Review Article: Managing Brain Tumors in In Vitro Fertilization Pregnancy: Systematic Review

Ramesh Baradaran Bagheri

Assistant Professor of Infertility & IVF, Department of Obstetrics and Gynecology, School of Medicine, Alborz University of Medical Sciences, Alborz, Iran. (Corresponding author / Email: - Orcid: 0000-0002-9853-6799)

Use yor device to scan and read the article online

Citation R. Baradaran Bagheri, **Managing brain Tumors in In Vitro Fertilization Pregnancy: Systematic review,** *EJCMPR* . 2022; 1(4):223-236.

https://doi.org/10.5281/zenodo.8125177

Article info:
Received: 02 May 2022
Accepted: 09 July 2022
Available Online:
ID: EJCMPR-2307-1066
Checked for Plagiarism: Yes
Peer Reviewers Approved by:
Dr. Amir Samimi
Editor who Approved Publication:
Dr. Frank Rebout

Keywords:
Brain Tumors, Pregnancy, Systematic Review

ABSTRACT

Introduction: This review addresses some of the issues that doctors encounter when treating a brain tumor in a patient who is pregnant, with a focus on radiation oncology viewpoints. Pregnancy and its effects on cancer survivors are outside the purview of this discussion.

Material and Methods: Using the terms " brain " " tumors" " brain tumors " " pregnancy " "pregnancy-related brain tumors " "pregnancy-related tumors " and " brain tumors in pregnancy " we searched the literature in Pubmed, Cochrane Library, Ovid, and Google for articles in English, Portuguese, and Spanish published in the previous 20 years or older, as appropriate

Results: Since there are no established management guidelines and there are numerous moral and ethical conundrums, the link between brain tumors and pregnancy presents a difficult challenge for the management team. Only small retrospective series of literature are currently available. It is necessary to develop a multidisciplinary plan with individualized management and thorough patient and family counseling at every stage.

Conclusion: This task should only be taken on by large centers with the resources to manage every aspect of therapy related to obstetrics, neonatology, and oncology. The creation of central registries might improve data collection and interpretation to inform future strategies.

Introduction

Fortunately, there isn't much evidence linking brain tumors and pregnancy [1]. An association of this kind released its first report in 1898. The Centers for Disease Control and Prevention and the National Cancer Institute Database in the United States reported 31,988 tumors of the central nervous system (CNS) in females of reproductive age (1999–2018, age 20–44 years, population of about 3 billion), with an age-adjusted incidence rate of 5–7 per lakh and an age–adjusted mortality rate of 3–6 per lakh(fig 1).

***Corresponding Author: Ramesh Baradaran Bagheri (**R_Baradaran@yahoo.com)*

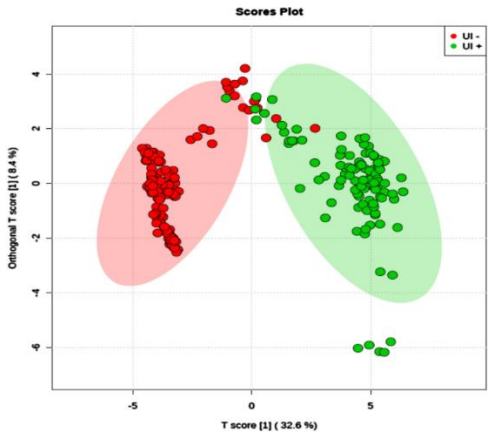

Figure 1: T score results in brain tumor

Simon estimated that there are around 90 pregnant women in the US each year who develop brain tumors, based on probabilistic calculations [2-4]. According to GLOBOCAN 2020, the age-adjusted incidence and mortality rates for CNS tumors in Indian females in the same age group (3514 cases) are estimated to be 1.3 per lakh and 1.0 per lakh, respectively, for the year 2020. This makes CNS tumors the seventh most common cancer and the fifth most common cause of death in this group [5-7].

On pregnancy and brain tumors, there are no published statistics or estimates from India. While some of these women may have brain tumors discovered incidentally while being evaluated for infertility, many of them may go into pregnancy undiagnosed [8-10]. Although the severity of symptoms like seizures and the growth rate seen on imaging may increase during pregnancy, especially in high-grade gliomas, the incidence of brain tumors does not appear to rise during pregnancy compared to the corresponding age-matched population. Despite its rarity, the aforementioned association presents a challenging challenge for the medical team, particularly when it comes to the curative management of the disease without jeopardizing maternal and fetal outcomes [11].

There may be a two-way relationship between brain tumors and pregnancy. During the assessment of infertility, a patient's brain tumor, which would otherwise be asymptomatic, may be discovered [12-14]. Surgery performed prior to conception will solve both problems if the tumor is determined to be aggressive or to be a factor in infertility. Others may experience seizures, mental health problems, or focal neurological deficits and develop a diagnosis of a de novo or recurrent brain tumor during any trimester of a healthy pregnancy [15-17].

The second scenario involves a patient who is undergoing testing or treatment for a brain tumor who becomes pregnant as a result of ineffective contraception [18-20]. In the latter case, treatment modifications and even abortion should be strongly considered in the event of incidental exposure to the teratogenic effects of drugs, diagnostic or therapeutic radiation, or periods of hypoxia after conception but before confirmation of pregnancy [21-23]. Even though spontaneous abortions are frequent during the first two to three weeks of pregnancy, exposure to chemotherapy typically does not increase the risk of teratogenesis during this time [24-26].

This review addresses some of the issues that doctors encounter when treating a brain tumor in a patient who is pregnant, with a focus on radiation oncology viewpoints. Pregnancy and its effects on cancer survivors are outside the purview of this discussion [27-29].

Materials and Methods

Using the terms " brain " " tumors" " brain tumors " " pregnancy " "pregnancy-related brain tumors " "pregnancy-related tumors " and " brain tumors in pregnancy " we searched the literature in Pubmed, Cochrane Library, Ovid, and Google for articles in English, Portuguese, and Spanish published in the previous 20 years or older, as appropriate.

