**Comparison of patient-reported outcome measures between home and hospital rehabilitation of patients following a hip fracture**

Abstract

Background

The anticipated increase in hip fractures (HF) due to the aging of the population and the rise in patronization of healthcare services provided at home, following the COVID-19 pandemic, emphasize the pressing need to compare outcomes between home and hospital HF rehabilitation. Research that compares the two settings has focused primarily on clinical outcomes but not on patient-reported outcomes (PROs). This study sought to evaluate PROs of patients with HF in the two rehabilitation settings.

Methods

This study was a longitudinal observational multi-center trial among patients with HF. PROs were measured using the SF36 questionnaire that evaluates eight themes: physical functioning, physical role-limitation, bodily pain, general health, vitality, social functioning, emotional role-limitation, and mental health. Patients were assessed at three points in time: 24–48 hours, 2 weeks, and 3 months after surgery. The first assessment was retrospective and reflected pre-fracture health quality and functionality. Descriptive statistics and mixed effect logistic regression were used to compare the two settings.

Results

A total of 86 patients with HF participated in the study; they included two groups, 45 and 41 patients in the hospital and home rehabilitation groups, respectively. With the exception of bodily pain, the measures of the SF36 were not significantly (P <0.05) different in improvement from the pre-fracture status to recovery, 3 months post-facture, between the two groups. In both groups, the physical and mental scores decreased 2 weeks after the HF, in comparison to the pre-fracture status. The patients' health statuses improved somewhat 3 months after the fracture but did not return to the pre-fracture score.

Conclusion

PROs of home and hospital rehabilitation were similar, suggesting that for suitable patients, rehabilitation at home can be as effective as hospital rehabilitation. PROs enable a richer and more comprehensive understanding of the health outcomes of patients with HF in different rehabilitation settings. This process of patient-centered care can improve quality healthcare in a growing population of patients.

**What is already known on this topic?** Following the COVID-19 pandemic, the number of patients with hip fractures discharged to continue rehabilitation at home has increased. Studies comparing home-based and hospital-based rehabilitation have focused primally on clinical outcomes but not on patient-reported outcomes (PROs). PROs can broaden our understanding of patients’ experiences and outcomes throughout the recovery process.

**What does this study add?** PROs of home and hospital-based rehabilitation were similar, suggesting that home rehabilitation is as effective as hospital-based rehabilitation.

**How this study might affect research, practice, or policy**? Findings from this study can help medical staff in deciding rehabilitation plans for patients with hip fractures and support the planning of policies on our preparedness for the growing need for rehabilitation units.

Introduction

Hospital admission rates of patients with hip fractures (HF) have increased substantially in the past decade (1) In older adults, HF is associated with poor outcomes, high costs, and a long rehabilitation process (2,3) Post-HF rehabilitation has been designed to reduce the effect of fractures on long-term disability (4), decrease the risk of mortality (5), and improve patients' quality of life (6).

Rehabilitation following an acute HF hospitalization can be performed in a hospital or at home (7). The decision to rehabilitate at home or hospital is dependent on social, medical, and cognitive determinants. Patients are referred for home rehabilitation, if they have a caregiver at home, do not require close medical attention, and/or are permitted to ambulate (8).

Multidisciplinary rehabilitative care has been reported to have a positive outcome in patients recovering from a HF (9,10). This treatment includes healthcare delivery by multiple health professionals, such as nurses, physicians, physiotherapists, occupational therapists, social workers, and dietitians. In Israel, post-HF rehabilitation is multidisciplinary and cost-free in both settings (8).

Rehabilitation in both settings has its objective advantages and disadvantages. Hospitalization of older adults with HF has been associated with an increased risk of infections (11) and cognitive and functional deterioration (12,13). In contrast, home care has been designed to reduce iatrogenic complications and hospitalization-related expenses and honor patients' wishes to stay at home (14). However, rehabilitation at home may lead to less medical attention and a burden on family caregivers (15–17).

Due to the aging of the population, the need for rehabilitation, in general, and home-based rehabilitation has increased in recent years (18). This change became increasingly evident when the advent of the COVID-19 pandemic made older adults afraid to leave their homes for treatment in medical facilities due to the risk of infection (19). Outcome comparisons of the two settings can help healthcare professionals recommend the best-suited rehabilitation setting for patients with HF and support policy planning by improving the preparedness for the growing need for rehabilitation units (14).

