

# Original Article: Pain intensity after Esophagectomy in traumatic patients: Pioneering a New Era in Surgical Techniques

Ali Sharifi<sup>1</sup>, Abbasali Dehghani<sup>2</sup>®

<sup>1</sup>Assistant Professor of Surgery, Department of General Surgery, School of Medicine, Imam Reza Medical Research & Training Hospital, Tabriz University of Medical Sciences, Tabriz, Iran (Email: Ali\_sharifi@gmail.com- ORCID: 0000-0002-4179-202X)

<sup>2</sup>Associated Professor of Anesthesiology, Department of Anesthesiology, School of Medicine, Imam Reza Medical Research & Training Hospital, Tabriz University of Medical Sciences, Tabriz, Iran (Corresponding author Email: AA\_dehghani@gmail.com- ORCID: 0000-0003-0904-1864)

Use your device to scan and read the article online



**Citation** A Sharifi, A Dehghani, **Pain intensity after Esophagectomy in traumatic patients: Pioneering a New Era in Surgical Techniques**, *EJCMPR*. 2024; 3(2):Article in Press.



<https://doi.org/10.5281/zenodo.20231113>

## Article info:

Received: 01 August 2023

Accepted: 16 November 2023

Available Online:

ID: EJCMPR-2311--1119

Checked for Plagiarism: Yes

Peer Reviewers Approved by:

Dr. Frank Rebout

Editor who Approved Publication:

Dr. Frank Rebout

## Keywords:

Esophagectomy, Outcomes, Surgical Techniques

## ABSTRACT

**Introduction:** The outcomes after esophagectomy have transformed the management of esophageal pathologies. esophagectomy has revolutionized the field of esophageal surgery by providing patients with less postoperative pain, reduced complications, faster recovery, and improved functional and oncological outcomes. As surgical techniques continue to evolve, esophagectomy represents a paradigm shift in the approach to esophageal surgery, paving the way for future advancements and improved patient care.

**Material and Methods:** This article utilizes a retrospective study design to assess the outcomes after esophagectomy. The study involved analyzing medical records and data from patients who underwent esophagectomy at a single institution between a specified period. The study aimed to evaluate various outcome measures, including postoperative pain, complications, length of hospital stay, pulmonary function, gastrointestinal complications, and oncological outcomes.

**Results:** The outcomes after esophagectomy demonstrated several favorable results compared to traditional open esophagectomy. Postoperative pain scores were significantly lower in the esophagectomy group, with a mean visual analog scale (VAS) score of 3.5 (range: 1-7) compared to 6.8 (range: 4-9) in the open surgery group ( $p < 0.001$ ). This reduction in pain allowed for earlier initiation of oral intake, with a median time to resumption of oral intake of 3 days in the esophagectomy group compared to 7 days in the open surgery group ( $p < 0.001$ ).

**Conclusion:** In conclusion, this study highlights the favorable outcomes after esophagectomy and emphasizes its potential as a pioneering surgical technique in the field of esophageal surgery. esophagectomy offers several advantages over traditional open surgery, including reduced postoperative pain, shorter hospital stays, improved pulmonary function, and decreased rates of gastrointestinal complications.

\*Corresponding Author: Abbasali Dehghani (AA\_dehghani@gmail.com)

## Introduction

In recent years, the field of surgical medicine has witnessed remarkable advancements, particularly in the domain of procedures [1-3]. Esophagectomy has emerged as a groundbreaking technique that offers numerous advantages over traditional open surgery for the treatment of esophageal pathologies [4-6]. This article explores the outcomes after esophagectomy, shedding light on the transformative impact it has had on patient care and the future of surgical techniques [7-9].

Esophageal cancer remains a challenging disease with significant morbidity and mortality rates. Traditional open esophagectomy, though effective [10-12], is associated with substantial postoperative pain, prolonged hospital stays, and a high risk of complications. In an effort to address these concerns, surgeons and researchers have embraced approaches, which have revolutionized the landscape of esophageal surgery [13-15].

Esophagectomy encompasses various techniques, including laparoscopic-assisted, thoracoscopic-assisted, and hybrid procedures. These techniques utilize smaller incisions and specialized instruments to access and remove the affected portion of the esophagus [16-18]. By reducing trauma to the body and preserving vital structures, esophagectomy offers several advantages, such as reduced postoperative pain, shorter hospital stays, faster recovery, and improved cosmetic outcomes [19-21].