INTERACTION OF PREGNANCY WITH BRAIN TUMOR ACTIVITY

It is common for women in the reproductive age range to develop benign brain tumors like pituitary adenomas, schwannomas, or meningiomas, as well as malignant tumors like gliomas (Grade 2-4), ependymomas, and very rarely neuroepithelial tumors, chondrosarcomas, lymphomas, or intracranial metastases from systemic malignancies. Pituitary tumors are the most common type of brain tumor in people between the ages of 20 and 44, followed by glial tumors and Grade 1 meningiomas, according to a report from the Central Brain Tumor Registry of the United States based on data from 2014 to 2018.

Females are much more likely than males to develop pituitary tumors and Grade 1 meningiomas. Pituitary and meningeal tumors are both hormone-driven, so during pregnancy, symptoms may worsen. This increases the chance of finding pre-existing, previously asymptomatic lesions. In their thorough analysis of gliomas and pregnancy, van Westrhenen et al. report on 337 gliomas discovered during pregnancy, 217 of which were newly discovered. According to their series, the proportion of Grade 1, 2, 3, and 4 gliomas was 4 percent, 65 percent, 8 point 6 percent, and 22 point 4 percent, respectively [30-32].

In patients with pre-existing gliomas, pregnancy may cause neurologic symptoms like seizures to worsen, and these symptoms may spark obstetric emergencies. The rise in intracranial tension (ICT) may be linked to gliomas' increased vascularity as a result of hormonal changes. Pregnancy-related hormonal changes may also promote the growth of tumors that are hormone-driven, such as gliomas, meningiomas, acoustic schwannomas, and brain metastases from breast cancer. Furthermore, the immune changes associated with pregnancy may weaken antitumor immunity [33-35].

A pregnancy-related diagnosis of low-grade glioma has no negative effects on survival. In patients with known gliomas, there is a chance of tumor growth (clinically and on imaging), dedifferentiation, and recurrence. It is essential to control secretory pituitary tumors before conception because they frequently result in infertility. Since hyperprolactinemia occurs naturally during pregnancy, disease control in this situation cannot be determined by prolactin levels. There have been reports of the pituitary expanding during pregnancy and involuting after delivery(Fig 2).

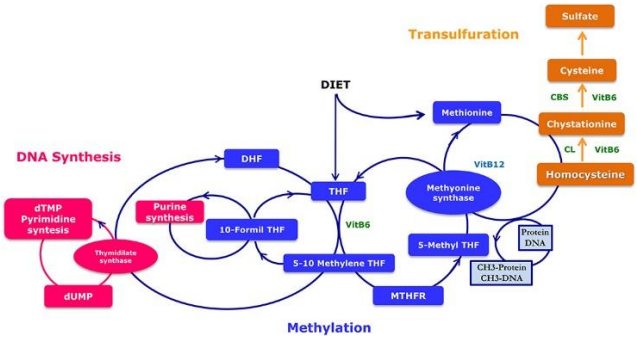

Figure 2: DNA Synthesis in pregnancy

Women with macrodenomas that have never been treated before have the highest risk of developing symptoms from a tumor growth (18.1%), followed by those who have

microadenomas that have been treated before becoming pregnant (2.5%). Pregnancy may be the time when some patients with large tumors first notice visual symptoms like field defects [36].

EVALUATION OF NEW CENTRAL NERVOUS SYMPTOMS DURING PREGNANCY

Antiepileptic drug (AED) levels in pregnant women who have known epilepsy decrease, but they may return to normal in the postpartum period. In a patient with a planned pregnancy, the doctor and gynecologist should be aware of this risk, and any seizure episode that occurs in this case needs to be evaluated for adequate drug levels of a safe AED [37-39].

To determine if the episode was actually a seizure, doctors should carefully review the medical histories of pregnant women with no prior history of epilepsy who have their first seizure. Aura history and potential seizure triggers like stress and lack of sleep should be investigated. A personality change, focal seizures with secondary generalization, especially in the first trimester, negative symptoms like focal deficits like unilateral motor or sensory loss, and visual field defects are other symptoms that call for early investigation [40-42].

These symptoms are especially concerning if they occur in the second or third trimester, when hyperemesis gravidarum is less common. A thorough workup is required, and the woman should preferably be admitted for self- and fetus-monitoring. Depending on how long a woman has been pregnant, different things could cause her to have seizures [43-45].

In the first trimester, metabolic changes or poisoning, syncope in the second trimester, and preeclampsia or stroke in the third trimester, may result in seizure-like manifestations. In the case of a single seizure episode, AEDs should not be recommended unless the diagnosis has been confirmed. Medication use, toxic agent exposure, and the possibility of metabolic changes should all be included in a proper history [46-48].

Any concomitant focal neurologic deficits and changes in mental state should be looked for during an examination. In accordance with the results of the clinical evaluation, investigations may also include lumbar puncture, a brain MRI, an electroencephalogram (EEG) or video EEG, and a toxicology screen [49].

Imaging would help identify any potential space-occupying lesion, such as an abscess, tuberculoma, neurocysticercosis, bleed, or brain tumor, after metabolic abnormalities and eclampsia have been ruled out. If a diagnosis of a potential brain tumor is made, consultation with neurosurgeons and oncologists should be sought to determine the best course of management based on symptoms, deficits, the extent and risk of progression of the brain tumor depending on radiologic impression, and the gestational period [50-52].

RISK TO MOTHER AND FOETUS WITH DIAGNOSTIC IMAGING

A brain or head-and-neck region computed tomography (CT) scan produces a fetal dose of between 01 and 03 centigrams (cGy). Even though a CT scan for a patient who is aware of being pregnant is not advised, if a CT scan for the purpose of evaluating a brain tumor is accidentally exposed, the need to terminate the pregnancy may need to be taken into account.

The diagnostic yield of brain CT or MRI with intravenous (IV) contrast is significantly increased. Iodinated contrast used in CT scanning may have unfavorable effects on the kidneys and allergies in the general population, but it has not been proven to directly cause birth defects. Neonatal thyroid function testing during the first week of life is advised when their mothers underwent such imaging during pregnancy, based on reports of rare cases of iodinated IV contrast causing hypothyroidism in the fetus [53-55]. MRI contrast is gadolinium-

based, has fewer adverse effects than CT contrast, is less likely to result in an allergic reaction, and has no potential to be nephrotoxic. Although MRI contrast can cross the placenta, no fetal birth defects have been reported [56-58].

