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The Effects of COVID-19 Pandemic on the Recovery of Hip Fracture Patients

Young Yool Chung, MD, Sung Nyun Baek, MD, Tae Gyu Park, MD, Min Young Kim, MD
Department of Orthopedic Surgery, Kwangju Christian Hospital, Gwangju, Korea

Purpose: To figure out how complete control of family visits to prevent infection of coronavirus disease 2019 (COVID-19) affected the activity recovery of hip fracture patients admitted to nursing hospitals.
Materials and Methods: Eighty-one patients with hip surgery in the two years prior to COVID-19 pandemic were classified as Group A, and 103 patients in the next two years were designated as Group B. The subjects' walking ability was evaluated by using the modified Koval index (MKI). In order to analyze the impact of the family visit control to the subjects, each group was classified into two different groups: (1) inpatients group who admitted to nursing hospitals and (2) home-treated patients. Additionally, statistical elements were processed in consideration of other factors that may affect the results of the experiment.
Results: The MKI evaluated at 6 months postoperative was 3.31±1.79 in Group A and 2.77±1.91 in Group B, and it was meaningfully low after the pandemic (P=0.04). There was significantly low among both of Group A 2.74±1.76 and Group B 1.93±1.81 after the pandemic (P=0.03) among those treated at the nursing hospital. The rate of deterioration of the MKI was 35 (43.2%) in Group A and 57 (55.3%) in Group B, which increased by 12.1% after the pandemic.
Conclusion: The pandemic had a negative effect on the recovery of postoperative activities of elderly hip fracture patients who admitted to nursing hospitals when family access was completely restricted to prevent infection.

Key Words: Femoral neck fractures, COVID-19 pandemic, Koval index, Rehabilitation

INTRODUCTION

In modern society, increased occurrence of hip fractures has been reported, in line with the increasing elderly population[1,2]. The number of surgical treatments for hip fractures continues to increase, and recovery treatment, including early postoperative walking, can significantly affect recovery of physical function and early return to daily life[3,4]. However, performance of early exercise on their own after surgery can be difficult for elderly patients, and assistance from medical personnel and supporters is required for recovery. This type of support can reduce the occurrence of postoperative

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Address reprint request to
Young Yool Chung, MD
(https://orcid.org/0000-0002-4959-1230)
Department of Orthopedic Surgery, Kwangju Christian Hospital,
37 Yangrim-ro, Nam-gu, Gwangju 61661, Korea
TEL: +82-62-650-5064
E-mail: wonderchung@naver.com

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complications and can improve the potential for early discharge from the hospital and return to daily life[5,6].

The number of elderly patients with hip fracture admitted to nursing hospitals for postoperative management has recently shown a continuous increase in South Korea. In regard to patients admitted to nursing hospitals, active participation of family members as assistants in recovery exercise treatment was believed to have a positive effect on improving symptoms by providing psychological stability and motivation, thus it was considered a normal routine before the pandemic. However, as a result of the continued coronavirus disease 2019 (COVID-19) pandemic over the two-year period, the severe restriction of unauthorized personnel in hospitals and isolation treatment systems has had a significant impact on the system of treatment for elderly patients with hip fracture. The plan for conduct of the study originated from the need to study the effect of the pandemic on postoperative recovery exercise for elderly patients admitted to nursing hospitals when family visits are prohibited, and to establish a treatment policy for patients who might be isolated from their families because of such a pandemic in the future. Thus, according to our hypothesis, restricting assistance from guardians such as family members who were responsible for a certain portion of walking recovery due to the COVID-19 pandemic would have negatively impacted the recovery of elderly patients with hip fracture.

