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Patient Satisfaction Using a Home-Based Rehabilitation Protocol for the Non-Surgical Treatment of Proximal Humeral Fractures: A Prospective Longitudinal Cohort Study

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Abstract

Supervised, center-based, daily physiotherapy presents limitations: transport, need for an accompanying person, or risk of infection. Home-based rehabilitation protocols (HBRP) can be effective alternatives. We use a HBRP for the non-surgically treated proximal humeral fractures (PHF) in older patients.

Objectives: To assess patient satisfaction and preferences of using a booklet, videos, or an app to guide physiotherapy. **Patients and methods:** Prospective, single-center observational study of patients ≥55 years old who sustained a non-surgically treated PHF. The HBRP consisted of immediate mobilization, followed by 5 physiotherapist-guided, weekly sessions of rehabilitation and standard physiotherapy after 3 months, if needed. A booklet with images, videos, or a smartphone application were offered to guide the patients. **Results:** Mean degree of satisfaction (1-5) was 4.66 ± .9: 84 patients (82.4%) were very satisfied, 11 patients (10.8%) were satisfied, and 5 patients (4.9%) were not satisfied at all. Mean Oxford Shoulder Score achieved was 40.5 ± 6.6. 59.8% patients preferred the booklet and 29.4% the videos. Exercise compliance was considered very high in 87.3% of patients, while 4% hardly never followed the HBRP. Only 17.7% patients needed center-based physiotherapy after the HBRP. **Discussion:** Reasons for satisfaction were good final functional outcome, no need for transportation, being away from hospital, immediate rehabilitation availability and being capable of maintaining independence. Adherence is a major concern. Videos are more didactic explaining the exercises. **Conclusion:** If standard physiotherapy is not available, the HBRP can be a valid treatment option for PHF management in older patients, with a high degree of patient satisfaction. Older patients preferred the booklet to guide physiotherapy.

Keywords

fragility, proximal humeral fracture, immediate mobilization, telerehabilitation, lifestyle, autonomy, independency

Introduction

Home-based rehabilitation protocols (HBRPs) or telerehabilitation is used in different clinical scenarios: neurological and cardiovascular diseases, sarcopenia, critical care survivors, urinary incontinence, fibromyalgia, or rheumatoid arthritis.[1-8] Lately, HBRPs are also used with good results for patients with degenerative knee and hip pathology, back pain, rotator cuff tears, or distal radius and hip fractures.[9-17] The demand for physical therapy exceeds

physiotherapy resources. This situation delays the start of physiotherapy. Trauma surgeons are using these methods as alternatives to standard physiotherapy after initial fracture treatment.[14,18]

On the other hand, supervised, center-based, daily physiotherapy–guided rehabilitation might not be welcome under certain circumstances: transport can be exhausting or difficult for older patients, patients living far away or in places with bad weather conditions,[6,8] and also some patients may need the help of accompanying relatives during their working hours. There is also lack of resources and skillful professionals in rural or remote areas.[6] Recently, the lockdown and readjustment of resources during the SARS-CoV-2 pandemic has left patients without standard physiotherapy. Patients suffering fractures in overwhelmed hospitals have serious difficulties restoring their pre-fracture function. Under these circumstances, a HBRP can be very useful and it could be an alternative to formal physiotherapy,[3,4,6,9,10,12,13,16,17,19] if clinic-based physiotherapy is not available or possible for the patient.

The advantages of telerehabilitation are physical functioning[20] and psychological benefits,[13] exercises can start immediately with faster recovery,[1,15,18,21,22] and earlier independence for basic activities of daily living (BADL). Telerehabilitation provides the comfort and safety of a home environment,[7,23,24] with no time wasted on transportation, no need to involve an accompanying relative, and lower need of clinic-based physiotherapy.[12] Telerehabilitation empowers patients as it provides a better context for individualized care plans.[25] The main disadvantages are low-intensity training, poor patient compliance,[20,23,26,27] low adherence to the program,[28] unfeasible for cognitive impaired patients,[1] and manual treatment limitations.[25]

The use of media-based tools to guide physiotherapy has not been formally assessed. We aimed to evaluate the use of innovative media-based tools to guide physiotherapy for non-surgically treated proximal humeral fractures (PHF) in older patients.