Despite these reports, imaging continues to play a contentious role, and whenever a noncontrast MRI is an option and does not compromise a diagnostic study, it should be used to reduce fetal risk. Sometimes technetium 99 m is used for ventilation-perfusion studies in pregnant women with suspected venous thromboembolism or for brain single-photon emission CT scans. It only emits gamma rays and has a short (6 hours) half-life [59].

The amount of fetal exposure from a single study was less than 0.5 cGy, which is regarded as safe during pregnancy. Contrarily, iodine-131 is not advised for use during pregnancy because of its long (8-day) half-life, ease with which it crosses the placenta, and potential risk to the fetal thyroid when administered after 10–12 weeks of gestation(Fig 3).

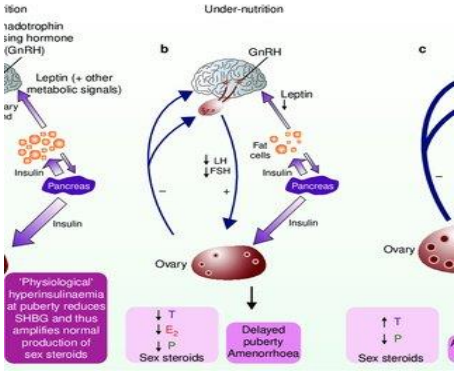

Figure 3: Brain and GnRH in brain

SURGERY/ANESTHESIA

The majority of brain tumors, especially those that are large, high grade, or aggressive, would require surgical resection as the initial treatment option to address the mass effect and establish a histopathologic diagnosis to inform the need for additional treatment [60-62]. The timing of gestation is not a factor in determining whether a cranotomy is required due to expected histology, symptoms, or a mass effect. There have been no reported negative surgical results. In the first trimester, there is a slightly increased risk of miscarriage. Patients with low-grade malignancies or benign diseases may be monitored for progression; if they are asymptomatic and stable, surgery may be delayed until delivery. However, efforts should be made to postpone surgery and delivery until fetal maturity in the early third trimester if stable high-grade gliomas discovered during pregnancy [63-65].

But because of increased ICT, there is a risk to maternal life. Due to the vulnerability of the fetus during the first trimester and the increased risk of intraoperative bleeding during the third trimester, surgery is safer to carry out in the second trimester with the continuation of pregnancy in the presence of moderately controlled symptoms in a brain tumor diagnosed in the first or second trimester [66-68].

In asymptomatic patients, labor induction at 34 weeks may be taken into consideration, followed by brain tumor surgery. It may be possible in some circumstances to perform surgery while receiving IV sedation and local or regional anesthesia without increasing the risk of teratogenesis and with a lower risk of complications with the mother's breathing [69]. Due to the higher risk of neurologic morbidity with a cerebrospinal fluid leak in the latter, general anesthesia (GA) is also acceptable and

regarded as being safer than spinal or epidural anesthesia [70-72].

By allowing the mother to breathe more deeply during tracheal intubation, the ICT is more easily controlled [73-75]. For lesions that are deeply embedded or in close proximity to eloquent regions of the brain, stereotactic biopsy under local anesthesia is a viable option for obtaining a tissue diagnosis. Especially after week 25 of pregnancy, it is advised to involve a maternal-fetal medicine service in the surgical procedure along with intraoperative fetal monitoring [76].

Depending on the location of the tumor as well as the need to maintain vena caval blood flow to lower fetal risk, patient positioning may need to be altered, necessitating a sitting or lateral position rather than a prone position. The postoperative period may also call for intermittent but increased fetal monitoring. Depending on the stage of pregnancy, pain management may involve avoiding medications that could harm the fetus [77-79]. If imaging is required, it is best to use as little ionizing radiation and contrast material as possible [80].

DRUG THERAPY

Pregnant women with brain tumors are advised to take corticosteroids to prevent intracranial edema and advance fetal lung maturity. However, prolonged steroid use has been linked to adrenal insufficiency in the developing fetus, so it is advised to use steroids with caution. Mannitol is not recommended because it could cause fetal dehydration [81-83]. During GA, propofol is regarded as safe and has not been shown to have any negative effects on the fetus. Sevoflurane, desflurane, and isoflurane have been shown to have neurotoxic effects on fetuses and should not be used [84-86].

In order to reduce exposure, anesthesia for all procedures during pregnancy should be administered with the shortest possible duration, the safest dose, and the shortest possible time between induction and the beginning of the resection. Remifentanil is the medication of choice for emergency cesarean sections (CS) in patients who have neurologic risk factors due to its opioid properties and quick onset of action. Another anesthetic regarded as pregnancy-safe is dexmedetomidine [87-89]. In between 25 and 30 percent of patients with brain tumors, pregnancy may bring on new seizures or lead to an increase in seizure frequency [90-92].

The lives of the mother and fetus may be in danger due to uncontrolled seizures and status epilepticus, while the newborn may suffer as a result of AED use. Although the use of AEDs during pregnancy is somewhat debatable, they are frequently used to treat patients with cortical brain tumors. AEDs are frequently known teratogens, including phenytoin and valproic acid. All AEDs pass through the placenta, and patients with epilepsy taking AEDs during pregnancy have a slightly higher congenital malformation rate (4–8%) than the general population (2–3%). However, it is generally acknowledged that, in a patient presenting with seizures, the risk of harm from repeated seizures outweighs the potential side effects from AEDs, including potential teratogenicity [93-95].