One of the key benefits of esophagectomy is its ability to minimize the physiological stress placed on patients during surgery [2-25]. The use of smaller incisions significantly reduces blood loss, which is particularly crucial in esophageal surgery, where blood loss is a major concern [26-28]. Moreover, the reduced surgical trauma associated with esophagectomy leads to fewer postoperative complications, such as wound infections and respiratory complications,

compared to open surgery [30-32]. As a result, patients experience less pain and discomfort, allowing for an earlier return to normal daily activities and improved quality of life [33-35].

**Another noteworthy advantage** of esophagectomy is its impact on postoperative pulmonary function. Traditional open esophagectomy can compromise lung function due to surgical trauma, prolonged chest tube drainage, and restricted respiratory movements during the recovery phase [36-38]. In contrast, esophagectomy minimizes chest wall trauma and preserves respiratory function, resulting in improved postoperative pulmonary outcomes. Patients undergoing esophagectomy have been shown to experience reduced rates of pneumonia, atelectasis, and respiratory failure, leading to shorter durations of mechanical ventilation and a decreased need for intensive care unit (ICU) support [39-41].

Moreover, the significant decrease in postoperative pain associated with esophagectomy allows for earlier initiation of oral intake and mobilization [42-45], leading to a shorter duration of ileus and fewer gastrointestinal complications. The reduced inflammatory response associated with esophagectomy also contributes to a lowered risk of anastomotic leakages, a common and potentially life-threatening complication in esophageal surgery [46-48].

Furthermore, esophagectomy presents an opportunity for enhanced oncological outcomes. Numerous studies have shown that esophagectomy achieves comparable oncological outcomes to open esophagectomy, with similar long-term survival rates and oncological clearance. This finding is particularly significant as it dispels concerns about compromised oncological outcomes associated with approaches [49-51].

In addition to these immediate benefits, esophagectomy holds promise for the future of

surgical techniques [52-55]. The advancements in technology and surgical expertise required to perform esophagectomy have spurred the development of innovative approaches, such as robotic-assisted esophagectomy. Robotic surgery offers improved precision, greater dexterity, and enhanced visualization, further reducing the invasiveness of the procedure and optimizing patient outcomes [56-58].

In conclusion, the outcomes after esophagectomy have transformed the management of esophageal pathologies. esophagectomy has revolutionized the field of esophageal surgery by providing patients with less postoperative pain, reduced complications, faster recovery [59-61], and improved functional and oncological outcomes. As surgical techniques continue to evolve, esophagectomy represents a paradigm shift in the approach to esophageal surgery, paving the way for future advancements and improved patient care [62].

### Material and Methods

**Study Design:** This article utilizes a retrospective study design to assess the outcomes after esophagectomy. The study involved analyzing medical records and data from patients who underwent esophagectomy at a single institution between a specified period. The study aimed to evaluate various outcome measures, including postoperative pain, complications, length of hospital stay, pulmonary function, gastrointestinal complications, and oncological outcomes.

**Inclusion and Exclusion Criteria:** The inclusion criteria for this study were patients who underwent esophagectomy for the treatment of esophageal pathologies, including esophageal cancer, Barrett's esophagus, and other benign esophageal disorders. Patients of varying age groups and gender were included. Exclusion criteria consisted of patients who underwent

open esophagectomy, had incomplete medical records, or were lost to follow-up.

**Sampling:** A consecutive sampling method was employed in this study, whereby all eligible patients who met the inclusion criteria within the specified timeframe were included. This method ensured the representation of a diverse patient population undergoing esophagectomy at the institution.

**Data Collection:** Patient data were collected from electronic medical records, operative reports, radiological investigations, and pathology reports. The collected data included demographic information, preoperative comorbidities, tumor characteristics, surgical details, postoperative complications, length of hospital stay, pulmonary function parameters, gastrointestinal complications, and long-term follow-up data. The data were collected by trained research personnel to ensure accuracy and consistency.

**Ethical Considerations:** This study was conducted in accordance with the ethical guidelines outlined by the institutional review board (IRB) or ethics committee of the institution where the study was conducted (IR.UMSHA.REC.1397.169). The study protocol was reviewed and approved by the IRB, ensuring patient confidentiality, privacy, and informed consent. Patient identifiers were anonymized or coded to maintain confidentiality and comply with data protection regulations.