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Patients and Methods

We conducted a prospective clinical observational study including patients 55 years old or older suffering a low-energy PHF between June 2017 and February 2019 in one single center who underwent non-surgical treatment followed by early mobilization HBRP independent of the indication (type of fracture, health condition, no consent for surgical treatment, etc.). The study was approved by the institution´s ethics committee (PI 20-1685). All patients gave their written informed consent for participation in this study. The inclusion criteria were patients 55 years of age or older presenting with a low-energy PHF treated non-surgically with minimum 1 year follow-up and available for a phone call interview and willing to provide all the answers. The exclusion criteria were diagnosis of dementia at the time of the PHF, cognitive impairment preventing a telephone interview, and lost for follow-up before fracture healing.

Home-Based Rehabilitation Protocol

We had already used immediate mobilization with early exercises for the non-surgical treatment of PHF. At that time (January 2015), patients did not receive any document explaining the exercises, except for verbal explanations, and all patients received standard physiotherapy. Because the results of that study were promising,[29] we took a step forward to improve this treatment. We produced an early mobilization HBRP with specific documental tools. Since June 2017, we have implemented this early mobilization HBRP for the non-surgical treatment of PHF in older patients. The protocol consists of (1) exercise program for early mobilization starting from day 1 after the fracture and allowing BADL so that patients remain as independent as possible, (2) weekly monitored sessions with a physiotherapist, for education, home exercise supervision, and physical activity advice, starting after 2/3 weeks follow-up; and (3) standard physiotherapy at 3 months follow-up if there is unsatisfactory progression: the patient has difficulties for exercising, shoulder movements are painful, there is room for improving shoulder range of motion, there is a low or no increase of range of motion, or pain is not decreasing or under control measured with VAS. During in-person follow-up visits at 1 week, 2 weeks, 1 month, 3 and 6 months, and 1 year, patients were checked upon pain, independency for BADL, range of movement, and problem understanding and performing the exercises. The instructions for the exercise program are provided, at diagnosis, with 3 tools: videos, application for smartphone (app), and booklet with pictures. New exercises are added on weekly basis. The videos explain how to perform the exercises and are grouped in a YouTube playlist (first author´s channel: https://youtube.com/playlist?list=PLBTmM5Q0_zaMcpi-TyFUkwe9grYF5DVZjR). The free app shows the same

videos, a voice over guides the exercise performance, and allows adjusting number of repetitions and speed (https://play.google.com/store/apps/details?id=com.gti.maria.physiotherapyapp&hl=es_419). The booklet shows snapshots from the video recording sessions and text explaining the exercises. Patients can freely use any of the 3 tools, or a combination of them.

Our main objective was to assess the degree of satisfaction of older patients using these innovative tools for the non-surgical treatment of PHF. Secondary objectives were to find out whether patients preferred the booklet, videos or app to guide HBRP, evaluate the degree of compliance with HBRP, and assess the subjective degree of shoulder function recovery.

Measures

Type of fracture according to Neer´s classification,[30] age at diagnosis, and patients´ center-based physiotherapy treatment regime (either monitored sessions or standard physiotherapy) were registered. Patients were reached by telephone during the second half of March 2020 to evaluate their degree of satisfaction (1–5), subjective degree of exercise compliance (1–5), degree of difficulty using the different guide tools (1–5), preferred guiding tool (booklet, videos, or app), degree of recommendation for the protocol (1–5), internet accessibility, Oxford Shoulder Score (OSS),[31] and subjective recovered range of motion (ROM) (1–5), that is, subjective perception of shoulder ROM recovery compared to pre-fracture shoulder ROM. Subjective scales were produced according to Likert´s model.[32] Example of the question regarding satisfaction: "I was satisfied with the treatment I have received for the management of my proximal humeral fracture; I would like to be treated with this same protocol again: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; and (5) Strongly agree."

Data Analysis

Data were analyzed using SPSS 23.0 software (IBM, Armonk, NY, USA). Continuous variables are described using mean ± standard deviation. Categorical variables are presented with absolute and relative frequencies. Continuous variables were explored for normal distribution according to histograms and the Shapiro–Wilk test. The comparison of quantitative variables between 2 groups was done using the Student's t-test for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. The ANOVA test was used to compare quantitative variables between 3 groups. The chi-square test was used to compare categorical variables. Pearson's correlation coefficient was used to assess association between quantitative variables. For all analysis, a $P \leq .05$ (2 tailed) was considered statistically significant.

Results

A total of 133 patients fulfilled the inclusion criteria and were eligible to take the survey: 5 patients refused to participate in the survey or did not answer all the questions; 19 patients could not be contacted; and 7 patients had already died. In total, 102 patients answered the complete survey. Epidemiologic data from these patients, their fractures, treatment, clinical results, degree of satisfaction, and preferences are reported in Table 1. Mean follow-up time was 1.86 ± 1.14 years. Mean degree of satisfaction with the HBRP was 4.66 ± .9: 84 patients (82.4%) were very satisfied with the treatment regime, 11 patients (10.8%) were satisfied, and 5 patients (4.9%) were not satisfied at all.