Previous studies on the comparison of both settings primarily focused on clinical and functional outcomes (20,21) but not on outcomes that are meaningful to the patient. In recent years, the use of patient-reported outcomes (PROs) in healthcare has increased (22,23). PROs are measured using validated questionnaires that assess the symptoms, function, and quality of life from the patient’s perspective. Therefore, the need to measure patient-valued outcomes is warranted (24). The aging global population and predictable increase in the incidence of HFs emphasize the need to establish outcome sets that would be most meaningful to patients. This study sought to evaluate PROs of patients with HF in home-based and hospital-based rehabilitation settings.

**Methods**

*Study design*

This study was a longitudinal observational multi-center trial among patients with HF. The study was designed based on the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) statement (25).

*Study-Setting*

Study participants were recruited from the two largest tertiary medical centers in the Middle East, the Sheba Medical Center, and Hadassah Medical Center, during the period from December 2021 to November 2022.

*Participants*

The inclusion criteria included (a) age of ≥60 years; (b) history of femoral neck fracture stabilization; (c) ability to understand and sign the informed consent form; and (d) ability to understand Hebrew. The exclusion criteria included (a) diagnosis of pathological fractures and (b) presence of a severe hearing disability.

Participants were recruited from two groups. Group 1 included patients who were discharged from the orthopedic department to their homes and received a visit from a member of the rehabilitation at-home team within 24–48 hours. Group 2 included patients who were admitted to the rehabilitation department directly from the orthopedic or emergency department. Patients were allocated to a specific group at the discretion of the medical team but not for the purpose of research. The setting was decided based on meetings between the clinical team, including the social worker, nurse, and medical team, and the patient with his/her family. The plan of discharge was decided by the medical team based on clinical and social criteria, such as patients' comorbidities, cognitive status, and social support. Group 2 participated as a control group in a different study.

Rehabilitation therapies in both settings were similar and included an integrative treatment approach by a multidisciplinary staff of geriatricians; orthopedic and rehabilitation specialists; nurses; dietitians; physiotherapists; and occupational, emotional, and speech therapists.

*Data collection*

At baseline, demographic and clinical data, including co-morbidities, functional status prior to fracture, and social support, were collected from patients' hospital and community medical files.

*Outcome Measurements*

PROs were measured using the short form (SF)-36 questionnaire. Although the SF36 is a general questionnaire that addresses specific conditions (28,29), it has been found to be suitable for measuring PROs in patients with HF (26) and evaluating recovery after lower extremity trauma (27). It consists of 36 questions that address eight themes: physical functioning, physical role limitation, bodily pain, general health, vitality, social functioning, emotional role limitation, and mental health. Results are interpreted by calculating scores for each topic and summarizing scores of several topics to generate a physical component score (PCS) and mental component score (MCS) (30,31).

Measurements were performed three times: 24–48 hours after surgery while hospitalized (T1), 2 weeks post-surgery (T2) while hospitalized or by phone, and 3 months later by phone (T3) (See Figure 1 for timeline). The first time point involved a retrospective assessment and reflected health quality and functionality before the fracture (32).

*Statistical measures*

Descriptive statistics were used to outline the patient's demographics and medical history. T-test and Chi-Square were used to detect differences in the characteristics of the groups. SF36 data were scaled; therefore, possible scores ranged from 0 (poor health) to 100 (excellent health) for the eight domains. Additionally, PCS and MCS that have been reported to be responsive in orthopedic conditions (35) were calculated. The calculations were performed according to the RAND Corporation website ([36-Item Short Form Survey (SF-36) | RAND](https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html)) and the oblique (correlated) factor solution that is recommended for orthopedic patients (36).

Mixed effect logistic regression was used to compare PROs. The mean scores were adjusted for age, sex, and Charlson co-morbidity index (CCI) (37), which is a predictive score of health outcomes in patients with HF (3,38). The PROs were not adjusted for fracture and surgery type, as others have reported no association between health-related quality of life and surgical approach (39–41). The minimal important difference (MCID) was calculated, assuming that changes of 9 points in one of the subscale scores and 2 points in the PCS and MCS of the SF36 are considered as the MCID (42,43). MCID was compared between the two groups and among assessment time points (pre-fracture and 2 weeks after (T1-T2), 2 weeks and 3 months after fracture (T2-T3), and pre-fracture status and 3 months post-fracture (T1-T3)).

The data were managed with Excel 2016 and analyzed using IBM SPSS Statistics for Windows Version 27 and Stata version 15.0.

*Sample size*

The sample size was determined using Winpepi 11.65. We considered a change of 9 points in one of the subscales of the SF36 to be the MCID (42). To detect a difference of 9 points on the subscale, assuming a standard deviation of 10 points and a power of 80% and P <0.05, a sample size of 20 participants in each group was required. Accounting for possible attrition due to the unfortunate increased risk for deterioration and mortality following a HF (44), we set a goal to increase the sample size of each group by at least 50%, totaling a minimum of 30 participants in each subgroup.