When there are no symptoms, they are not advised for seizure prevention. The choice of suitable AEDs may be assisted by a neurologist. Lamotrigine, levetiracetam, and carbamazepine monotherapy are the safest and best AEDs, whereas valproate causes developmental delay and is not recommended. Drugs like bromocriptine and dopamine analogs, which may delay or obviate the need for surgical resection in prolactin-secreting pituitary tumors, have acceptable safety profiles with no increase in the risk of spontaneous abortion, preterm labor, multiple births, or congenital malformations [96]. However, they must be used with caution in breastfeeding mothers. Due to the high risk of congenital malformations in

nearly 20% of patients, the European Society of Medical Oncology's clinical practice guidelines on systemic therapy in pregnancy advise against chemotherapy during the first trimester. Consider having the pregnancy terminated if you have a cancer that requires chemotherapy in the first trimester. The majority of chemotherapeutic drugs—but not all—might be safe to use in later trimesters, but each situation's need and risk, no matter how slight, should be carefully considered. Vinblastine is safe even during the first trimester, as are antimetabolites cytarabine and 5-fluorouracil, anthracyclines doxorubicin and epirubicin, vinca alkaloids vinblastine, vincristine, and vinorelbine, taxanes paclitaxel and docetaxel, and platinum agents cisplatin and carboplatin. It is best to steer clear of medications like oxaliplatin, busulfan, idarubicin, and daunorubicin [97]. Due to a lower risk of adverse fetal events, carboplatin should be chosen over cisplatin when treating cancer patients. Methotrexate should not be used during any trimester of pregnancy. Some cytotoxic agents should be given different doses during pregnancy, and there should be room for pharmacokinetic changes as well. If chemotherapy is given during the third trimester, efforts should be made to ensure a 3-week gap before delivery in order to avoid giving birth when blood counts are at their lowest.

Chemotherapy should not be administered past week 33 in order to achieve this goal because it is possible for a woman to give birth prematurely or spontaneously at any time after week 34. If chemotherapy is desired after this gestational period, weekly schedules (doxorubicin, epirubicin, and paclitaxel) may be safer due to lower hematological toxicity and shorter nadir duration. Chemotherapy administered after the first trimester has passed has the potential to result in intrauterine growth retardation, low birth weight, premature birth, stillbirth, myocardial toxicity, impaired functional development, and myelosuppression. There is no evidence that children exposed to chemotherapy in utero have cognitive, academic, or behavioral impairments. Maggen and associates. have shed light on the transplacental passage of cytotoxic agents, finding that platinum compounds have the highest concentrations (>60%) and taxanes have the lowest (2%). Following exposure to cisplatin, they advise postnatal echocardiography, and after exposure to anthracyclines, postnatal auditory testing.

Conclusion

Since there are no established management guidelines and there are numerous moral and ethical conundrums, the link between brain tumors and pregnancy presents a difficult challenge for the management team. Only small retrospective series of literature are currently available. It is necessary to develop a multidisciplinary plan with individualized management and thorough patient and family counseling at every stage. This task should only be taken on by large centers with the resources to manage every aspect of therapy related to obstetrics, neonatology, and oncology. The creation of central registries might improve data collection and interpretation to inform future strategies.

References

[1] D Alvandfar., M. Alizadeh, M. Khanbabayi Gol, *Prevalence of pregnancy varicose and its effective factors in women referred to gynecology hospitals in Tabriz.* The Iranian Journal of Obstetrics, Gynecology and Infertility, **2019**. 22(9): p. 1-7.[Crossref], [Google Scholar], [Publisher]

[2] M Montazer., et al., *Relationship of Body Mass Index with Chronic Pain after Breast Surgery in Women with Breast Cancer.* The Iranian Journal of Obstetrics, Gynecology and Infertility, **2019**.

22(8): p. 10-18. [Crossref], [Google Scholar], [Publisher]

[3]M Khanbabayi Gol., F. Jabarzade, V. Zamanzadeh, *Cultural competence among senior nursing students of medical universities in north-west Iran.* Nurs Midwifery J, **2017**. 15(8): p. 612-9. [Google Scholar], [Publisher]

[4]M Khanbabaei Gol., et al., *Sexual violence against mastectomy women improved from breast cancer.* The Iranian Journal of Obstetrics, Gynecology and Infertility, **2019**. 22(5): p. 52-60. [Crossref], [Google Scholar], [Publisher]

[5]D Aghamohamadi., M.K. Gol, *Checklist for determining severity of pain and type and dosage of analgesics administered to patients undergoing breast surgeries.* Int J Womens Health Reprod Sci, **2020**. 8(2): p. 227-31. [Google Scholar], [Publisher]

[6]K Hashemzadeh., M. Dehdilani, and M.K. Gol, *Effects of Foot Reflexology on Post-sternotomy Hemodynamic Status and Pain in Patients Undergoing Coronary Artery Bypass Graft: A Randomized Clinical Trial.* Crescent Journal of Medical & Biological Sciences, **2019**. 6(4). [Google Scholar], [Publisher]

[7]M.K Gol., A. Dorosti, and M. Montazer, *Design and psychometrics cultural competence questionnaire for health promotion of Iranian nurses.* Journal of education and health promotion, **2019**. 8. [Crossref], [Google Scholar], [Publisher]

[8] M Eftekhar., et al., Evaluation of pretreatment with Cetrotide in an antagonist protocol for patients with PCOS undergoing IVF/ICSI cycles: a randomized clinical trial. JBRA assisted reproduction, **2018**. 22(3): p. 238.[Crossref], [Google Scholar], [Publisher]

[9]A Aflatoonian., et al., Pregnancy outcome of "delayed start" GnRH antagonist protocol versus GnRH antagonist protocol in poor responders: a clinical trial study. International journal of reproductive biomedicine, **2017**. 15(4): p. 231.[Crossref], [Google Scholar], [Publisher]

[10] A Aflatoonian., R.B. Bagheri, and R. Hosseinisadat, The effect of endometrial injury on pregnancy rate in frozen-thawed embryo transfer: A randomized control trial. International Journal of Reproductive BioMedicine, **2016**. 14(7): p. 453. [Google Scholar], [Publisher]

[11] M Eftekhar., et al., Effect of granulocyte colony stimulating factor (G-CSF) on IVF outcomes in infertile women: An RCT. International Journal of Reproductive BioMedicine, **2016**. 14(5): p. 341. [Google Scholar], [Publisher]

[12] A Fattahi, A Jahanbakhshi, et al., Penetrating sacral injury with a wooden foreign body, Case reports in medicine **2018** [Crossref], [Google Scholar], [Publisher]

[13] MH Abdollahi, et al. The effect of preoperative intravenous paracetamol administration on postoperative fever in pediatrics cardiac surgery. Nigerian medical journal: journal of the Nigeria Medical Association. **2014**; 55(5): 379. [Google Scholar], [Publisher]

[14] A Afshari, et al.,. Biomaterials and Biological Parameters for Fixed-Prosthetic Implant-Supported Restorations: A Review Study. Advances in Materials Science and Engineering. **2022**;2022:2638166. [Crossref], [Google Scholar], [Publisher]