MATERIALS AND METHODS

A retrospective study of elderly patients (age ≥65 years) who underwent surgery for treatment of a hip fracture from January 2018 to December 2021 at Kwangju Christian Hospital was conducted; patients who had difficulty undergoing accurate evaluation due to severe cognitive impairment and those who could not be tracked for longer than six months after the surgeries were excluded. Patients who underwent surgical treatments from January 2018 to December 2019 were classified as Group A, and those who underwent surgical treatments from January 2020 to December 2021 after the outbreak of the COVID-19 pandemic were designated as Group B. As a routine, two weeks from the day of surgery, which was usually when stitches were removed, was scheduled as the date of discharge, and transfer from the nursing hospital was based on the guardian's decision according to the patient's condition. The modified Koval index was used to evaluate patients' walking ability[7]. Interviews with both patients and their guardians were conducted for evaluation of the patients' walking ability before the fracture. Recovery exercise treatments after surgery were started with use of walkers, and exercise time and the number of times exercise was performed were not limited. The final follow-ups for evaluation of gait ability were performed six months after surgery. Analysis and comparison of walking ability prior to the fracture, age and gender before the fracture, and whether or not the patient was hospitalized in a nursing hospital before and after the pandemic were performed in order to determine which factors affected the degree of recovery of walking ability. Independent *t*-test and multiple regression test from the PASW Statistics (ver. 18.0; IBM) program were used for statistical analysis. A $P<0.05$ was considered statistically significant. This retrospective study was conducted with the approval of Kwangju Christian Hospital's Institutional Bioethics Committee (No. KCH-M-2022-11-014), and obtaining written consent from the patient was exempted by the Institutional Bioethics Committee. The conflict of interest is written accurately.

RESULTS

The study included 184 patients, 81 patients in Group A and 103 patients in Group B. Using means and standard deviation, the mean age of 81 patients in Group A was 76.59±10.60 years, with 64 females and 17 males. In Group A, 46 patients (56.8%) were re-admitted to nursing hospitals for recovery exercise treatments after discharge from the hospital, and the remaining patients were managed for recovery exercise with assistance from their families at home. The mean age of 103 patients in Group B was 77.70 ±10.12 years, with 80 females and 23 males. No study on the rates of transfer of hip fracture patients to a nursing hospital has been conducted; however, in our study, 46 patients (56.8%) with hip fracture from pre-pandemic (Group A) and 54 patients (52.4%) from post-pandemic (Group B) were transferred to nursing hospitals instead of home care for exercise recovery treatments after the surgeries. Regarding the rates of femoral neck and trochanteric fractures, there were 41 cases (50.6%) and 40 cases (49.4%) in Group A, and 61 cases (59.2%) and 42 cases (40.8%) in Group B. The ratio of arthroplasty and osteosynthesis was 58 cases (71.6%) and 23 cases (28.4%) in Group A and 90 cases (87.4%) and 13 cases (12.6%) in Group B, respectively. The modified Koval index before fracture was 4.23±1.13 in Group A and 4.04±1.28 in Group B, and no statistical difference was observed between the two groups ($P=0.28$). The modified Koval index for the follow-ups six months

after surgery was 3.31±1.79 in Group A and 2.77±1.91 in Group B, indicating a statistical reduction in the recovery of walking ability in Group B (*P*=0.04). The modified Koval index before fracture for patients admitted to nursing hospitals was 3.87±1.22 in Group A and 3.67±1.39 in Group B, and no statistically significant differences were observed between the two groups (*P*=0.44). However, at six months after surgery, the modified Koval index was 2.74±1.76 in Group A and 1.93±1.81 in Group B, indicating a statistical decrease in the recovery of walking ability in patients who were admitted to nursing hospitals after the pandemic (*P*=0.03). The modified Koval index before fracture for patients who underwent exercise recovery treatments at home was 4.71±0.79 before surgery in Group A and 4.45