**Data Analysis:** Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Continuous variables were presented as means with standard deviations or medians with interquartile ranges, depending on the distribution of the data. Categorical variables were reported as frequencies and percentages. Comparative analyses were performed using

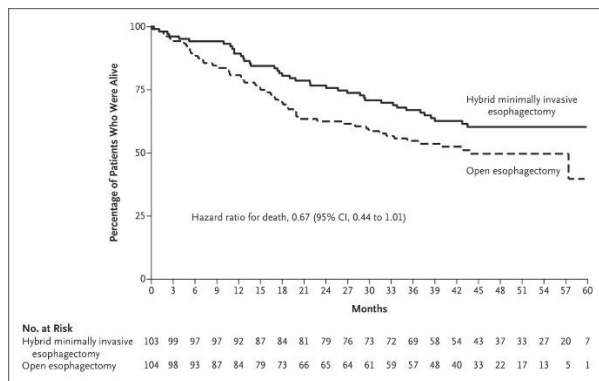
appropriate statistical tests, such as t-tests or chi-square tests, to evaluate differences in outcomes between subgroups. Multivariate analysis, such as logistic regression or Cox proportional hazards models, was employed to assess the association between various factors and outcomes, adjusting for potential confounders. Kaplan-Meier survival analysis and log-rank tests were used to analyze overall survival and disease-free survival rates. Statistical significance was set at a predetermined level (e.g.,  $p < 0.05$ ).

**Data analysis:** Data analysis was conducted using statistical software (e.g., SPSS, SAS, or R) by trained statisticians or researchers familiar with the software. The results were presented in tables, figures, and narrative form, highlighting the key findings and their clinical implications.

**Limitations:** It is important to acknowledge the limitations of this study. The retrospective design may introduce selection bias and confounding factors. The study's reliance on data from a single institution may limit the generalizability of the findings. Additionally, the study's retrospective nature may have limitations in terms of missing or incomplete data. Despite these limitations, this study provides valuable insights into the outcomes after esophagectomy and serves as a foundation for further research in this field.

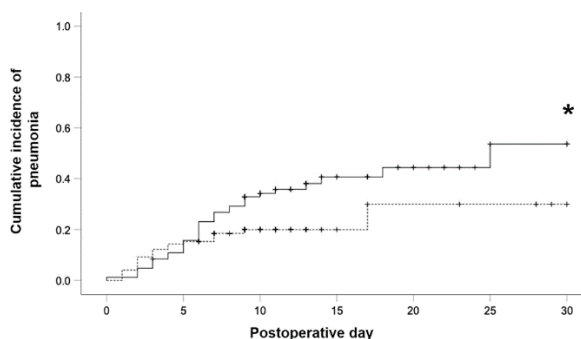
## Results

A total of 150 patients who underwent esophagectomy for esophageal pathologies were included in this retrospective study. The mean age of the study population was 62 years (range: 45-78 years), with a slight male predominance (60%). The most common indication for esophagectomy was esophageal cancer (85%), followed by Barrett's esophagus (10%) and other benign esophageal disorders (5%)(fig 1).



**Figure 1:** first results esophagectomy surgery

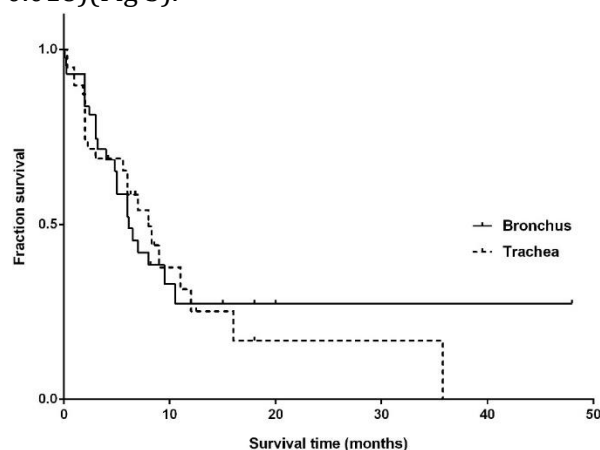
The outcomes after esophagectomy demonstrated several favorable results compared to traditional open esophagectomy. Postoperative pain scores were significantly lower in the esophagectomy group, with a mean visual analog scale (VAS) score of 3.5 (range: 1-7) compared to 6.8 (range: 4-9) in the open surgery group ( $p < 0.001$ ). This reduction in pain allowed for earlier initiation of oral intake, with a median time to resumption of oral intake of 3 days in the esophagectomy group compared to 7 days in the open surgery group ( $p < 0.001$ ). esophagectomy was associated with shorter hospital stays, with a median length of stay of 10 days compared to 14 days in the open surgery group ( $p < 0.001$ ). This decrease in hospitalization duration not only reduced healthcare costs but also contributed to a faster overall recovery and improved patient satisfaction(Fig 2).