[15] A Afshari, et al. Free-Hand versus Surgical Guide Implant Placement. Advances in Materials Science and Engineering. **2022**;2022:6491134. [Crossref], [Google Scholar], [Publisher]

[16] SS Aghili, et al., COVID-19 Risk Management in Dental Offices: A Review Article. Open Access Maced J Med Sci. **2022** Nov 04; 10(F):763-772. [Crossref], [Google Scholar], [Publisher]

[17] SE Ahmadi, et al., Succinct review on biological and clinical aspects of Coronavirus

disease 2019 (COVID-19), Romanian Journal of Military Medicine, **2022**,356-365, [Google Scholar], [Publisher]

[18] H Ansari lari, et al. In Vitro Comparison of the Effect of Three Types of Heat-Curing Acrylic Resins on the Amount of Formaldehyde and Monomer Release as well as Biocompatibility. Advances in Materials Science and Engineering. **2022**;2022:8621666. [Google Scholar], [Publisher]

[19] DH Birman, Investigation of the Effects of Covid-19 on Different Organs of the Body, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2023**, 2 (1), 24-36 [Google Scholar], [Publisher]

[20] S Birmangi, A Review of the Effect of Corona on the Human Brain – Short Review, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2022**, 1 (3), 80-87 [Google Scholar], [Publisher]

[21] H Danesh, et al., Pharmacological Evaluation of Covid 19 Vaccine in Acute and Chronic Inflammatory Neuropathies, Journal of Medicinal and Chemical Sciences, **2022**, 561-570, [Crossref], [Google Scholar], [Publisher]

[22] MN Darestani, et al., Assessing the Surface Modifications of Contaminated Sandblasted and Acid-Etched Implants Through Diode Lasers of Different Wavelengths: An In-Vitro Study. Photobiomodulation, Photomedicine, and Laser Surgery. **2023**. [Crossref], [Google Scholar], [Publisher]

[23] R Dargahi, et al., Does coronavirus disease affect sleep disorders in the third trimester of pregnancy in women with low back pain? International Journal of Women's Health and Reproduction Sciences. **2021**; 9(4):268-273. [Google Scholar], [Publisher]

[24] M Eidi, et al., A comparison of preoperative ondansetron and dexamethasone in the prevention of post-tympanoplasty nausea and vomiting. Iranian Journal of Medical Sciences. **2012**; 37(3):166-172. [Google Scholar], [Publisher]

[25] Eidy M, Ansari M, Hosseinzadeh H, Kolahdouzan K. Incidence of back pain following spinal anesthesia and its relationship to various factors in 176 patients. Pakistan Journal of Medical Sciences. **2010**; 26(4):778-781. [Google Scholar], [Publisher]

[26] Esmaeilzadeh, AA, et al., Identify Biomarkers and Design Effective Multi-Target Drugs in Ovarian Cancer: Hit Network-Target Sets Model Optimizing, Biology, **2022**, 11 (12), 1851 [Crossref], [Google Scholar], [Publisher]

[27] Eydi M, Golzari SEJ, Aghamohammadi D, Kolahdouzan K, Safari S, Ostadi Z. Postoperative management of shivering: A comparison of pethidine vs. ketamine. Anesthesiology and Pain Medicine; **2014**: 4(2),e15499 [Crossref], [Google Scholar], [Publisher]

[28] F Beiranvandi, et al., Investigation Of Medical Services In Patients With Diabetes And Cardio-Vascular Disease & High Blood Pleasure In ICU With Radiological & Pathology Point: The Original Article, Journal of Pharmaceutical Negative Results, **2022** 4417-4425 [Crossref], [Google Scholar], [Publisher]

[29] F Safari, H Safari, Synthesis of Graphene Oxide Nano Carriers Containing Alcoholic Extracts of Turmeric, Sedum, and Rosemary in Order to Treat Breast Cancer in Dogs, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2022** 1 (2), 150-154 [Google Scholar], [Publisher]

[30] FB SS Seyedian,A Akbar shayesteh, Dataset for evaluation of threescoring systems for forecasting the clinical outcomes of patients with upper gastrointestinal bleeding(UGIB)-Ahvaz, Iran, Elsevier, **2018** 2526-2530 [Crossref], [Google Scholar], [Publisher]

[31] G Sharifi, A Jahanbakhshi, et al., Bilateral three-level lumbar spondylolysis repaired by hook-screw technique, Global spine journal, **2012** 2 (1), 051-055 [Crossref], [Google Scholar], [Publisher]

[32] G Sharifi, A Jahanbakhshi, Quadrigeminal cistern arachnoid cyst treated by endoscopic

ventriculocystostomy through the trigonal region, Journal of Neurological Surgery Part A: Central European Neurosurgery, **2013** 74, e145-e148 [Crossref], [Google Scholar], [Publisher]

[33] Gheisari R, Doroodizadeh T, Estakhri F, Tadbir A, Soufdoost R, Mosaddad S. Association between blood groups and odontogenic lesions: a preliminary report. Journal of Stomatology. **2019**;72(6):269-73. [Crossref], [Google Scholar], [Publisher]

[34] Gheisari R, Resalati F, Mahmoudi S, Golkari A, Mosaddad SA. Do Different Modes of Delivering Postoperative Instructions to Patients Help Reduce the Side Effects of Tooth Extraction? A Randomized Clinical Trial. Journal of Oral and Maxillofacial Surgery. **2018**;76(8):1652.e1-.e7.[Crossref], [Google Scholar], [Publisher]

[35] Gheisari R, Resalati F, Mahmoudi S, Golkari A, Mosaddad SA. Do Different Modes of Delivering Postoperative Instructions to Patients Help Reduce the Side Effects of Tooth Extraction? A Randomized Clinical Trial. Journal of Oral and Maxillofacial Surgery. **2018**;76(8):1652.e1-.e7.[Crossref], [Google Scholar], [Publisher]

[36] Golfeshan F, Ajami S, Khalvandi Y, Mosaddad SA, Nematollahi H. The Analysis of the Differences between the Influence of Herbal Mouthwashes and the Chlorhexidine Mouthwash on the Physical Characteristics of Orthodontic Acrylic Resin. Journal of Biological Research - Bollettino della Società Italiana di Biologia Sperimentale. **2020**;93(1). [Google Scholar], [Publisher]

