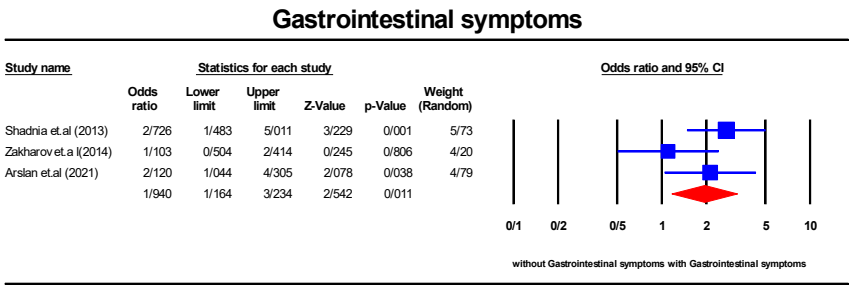

International Journal of
Medical Toxicology & Forensic Medicine

Figure 16. Forest plot of gastrointestinal symptoms to predict the mortality of methanol intoxication patients

15). Visual disturbance was identified as a weak predictor of methanol poisoning as a risk factor.

Data pertaining to gastrointestinal symptoms was obtained from five studies. The polled data, as analyzed using a random-effects model, produced an OR of 0.736 (95% CI, 0.22%, 2.44%, P=0.617). Notably, there was a significant degree of heterogeneity (I^2=90.85%, P<0.001). Sensitivity analysis revealed that two studies potentially were outliers. Upon exclusion of these two studies, the OR was recalculated to be 1.940 (95% CI, 1.164%, 3.22%, P=0.011), resulting in a substantial reduction in heterogeneity (I^2=38.22%, P=0.198) (Figure 16). Ultimately, it was determined that gastrointestinal symptoms exhibit limited predictive power in relation to methanol poisoning mortality as a risk factor.

Discussion

Methanol intoxication is a significant medical condition that can result in serious illness and death. The act of comparing various study findings poses inherent challenges. During the initial phases, medical practitioners may encounter difficulties in identifying cases of methanol poisoning, thus resulting in delayed treatment. The potential variation in mortality rates resulting from methanol poisoning across various studies could plausibly be attributed to dissimilarities in geographical location, racial backgrounds, and patterns of methanol consumption. Nonetheless, achieving favorable outcomes for these afflicted individuals hinges upon the expeditious identification of poisoning, standard provision of supportive treatment, and prompt availability of resources to execute methanol detoxification protocols [12]. In order to better identify patients at risk, it is vital to identify the factors related to the consequences of methanol poisoning, and it is also important to predict the possibility of complications after poisoning and to adopt appropriate strategies to minimize these complications [24]. Methanol intoxication has the potential to induce detrimental physiological repercussions, including somnolence, cognitive disarray, cephalalgia, vertigo, and ultimately, fatality. The incidence of mortality and morbidity after methanol poisoning may be influenced by variables, such as the availability of healthcare access and fiscal steadiness. Identifying risk factors and implementing efficacious therapeutic modalities can avert the prompt and protracted sequelae associated with methanol poisoning [23]. This study aimed to identify the predictors of mortality in patients with methanol poisoning.

Results showed that 15 factors were significantly associated with mortality due to methanol poisoning, including serum methanol concentration, blood glucose, time of hemodialysis, coma, visual disturbances, gastrointestinal symptoms, white blood cell count, sodium, potassium, creatinine, and ALT levels, pH, base deficit, HCO_3, and venous blood PCO_2. Among these factors, coma and elevated creatinine levels above the normal range were the strongest predictors of mortality following methanol intoxication, with ORs of 13.10 and 32.73, respectively. Chang et al. demonstrated that serum creatinine concentration due to methanol intoxication is a significant risk factor for acute kidney injury (AKI) [25], which can cause mortality due to renal impairment [26, 27]. A systematic review by Gharaeikhezri et al. [28] showed that methanol poisoning is associated with a 28.18% prevalence of AKI. Chang et al. [25] stated that one of the methanol intoxication side effects is kidney injury due to changes in creatinine levels.

A study reported that a rise in creatinine levels can cause silent stroke and death [29]. Some studies have stated that AKI in patients results in both immediate and enduring ramifications, eventually encompassing fatality [30, 31]. Other studies have reported that inflammation in the brain and other organs can occur following AKI [32-34].

In instances of methanol poisoning, the administration of hemodialysis is imperative for rectifying electrolyte imbalances, such as creatinine, thereby mitigating cerebral harm after intoxication. This investigation undertook the examination of several prognostic determinants associated with fatality in the aftermath of methanol poisoning. It is anticipated that the findings of this inquiry will facilitate medical practitioners in rendering prompt and accurate decisions aimed at reducing the mortality rate among these patients.

Overall, the outcomes of this investigation offer crucial perceptions of the variables linked to fatality caused by methanol intoxication. The discoveries can be employed to enhance the quality of medical care and enhance the consequences for patients. Additional investigation is required to validate these findings and recognize supplementary variables that might be connected to methanol intoxication.

Conclusion

Several related factors associated with the mortality of methanol intoxication have been identified and documented. The current study identified 15 crucial factors that forecast mortality resulting from methanol poisoning, which exhibit a significant correlation with the prognosis of methanol poisoning. It is hoped that these significant predictive factors will assist medical professionals in making more informed and expeditious clinical judgments during the treatment course and serve as a valuable point of reference.

Limitations of the study

The first limitation is the lack of access to some databases to expand the search domain of articles. The second limitation is the low number of articles investigating the effect of some factors, and it is suggested to conduct new studies with a high sample size and examine all the variables under consideration. Other limitations include different methodologies, non-uniform reporting of articles, lack of conformity, and unavailability of the full text of articles mentioned in conferences.

Ethical Considerations

Compliance with ethical guidelines

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Isfahan University of Medical Sciences approved this study (Code: IR.MUI.MED.REC.1401.321). Additionally, this study was compiled based on the PRISMA checklist, and its protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) website (ID: CRD42023463298).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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