Original Article

HEMORRHAGIC BRAIN LESIONS AS COMPLICATION OF METHANOL INTOXICATION: A CASE REPORT

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Abstract

Methanol poisoning could lead to life-threatening comorbidities including fatal brain hemorrhages that its etiology has not been studied enough. Herein a rare case of intracranial and intraventricular hemorrhages was presented in a 32 years old man leading to brain death. Methanol poisoning could initiate coagulopathies and vascular endothelium damage by metabolic acidosis, and toxic effects of its metabolites that beside other risk factors in alcohol abusers like liver disease could lead to fatal hemorrhagic adverse events. Early diagnosis and sufficient therapeutic approaches are essential in reducing mortality and morbidity of this toxicological emergency that implies the importance of available facilities and medications in emergency departments for management of methanol poisoning.

Keywords: Intracranial hemorrhage, Methanol, toxicity, intraventricular hemorrhage, acidosis.

Introduction

Methanol (CH3OH) is a toxic alcohol and a common ingredient in many organic solvents, paint thinners, perfumes, photocopying fluids, fraudulent or homemade adulterated alcoholic beverages (1). Methanol poisoning is a toxicology emergency and occasionally occur after ingestion of fraudulent alcoholic beverages. It will have a poor prognosis unless being diagnosed and treated immediately (2). Methanol and its metabolites especially formic acid may cause inebriation, nausea, vomiting, vertigo, seizure, visual disturbance, metabolic acidosis, brain ischemia and necrosis. Also methanol intoxication rarely cause life threatening brain hemorrhage especially in basal ganglia with indeterminate reason (3). Herein a case of methanol poisoning with hemorrhagic lesions was presented and possible underlying causes were discussed.

Case Presentation

A 32-year-old man was brought to the emergency department due to nausea and vomiting, frothing and altered mental status. On admission, he had low level of consciousness (GCS=7) and in physical examination central and peripheral cyanosis, mottling of limbs, bilateral undetectable radial pulses were detected. Dilated pupils with

sluggish reaction to light and optic disk hyperemia were observed in direct ophthalmoscopy, alcohol smell was being sense of his cloths. He was addicted to opium and cigarette and was an alcohol abuser. Vital signs on admission were as follow: SpO2 (Room Air) =82%, blood pressure=75/55 mmHg, pulse rate=87 beats/minute, respiratory rate=15 respirations/min and temperature=36.5 °C with a thermal scanner.

Patient was intubated immediately on admission. Electrocardiogram (figure-1) showed normal sinus rhythm, normal axis, inverse T-wave in v4-v5 pericordial leads, brain computed tomography (CT) (figure-2) and high-resolution computed tomography (HRCT) of lungs did not demonstrate markable lesions. Urine analysis results were as follow: specific gravity=1027, urinary PH=6, Glucose=2+, ketone=1+, and protein=3+; blood analysis results presented at table-1. Unfortunately, measuring ethanol, methanol and lactate serum levels were not available in our site. Urine multidrug screening test results were negative for Amphetamine, Tricyclic antidepressant, Marijuana, Methadone, methamphetamine, benzodiazepine, tramadol, cocaine, buprenorphine but positive for Morphine. With diagnose of methanol poisoning, ethanol 20% solution was gavaged by nasogastric (NG) tube. Infusion of bicarbonate was started and the metabolic acidosis corrected in next 12 hours after admission. Clinical toxicologist recommended administration of 500 mg methylprednisolone sodium succinate pulse every 12 hours, 50 mg folinic acid every 6 hours, erythropoietin, vitamin B-complex, N-Acetyl cysteine and because of low blood pressure infusion of normal saline and norepinephrine started. Hemodialysis catheter insertion was performed and hemodialysis prescribed for him that was done two times (setting in table-2). Anticoagulation was not prescribed for hemodialysis.

Figure 1: Patient's electrocardiogram at admission.