[37] Golfeshan F, Mosaddad SA, Babavalian H, Tebyanian H, Mehrjuyan E, Shakeri F. A Summary of Planarian Signaling Pathway for Regenerative Medicine. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. **2022**;92(1):5-10. [Google Scholar], [Publisher]

[38] Golfeshan F, Mosaddad SA, Ghaderi F. The Effect of Toothpastes Containing Natural Ingredients Such As Theobromine and Caffeine on Enamel Microhardness: An In Vitro Study. Evidence-Based Complementary and Alternative Medicine. **2021**;2021:3304543. [Crossref], [Google Scholar], [Publisher]

[39] Haghdoost M, Mousavi S, Gol MK, Montazer M. Frequency of Chlamydia trachomatis Infection in Spontaneous Abortion of Infertile Women During First Pregnancy Referred to Tabriz University of Medical Sciences by Nested PCR Method in 2015. International Journal of Women's Health and Reproduction Sciences. **2019**; 7(4): 526-30. [Google Scholar], [Publisher]

[40] Haghdoost M, Mousavi S, Gol MK, Montazer M. Frequency of Chlamydia trachomatis Infection in Spontaneous Abortion of Infertile Women During First Pregnancy Referred to Tabriz University of Medical Sciences by Nested PCR Method in 2015. International Journal of Women's Health and Reproduction Sciences. **2019**; 7(4): 526-30. [Google Scholar], [Publisher]

[41] Hasanpour Dehkordi A, Khaji L, Sakhaei Shahreza MH, Mashak Z, Safarpoor Dehkordi F, Safaee Y, Hosseinzadeh A, Alavi I, Ghasemi E, Rabiei-Faradonbeh M. One-year prevalence of antimicrobial susceptibility pattern of methicillin-resistant Staphylococcus aureus recovered from raw meat. Tropical Biomedicine. **2017**;34(2):396-404. [Crossref], [Google Scholar], [Publisher]

[42] Irajian M, Beheshtirooy A. Assessment of Frequency of Long Bone Osteomyelitis in Traumatic Patients Undergoing Orthopedic Surgery in Imam Reza (AS) Hospital-Tabriz. International Journal of Current Microbiology and Applied Sciences. **2016**;5(1): 818-825.[Google Scholar], [Publisher]

[43] Irajian M, Faridaalaee G. Establishing a field hospital; a report on a disaster maneuver. Iranian Journal of Emergency Medicine.

2016;3(3): 115-118. [Crossref], [Google Scholar], [Publisher]

[44] Khaji L, Shahreza MH. SCCmec types in methicillin-resistant Staphylococcus aureus strains of various types of milk. Electronic Journal of Biology. **2016**;13:1. [Google Scholar], [Publisher]

[45] Kheradjoo H, et al., Mesenchymal stem/stromal (MSCs)-derived exosome inhibits retinoblastoma Y-79 cell line proliferation and induces their apoptosis, Molecular Biology Reports, **2023**, 50, 4217–4224, [Crossref], [Google Scholar], [Publisher]

[46] M Irajian, V Fattahi, Rebound Pain after Peripheral Nerve Block for Ankle Surgery and Postoperative Analgesic: Systematic Review, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2023** 2 (3), 43-52 [Crossref], [Google Scholar], [Publisher]

[47] M Jalessi, A Jahanbakhshi, et al., Endoscopic repair of transsellar transsphenoidal meningoencephalocele; case report and review of approaches, Interdisciplinary Neurosurgery, **2015** 2 (2), 86-89 [Crossref], [Google Scholar], [Publisher]

[48] M Milanifard, Effects of Micronutrients in Improving Fatigue, Weakness and Irritability, GMJ Medicine, 2021 5 (1), 391-395 [Crossref], [Google Scholar], [Publisher]

[49] M Najafi, A Jahanbakhshi, et al., State of the art in combination Immuno/Radiotherapy for brain metastases: Systematic review and meta-analysis, Current Oncology, **2022** 29 (5), 2995-3012 [Crossref], [Google Scholar], [Publisher]

[50] Mahkooyeh SA, et al., Chemical laboratory findings in children with covid-19: A systematic review and meta-analysis, Eurasian Chemical Communications, **2022**, 338-346, [Crossref], [Google Scholar], [Publisher]

[51] Mahmoodpoor A, Hamishehkar H, Shadvar K, Sanaie S, Iranpour A, Fattahi V. Validity of bedside blood glucose measurement in critically ill patients with intensive insulin therapy. Indian Journal of Critical Care Medicine.**2016**; 20(11): 653. [Crossref], [Google Scholar], [Publisher]

[52] Mahmoudi H, et al., Stem cell-derived nano-scale vesicles promotes the proliferation of retinal ganglion cells (RGCs) by activation PI3K/Akt and ERK pathway, Nanomedicine Research Journal, **2022**, 7(3), 288-293, [Crossref], [Google Scholar], [Publisher]

[53] Margy S, A Review of the Effect of Brain imaging- Short Review, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2022**, 1 (3), 88-99 [Google Scholar], [Publisher]

[54] Mashak Z, Jafariaskari S, Alavi I, Sakhaei Shahreza M, Safarpoor Dehkordi F. Phenotypic and genotypic assessment of antibiotic resistance and genotyping of vacA, cagA, iceA, oipA, cagE, and babA2 alleles of Helicobacter pylori bacteria isolated from raw meat. Infection and Drug Resistance. **2020** 29:257-72. [Crossref], [Google Scholar], [Publisher]

[55] MM Fard, et al., A Brief Study of a Comprehensive Meta-Analysis Study of the Birth Outcomes of Corona Mothers in Iran, Journal of Chemical Reviews, **2019** 3 (3), 181-195 [Crossref], [Google Scholar], [Publisher]

[56] Mobaraki-Asl N, Ghavami Z, Gol MK. Development and validation of a cultural competence questionnaire for health promotion of Iranian midwives. Journal of education and health promotion. **2019**;8:179.