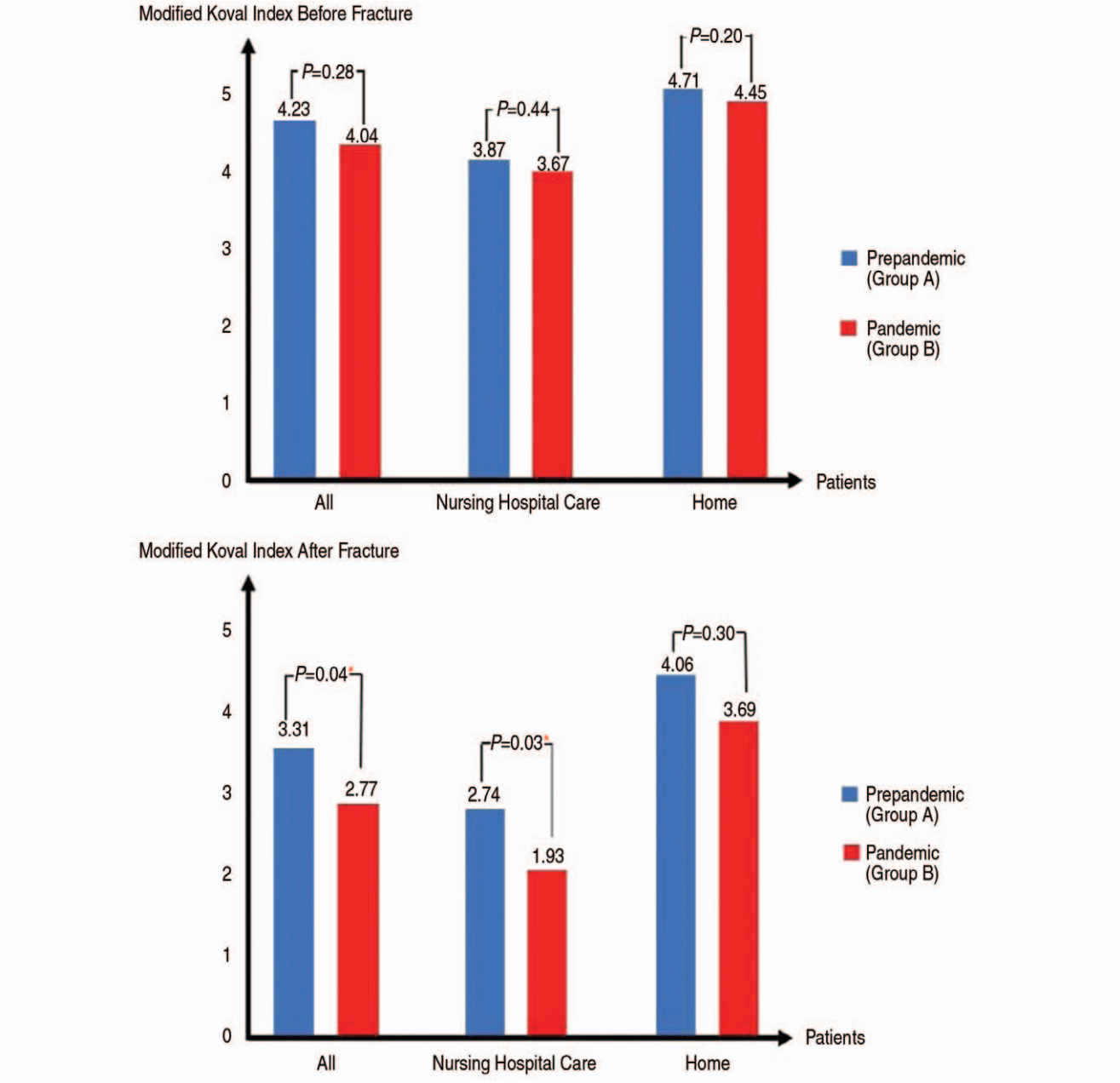

Fig. 1. Comparative graph of changes in modified Koval index in nursing hospitals and home care between pre-pandemic and pandemic.
Group A: patients who underwent surgical treatments from January 2018 to December 2019, Group B: patients who underwent surgical treatments from January 2020 to December 2021 after the outbreak of the COVID-19 pandemic.
* *P*<0.05.

±1.00 in Group B (*P*=0.20). At six months' postoperative follow-up, the modified Koval index was 4.06±1.57 in Group A and 3.69±1.57 in Group B, showing no statistical difference (*P*=0.30) according to independent sample *t*-tests (Fig. 1).

The deterioration rate of the modified Koval index was 35 (43.2%) in Group A and 57 (55.3%) in Group B, an increase of 12.1% after the pandemic. The rate observed for patients admitted to nursing hospitals was 25 (54.3%) in Group A and 37 (68.5%) in Group B, an increase of 14.2% after the pandemic. By contrast, the rate observed for patients who received treatment at home was 10 (28.6%) in Group A and 20 (40.8%) in Group B, an increase of 12.2% after the pandemic (Table 1). The results of multiple regression analysis of the factors affecting the modified Koval index showed that the main factors were the COVID-19 pandemic (*β*=–0.12, *P*=0.04), age (*β*=–0.28, *P*<0.001), and nursing hospital admission (*β*=–0.36, *P*<0.001), and the influence index was in the order of nursing hospital admission, age, and COVID-19 pandemic (Table 2).