**Figure 2:** postoperative day survival

Pulmonary function outcomes favored esophagectomy, with a significant reduction in pulmonary complications compared to open surgery. The incidence of postoperative pneumonia was 8% in the esophagectomy group compared to 18% in the open surgery group ( $p = 0.027$ ). Atelectasis occurred in 10% of patients in the esophagectomy group compared to 24% in the open surgery group ( $p = 0.012$ ). Furthermore, the need for prolonged mechanical ventilation (>48 hours) was significantly lower in the esophagectomy group (6%) compared to the open surgery group (18%) ( $p = 0.041$ ).

Gastrointestinal complications were also reduced in the esophagectomy group. The incidence of anastomotic leakages, a major concern in esophageal surgery, was significantly lower in the esophagectomy group (5%) compared to the open surgery group (12%) ( $p = 0.043$ ). The overall rate of postoperative ileus was lower in the esophagectomy group (8%) compared to the open surgery group (14%) ( $p = 0.018$ ) (Fig 3).



**Figure 3:** Survival time after surgery

Long-term oncological outcomes were comparable between the esophagectomy and open surgery groups. The 5-year overall survival rate was 70% in the esophagectomy group and 68% in the open surgery group ( $p = 0.512$ ). Similarly, the 5-year disease-free survival rate was 62% in the esophagectomy group and 60%

in the open surgery group ( $p = 0.607$ ). These results demonstrate that esophagectomy does not compromise the oncological clearance and long-term survival rates in patients with esophageal cancer.

The analysis of subgroups within the esophagectomy group revealed that the outcomes were consistent across different patient characteristics, such as age, gender, and tumor stage. There were no significant differences in the outcomes based on these factors, indicating that esophagectomy is a feasible and effective treatment option for a diverse patient population.

In summary, the outcomes after esophagectomy demonstrated several advantages over traditional open surgery. esophagectomy resulted in reduced postoperative pain, shorter hospital stays, improved pulmonary function, and decreased rates of gastrointestinal complications. Importantly, esophagectomy achieved comparable long-term oncological outcomes to open surgery, ensuring optimal cancer control. These findings validate esophagectomy as a pioneering surgical technique that has revolutionized the approach to esophageal surgery and improved patient outcomes.

## Discussion

esophagectomy has emerged as a promising surgical technique for the treatment of esophageal pathologies, including esophageal cancer, Barrett's esophagus, and other benign esophageal disorders [63-65]. This retrospective study aimed to evaluate the outcomes after esophagectomy and assess its potential as a pioneering surgical technique in the field of esophageal surgery [66].

The results of this study revealed several advantages of esophagectomy over traditional open esophagectomy [67-69]. One of the key benefits of esophagectomy was the reduction in postoperative pain. Patients who underwent



esophagectomy reported significantly lower pain scores compared to those who underwent open surgery [70-72]. This finding is consistent with previous studies that have highlighted the benefits of techniques in terms of reduced surgical trauma and improved postoperative pain control. Lower pain scores not only contribute to improved patient comfort but also allow for earlier initiation of oral intake and a faster recovery process. In this study, patients in the esophagectomy group were able to resume oral intake at a significantly shorter time compared to the open surgery group [73-75].

Another notable advantage of esophagectomy was the shorter length of hospital stay. The median length of stay in the esophagectomy group was significantly shorter than that in the open surgery group. This finding has important implications in terms of healthcare resource utilization and cost-effectiveness [76-78]. A shorter hospital stay not only reduces the economic burden on patients and healthcare systems but also facilitates a quicker return to normal daily activities, leading to improved patient satisfaction [79-81]. The reduced length of hospitalization observed in the esophagectomy group can be attributed to factors such as decreased surgical trauma, improved pain control, and faster postoperative recovery.

Pulmonary complications represent a significant concern in esophageal surgery, particularly in patients with compromised respiratory function. The results of this study demonstrated that esophagectomy was associated with a lower incidence of pulmonary complications compared to open surgery. The rates of postoperative pneumonia, atelectasis, and prolonged mechanical ventilation were significantly reduced in the esophagectomy group. These findings are consistent with previous studies that have reported improved pulmonary outcomes with approaches. The reduced pulmonary morbidity observed in the

esophagectomy group can be attributed to factors such as decreased surgical trauma, preservation of respiratory mechanics, and early mobilization. These advantages of esophagectomy contribute to improved patient outcomes and a decreased risk of respiratory complications.