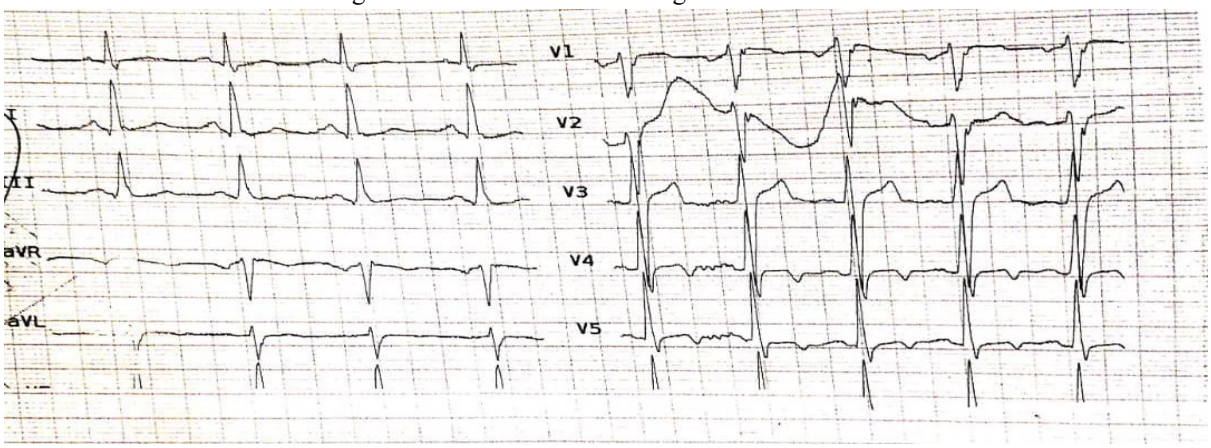


Table 1. Patient's laboratory profile.

Parameter*	Day1	Day2	Day3	Day4	Day5	Normal range
FBS	174	207	240	127		<100mg/dl
Cr	2	1.3	1.4	1.6		
Urea	26	23	28	38		6-24mg/dl
AST	213	86	76			8-48u/l
ALT	383	194	195			7-55u/l
BT	0.83	1.57				0.3-1.2
BD	0.31	0.57				0.0-0.4

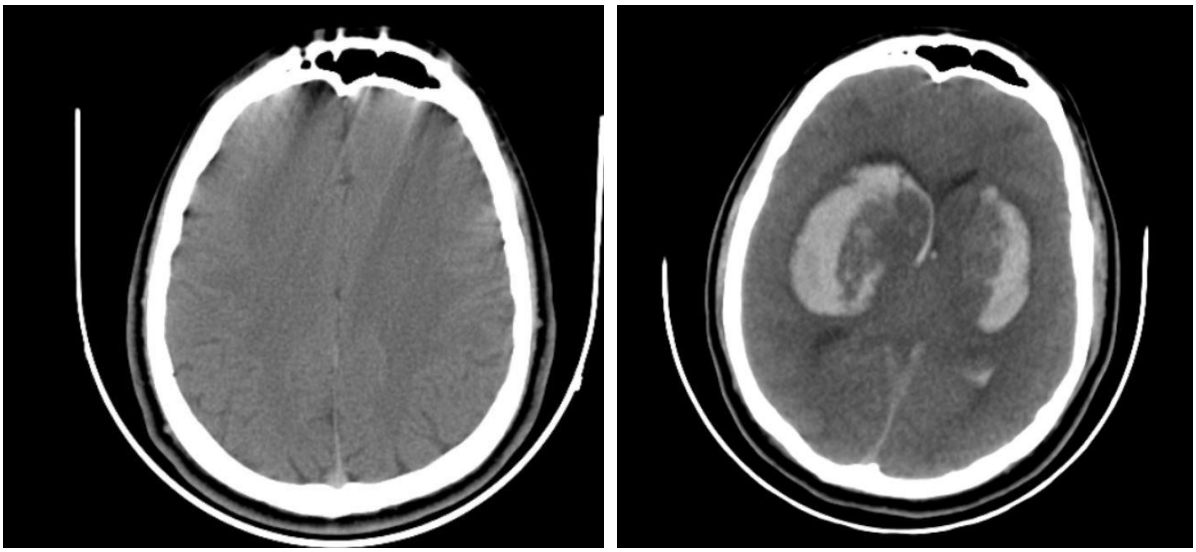
PT	12	12		12		9-11 seconds
PTT	52.4	27.9		27.2		25-38 seconds
Hg	20.7	16.1	16.5	17.2	15.1	13.2-16.6 gr/dl
PH	6.73	7.3	7.3	7.24	7.2	7.35-7.45
Pco2	35.6	52	50	49.5	46	35-45 mmHg
Hco3	4.5	25	23.9	20.5	17.5	22-26 mEq/l
PLT	180000	104000	92000	83000	86000	150000-450000
Na	143		153	155	157	135-145 mEq/l
K	3.3	3.3	2.8	3.4	3.1	3.5-5.2 mmol/l