[57] Moharrami M, Nazari B, Anvari HM. Do the symptoms of carpal tunnel syndrome improve following the use of Kinesio tape? Trauma Monthly. **2021**; 26(4):228-234. [Crossref], [Google Scholar], [Publisher]

[58] Mokhtari Ardekani AB, et al., miR-122 dysregulation is associated with type 2 diabetes mellitus-induced dyslipidemia and hyperglycemia independently of its rs17669 variant, BioMed Research International, **2022**, Article ID 5744008, [Crossref], [Google Scholar], [Publisher]

[59] Mosaddad SA, Beigi K, Doroodizadeh T, Haghnegahdar M, Golfeshan F, Ranjbar R, et al.

Therapeutic applications of herbal/synthetic/bio-drug in oral cancer: An update. Eur J Pharmacol. **2021**;890:173657.[Crossref], [Google Scholar], [Publisher]

[60] Mosaddad SA, Gheisari R, Erfani M. Oral and maxillofacial trauma in motorcyclists in an Iranian subpopulation. Dental Traumatology. **2018**;34(5):347-52. [Crossref], [Google Scholar], [Publisher]

[61] Mosaddad SA, Namanloo RA, Aghili SS, Maskani P, Alam M, Abbasi K, et al. Photodynamic therapy in oral cancer: a review of clinical studies. Medical Oncology. **2023**;40(3):91. [Crossref], [Google Scholar], [Publisher]

[62] Mosaddad SA, Rasoolzade B, Namanloo RA, Azarpira N, Dortaj H. Stem cells and common biomaterials in dentistry: a review study. Journal of Materials Science: Materials in Medicine. **2022**;33(7):55. [Crossref], [Google Scholar], [Publisher]

[63] Mosaddad SA, Salari Y, Amookhteh S, Soufdoost RS, Seifalian A, Bonakdar S, et al. Response to Mechanical Cues by Interplay of YAP/TAZ Transcription Factors and Key Mechanical Checkpoints of the Cell: A Comprehensive Review. Cell Physiol Biochem. **2021**;55(1):33-60.[Crossref], [Google Scholar], [Publisher]

[64] Mosaddad SA, Yazdanian M, Tebyanian H, Tahmasebi E, Yazdanian A, Seifalian A, et al. Fabrication and properties of developed collagen/strontium-doped Bioglass scaffolds for bone tissue engineering. Journal of Materials Research and Technology. **2020**;9(6):14799-817. [Crossref], [Google Scholar], [Publisher]

[65] Mosaddad, SA, Abdollahi Namanloo, R, Ghodsi, R, Salimi, Y, Taghva, M, Naeimi Darestani, M. Oral rehabilitation with dental implants in patients with systemic sclerosis: a systematic review. Immun Inflamm Dis. **2023**; 11:e812. [Crossref], [Google Scholar], [Publisher]

[66] Movassagi R, Montazer M, Mahmoodpoor A, Fattahi V, Iranpour A, Sanaie S. Comparison of pressure vs. volume-controlled ventilation on oxygenation parameters of obese patients undergoing laparoscopic cholecystectomy. Pakistan journal of medical sciences.**2017**; 33(5): 1117 .[Crossref], [Google Scholar], [Publisher]

[67] Musaei S, The Effect of Pregnancy on the Skin, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2023**, 2(1), 17-23. [Google Scholar], [Publisher]

[68] Namanloo RA, Ommani M, Abbasi K, Alam M, Badkoobeh A, Rahbar M, et al. Biomaterials in Guided Bone and Tissue Regenerations: An Update. Advances in Materials Science and Engineering. **2022** :2489399. [Crossref], [Google Scholar], [Publisher]

[69] Nazardani SZ, et al., A comprehensive evaluation of the Sports Physiotherapy curriculum, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2023**, 2, 10-16. [Google Scholar], [Publisher]

[70] Nazari B, Amani L, Ghaderi L, Gol MK. Effects of probiotics on prevalence of ventilator-associated pneumonia in multitrauma patients hospitalized in neurosurgical intensive care unit: a randomized clinical trial. Trauma Monthly.**2020**; 25(6): 262-268. [Crossref], [Google Scholar], [Publisher]

[71] Ranjbar R, Safarpoor Dehkordi F, Sakhaei Shahreza MH, Rahimi E. Prevalence, identification of virulence factors, O-serogroups and antibiotic resistance properties of Shiga-toxin producing Escherichia coli strains isolated from raw milk and traditional dairy products. Antimicrobial Resistance & Infection Control. **2018**;7(1):1-1. [Crossref], [Google Scholar], [Publisher]

[72] Ranjbar R, Shahreza MH, Rahimi E, Jonaidi-Jafari N. Methicillin-resistant Staphylococcus aureus isolates from Iranian restaurant food samples: Panton-Valentine Leukocidin, SCCmec phenotypes and

antimicrobial resistance. Tropical Journal of Pharmaceutical Research. **2017** 7;16(8):1939-49. [Crossref], [Google Scholar], [Publisher]

[73] Ranjbar R, Shahreza MH. Prevalence, antibiotic-resistance properties and enterotoxin gene profile of Bacillus cereus strains isolated from milk-based baby foods. Tropical Journal of Pharmaceutical Research. **2017** 7;16(8):1931-7. [Crossref], [Google Scholar], [Publisher]

[74] S Cozzi, M Najafi, et al., Delayed effect of dendritic cells vaccination on survival in glioblastoma: a systematic review and meta-analysis, Current Oncology, **2022** 29 (2), 881-891 [Crossref], [Google Scholar], [Publisher]

[75] S Saedi, A Saedi, MM Ghaemi, MM Fard, Pidemiological Study of Breast Cancer in Iran, a review study, Eurasian J. Sci. Technol, **2022** 2, 233-241 [Crossref], [Google Scholar], [Publisher]

[76] SA Mahkooyeh, S Eskandari, E Delavar, M Milanifard, FE Mehni, Chemical laboratory findings in children with covid-19: A systematic review and meta-analysis, Eurasian Chemical Communications, **2022** 338-346 [Crossref], [Google Scholar], [Publisher]

[77] Sarejloo SH, et al., Neutrophil-to-Lymphocyte Ratio and Early Neurological Deterioration in Stroke Patients: A Systematic Review and Meta-Analysis, **2022**, Article ID 8656864 [Crossref], [Google Scholar], [Publisher]