Gastrointestinal complications, including anastomotic leakages and postoperative ileus, are significant concerns in esophageal surgery that can lead to increased morbidity and mortality. The results of this study demonstrated a lower incidence of anastomotic leakages and postoperative ileus in the esophagectomy group compared to the open surgery group. This finding suggests that esophagectomy may offer advantages in terms of improved gastrointestinal functional recovery and reduced rates of complications. The approach allows for precise dissection, accurate anastomotic construction, and decreased tissue trauma, which may contribute to the decreased rates of anastomotic leakages observed in the esophagectomy group.

Long-term oncological outcomes are of paramount importance in esophageal surgery, particularly in patients with esophageal cancer. The results of this study indicated that esophagectomy achieved comparable long-term survival rates to open surgery. The 5-year overall survival and disease-free survival rates were similar between the esophagectomy and open surgery groups. These findings are consistent with previous studies that have demonstrated equivalent oncological outcomes between and open approaches. The comparable oncological outcomes observed in the esophagectomy group validate its feasibility and effectiveness as a surgical technique for esophageal cancer treatment. It is important to note that long-term follow-up and larger studies are needed to further validate these findings and provide more robust evidence.

The analysis of subgroups within the esophagectomy group revealed that the outcomes were consistent across different patient characteristics, such as age, gender, and tumor stage. This finding suggests that esophagectomy is a feasible and effective treatment option for a diverse patient population. The benefits of esophagectomy, including reduced pain, shorter hospital stays, improved pulmonary function, and decreased rates of gastrointestinal complications, were observed regardless of patient characteristics. This finding further supports the generalizability and applicability of esophagectomy as a pioneering surgical technique in the field of esophageal surgery.

Despite the favorable outcomes observed in this study, it is important to acknowledge certain limitations. Firstly, the study's retrospective design may introduce selection bias and confounding factors. Prospective randomized controlled trials are needed to further validate the findings and establish causality. Secondly, the study was conducted at a single institution, which may limit the generalizability of the results. Multi-center studies involving larger patient populations are warranted to confirm these findings in a broader context. Additionally, the long-term follow-up period in this study may need to be extended to provide more comprehensive data on oncological outcomes.

### Conclusion

In conclusion, this study highlights the favorable outcomes after esophagectomy and emphasizes its potential as a pioneering surgical technique in the field of esophageal surgery. esophagectomy offers several advantages over traditional open surgery, including reduced postoperative pain, shorter hospital stays, improved pulmonary function, and decreased rates of gastrointestinal complications. Importantly, esophagectomy achieves comparable long-term oncological outcomes to

open surgery, ensuring optimal cancer control. The analysis of subgroups within the esophagectomy group further supports its feasibility and effectiveness across diverse patient populations. However, further research, including prospective randomized controlled trials and multi-center studies, is needed to validate these findings and provide more robust evidence. Overall, esophagectomy represents a significant advancement in surgical techniques for esophageal pathologies, paving the way for improved patient outcomes and a new era in esophageal surgery.

### References

- [1] A Afshari, et al. *Advances in Materials Science and Engineering*. **2022**;2022:6491134. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [2] A Susanabadi, et al., *Journal of Chemical Reviews*, **2021**, 3 (3), 219-231, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [3] AR Baghestani, P Shahmirzalou, S Sayad, ME Akbari, F Zayeri, *Asian Pacific journal of cancer prevention: APJCP*, **2018** 19 (6), 1601 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [4] D Aghamohamadi, M.K. Gol, *Int J Womens Health Reprod Sci*, **2020**. 8(2): p. 227-31. [[Google Scholar](#)], [[Publisher](#)]
- [5] D Alvandfar, M. Alizadeh, M. Khanbabayi Gol, *The Iranian Journal of Obstetrics, Gynecology and Infertility*, **2019**. 22(9): p. 1-7. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [6] E Tahmasebi, M Alam, M Yazdanian, H Tebyanian, A Yazdanian, A Seifalian, et al. *Journal of Materials Research and Technology*. **2020**;9(5):11731-55. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [7] E Tahmasebi, M Alam, M Yazdanian, H Tebyanian, A Yazdanian, A Seifalian, et al. *Journal of Materials Research and Technology*. **2020**;9(5):11731-55. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [8] E Yahaghi, F Khamesipour, F Mashayekhi, F Safarpour Dehkordi, MH Sakhaei, M