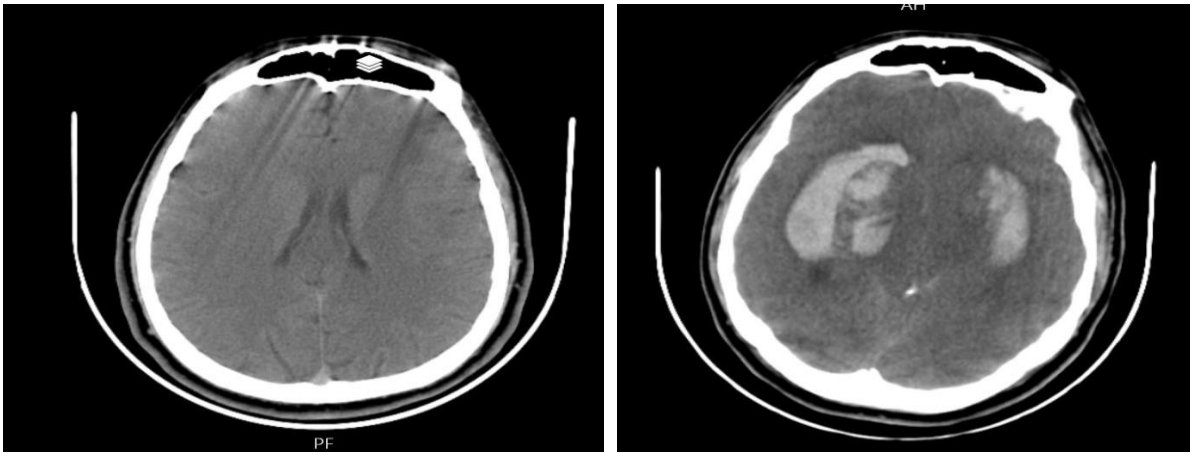
*Level of LDH and CPK were 678 and 154 units per liter respectively.

FBS: fasting blood sugar; AST: aspartate transaminase; ALT: alanine transaminase; BT: total bilirubin; BD: direct bilirubin; PT: Prothrombin Time; PTT: Partial Thromboplastin Time; Hg: hemoglobin; Pco2: partial pressure of carbon dioxide; Hco3: bicarbonate; PLT: platelet

On second day blood analysis results were including pH=7.3, pCO2 =52, HCO3=25, Hg=16.1, platelet=104000, pupils were fixed and dilated, GCS=3, reflexes of cornea, Gag, dolls eye, oculocephalic were absent, and respiration was facilitated by ventilator. Brain CT showed bilateral severe intracranial hemorrhage in basal ganglia and intraventricular hemorrhage (figure-2). Consultation by a neurologist and a neurosurgeon was requested, considering severe deep brain hemorrhage neurosurgery intervention was cancelled. Absence of brain stem reflexes and auto-respiration plus a flat EEG considered brain death for him.