DISCUSSION

A higher rate of infection with COVID-19 was observed among elderly people compared to younger persons during the same period[8]. Higher mortality rates and serious complications resulting from infection have been reported, particularly among older patients with hip fracture, for which a large number of complications and a high mortality rate have been reported[9-12]. Although older patients must undergo surgery for treatment of fracture injuries as soon as possible, according to some reports, hospitalization and surgery were sometimes delayed in the early stage of the pandemic, increasing the hospitalization period and aggravating mortality[13,14]. However, it was also reported that acceptable results were achieved with prompt surgical treatment of

Table 1. Comparison of Modified Koval Index of All Patients Pre & Post Pandemic, Nursing Hospital and Home Care, and Comparison of Exacerbation Rate during Pre & Post Pandemic

Modified Koval index	All patient		Nursing hospital care		Home care	
	Pre- Group A (n=81)	Pan- Group B (n=103)	Pre- Group A (n=46)	Pan- Group B (n=54)	Pre- Group A (n=35)	Pan- Group B (n=49)
Before fracture	4.23±1.13	4.04±1.28	3.87±1.22	3.67±1.39	4.71±0.79	4.45±1.00
P-value	0.28		0.44		0.20	
After fracture	3.31±1.79	2.77±1.91	2.74±1.76	1.93±1.81	4.06±1.57	3.69±1.57
P-value	0.04*		0.03*		0.30	
Exacerbation	35 (43.2%)	57 (55.3%)	25 (54.3%)	37 (68.5%)	10 (28.6%)	20 (40.8%)
	12.1%		14.2%		12.2%	

Values are presented as mean±standard deviation.
Group A: patients who underwent surgical treatments from January 2018 to December 2019, Group B: patients who underwent surgical treatments from January 2020 to December 2021 after the outbreak of the COVID-19 pandemic.
Pre-: pre-pandemic, Pan-: pandemic.
* *P*<0.05; by independent *t*-test.

Table 2. Factors Affecting the Modified Koval Index

	B	SE	*β*	*P*-value
Pandemic (post)	–0.46	0.24	–0.12	0.04*
Age	–0.05	0.01	–0.28	0.00*
Sex (female)	0.44	0.30	0.10	0.15
Nursing hospital care	–1.34	0.25	–0.36	0.00*

Reference: pandemic (pre), sex (male), home care.
R^2=0.27, Durbin-Watson=1.78, F (*P*)=16.15(0.00).
SE: standard error.
* *P*<0.05; by multiple regression analysis.

patients with hip fracture without increasing complications even during the pandemic period[15]. As many studies have reported on increased complications and mortality rates after hip fracture during the pandemic, the necessity of thorough preparation for elderly patients with hip fracture was mentioned in the case of another such pandemic occurring in the future[16].

When elderly patients receive active support provided by medical personnel and assistants for treatment aimed at recovery after surgery, early recovery and a normal return to daily life before fractures can be expected[17]. Therefore, various programs have been implemented for recovery of exercise ability in elderly patients with hip fracture. Use of a multidisciplinary team approach, which requires assistance from various specialties, is important for achievement of rapid recovery of exercise ability, and to reduce complications that may occur after surgery in elderly patients[18]. In particular, family-centered care, which involves family participation in the recovery stage after surgery, is regarded as a much better approach to recovery for older patients with hip fracture[19-21]. In the pre-pandemic period, families were able to visit their elderly family members at medical institutions without restriction, and they were responsible for not only pre-operative treatments but also exercise recovery treatments for the elderly patients. The family's participation in the treatment of elderly patients was considered a positive experience for both physical and mental recovery after the surgeries. With the COVID-19 pandemic, almost every aspect of our society has changed. In many sectors of society, an unfamiliar environment known as non-face-to-face has replaced the face-to-face environment. PCR (polymerase chain reaction) testing was essential for all patients hospitalized in adjacent rooms located along the corridor[22]. Visits from patients' guardians were also completely prohibited in an effort to minimize contact between inpatients and outsiders. These environmental changes would have impacted elderly hospitalized patients and their family members in many ways. In a study on postoperative exercise recovery in elderly patients with hip fracture during the pandemic, Anusitviwat et al.[23] reported that recovery of motor ability decreased and complications increased over a period of three months after surgery compared to the pre-pandemic.