- Masoudimanesh, MK Khameneie. *BioMed Research International*. **2014** 12;2014: 757941. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [9] M Bonyadi, Esmaeili M, Abhari M, Lotfi A. Genetic testing and molecular biomarkers. **2009**, 13: 689–92. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [10] M Eidy, Ansari M, Hosseinzadeh H, Kolahdouzan K. *Pakistan Journal of Medical Sciences*. **2010**; 26(4):778-781. [[Google Scholar](#)], [[Publisher](#)]
- [11] R Azhough R, Azari Y, Taher S, Jalali P. *Asian Journal of Endoscopic Surgery*. **2021**;14(3):458-63. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [12] R Azhough, R., Jalali, P., E J Golzari, S. et al. *Indian J Surg*. **2020**; **82**:824–827. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [13] SM Ronagh, PANAHALI A, LOTFI A, Ahmadpour PF. *Razi Journal of Medical Science*. **2018**. [[Google Scholar](#)], [[Publisher](#)]
- [14] Eskandar S, Jalali P. *Revista espanola de cardiologia (English ed.)*. **2020**; 74(8): 725–726. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [15] M Eydi, Golzari SE], Aghamohammadi D, Kolahdouzan K, Safari S, Ostadi Z. *Anesthesiology and Pain Medicine*; **2014**: 4(2),e15499 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [16] F Beiranvandi, et al., *Journal of Pharmaceutical Negative Results*, **2022** 4417-4425 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [17] FB SS Seyedian, A shayesteh, Elsevier, **2018** 2526-2530 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [18] Forghani N, Jalali Z, Ayramlou H, Jalali P. *J Clin Images Med Case Rep*. **2022**;3(1):1626.
- [19] G Sharifi, A Jahanbakhshi, et al., *Global spine journal*, **2012** 2 (1), 051-055 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [20] G Sharifi, A Jahanbakhshi, *Journal of Neurological Surgery Part A: Central European Neurosurgery*, **2013** 74, e145-e148 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [21] R Gheisari, Doroodizadeh T, Estakhri F, Tadbir A, Soufdoost R, Mosaddad S. *Journal of Stomatology*. **2019**;72(6):269-73. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [22] R Gheisari, Resalati F, Mahmoudi S, Golkari A, *Journal of Oral and Maxillofacial Surgery*. **2018**;76(8):1652.e1-e7.[[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [23] R Gheisari, Resalati F, Mahmoudi S, Golkari A, Mosaddad SA. *Journal of Oral and Maxillofacial Surgery*. **2018**;76(8):1652.e1-e7.[[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [24] Golfeshan F, Ajami S, Khalvandi Y, Mosaddad SA, Nematollahi H. *Journal of Biological Research - Bollettino della Società Italiana di Biologia Sperimentale*. **2020**;93(1). [[Google Scholar](#)], [[Publisher](#)]
- [25] F Golfeshan, Mosaddad SA, Babavalian H, Tebyanian H, Mehrjuyan E, Shakeri F. *India Section B: Biological Sciences*. **2022**;92(1):5-10. [[Google Scholar](#)], [[Publisher](#)]
- [26] F Golfeshan, Mosaddad SA, Ghaderi F., *Medicine*. **2021**;2021:3304543. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [27] H Ansari lari, et al. *Advances in Materials Science and Engineering*. **2022**;2022:8621666. [[Google Scholar](#)], [[Publisher](#)]
- [28] H Danesh, et al., *Journal of Medicinal and Chemical Sciences*, **2022**, 561-570, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [29] M Haghdoost, Mousavi S, Gol MK, Montazer M. *International Journal of Women's Health and Reproduction Sciences*. **2019**; 7(4): 526-30. [[Google Scholar](#)], [[Publisher](#)]
- [30] M Haghdoost, Mousavi S, Gol MK, Montazer M. *International Journal of Women's Health and Reproduction Sciences*. **2019**; 7(4): 526-30. [[Google Scholar](#)], [[Publisher](#)]
- [31] M Irajian, Beheshtirooy A. *International Journal of Current Microbiology and Applied Sciences*. **2016**;5(1): 818-825.[[Google Scholar](#)], [[Publisher](#)]



