Turkish Journal of Clinical Research

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

RESEARCH ARTICLE

Hernia adverse events associated with olmesartan use: A pharmacovigilance study

Olmesartan kullanımıyla ilişkili fıtık advers olayları: Bir farmakovijilans çalışması

Nesrin CAGLAYAN DUMAN[1]

[1]Ordu University, Faculty of Medicine, Department of Medical Pharmacology, Ordu, Türkiye

Abstract

Aim: Olmesartan is an angiotensin receptor blocker with adverse effects on multiple organ systems. This retrospective study was to evaluate the occurrence of adverse events related to hernias in patients treated with olmesartan using real-world data.

Methods: The study included adverse event reports relating to hernia from olmesartan that were reported in the United States of America Food and Drug Administration (FDA) Adverse Event Reporting System (FAERS) database. Data mining and disproportionality analysis of these adverse events were performed with OpenVigil 2.1 software package. Proportional reporting ratio (PRR) and reporting odds ratio (ROR) values were used to evaluate the signal strength of hernia adverse events.

Results: After data mining from the pharmacovigilance database, 990 primary suspected reports related to olmesartan, and hernia were included in the study. According to disproportionality analysis, the three hernias with the highest signal strength were spigelian hernia (ROR 173.098; PRR 173.059), hiatus hernia (ROR 134.38; PRR 127.288) and umbilical hernia (ROR 44.716; PRR 44.421). The most common hernia adverse event reported was hiatus hernia (72.4%).

Conclusion: This study demonstrated positive signalling strength between olmesartan use and hernia adverse effect reports. In conclusion, many hernias that can cause serious consequences, such as hiatus hernia, have been identified as new potential AEs that require clinicians' attention. However, further clinical research is needed to confirm these findings and to assess the causality between drug and adverse effect.

Keywords: Olmesartan, hernia, adverse event, pharmacovigilance.

Özet

Amaç: Olmesartan, birçok organ sistemi üzerinde advers etkileri olan bir anjiyotensin reseptör blokeridir. Bu retrospektif çalışma, olmesartan ile tedavi edilen hastalarda fıtıklarla ilişkili advers olayların görülme sıklığını gerçek dünya verilerini kullanarak değerlendirmek amacıyla yapılmıştır.

Yöntemler: Çalışma, Amerika Birleşik Devletleri Gıda ve İlaç İdaresi (FDA) Advers Olay Bildirim Sistemi (FAERS) veritabanında bildirilen olmesartan kaynaklı fıtıklarla ilgili advers olay raporlarını içermektedir. Bu advers olayların veri madenciliği ve orantısızlık analizi OpenVigil 2.1 yazılım paketi ile gerçekleştirilmiştir. Fıtık advers olaylarının sinyal gücünü değerlendirmek için orantılı raporlama oranı (PRR) ve raporlama olasılık oranı (ROR) değerleri kullanılmıştır.

Bulgular: Farmakovijilans veritabanından veri madenciliği yapıldıktan sonra, olmesartan ve fıtık ile ilgili 990 birincil şüpheli rapor çalışmaya dahil edilmiştir. Orantısızlık analizine göre, en yüksek sinyal gücüne sahip üç fıtık spigelian fıtık (ROR 173,098; PRR 173,059), hiatus hernisi (ROR 134,38; PRR 127,288) ve umbilikal fıtık (ROR 44,716; PRR 44,421) idi. Bildirilen en yaygın fıtık advers olayı hiatus hernisiydi (%72,4).

Sonuç: Bu çalışma, olmesartan kullanımı ile fıtık advers etki raporları arasında pozitif sinyal gücü olduğunu göstermiştir. Sonuç olarak, hiatus hernisi gibi ciddi sonuçlara neden olabilecek birçok fıtık, klinisyenlerin dikkatini gerektiren yeni potansiyel AE'ler olarak tanımlanmıştır. Ancak, bu bulguları doğrulamak ve ilaç ile advers etki arasındaki nedenselliği değerlendirmek için daha fazla klinik araştırma yapılması gerekmektedir.