In our study, evaluation of walking ability using the modified Koval index six months after surgery showed a statistical decrease in walking ability since emergence of the pandemic. According to the results of a survey of the exacerbation rate of the modified Koval index, an increase also occurred after the pandemic. It is believed that these results were caused by direct and active prohibition of visits from guardians due to infection control policies after the pandemic. This tendency was more pronounced in patients admitted to nursing hospitals. No meaningful difference was observed between the pandemic and pre-pandemic groups among patients who were discharged to "home" where they can be with family members. However, a statistically significant decrease in walking ability was observed in patients admitted to nursing care hospitals after the pandemic. These results have been attributed to the lack of active support in management of exercise recovery treatments due to the complete control of parental visits to nursing hospitals and restrictions on contact with caregivers and medical personnel under the stringent infection control policies utilized during the pandemic. By contrast, in the case of home treatment where the influence of COVID-19 was relatively minor, the patient received active family support in performance of walking recovery exercise.

This study has some limitations. First, a retrospective research method was used in the design of this study. Due to the unexpected pandemic, designing a prospective study was difficult. Second, the study period of two years before and after the pandemic was short, and these patients were designated as the population subjects, so that the number was not sufficient. However, despite these limitations, the findings of this study can be regarded as meaningful in that they may be helpful in determining directions for the future as well as further research on treatment for recovery activities including postoperative gait exercise in elderly patients with hip fracture in situations such as the COVID-19 pandemic.

CONCLUSION

The COVID-19 pandemic had a negative effect on the recovery of walking ability of elderly patients who underwent surgery for treatment of hip fracture, which was particularly evident in nursing hospitals where family visits were completely prohibited. Therefore, establishment of a specific and accurate system for management of exercise recovery treatment for elderly patients with hip fracture in the event of a new pandemic such as COVID-19 in the future and for conduct of a prospective study will be necessary.

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CONFLICT OF INTEREST

No other potential conflict of interest relevant to this article was reported.

ORCID

Young Yool Chung (https://orcid.org/0000-0002-4959-1230)
Sung Nyun Baek (https://orcid.org/0000-0002-6211-4527)
Tae Gyu Park (https://orcid.org/0000-0002-6100-6268)
Min Young Kim (https://orcid.org/0000-0003-3073-5481)