[78] Shahreza MH, Rahimi E, Momtaz H. Shiga-toxigenic Escherichia coli in ready-to-eat food staffs: Prevalence and distribution of putative virulence factors. Microbiology Research. **2017** 22;8(2):7244. [Crossref], [Google Scholar], [Publisher]

[79] Shahreza MS, Dehkordi NG, Nassar MF, Al-Saedi RM. Genotyping of Campylobacter jejuni isolates from raw meat of animal species. Academic Journal of Health Sciences: Medicina balear. **2022**;47(4):52-7. [Crossref], [Google Scholar], [Publisher]

[80] Shahreza MS, Dehkordi NG, Nassar MF, Al-Saedi RM. Virulence characters and linotyping of Pseudomonas aeruginosa isolated from meat and assessment of the antimicrobial effects of Zataria multiflora against isolates. Academic Journal of Health Sciencies: Medicina Balear. **2022**. 37(4): 11-16. [Google Scholar], [Publisher]

[81] Shahreza MS. Ready To Eat Food Samples As Reservoirs Of Shiga Toxigenic Escherichia Coli. Journal of Pharmaceutical Negative Results. **2022** 31:9761-6. [Crossref], [Google Scholar], [Publisher]

[82] Shahreza, M. H. S., & Soltani, A. Genotyping and antibiotic resistance of methicillin-resistant staphylococcus aureus strains isolated from raw and frozen meat samples and assessment of the antimicrobial effects of origanum vulgare against MRSA isolates. International Journal of Health Sciences, **2022**, 6(S6), 4840–4852. [Google Scholar], [Publisher]

[83] Shahreza, M. S., & Afshari, H. Ribotyping and assessment of toxigenic genes of clostridium difficile strains isolated from raw meat. International Journal of Health Sciences, **2022**, 6(S6), 4853–4863. [Crossref], [Google Scholar], [Publisher]

[84] Shirvani M, et al., The Diagnostic Value of Neutrophil to Lymphocyte Ratio as an Effective Biomarker for Eye Disorders: A Meta-Analysis, BioMed Research International, **2022**, Article ID 5744008, [Crossref], [Google Scholar], [Publisher]

[85] SS Beladi Mousavi, et al., Reducing Dialysate Temperature and Hemodynamic Stability among Hemodialysis Patients who were Susceptible to Hemodynamic Instability- a Cross Over Study, Jundishapur Scientific Medical Journal (JSMJ), **2014** 13 (1), 11-20 [Google Scholar], [Publisher]

[86] A Susanabadi, et al., A Systematic Short Review in Evaluate the Complications and Outcomes of Acute Severe of Pediatric Anesthesia, Journal of Chemical Reviews, **2021**,

3 (3), 219-231, [Crossref], [Google Scholar], [Publisher]

[87] Susanabadi A, et al., Evaluating the Outcome of Total Intravenous Anesthesia and Single Drug Pharmacological to Prevent Postoperative Vomiting: Systematic Review and Meta-Analysis, Annals of the Romanian Society for Cell Biology, **2021**, 25 (6), 2703-2716, [Google Scholar], [Publisher]

[88] E Tahmasebi, M Alam, M Yazdanian, H Tebyanian, A Yazdanian, A Seifalian, et al. Current biocompatible materials in oral regeneration: a comprehensive overview of composite materials. Journal of Materials Research and Technology. **2020**;9(5):11731-55. [Crossref], [Google Scholar], [Publisher]

[89] E Tahmasebi, M Alam, M Yazdanian, H Tebyanian, A Yazdanian, A Seifalian, et al. Current biocompatible materials in oral regeneration: a comprehensive overview of composite materials. Journal of Materials Research and Technology. **2020**;9(5):11731-55. [Crossref], [Google Scholar], [Publisher]

[90] S Torkan, MH Shahreza. VacA, CagA, IceA and OipA genotype status of Helicobacter pylori isolated from biopsy samples from Iranian dogs. Tropical Journal of Pharmaceutical Research. **2016** 4;15(2):377-84. [Crossref], [Google Scholar], [Publisher]

[91] E Yahaghi, F Khamesipour, F Mashayekhi, F Safarpoor Dehkordi, MH Sakhaei, M Masoudimanesh, MK Khameneie. Helicobacter pylori in vegetables and salads: genotyping and antimicrobial resistance properties. BioMed Research International. **2014** 12;2014: 757941. [Crossref], [Google Scholar], [Publisher]

[92] M Yazdanian, A Rahmani, E Tahmasebi, H Tebyanian, A Yazdanian, SA Mosaddad. Current and Advanced Nanomaterials in Dentistry as Regeneration Agents: An Update. Mini Reviews in Medicinal Chemistry. **2021**;21(7):899-918. [Crossref], [Google Scholar], [Publisher]

[93] S Sayad, SAY Ahmadi, M Moradi, R Nekouian, K Anbari, F Shahsavar, A meta-analysis on diagnostic accuracy of serum HLA-G level in breast cancer, Expert Review of Precision Medicine and Drug Development, **2020** 5 (2), 109-114 [Google Scholar], [Publisher]

[94] AR Baghestani, P Shahmirzalou, S Sayad, ME Akbari, F Zayeri, Comparison cure rate models by DIC criteria in Breast Cancer data, Asian Pacific journal of cancer prevention: APJCP, **2018** 19 (6), 1601 [Crossref], [Google Scholar], [Publisher]

[95] S Sayad, SA Dastgheib, et al., Association of PON1, LEP and LEPR Polymorphisms with Susceptibility to Breast Cancer: A Meta-Analysis, Asian Pacific Journal of Cancer Prevention: APJCP, **2021** 22 (8), 2323 [Crossref], [Google Scholar], [Publisher]

[96] SAY Ahmadi, S Sayad, et al., Expression of angiogenesis-related genes in a group of Iranian cases of breast cancer, Current Pharmacogenomics and Personalized Medicine, **2020** 17(3) 197-205 [Crossref], [Google Scholar], [Publisher]

[97] S Sayad, SAY Ahmadi, R Nekouian, M Panahi, K Anbari, Epidemiological and pathological characteristics of postsurgical cases of invasive breast cancer among ethnicities of Iran in 2018: A single center cross-sectional study, Current Pharmacogenomics and Personalized Medicine, **2020**, [Google Scholar], [Publisher]