Anahtar kelimeler: Olmesartan, fıtık, advers olay, farmakovijilans.

INTRODUCTION

Olmesartan is an angiotensin receptor blocker that exerts its effect through selective antagonism of the angiotensin II type 1 receptor (1). In 2002, it was approved by the U.S. Food and Drug Administration (FDA) for the treatment of hypertension (2).

Angiotensin receptor blockers have a similar frequency of adverse events (3). Analysis of the adverse effect profiles of angiotensin receptor blockers reveals significant differences in safety, particularly in skin disorders, cardiovascular events and gastrointestinal effects. In this

Corresponding Author: Nesrin CAGLAYAN DUMAN nesrincglyndmn@gmail.com
Cite as: Caglayan Duman N. Hernia adverse events associated with olmesartan use: A pharmacovigilance study. Turk J Clin Res. 2025;1(3):175-180

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial-NonDerivatives 4.0 International License

Received: 27 October 2025 | **Accepted:** 25 December 2025 | **Published:** 31 December 2025

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

analysis, olmesartan was reported to have a higher risk of gastrointestinal disorders when compared to other angiotensin receptor blockers (4). Olmesartan is known to cause sprue-like enteropathy and gastric mucosal inflammation in the gastrointestinal tract (5).

A hernia is defined as an abnormal protrusion of an organ or tissue in various parts of the body through a defect in the surrounding walls. Although their prevalence and etiology are not fully understood (6). Several types of hernia, such as abdominal hernia, are included as adverse events in the FDA Adverse Event Reporting System (FAERS) that is the most comprehensive database on adverse events (AEs) (7). FAERS is a publicly accessible database of AE reports voluntarily submitted by physicians, patients and pharmaceutical companies and reflects the real-world occurrence of AEs (8). In the FAERS database, all AEs are coded using the preferred terms (PTs) from the Medical Dictionary of Regulatory Activities (MedDRA) (9).

Disproportionality analysis has become an important method of drug safety monitoring in large databases of spontaneous AE reporting systems (10,11). In pharmacovigilance, the proportional reporting ratio (PRR) and the reporting odds ratio (ROR) are the most used methods for detecting AE signals (12,13). OpenVigil is an analysis tool that calculates ROR and PRR values using data from the FAERS database (14).

Hernias are a comman conditions that may be asymptomatic or symptomatic, and may be repaired electively or require emergency surgical repair due to complications. Post-repair complications and recurrence are also possible (15,16). Due to the seriousness of the consequences of hernia formation, it is important to analyse the reported adverse events related to hernia for drugs. This research is one of the studies designed to identify new potential AEs through advanced signal mining techniques from the FAERS database on the safety of olmesartan, which has been in use for decades (4,17). The aim of this study was to describe the signal strength of hernia-related adverse events that may occur with olmesartan use using real-world data.

METHODS

Data Source and Collection

The data in FDA Adverse Event Reporting System is de-identified and not considered personal data. Therefore, ethical approval was not required.

In this observational, retrospective pharmacovigilance study, the adverse drug reactions reported in the public version of the FAERS database were utilized. The present study used OpenVigil 2.1-MedDRA-v24 (OpenVigil, Kiel, Germany) to query the FAERS database. All hernia-related adverse event reports for the generic name 'olmesartan' and 'olmesartan medoxomil' submitted until December 31, 2024, were selected and included in this study. This study included adverse reaction reports where the reporter indicated these medicines as 'Primary Suspect'. Hernia-related adverse event reports in the FAERS database were queried for each drug individually using the OpenVigil analysis tool. The association between drug and adverse events was analyzed by selecting 'Frequency' as the analysis method and 'Entire Cases' as the case type in the query tab of this tool.

Data Analysis

A disproportionality analysis was performed using OpenVigil version 2.1. PRR and ROR were employed to detect safety signals. All algorithms are based on 2×2 contingency tables. In this study, PTs with a reported frequency of ≥3 was selected for the initial screening procedure. Signal intensity above 2 for ROR or PRR was considered a positive signal. Ratios with a lower limit of the 95% confidence interval >1 and a chi-square value >4 are considered statistically significant (13,18,19).