Figure 2: (a) axial view of brain CT of admission without any pathological feature. (b) axial view of brain CT at second day of admission with severe bilateral hemorrhage of basal ganglia and intraventricular hemorrhage.





a b

On third day of admission abdominopelvic sonography revealed fatty liver grade 2 and he had experienced rapid atrial fibrillation on the next day which was managed with amiodarone and amount of KCl infusion elevated; Management of electrolyte disturbances was done by an internist with close monitoring and direct observation. Coffee ground secretions of NG-tube caused us to increase dosage of pantoprazole infusion and monitor the patient carefully. In the morning of fifth day cardiac arrest happened; 45 minutes cardiopulmonary resuscitation was not effective and the patient was expired (11-13).

Table 2. Acute hemodialysis prescription.

Duration	**4 hours**
BFR (Qb)	200 ml/min
DFR (Qd)	400 ml/min
Sodium	145 mmol/L
Potassium	3 mmol/L
Heparin	Nil
Saline flushes	Every 30-60 min
UF	1500 ml + 500 ml washback
Observation	Every 15 min

Discussion

Methanol intoxication is a life-threatening condition which can cause severe permanent damages to a wide variety of organs. Ingestion of 30 ml pure methanol without medical therapeutic actions usually cause death (4). Diagnosing and starting treatment as soon as possible can manage this condition without any harms, so awareness of side-effects and signs of methanol intoxication and immediately referring to a hospital can improve prognosis of patients. Unfortunately (14), laws of prohibiting alcoholic beverages production developed the trade of homemade adulterated alcoholic beverages. Illegality of alcohol consumption leads to late referring to hospital (5).

Methanol converts formaldehyde by alcohol dehydrogenase in liver and then aldehyde dehydrogenase (ADH) makes formic acid of formaldehyde (15-17). Methanol itself is not toxic but its metabolites especially formic acid

is absolutely toxic and harmful. Formic acid accumulates in body because of long half-life and inhibits cytochrome C oxidase of mitochondria so disturb aerobic respiration and leads to metabolic acidosis because of anaerobic acidosis (6). fomepizole and ethanol are antidotes of methanol (18-20), fomepizole is an ADH inhibitor but ethanol is a competitive ADH substrate. In a systematic review mortality rates of methanol poisoning were 21.8% for ethanol versus 17.1% for fomepizole and 5.5% for administrating both antidotes; also kidney injury (21-23), pneumonia and pancreatitis reported more frequently with ethanol versus fomepizole, other advantage of fomepizole are the unnecessity of monitoring its serum levels and potency of pediatric administration unlike ethanol (7)(8). Intravenous ethanol is preferred to gavage of ethanol because of easier administration and prevention of potential adverse effects like gastrointestinal injury (9). Lack of fomepizole and intravenous ethanol accessibility can deteriorate the prognosis of patients (7). According to World Health Organization (WHO) fomepizole is in list of the essential medicines but it is not widely accessible in medical centers all over the world yet (8, 24-26). Iran has the highest incidence of methanol poisoning in Middle Eastern countries(10, 27-29); that implies importance of providing adequate therapeutic and diagnostic facilities (30-32)

Patients with methanol poisoning are susceptible for brain hemorrhage this may be a result of metabolic acidosis. *Wenjun zhou martini* in an article represented that metabolic acidosis can lead to coagulopathy disorder, decrease in platelets number and malfunction of platelets concomitant with disturbance in platelet aggregation. Negative effects of metabolic acidosis remains even after correction (11, 32-34). Also *juyoung lee* et al., represented that metabolic acidosis could be a risk factor of brain hemorrhage in preterm neonates (12, 35-37). So it is important to prevent metabolic acidosis and correct low blood pH before inverting to severe acidosis (11). Furthermore, in methanol intoxication concomitant by metabolic acidosis, administration of heparin or other anticoagulants is not recommended (13, 38-40) also blood products containing fibrinogen might be beneficial for preventing acidosis induced hemorrhage (11, 41-43); Nevertheless other signs of coagulopathy like petechiae, purpura and normal lab markers are in favor of low possibility of heparin role in the presented case (44-46). Another reason of brain hemorrhage might be the direct toxic effects of formic acid on vascular endothelium and even could lead to congestion and dilation of capillaries (14, 47-49). *Aisa and Ballut* reported a patient of methanol poisoning which underwent hemodialysis without heparin but the patient experienced brain hemorrhage and brain death eventually (13, 50-52). in another study there was a 14 days gap between hemodialysis with heparin and onset of brain hemorrhage, short half-life of heparin can roll out the heparin role in brain hemorrhage of this case (3, 53-55).