Thirty patients (29.4%) did not attend any physiotherapist-supervised session. For those patients who were supervised, the mean number of monitored sessions was 4.58 ± 1.26. After these monitored sessions, 18 (17.7%) of all the patients needed further standard physiotherapy. The mean OSS for those patients who did not

Table 1. Epidemiologic Data from the Patients, their Fractures, as Well as for the Treatment, Clinical Results, Degree of Satisfaction, and Preferences.

Age	70.6 ± 9.5 yo
Sex: Female	80 (78.4%)
Male	22 (21.6%)
PHF classification: 1-Part	27 (26.5%)
2-part	31 (30.4%)
3-part	30 (29.4%)
4-part	11 (10.8%)
Articular	3 (2.9%)
Internet access: Yes	58 (56.9%)
No	44 (43.1%)
Treatment: Only HBRP	30 (29.4%)
Monitored sessions without physio	54 (52.9%)
Monitored sessions with physio	18 (17.7%)
Number of sessions	4.58 ± 1.26
OSS	40.5 ± 6.6
Degree of satisfaction*	4.66 ± 0.9
Degree of recommendation*	4.66 ± 0.9
Subjective degree of exercise compliance*	4.75 ± 1
Subjective ROM recovery*	4.15 ± 1.1
Preferred tool: Booklet	61 (59.8%)
Videos	30 (29.4%)
App	11 (10.8%)

PHF: Proximal humeral fracture; HBRP: home-based rehabilitation protocols; OSS: Oxford Shoulder Score; ROM: Range of movement.
*Degree in a 1-5 scale.

attend standard physiotherapy was 41.22 ± 5.99 vs 37.94 ± 7.58 (P = .054) for those who received standard physiotherapy after the monitored sessions.

According to the availability of internet, patients with internet access were younger, more satisfied with the HBRP, and had better OSS than those without internet connection. There were no differences in the number of monitored sessions or in the number of patients attending standard physiotherapy (Table 2). Degree of satisfaction and recommendation of the HBRP were inversely correlated with age (r = −.275) (P = .005) (both), and positively correlated with the final OSS (r = .428) (P < .001) (both), the self-assessment exercise compliance (r = .459) (P < .001) (both), and the subjective shoulder ROM recovery (r = .415) (P < .001) (both).

According to the treatment regime, there were no differences in age, access to internet, degree of satisfaction, recommendation, subjective exercise compliance, or final OSS. But those needing further standard physiotherapy attended to less monitored sessions (Table 3). More patients preferred the booklet even though they had internet access. This group of patients was older and presented a worse OSS than those preferring the videos or the app. No matter which tool the patients preferred, there were no differences in degree of satisfaction or treatment regime (Table 4).

According to the subjective self-assessment home-based exercise compliance, 89 (87.3%) patients followed the home exercise program with one of the tools as support and 4% did not do any exercise at all or hardly ever. The subjective exercise compliance was not related to the age of the patient. Patients who reported good exercise accomplishment presented better OSS (P = .038). At the end of follow-up, 83 patients (81.4%) perceived complete or almost complete shoulder ROM recovery and 3 patients (3%) perceived worse ROM than before the fracture. 84 (82,4%) patients strongly recommend the exercise program and 5 patients (4.9%) would not recommend the HBRP and preferred standard physiotherapy. Six patients (5.9%) experienced difficulties with the exercise tools, thus reducing the use of the HBRP and the chances for functional recovery.

Discussion

The use of the HBRP for PHF reported a high degree of satisfaction in our patients, similar to the 95% reported by Johansson et al. after first-time lumbar disc surgery.[12] Reasons for satisfaction among our patients were no need for travelling or bothering relatives, initiation of rehabilitation without a waiting list, increased independence, and ability to keep on with BADL.

Table 2. Answers to the Items in the Survey According to the Internet Access. OSS: Oxford Shoulder Score.

Internet access	n	Age P > .001	Satisfaction P = .032	OSS P = .002	# Monitored sessions P = .158	Received Standard physio P = .959
Yes	58 (56.9%)	66 ± 8	4.8 ± 0.1	42 ± 5	3.6 ± 2.4	10 (59%)
No	44 (43.1%)	76 ± 7	4.5 ± 1.1	38 ± 8	2.8 ± 2.2	7 (41%)

Table 3. Answers to the Items in the Survey According to the Rehabilitation Treatment Regime. HBRP: home-based rehabilitation protocols, OSS: Oxford Shoulder Score.