*Ethics approval and consent of participation*

The study was approved by the ethics committees of Sheba (#SMC-7933-20) and Hadassah Medical Centers (#HMO-0691-21). All participants provided written informed consent before enrolling in the study.

Results

*Characteristics of participants*

Eighty-six patients with HF participated in the study; 45 and 41 patients underwent rehabilitation in the hospital and at home, respectively (see Figure 2 for the description of study participants’ groups and follow-up at 2 weeks and 3 months later). With the exception of age and CCI, all other characteristics were similar between both groups (P >0.05) (see Table 1). No differences in demographic, clinical, and social characteristics were found between study participants and patients excluded from the study (n=141) for self-reported reasons, such as health issues, hearing difficulties, and language barriers (P >0.05).

Table 1: Comparison of characteristics between inpatient and home groups

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inpatient rehabilitation | Home rehabilitation | P-Value |
| Age, Mean (SD) | 82.4 (7.6) | 77.24 (7.7) | 0.02 |
| Woman, n (%) | 33 (73) | 25 (61) | 0.183 |
| Charlson co-morbidity score, Mean (SD) | 5.3 (1.6) | 4.5 (1.8) | 0.023 |
| Days from hospitalization to surgery, Mean (SD) | 1.4 (1.2) | 1.16 (0.9) | 0.96 |
| Days from hospitalization to rehabilitation, Mean (SD) | 7.02 (4.2) | 8.3 (4.4) | 0.12 |
| Extracapsular fracture, n (%) | 33 (73) | 29 (71) | 0.81 |
| PFNA (or other nailing) n (%) | 33 (73) | 31 (75) | 0.21 |

*PROs*

Response rates were 100%, 98%, and 91% at T1, T2, and T3, respectively. Figure 3 presents the physical and mental summary scores, adjusted for age, sex, and CCI, of the participants in the home and hospital groups. No significant differences in the scores (P <0.05) were observed when comparing the PROs scores between both groups at T1, T2, and T3. In both groups, the physical and mental scores plummeted 2 weeks after the HF (T2), in comparison to the pre-fracture status (T1). As presented in Table 2, this deterioration was MCID in all health domains and the two summary domains, PCS and MCS. The patients' health statuses improved somewhat 3 months after the fracture (T3). This difference was MCID primarily for the physical health domains (PCS, physical function, and pain) and MCS.

With the exception of physical function, in all of the SF36 health scores, the home and inpatient groups had similar declines 2 weeks after their fractures in comparison to their pre-fracture status. With the exception of bodily pain, no significant (P <0.05) differences in improvement from T1 and T3 were observed between both groups.

Table 2: Comparison of the difference in PRO scores among time points (T1-T2, T2-T3, T1-T3) in the inpatient and home groups adjusted for sex, age, and CCI

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Delta between times | PF, Mean (SE) | RL, Mean (SE) | BP, Mean (SE) | GH, Mean (SE) | V, Mean (SE) | SF Mean (SE) | EL Mean (SE) | MH Mean (SE) | PCS Mean (SD) | MCS Mean (SD) |
| Home | T1- T2 | 61.34\* | 73.65 | 38.14 | 12.39 | 21.76 | 31.34 | 19.89 | 15.4 | 34.86 | 16.35 |
| T2 -T3 | -34.38 | -38.16 | -8.34 | 0.27 | -7.27 | -3.18 | 0.17 | -2.41 | -14.99 | -2.49 |
| T1- T3 | 26.92 | 35.47 | 29.8\* | 7.84 | 15.01 | 28.16 | 20.06 | 12.98 | 20.45 | 13.87 |
| Hospital | T1- T2 | 46.38\* | 56.85 | 25.41 | 14.77 | 16.09 | 24.26 | 16.11 | 9.31 | 27.38 | 12.15 |
| T2 -T3 | -30.13 | -24.96 | -17.31 | -9.1 | -8.42 | -12.18 | -13.81 | -4.07 | -14.67 | -6.19 |
| T1- T3 | 16.25 | 31.89 | 8.1\* | 5.67 | 7.67 | 18.08 | 2.3 | 5.24 | 12.71 | 5.96 |

\*Values in a row that differ statically (P <0.05) when compared between groups, home, and hospital groups, at the 5% probability level according to the multi-analysis regression. PF- physical functioning, RL- physical role limitation, BP- bodily pain, GH-general health, V- vitality, SF social functioning, EL-emotional role limitation, MH- mental health. PCS- physical component score, MCS-mental component score.