Chronic alcohol consumption could lead to liver damage and followed by thrombocytopenia and impaired platelet function that could make patients susceptible for hemorrhage (15, 16, 56-58). Chronic alcohol abuse in our patient could take apart in his brain hemorrhage as he experienced mild elevation of hepatic enzymes (59-62).

Conclusion

Acute methanol poisoning can cause significant morbidity and mortality. Community should know symptoms and potential injuries of methanol poisoning also it should be accurate supervision on dealers of alcoholic beverages. Diagnosing tests and therapeutic equipment like fomepizole are necessary in hospital and physicians should pay attention to wide variety of injuries related to methanol poisoning. More studies are needed to determine the exact reason of hemorrhages and coagulopathy induced by methanol poisoning.

References:

1. Askar A, Al-Suwaida A. Methanol intoxication with brain hemorrhage: catastrophic outcome of late presentation. Saudi J Kidney Dis Transpl. 2007;18(1):117–22.
2. Erfanifar A, Mahjani M, Salimpour S, Zamani N, Moghaddam HH. Diabetic ketoacidosis as a complication of methanol poisoning ; a case report. BMC Endocr Disord [Internet]. 2022;10–5. Available from: https://doi.org/10.1186/s12902-022-01037-z.
3. Report C. Intracranial Hemorrhage in Methanol Toxicity: Challenging the Probable Heparin Effect during Hemodialysis. 2017;4–7.
4. Article O. Methanol Poisoning : Ocular and. 2012;89(2):178–82.

5. Aghababaeian H, Ahvazi LA. Rapid paper The Methanol Poisoning Outbreaks in Iran 2018. 2019;54(January):128–30.

6. Nekoukar Z, Zakariaei Z, Taghizadeh F, Musavi F, Banimostafavi ES, Sharifpour A, et al. Methanol poisoning as a new world challenge: A review. Ann Med Surg [Internet]. 2021;66(May):102445. Available from: https://doi.org/10.1016/j.amsu.2021.102445

7. Beatty L, Green R, Magee K, Zed P. A Systematic Review of Ethanol and Fomepizole Use in Toxic Alcohol Ingestions. Emerg Med Int. 2013;2013:1–14.

8. Taylor P, Zakharov S, Pelclova D, Navratil T, Belacek J, Komarc M, et al. Fomepizole versus ethanol in the treatment of acute methanol poisoning : Comparison of clinical effectiveness in a mass poisoning outbreak Fomepizole versus ethanol in the treatment of acute methanol poisoning : Comparison of clinical effectiveness in a m. 2015;(July).

9. Paula A, Motta G, Raphael F, Gimenes E. Nasogastric / nasoenteric tube-related adverse events : an integrative. 2021;

10. Simani L, Ramezani M, Roozbeh M, Shadnia S. The outbreak of methanol intoxication during COVID-19 pandemic : prevalence of brain lesions and its predisposing factors of brain lesions and its predisposing factors. Drug Chem Toxicol [Internet]. 2022;45(4):1500–3. Available from: https://doi.org/10.1080/01480545.2020.1845192

11. Generation T, Availability F. Coagulopathy by Hypothermia and Acidosis : Mechanisms of. 2009;67(1).

12. Lee J, Hong M, Yum SK, Lee JH. Perinatal prediction model for severe intraventricular hemorrhage and the effect of early postnatal acidosis. 2018;2215–22.