The human-related datasets utilized in this study are available to the public for research purposes. The procurement of patient consent was not a prerequisite for this study due to the nature of the data source. The research did not require ethics committee approval because the authors had no knowledge of data collection or the participants in the present study.

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

RESULTS

Hernia Reports

A search of the FAERS database identified 18320 adverse drug event reports related to olmesartan. Of these, 1303 were found to be reports of hernia cases included in the study. Details of demographic data on drugs are presented in table 1.

Disproportionality Analysis

After data mining with OpenVigil, it was found that olmesartan was recorded as the primary suspect in 13485 of these reports in the FAERS database. Of these reports, 990 (7.34%) were related to hernia. These PTs of hernias were abdominal, diaphragmatic, hiatal, umbilical, incisional, inguinal, spigelian, internal and incarceration. Apart from these types of hernias, there are 32 cases reported as 'hernia' only. Of the hernias that have been documented to be induced by olmesartan, it has been noted that spigelian hernia has shown a marked augmentation in the signal strength, demonstrating the highest ROR (173.098) and PRR (173.059) values.

A total of 717 reports of adverse events were attributed to a hiatus hernia, constituting 5.317% of the total number of reports for olmesartan. Concurrently, hiatus hernia was documented in 72.4% of the reports included in the study. Hiatal hernia ranks second among hernias according to signal strength (ROR 134.380, PRR 127.288). The umbilical hernia was the third most prevalent condition, with an ROR of 44.716 and a PRR of 44.421. The abdominal hernia was the fourth most prevalent condition, with an ROR of 32.812 and a PRR of 32.656.

The remaining hernias were classified as internal (ROR 39.235; PRR 39.227), diaphragmatic (ROR 30.411; PRR 30.387), incarceration (ROR 21.323; PRR 21.319), incisional (ROR 20.548; PRR 20.529) and inguinal (ROR 17.661; PRR 17.598) hernias according to signal strength. Table 2 presents disproportionality analysis information of olmesartan-related hernia adverse events.

Table 1. Basic information on hernia adverse event reports related to olmesartan

		Hiatus	Umblical	Abdominal	Inguinal	Hernia	Incisional	Diaphragmatic	Spigelian	Internal	Incarcerated
Number of cases (n)		945	120	92	70	39	14	13	4	3	3
Gender	Female	42	0	3	3	2	0	0	0	0	0
	Male	21	9	1	7	2	0	0	0	0	0
	Not specified	882	111	88	60	35	14	13	4	3	3
Age (years)	18-64	34	2	2	6	2	0	0	0	0	0
	65-84	27	1	2	4	1	0	0	0	0	0
	Not specified	884	117	88	60	36	14	13	4	3	3
Type of reporter	Healthcare professional	17	8	0	3	1	0	0	0	0	0
	Consumer	924	112	92	66	36	14	13	4	3	3
	Not specified	4	0	0	1	2	0	0	0	0	0
Report year	2004-2013	4	2	0	2	2	0	0	4	0	0
	2014-2019	935	116	92	68	37	14	13	0	3	3
	2020-2024	6	2	0	0	0	0	0	0	0	0

** U.S. Food and Drug Administration (FDA) Adverse Event Reporting System (FAERS) public dashboard was used when preparing this table*

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

Table 2. Disproportionality analysis information for hernia adverse event reports related to olmesartan

PTs of hernia	Reports (n)	ROR	95% CI	PRR	χ^2	DE/D (%)
Hiatus	717	134.380	124.084; 145.531	127.288	79441.87	5.317
Umbilical	91	44.716	36.219; 55.206	44.421	3654.068	0.675
Abdominal	66	32.812	25.661; 41.956	32.656	1929.799	0.489
Inguinal	51	17.661	13.383; 23.308	17.598	768.263	0.378
Hernia	32	3.063	2.164; 4.335	3.058	42.178	0.237
Incisional	13	20.548	11.861; 35.598	20.529	217.812	0.096
Diaphragmatic	11	30.411	16.685; 55.428	30.387	275.369	0.082
Spigelian	3	173.098	50.721; 590.737	173.059	302.100	0.022
Internal	3	39.235	12.372; 124.427	39.227	73.814	0.022
Incarcerated	3	21.323	6.793; 66.938	21.319	38.697	0.022