Discussion

The findings suggest that the rehabilitation setting did not influence PROs. Therefore, the choice of rehabilitation setting should be based on other factors, such as the patient and family/caregiver’s preference and ability to provide homecare and the patients' medical condition. For the pre-fracture evaluation, the hospital group had a lower SF36 score than the home group. Expectedly, patients with more co-morbidities are often referred for inpatient rehabilitation, as opposed to home rehabilitation (45,46). For a more balanced comparison of both groups, the outcomes were controlled for age, sex, and CCI. However, although the preliminary SF36 score of the home rehabilitation group was higher than that of the inpatient population, the outcomes were mostly similar (P >0.05).

The findings from this study are consistent with findings from previous studies that compared clinical outcomes, such as 30-day readmission rates, mortality rates during or 90 days after rehabilitation, and functional improvement. No significant difference in these outcomes were observed between home-based rehabilitation and hospital care (20,47–50). In fact, patients undergoing home rehabilitation have been reported to experience fewer adverse events (51), such as infections (52). Additionally, home rehabilitation has been found to have a positive effect, in the early stages of rehabilitation, on patients’ balance confidence (17), self-efficacy (53), functionality (54), time-space orientation, collaboration (50), and even caregivers’ burden (55). These findings are consistent with findings from studies that compare PROs of acute patients undergoing rehabilitation at home and hospital (16). They suggest that patients with HF can be managed at home while achieving equivalent outcomes and using lesser resources than those being managed in inpatient settings (56,57). This information is especially valuable due to the shortage of rehabilitation beds in long-term facilities (58).

PRO data provided a richer understanding of the outcomes, functionality, and well-being of patients with HF throughout time. As expected, patients' physical and functional statuses were altered by the fracture. However, our findings suggest that a HF affects general, emotional, and mental health and social functioning. A sharp decline in SF36 scores post-HF and only a partial recovery after rehabilitation have been reported previously (40,41). Jaglala (59) reported that the same trend continues 6 months post-fracture.

*Strengths and limitations*

The study demonstrated several strengths that were not reported previously. Others (14) have stressed the importance of conducting studies that compare the outcomes of home-based and hospital-based care. This study examined the PROs of patients with HF undergoing home and hospital rehabilitation. In contrast to previous studies, which compared quality of life between patients with HF undergoing home rehabilitation and those undergoing no treatment (17,51,55,60–63) or had small sample sizes (50,64), our study measured the PROs of inpatient and home rehabilitation. As such, we performed a more balanced comparison between the two rehabilitation settings. This study had relatively higher response rates in all age groups than other HF PRO studies (54–15%), which reported a lack of representation of older adults (65–67). The high response rates could be due to the use of a single questionnaire that reduced survey fatigue (68) and the use of sequential methods, in-person and phone-based assessment, which has been associated with higher survey response rates (69). Unlike other studies (70), we collected patient pre-fracture PROs and evaluated the effect of HF on patients. To our knowledge, this study is the first PRO study in Israel to focus on the context of real-practice rehabilitation settings of patients with HF. The study was conducted in two large tertiary hospitals, and the results can serve as a benchmark for the comparison of future PROs in patients with HF.

A possible limitation is that naturally, this study cannot evaluate if patients who received rehabilitative care in the hospital would have had similar improvements if they were cared for at home and vice versa. Additionally, factors, such as socioeconomic status, may have influenced the referral of patients for home or hospital rehabilitation. Assessment at 3 months and aspects of the assessment at 2 weeks were performed by telephone interviews. Previous studies have reported that telephone-administered questionnaires usually result in a more optimistic health-related quality of life (71–73), suggesting that the recovery of patients with HF may be worse than the reported outcomes described in the study.

The COVID-19 pandemic has had an effect on rehabilitation services. Increased use of home-based rehabilitation and telerehabilitation was designed to ensure the safety of patients and their staff (74). In keeping with this new reality, the study of the outcomes and effectiveness of HF rehabilitation in different settings is needed. Findings from this study can help with decisions on where to discharge the patient and support policy planning regarding the development of future rehabilitation services.

*Conclusion*

Patient-reported outcomes of home rehabilitation and inpatient rehabilitation are similar, suggesting that both settings are similarly effective. PROs ensure a richer and more comprehensive understanding of the healthcare outcomes of patients with HF in different rehabilitation settings. This process of patient-centered care can improve quality healthcare in a growing population of patients.

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