13. Aisa TM, Ballut OM. Clinical Note. 2016;21(3):275–7.

14. Satar S. Intracranial hemorrhage associated with methanol intoxication Intracranial Hemorrhage Associated with Methanol Intoxication.

15. Hamaguchi M, Obora A, Okamura T, Hashimoto Y, Kojima T, Fukui M, et al. Changes in metabolic complications in patients with alcoholic fatty liver disease monitored over two decades : NAGALA study. 2020;

16. Ziai WC, Torbey MT, Kickler TS, Oh S, Bhardwaj A, Wityk RJ. Platelet Count and Function in Spontaneous Intracerebral Hemorrhage. 2003;12(4):201–6.

17. A Molaei, H Alizadeh Otaghvar, M Tarahomi, D Shojaei, L Mohajerzadeh, M Baghoori, F Niazi, A bizarre presentation of Peutz–jegher's syndrome in a 2 year old, Iranian Journal of Pediatric Surgery, 2017, 3 (2), 104-106

18. A Molaei, HA Otaghvar, M Tarahomi, D Shojaei, L Mohajerzadeh, et al., A bizarre presentation of Peutz–jegher's syndrome in a 2 year old, Iranian Journal of Pediatric Surgery 3 (2), 2017, 104-106

19. A Nurmeksela, et al., Relationships between nursing management, nurses' job satisfaction, patient satisfaction, and medication errors at the unit Level: A correlational study. Research Square 2020; 1 (1): 1-22.

20. B Sabzevari, Z Abbasi, V Vakili, et al., Assesmrnt the Release of Nickel Ion from simulated orthodontic Appliances for orthognathic Patients and comparison with safe level of Nickel.JRUMS,2015,14(6),455-466.

21. A Zeidani, N Qaderi, S Akbari Zavieh, S Golalipour, M Golmohammadi, Cardiovascular outcomes and Dental careof COVID-19: a systematic review and met analysis, Neuro Quantology, 2022, 20(8), 3060-3066

22. B Shakiba, et al., Medical Workplace Civility Watch: An Attempt to Improve the Medical Training Culture, Journal of Iranian Medical Council, 2022, 5 (1), 227-228

23. H Danesh, A Bahmani, F Moradi, B Shirazipour, M Milani Fard, Pharmacological Evaluation of Covid 19 Vaccine in Acute and Chronic Inflammatory Neuropathies, Journal of Medicinal and Chemical Sciences, 5(4), 2022, 561-570

24. F Karimzadeh, et al., Comparative evaluation of bacterial colonization on removable dental prostheses in patients with COVID-19: A clinical study, The Journal of Prosthetic Dentistry, 2021, 1-3

25. F Najafi, et al., The Relationship between General Health and Quality of Work Life of Nurses Working in Zahedan Teaching Hospitals. Iranian J of Rehabilitation Research in Nursing 2018; 4 (2): 53-9.

26. F Zabihi, MA Abbasi, R Alimoradzadeh, The Association of Serum Albumin Level with Cognition and Daily Function in Patients Undergoing Hemodialysis, Annals of the Romanian Society for Cell Biology, 2021, 2573–2579

27. AAR Ghahroudi, AR Rokn, AR Shamshiri, N Samiei, Does timing of implant placement affect esthetic results in single-tooth implants? A cohort evaluation based on Mpes, Journal of Esthetic and Restorative Dentistry, 32(7), 2020, 715-725

28. H Daneste; A Sadeghzadeh; M Mokhtari; H Mohammadkhani; F Lavaee; J Moayedi; Immunoexpression of p53 mutant-type in Iranian patients with primary and recurrence oral squamous cell carcinoma. European Journal of Translational Myology, 2022

29. H Jahandideh, A Yarahmadi, S Rajaieh, AO Shirazi, M Milanifard, et al., Cone-beam computed tomography guidance in functional endoscopic sinus surgery: a retrospective cohort study, J Pharm Ree Int, 2020, 31 (6), 1-7