** The information in this table was analysed using the OpenVigil tool*
Abbreviations: 95% CI, confidence interval; x2, Chi-squared with Yates' correction; D, Drug was used; DE, Both the drug was used, and the event occurred; n, number of reports; PRR, proportional reporting ratio; PTs, preferred terms; ROR, reporting odds ratio.

DISCUSSION

The findings in this study provide evidence linking olmesartan treatment with the development of various hernias. The proportion of reports of hernias among adverse events related to olmesartan use was found to be quite high. In addition, all hernias included in this study were shown to have different values of positive signal strength (ROR 3.063-173.098; PRR 3.058-173.059). This study will be an important resource to increase physician awareness of possible hernia adverse effects that may occur as a result of olmesartan use and to reduce or prevent olmesartan treatment from causing another disease.

In this study, the evaluation of olmesartan and hernia reports found that hiatal hernia was responsible for most cases and had high signal strength. A meta-analysis reported that hiatus hernia was more common in men and was more common with increasing age and body mass index. However, no medication was reported as a cause (20). In the present study, although the number of cases with no reported gender was higher, the number of women with hiatus hernia was higher among those reported. In addition, the presence of hypertension in patients undergoing hiatal hernia surgery has been associated with an increased risk of morbidity (21). Due to the potential risk, it is of great importance to evaluate the combination of hypertension, olmesartan, and hiatal hernia in the current study in a clinical setting.

This study could not provide any evidence on the cause of the association between hiatus hernia and olmesartan. The study by Tyber suggested a link between tricyclic antidepressant drugs and hiatus hernia, pointing to their anticholinergic effects as a potential cause (22). Ankit et al. suggested that the calcium channel blocking effect may have caused a gradual weakening of the diaphragm muscle and worsening of hiatal hernia in a patient taking diltiazem over a long period of time (23). It is noteworthy that the patient in this study was on concomitantly taking losartan, which has the same mechanism of action as olmesartan.

A different way of looking at these results is that olmesartan is a drug used in the treatment of hypertension. Gastroesophageal reflux has been reported to cause hypertension (24). Hiatal hernia is one of the causes of gastroesophageal reflux (25). This information suggests the possibility that hypertension may have occurred because of hiatal hernia and that hypertension may have been treated with olmesartan, but this cannot be proven in this study.

Possible mechanisms explaining the association between olmesartan use and hernia are currently not available. Drugs such as levonorgestrel and vedolizumab, which were analysed for disproportionality using the FAERS database, have also been reported to generate signals related to abdominal hernia (26,27). In these studies, due to the nature of the data source, no information on the cause-and-effect relationship could be provided.

Although they are less frequent, newly identified signals such as spigelian, internal and incarceration hernias

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

have a strong signal strength and should be considered in clinical practice.

In the current study, it was reported that age information was missing in 41.9% of consumer reports. When those who reported age were compared with those who did not in a study conducted using FAERS database information related to this event, it can be said that age information did not cause a big difference in reporting a serious event (28). The fact that most reporter types in the study were consumers and demographic information such as age was missing suggests that there should be clearer reporting when describing a medicines-related adverse medical event in the pharmacovigilance database.

There is no information about hernia in the manufacturer information of olmesartan (29). This study describes the signalling strength of hernias; a new group of adverse events related to olmesartan not previously described in the literature.