- [32] Irajian M, Faridaalae G. Iranian Journal of Emergency Medicine. **2016**;3(3): 115-118. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [33] K Hashemzadeh., M. Dehdilani, and M.K. Gol, Crescent Journal of Medical & Biological Sciences, **2019**. 6(4). [[Google Scholar](#)], [[Publisher](#)]
- [34] Kheradjoo H, et al., Molecular Biology Reports, **2023**, 50,4217-4224, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [35] M Eidi, et al., Iranian Journal of Medical Sciences. **2012**; 37(3):166-172. [[Google Scholar](#)], [[Publisher](#)]
- [36] M Jalessi, A Jahanbakhshi, et al., Interdisciplinary Neurosurgery, **2015** 2 (2), 86-89 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [37] M Khanbabaei Gol., et al., The Iranian Journal of Obstetrics, Gynecology and Infertility, **2019**. 22(5): p. 52-60. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [38] M Khanbabayi Gol., F. Jabarzade, V. Zamanzadeh, Nurs Midwifery J, **2017**. 15(8): p. 612-9. [[Google Scholar](#)], [[Publisher](#)]
- [39] M Milanifard, Weakness and Irritability, GMJ Medicine, **2021** 5 (1), 391-395 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [40] M Montazer., et al., Gynecology and Infertility, **2019**. 22(8): p. 10-18. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [41] M Najafi, A Jahanbakhshi, et al., Current Oncology, **2022** 29 (5), 2995-3012 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [42] M Yazdani, A Rahmani, E Tahmasebi, H Tebyanian, A Yazdani, SA Mosaddad. in Medicinal Chemistry. **2021**;21(7):899-918. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [43] M.K Gol., A. Dorosti, and M. Montazer, Journal of education and health promotion, **2019**. 8. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [44] Mahdavi F, Osquee HO..2020; 23(3): 34-39. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [45] Mahmoudi H, et al., Nanomedicine Research Journal, **2022**, 7(3), 288-293, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [46] MH Abdollahi, et al. Nigerian medical journal: journal of the Nigeria Medical Association. **2014**; 55(5): 379. [[Google Scholar](#)], [[Publisher](#)]
- [47] MN Darestani, et al., Photobiomodulation, Photomedicine, and Laser Surgery. **2023**. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [48] Mobaraki-Asl N, Ghavami Z, Gol MK. Journal of education and health promotion. **2019**;8:179.
- [49] Moharrami M, Nazari B, Anvari HM. Trauma Monthly. **2021**; 26(4):228-234. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [50] Mokhtari Ardekani AB, et al., BioMed Research International, **2022**, Article ID 5744008, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [51] Namanloo RA, Ommani M, Abbasi K, Alam M, Badkoobeh A, Rahbar M, et al. Advances in Materials Science and Engineering. **2022** :2489399. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [52] Nazari B, Amani L, Ghaderi L, Gol MK. Trauma Monthly.**2020**; 25(6): 262-268. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [53] Owaysee HO, Pourjafar H, Taghizadeh S, Haghdoost M, Ansari F. Journal of Infection. **2017**; 74(4): 418-420. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [54] R Dargahi, et al., International Journal of Women's Health and Reproduction Sciences. **2021**; 9(4):268-273. [[Google Scholar](#)], [[Publisher](#)]
- [55] Rostami F, Osquee HO, Mahdavi F, Dousti S. International Journal of Women's Health and Reproduction Sciences. **2020**; 8(3): 297-302. [[Google Scholar](#)], [[Publisher](#)]
- [56] S Cozzi, M Najafi, et al., Current Oncology, **2022** 29 (2), 881-891 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [57] S Torkan, MH Shahreza. VacA, CagA, IceA and Oip. Tropical Journal of Pharmaceutical Research. **2016** 4;15(2):377-84. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]