30. H Mirfakhraee, S Golalipour, F Ensafi, A Ensafi, S Hajisadeghi, Survival rate of Maxillary and Mandibular Implants used to Support Complete-arch Fixed Prostheses & Investigation of internal and Neurological manifestations, NeuroQuantology, 2022, 20 (6), 5118-5126

31. H Tahernia, et al., Diagnosis and Treatment of MS in Patients Suffering from Various Degrees of the Disease with a Clinical Approach: The Original Article, Journal of Pharmaceutical Negative Results, 2022, 13 (1), 1908-1921

32. I Karampela, M Dalamaga, Could Respiratory Fluoroquinolones, Levofloxacin and Moxifloxacin, prove to be Beneficial as an Adjunct Treatment in COVID-19? Archives of medical research. 2020;51(7):741-2.

33. I Seifi, D Shojaei, SJ Barbin, A Bahmani, Z Seraj, Methods of Diagnosis and Treatment of MS Disease Based on a Clinical Trial: The Original Article, Tobacco Regulatory Science (TRS),2022, 2351-2384

34. JP Montani, Vliet VB. General physiology and pathophysiology of the renin-angiotensin system. Angiotensin Vol. I: Springer; 2004: 3-29.

35. K Goyal, et al., Fear of COVID 2019: First suicidal case in India! Asian J of psychiatry 2020; 49: 101989.

36. M Aminzadeh, et al., The Frequency of Medication Errors and Factors Influencing the Lack of Reporting Medication Errors in Nursing at Teaching Hospital of Qazvin University of Medical Sciences, 2012. J of Health 2015; 6 (2): 169-79.

37. M Barzideh, A Choobineh, Tabatabaei S. Job stress dimensions and their relationship to general health status in nurses. Occupational Medicine 2012; 4 (3): 17-27.

38. M Milanifard, G Hassanzadeha, Anthropometric study of nasal index in Hausa ethnic population of northwestern Nigeria, J Contemp Med Sci|, 2018, 4 (1), 26-29

39. M Mileski, et al., The impact of nurse practitioners on hospitalizations and discharges from long-term nursing facilities: a systematic review. Healthcare 2020; 8 (2): 114-34.

40. M Tarahomi, H Alizadeh Otaghvar, D Shojaei, F Goravanchi, A Molaei, Primary hydatid cyst of umbilicus, mimicking an umbilical hernia, Case Reports in Surgery 2016

41. MGS Borba, et al. Effect of high vs low doses of chloroquine diphosphate as adjunctive therapy for patients hospitalized with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection: a randomized clinical trial. JAMA network open. 2020;3(4): e208857-e.

42. MJ Gadlage, et al., Murine hepatitis virus nonstructural protein 4 regulates virus-induced membrane modifications and replication complex function. J Virol, 2010. 84(1): p. 280-90.

43. MR Moghadam, A Shams, ZS Moosavifard, F Shahnazari, D Shojaei, Principles of Health Care for Patients Involved in Fracture, Multiple Trauma and Type of Burns in Operating Room & Intensive Care Unit: The Original Article, Tobacco Regulatory Science (TRS), 2022, 2839-2854

44. N Alrabadi, et al. Medication errors: a focus on nursing practice. J of Pharmaceutical Health Services Research 2021; 12 (1): 78-86.

45. N Asadi, et al., Investigating the Relationship Between Corona Anxiety and Nursing Care Behaviors Working in Coronary Referral Hospitals. IJPCP 2020; 26 (3): 306-19.

46. N Zaimzadeh, et al., Comparison of vitamin D dietary intake among four phenotypes of polycystic ovary syndrome and its association with serum androgenic components, Razi Journal of Medical Sciences, 2018, 25 (2), 87-96

47. N Zaimzadeh, et al., The study of dietary intake of micronutrients in four phenotypes of polycystic ovary syndrome separately based on Rotterdam criteria, Razi Journal of Medical Sciences, 2018, 25 (3), 59-68

48. S Ahmadsimab, B Fazeli, G Barahman, NJ Sangani, R Alimoradzadeh, Systematic Review of Treatment Staff Services for Patients with Cardiovascular Problems with Covid-19 based on Radiological Images, Tobacco Regulatory Science (TRS), 2022, 3317-3338

49. S Azizi Aram, S Bashar poor, The role of rumination, emotion regulation and responsiveness to stress in predicting of Corona anxiety (COVID-19) among nurses. Quarterly J of Nursing Management 2020; 9 (3): 8-18.