One of the weaknesses of the study is that in the spontaneous reports in the FAERS database, in many cases the reporters were not healthcare professionals and self-identified the drugs as the primary suspect. This study does not include information on the effect of dose and duration of use on the occurrence of hernias, comorbidity and concomitant drug use due to lack of data or unavailability of data. These limitations may affect the results. Finally, no causal relationship between the adverse effect and the drug could be established in this study. Despite these limitations inherent in pharmacovigilance studies, spontaneous reporting systems are valuable because they provide a large amount of data for safety assessment of suspected hernias.

CONCLUSION

No studies evaluating hernia-related adverse effects of olmesartan have yet been found. Statistical analysis of the reports of these adverse effects using disproportionality methods was used to determine the signal strength of the association between olmesartan and hernia but cannot explain causality. There may be reports of hernias that occurred because of olmesartan use but were not reported because a causal relationship could not be established. Further clinical research is needed to understand the role of the drug in causing the event. Despite the favourable effects of olmesartan in the treatment of hypertension, the new potential hernia signals identified by this study should be considered.

Acknowledgements: None.

Ethics approval: The data in Food and Drug Administration (FDA) Adverse Event Reporting System is de-identified and not considered personal data. Therefore, ethical approval was not required.

Conflict of interest: The author declare that they have no conflict of interests.

Financial disclosure: The authors declare that they have received no financial support for the study.

Author Contributions: Idea/Concept: N.C.D.; Design: N.C.D.; Supervision: N.C.D.; Resources: N.C.D.; Materials: N.C.D.; Data Collection and/or Processing: N.C.D.; Analysis and/or Interpretation: N.C.D.; Literature Review: N.C.D.; Written by: N.C.D.; Critical Review: N.C.D.

REFERENCES

1. Gardner SF, Franks AM. Olmesartan medoxomil: the seventh angiotensin receptor antagonist. Ann Pharmacother. 2003;37(1):99-105.
2. U.S. Food and Drug Administration. Drugs@FDA: FDA-Approved Drugs. [Internet]. [cited 4 Jun 2025]. Available from: https://www.accessdata.fda.gov
3. Wang L, Zhao JW, Liu B, Shi D, Zou Z, Shi XY. Antihypertensive effects of olmesartan compared with other angiotensin receptor blockers. Am J Cardiovasc Drugs. 2012;12(5):335-344.
4. Ogura T, Shiraishi C. Comparison of adverse events among angiotensin receptor blockers in hypertension using the United States Food and Drug Administration Adverse Event Reporting System. Cureus. 2025;17(4):e81912.
5. Iwamuro M, Kawano S, Otsuka M. Drug-induced mucosal alterations observed during esophagogastroduodenoscopy. World J Gastroenterol. 2024;30(16):2220-32.
6. Townsend CM, Beauchamp RD, Evers BM, Mattox KL. Sabiston Textbook of Surgery. 21st ed. Elsevier; 2022. p.1105-1133.
7. Kommu S, Carter C, Whitfield P. Adverse drug reactions. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 28 Nov 2025]. Available from: https://www.ncbi.nlm.nih.gov