REFERENCES

1. Kim BS, Lim JY, Ha YC. *Recent epidemiology of hip fractures in South Korea. Hip Pelvis. 2020;32:119-24. https://doi.org/10.5371/hp.2020.32.3.119*
2. Hong S, Han K. *The incidence of hip fracture and mortality rate after hip fracture in Korea: a nationwide population-based cohort study. Osteoporos Sarcopenia. 2019;5:38-43. https://doi.org/10.1016/j.afos.2019.06.003 Erratum in: Osteoporos Sarcopenia. 2019;5:102. https://doi.org/10.1016/j.afos.2019.08.002*
3. Oldmeadow LB, Edwards ER, Kimmel LA, Kipen E, Robertson VJ, Bailey MJ. *No rest for the wounded: early ambulation after hip surgery accelerates recovery. ANZ J Surg. 2006;76:607-11. https://doi.org/10.1111/j.1445-2197.2006.03786.x*
4. Okamoto T, Ridley RJ, Edmondston SJ, Visser M, Headford J, Yates PJ. *Day-of-surgery mobilization reduces the length of stay after elective hip arthroplasty. J Arthroplasty. 2016;31:2227-30. https://doi.org/10.1016/j.arth.2016.03.066*
5. Oberfeld J, von Hertzberg-Boelch SP, Weissenberger M, Holzapfel BM, Rudert M, Jakuscheit A. *Effect of mobilization on the day of surgery after total hip arthroplasty in elderly, obese, and severely diseased patients. J Arthroplasty. 2021;36:3686-91. https://doi.org/10.1016/j.arth.2021.06.024*
6. Pfeufer D, Kammerlander C, Stadler C, et al. *Multidisciplinary inpatient rehabilitation improves the long-term functional status of geriatric hip-fracture patients. Eur J Med Res. 2020;25:31. https://doi.org/10.1186/s40001-020-00433-2*
7. Koval KJ, Skovron ML, Aharonoff GB, Meadows SE, Zuckerman JD. *Ambulatory ability after hip fracture. A prospective study in geriatric patients. Clin Orthop Relat Res. 1995;(310):150-9.*
8. Kang SJ, Jung SI. *Age-related morbidity and mortality among patients with COVID-19. Infect Chemother. 2020;52:154-64. https://doi.org/10.3947/ic.2020.52.2.154*
9. Egol KA, Konda SR, Bird ML, et al. *Increased mortality and major complications in hip fracture care during the COVID-19 pandemic: a New York City perspective. J Orthop Trauma. 2020;34:395-402. https://doi.org/10.1097/BOT.0000000000001845*
10. Slullitel PA, Lucero CM, Soruco ML, et al. *Prolonged social lockdown during COVID-19 pandemic and hip fracture epidemiology. Int Orthop. 2020;44:1887-95. https://doi.org/10.1007/s00264-020-04769-6*
11. Zamora T, Sandoval F, Demandes H, et al. *Hip fractures in the elderly during the COVID-19 pandemic: a Latin-American perspective with a minimum 90-day follow-up. Geriatr Orthop Surg Rehabil. 2021;12:21514593211024509. https://doi.org/10.1177/21514593211024509*
12. Zhong H, Poeran J, Liu J, Wilson LA, Memtsoudis SG. *Hip fracture characteristics and outcomes during COVID-19: a large retrospective national database review. Br J Anaesth. 2021;127:15-22. https://doi.org/10.1016/j.bja.2021.04.003*
13. Wignall A, Giannoudis V, De C, et al. *The impact of COVID-19 on the management and outcomes of patients with proximal femoral fractures: a multi-centre study of 580 patients. J Orthop Surg Res. 2021;16:155. https://doi.org/10.1186/s13018-021-02301-z*
14. Liu G, Yang M, Li N, Li S, Zhu S, Wu X. *The effects of COVID-19 on geriatric hip fracture management and 1-year mortality in Beijing. Orthop Surg. 2022;14:2527-34. https://doi.org/10.1111/os.13464*
15. Simunovic N, Devereaux PJ, Sprague S, et al. *Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. CMAJ. 2010;182:1609-16. https://doi.org/10.1503/cmaj.092220*
16. Malik-Tabassum K, Robertson A, Tadros BJ, et al. *The effect of the COVID-19 lockdown on the epidemiology of hip fractures in the elderly: a multicentre cohort study. Ann R Coll Surg Engl. 2021;103:337-44. https://doi.org/10.1308/rcsann.2020.7071*
17. Munin MC, Begley A, Skidmore ER, Lenze EJ. *Influence of rehabilitation site on hip fracture recovery in community-dwelling subjects at 6-month follow-up. Arch Phys Med Rehabil. 2006;87:1004-6. https://doi.org/10.1016/j.apmr.2006.04.002*
18. Patel JN, Klein DS, Sreekumar S, Liporace FA, Yoon RS. *Outcomes in multidisciplinary team-based approach in geriatric hip fracture care: a systematic review. J Am Acad Orthop Surg. 2020;28:128-33. https://doi.org/10.5435/JAAOS-D-18-00425*
19. Ariza-Vega P, Prieto-Moreno R, Castillo-Pérez H, Martínez-Ruiz V, Romero-Ayuso D, Ashe MC. *Family caregivers' experiences with tele-rehabilitation for older adults with hip fracture. J Clin Med. 2021;10:5850. https://doi.org/10.3390/jcm10245850*
20. Karlsson Å, Lindelöf N, Olofsson B, et al. *Effects of geriatric interdisciplinary home rehabilitation on independence in activities of daily living in older people with hip fracture: a randomized controlled trial. Arch Phys Med Rehabil. 2020;101:571-8. https://doi.org/10.1016/j.apmr.2019.12.007*
21. Wu D, Zhu X, Zhang S. *Effect of home-based rehabilitation for hip fracture: a meta-analysis of randomized controlled trials. J Rehabil Med. 2018;50:481-6. https://doi.org/10.2340/16501977-2328*
22. Chung JW, Ha YC, Lee MK, Kim JH, Park JW, Koo KH. *Hip fracture management during the COVID-19 pandemic in South Korea. Clin Orthop Surg. 2021;13:474-81. https://doi.org/10.4055/cios21123*
23. Anusitviwat C, Vanitcharoenkul E, Chotiyarnwong P, Unnanuntana A. *Surgical treatment for fragility hip fractures during the COVID-19 pandemic resulted in lower short-term postoperative functional outcome and a higher complication rate compared to the pre-pandemic period. Osteoporos Int. 2022;33:2217-26. https://doi.org/10.1007/s00198-022-06485-w*