50. S Ghorbanizadeh, Y Raziani, M Amraei, M Heydarian, Care and precautions in performing CT Scans in children, Journal of Pharmaceutical Negative Results, 2021, 12 (1), 54

51. S Golalipour, et al., Examination of Dental Problems and Radiological and Cardiac Evaluations in Patients Affected by Covid-19, NeuroQuantology, 2022, 20 (8), 1519- 1527

52. S Hariri, S Golalipour, et al., Examining the Fracture Strength of Implant-based Fixed Partial Prostheses with Different Dimensions of Connectors in the System CAM/CAD/Zir, Tobacco Regulatory Science (TRS), 2022, 2310-2329

53. S Motamed, E Hasanpour, HA Otaghvar, M Nazemian, D Shojaei, G Ghoseiri, Successful Treatment of Gynecomastia Grade III with Periareolar Excision Technique, Clin Surg. 2017; 2 1365

54. S Sheikh, F Hatami, D Shojaei, A Shams, R Sourani, The Principles Of Treatment Staff Care Of Elderly Patients Under Burn & Plastic Surgery And With Covid-19 In ICU & Operating Room Based On Clinical Points: The Original Article, Journal of Pharmaceutical Negative Results, 2022 1967-1983

55. S.E Hassanpour, S.M Moosavizadeh, M.R H Sichani, H Alizadeh Otaghvar, M Tarahomi, D Shojaei, A Molaei, L Mohajerzadeh, Evaluation of Staggered Osteotomy in Surgical Treatment of Trigonocephaly, Iranian Journal of Pediatric Surgery, 2017, 3 (1), 28-32

56. S.H Salehi, K As'adi, S.J Mousavi, S Shoar, Evaluation of Amniotic Membrane Effectiveness in Skin Graft Donor Site Dressing in Burn Patients, Indian J Surg, 2015 Dec;77(Suppl 2):427-31.

57. S.H Salehi, M.J Fatemih, K Aśadi, S Shoar, A Der Ghazarian, R Samimi, Electrical injury in construction workers: a special focus on injury with electrical power, Burns, 2014 Mar;40(2):300-4.

58. N Samiei, H kaseb ghane, R fekrazad, Diode Laser Surgery as a Conservative Management of Hairy Tongue Lesion Resistance to Treatment: a case report study, Hindawi Case Report in Dentistry, 2021, 21(3), 1-5

59. AAR Ghahroudi, AR Rokn, AR Shamshiri, N Samiei, Does timing of implant placement affect esthetic results in single-tooth implants? A cohort evaluation based on Mpes, Journal of Esthetic and Restorative Dentistry, 32(7), 2020, 715-725

60. Fereshteh Baghaei, Alireza Abdollahi, Hadiseh Mohammadpour, Mahsa Jahanbin et.al, PTEN and miR-26b: Promising prognostic biomarkers in initiation and progression of Oral Squamous Cell Carcinoma, The Orginal Article,Journal of oral pathology& medicine,2019,48(1),31-35

61. HD Soltani, M Jahanbin, S khorshidi et al, Evaluation of Alveolar crest Bone Resorption Around contilever Based Implants and Its comparison with single Tooth Restorative Implants, The orginal Article, Tobaccco Regulatory science(TRS),8(1), 2022,2385-2401

62. Z Khezerlou, D Shojaei, S Jafari, A Arabkhazaie, SHA Abadi, The Principles of Care of the Treatment Staff for the Elderly with Fracture Problems and Corona Virus in the Special Care Unit, Tobacco Regulatory Science (TRS), 2022, 2825-2838