Turk J Clin Res. 2025;1(3):175-180
https://doi.org/10.63909/1453032

8. Wu SN, Huang C, Wang YQ, Li X, Zhang SQ, Chen XD, et al. Adverse events of topical ocular prostaglandin medications for glaucoma treatment: a pharmacovigilance study based on the FAERS database. Ther Adv Drug Saf. 2024;15:20420986241285930.
9. U.S. Food and Drug Administration. FDA Adverse Event Reporting System (FAERS). [Internet]. [cited 6 Jan 2025]. Available from: https://www.fda.gov
10. Salvo F, Raschi E, Moretti U, Chiarolanza A, Fourrier-Réglat A, Moore N, et al. Pharmacological prioritisation of signals of disproportionate reporting: proposal of an algorithm and pilot evaluation. Eur J Clin Pharmacol. 2014;70(5):617-25.
11. Davis SE, Zabotka L, Desai RJ, Wang SV, Maro JC, Coughlin K, et al. Use of electronic health record data for drug safety signal identification: a scoping review. Drug Saf. 2023;46(8):725-42.
12. van Puijenbroek EP, Bate A, Leufkens HG, Lindquist M, Orre R, Egberts AC. A comparison of measures of disproportionality for signal detection in spontaneous reporting systems for adverse drug reactions. Pharmacoepidemiol Drug Saf. 2002;11(1):3-10.
13. Evans SJ, Waller PC, Davis S. Use of proportional reporting ratios (PRRs) for signal generation from spontaneous adverse drug reaction reports. Pharmacoepidemiol Drug Saf. 2001;10(6):483-6.
14. Böhm R, von Hehn L, Herdegen T, Klein HJ, Bruhn O, Petri H, et al. OpenVigil FDA – inspection of U.S. American adverse drug events pharmacovigilance data and novel clinical applications. PLoS One. 2016;11(6):e0157753.
15. Goglia M, Reitano E, Gallo G, Perretta S, Aurello P, Petrucciani N, et al. Management of recurrent hiatal hernia: a systematic review and meta-analysis comparing mesh versus no mesh reinforcement. Hernia. 2025;29(1):195.
16. Eguchi M, Souza E Silva Silva T, Guimarães Forchezatto E, Biscola da Cruz Y, Neves V, Padilha D, et al. Watchful waiting vs early repair for asymptomatic and mildly symptomatic inguinal hernia—silent hernia, loud debate: a qualitative systematic review. Hernia. 2025;30(1):19.
17. Meader R, Papasotiriou S, Ahdi H, Dang H, Ehrenpreis ED. Angiotensin receptor blocker–related sprue-like enteropathy: review of Food and Drug Administration Adverse Event Reporting System. Ann Pharmacother. 2024;58(5):494-500.
18. Pan Y, Wang Y, Zheng Y, Chen J, Li J. A disproportionality analysis of FDA adverse event reporting system (FAERS) events for ticagrelor. Front Pharmacol. 2024;15:1251961.
19. OpenVigil. Open tools for data-mining and analysis of pharmacovigilance data. [Internet]. [cited 2 Jan 2025]. Available from: http://openvigil.sourceforge.net
20. Menon S, Trudgill N. Risk factors in the aetiology of hiatus hernia: a meta-analysis. Eur J Gastroenterol Hepatol. 2011;23(2):133-138.
21. Brandt A, Leslie Z, Rawson M, Ikramuddin S, Wise E. Morbidity of emergent versus elective hiatal hernia repair: an analysis of the NIS database. Surg Endosc. 2025;39(6):3979-85.
22. Tyber MA. The relationship between hiatus hernia and tricyclic antidepressants: a report of five cases. Am J Psychiatry. 1975;132(6):652-3.
23. Agrawal A, Bandla H, Bajaj D, Bajaj S. Diltiazem and hiatal hernia: an unknown association. Am J Ther. 2020;27(4):414-5.
24. Wei N, Liu MH, Song YH. Causal associations between gastroesophageal reflux disease and essential hypertension: a bidirectional Mendelian randomization study. World J Clin Cases. 2024;12(5):880-90.
25. Yu HX, Han CS, Xue JR, Han ZF, Xin H. Esophageal hiatal hernia: risk, diagnosis and management. Expert Rev Gastroenterol Hepatol. 2018;12(4):319-29.
26. Xu Q, Zhang J, Tang W, Zhou M, Zhang X, Yuan P. Data mining and analysis of adverse events of vedolizumab based on the FAERS database. Sci Rep. 2025;15(1):278.
27. Leelakanok N, Methaneethorn J. A systematic review and meta-analysis of the adverse effects of levonorgestrel emergency oral contraceptive. Clin Drug Investig. 2020;40(5):395-20.
28. Pham P, Cheng C, Wu E, Kim I, Zhang R, Ma Y, et al. Leveraging case narratives to enhance patient age ascertainment from adverse event reports. Pharmaceut Med. 2021;35(5):307-16.
29. Cosette Pharmaceuticals Inc. Benicar® (olmesartan medoxomil) full prescribing information. [Internet]. 2022 [cited 8 May 2025]. Available from: https://www.benicar.com