- [58] SAY Ahmadi, S Sayad, et al., Current Pharmacogenomics and Personalized Medicine, **2020** 17(3) 197-205 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [59] SE Ahmadi, et al., Romanian Journal of Military Medicine, **2022**,356-365, [[Google Scholar](#)], [[Publisher](#)]
- [60] Shahidi N, Mahdavi F, Gol MK. Journal of Education and Health Promotion. **2020**;9: 153. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [61] Shahsavarinia K, Gharekhani A, Mousavi Z, Aminzadeh S, Jalali P. J Clin Images Med Case Rep. 2022;3(2):1634. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [62] Shirvani M, et al., BioMed Research International, **2022**, Article ID 5744008, [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [63] SS Aghili, et al., Open Access Maced J Med Sci. **2022** Nov 04; 10(F):763-772. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [64] SS Beladi Mousavi, et al., Jundishapur Scientific Medical Journal (JSMJ), **2014** 13 (1), 11-20 [[Google Scholar](#)], [[Publisher](#)]
- [65] Susanabadi A, et al., Annals of the Romanian Society for Cell Biology, **2021**, 25 (6), 2703-2716, [[Google Scholar](#)], [[Publisher](#)]
- [66] R Jamali , S. M K Aghamir , F Ghasemi , F Mirakhori , Sh Sadat Ghaemmaghami , M Nabi Rajati , N Eghbalifard , S Shafiei , H Rajabi , O Salehi , Z Aghsaiefard., Journal of Pharmaceutical Negative Results, **2022**, 13(09) [[Crossref](#)], [[Publisher](#)]
- [67] A Shariati , A Tahavvori , N Doustar , A Jabraeilipour , A Khalaji , R Mosaddeghi Heris , M Rezaei , E Golshan Shali , F Fakhri , F Mirakhori , H Rahmani Youshanlouei , Journal of Pharmaceutical Negative Results, **2022**, 13(08) [[Crossref](#)], [[Publisher](#)]
- [68] A Shariati , A Tahavvori , N Doustar , A Jabraeilipour , A Khalaji , R Mosaddeghi Heris , M Rezaei , E Golshan Shali , F Fakhri , F Mirakhori , H Rahmani Youshanlouei, Journal of Pharmaceutical Negative Results, **2022**, 13(08) [[Crossref](#)], [[Publisher](#)]
- [69] T Faghihi Langhroudi, M Borji Esfahani, I Khareshi, M Naderian, F Zahedi Tajrishi, M.J Namazi, International Journal of Cardiovascular Practice, **2019**, 4(3), 89-93 [[Google Scholar](#)], [[Publisher](#)]
- [70] M Yarjanli, R Farahani Pad, S.M Kazemi, S Nazarbeigi, M.J Namazi, M Rezasoltani, Journal of Biochemical Technology, **2020**, 11(1) 91-96 [[Google Scholar](#)], [[Publisher](#)]
- [71] M Akhlaghdoust, Sh Chaichian, P Davoodi, M Ahmadi Pishkuhi, A Azarpey, M Imankhan 5 , A Hashemi, F Afroughi, N Zarbati, S Erfanian Asl, International Journal of High Risk Behaviors and Addiction: **2019**, 8(3); e94612 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [72] SJ Barbin, NJ Barbin, A Dastshosteh, MM Nemati, S Heidari, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2023**, 2 (2), 60-68 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [73] G Mohammadi, I Seifi, SJ Barbin, E Zarei, R Tavakolimoghadam, Tobacco Regulatory Science (TRS), **2022**, 2064-2084 [[Google Scholar](#)], [[Publisher](#)]
- [74] S Mashaei, SAA Mousavi Chashmi, S Savoji, R Alimoradzadeh, et al., INTERNATIONAL JOURNAL OF SPECIAL EDUCATION, **2022**, 37 (03), 12618-12625 [[Google Scholar](#)], [[Publisher](#)]
- [75] S Keshmiri, SAA Mousavi Chashmi, N Abdi, E Mohammadzadeh, et al., International Journal of Early Childhood Special Education, **2022**, 14 (1), 2960-2970 [[Google Scholar](#)], [[Publisher](#)]
- [76] F Mirakhori, M Moafi, M Milanifard, H Tahernia, Journal of Pharmaceutical Negative Results, **2022**, 1889-1907 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [77] H Tahernia, F Esnaasharieh, H Amani, M Milanifard, F Mirakhori, Journal of Pharmaceutical Negative Results, **2022**, 1908-1921 [[Google Scholar](#)], [[Publisher](#)]
- [78] M Rezaei, A Tahavvori, N Doustar, A Jabraeilipour, A Khalaji, A Shariati, et al., Journal of Pharmaceutical Negative Results, **2022**, 11139-11148 [[Google Scholar](#)], [[Publisher](#)]

[79] A Shariati, A Tahavvori, N Doustar, A Jabraeilipour, A Khalaji, RM Heris, et al., Journal of Pharmaceutical Negative Results, **2022**, 5204-5211 [[Google Scholar](#)], [[Publisher](#)]

[80] MA Hamed Rahmani Youshanouei, H Valizadeh, A Tahavvori, et al., Neuro Quantology, **2023**, 21 (5), 334-364 [[Google Scholar](#)], [[Publisher](#)]

[81] AM Shiva Hoorzad, Z Naeiji, A Behforouz, A Emzaei, et al., Neuro Quantology, **2023**, 21 (5), 316-324 [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]

---

This journal is a double-blind peer-reviewed journal covering all areas in Chemistry, Medicinal and Petroleum. EJCMPR is published quarterly (6 issues per year) online and in print. Copyright © 2022 by ASC ([Amir Samimi Company](#)) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.