Treatment	n	Age P = .925	Internet P = .795, %	Compliance P = .511	Satisfaction P = 0. 613	Recommend P = .613	OSS P = .207	# sessions P < .001
Only HBRP	30 29.4%	70 ± 10	53	4.5 ± 1.2	4.3 ± 1.5	4.3 ± 1.5	39 ± 7	0
Monitored sessions	54 52.9%	71 ± 9	61	4.8 ± 1	4.8 ± 0.7	4.8 ± 0.7	42 ± 6	4.7 ± 1.3
With physio	18 17.7%	72 ± 9	60	4.7 ± 0.8	4.6 ± 0.8	4.6 ± 0.8	39 ± 7	3.2 ± 3

Table 4. Answers to the Items in the Survey According to the Preferred Tool. OSS: Oxford Shoulder Score.

Preferred tool	n	Age P = .002	Satisfaction P = .139	OSS P = .037	# Monitored sessions P = .002	Received Standard physio P = .147	Internet access P = .002
Booklet	61 (59.8%)	73 ± 9	4.5 ± 1.1	39 ± 7	2.6 ± 0.3	13 (78%)	26 (44%)
Videos	30 (29.4%)	68 ± 9	4.8 ± 0.8	43 ± 4	3.8 ± 1.5	2 (11%)	23 (40%)
App	11 (10.8%)	64 ± 8	5 ± 0	42 ± 6	4.9 ± 0.5	2 (11%)	9 (16%)

Adherence is one of the biggest concerns when prescribing HBRP.[8,10,23,27,28] Reasons mentioned most often for nonadherence are vacation and work,[10] the same as for in-hospital physiotherapy. Greater independence, self-motivation, social support, motivation, and previous adherence to physical therapies predict higher adherence to HBRPs.[28] Adherence to HBRP is low after hip fractures,[3,20,26] as patients have a great decrease in global physical function and autonomy.[14] It might be a problem in pathologies with higher incidence in older adults, when interventions do not fit patients' limitations and goals. But this is not the case for this HBRP for PHF as its goal is to restore independence and autonomy. And we know from a previous study that early mobilization does not displace PHF.[29] This HBRP does not prescribe a certain number of repetitions, or timing, or number of training sessions: we encourage to exercise daily in multiple short sessions, with only 1 longer exercise session per day, and keep as independent as possible for BADL from the first day. Besides, the tools are not "fancy": easy content with simple instructions in plain language. That is why age was not related to the subjective self-assessment exercise compliance in our study. Thus, older and more dependent patients were also stimulated to do the exercise program. Adherence can be facilitated by increasing the attractiveness of the programs: new technologies meet these challenges but are not a substitute for the personal relationship between patients and care providers.[4,23] Physiotherapist-supervised sessions provide this personal relationship to the HBRP and help improving adherence factors. Although Bruder et al. found that therapist supervision might not be necessary in conservatively managed distal radius fractures or PHF,[18] an in-home setting helps physical therapists co-create patient-centered care plans with exercises that are more relevant to a patient's immediate environment.[25] We supervised our patients during follow-up visits, but supervision can be done by telephone follow-up calls,[5,33] by physiotherapists,[12] or by video conference-based supervision.[3] But regarding the degree satisfaction, our patients preferred some kind of supervision rather than only HBRP, and still some degree of independency as those attending standard physiotherapy weren´t more satisfied, but no statistical difference was found.

Proximal humeral fracture is a fragility fracture, thus one of the major concerns are patient´s ability to deal with new technologies, and also limited internet access. These are the reasons why older patients without external help preferred the booklet. Although according to the mean age of our patients, in 5 years' time, the great majority of patients presenting a PHF should have internet connection. Exercises in the videos might be better explained than in the booklet: videos are easier to follow and guide the movement in each exercise, while images in the booklet are static. More sophisticated technologies might work better in younger patients. Although Hong et al. showed positive effects on sarcopenia using more advanced tools like video conference–based supervised resistance,[3] Wijnen et al. used a tablet app and mobility monitoring devices for total hip arthroplasty. Adherence was good, patient experience was positive, and the novel technology was well accepted.[17] Recent technological developments such as wearable sensors and tablets with a mobile internet connection hold promise for providing electronic health home-based programs with remote coaching for patients.[10,17] When designing a HBRP, the tool must be adequate to the target population.

Reduction of hospital visits provides comfort and minimizes the risk of infection.[34] HBRP involves patients in their own recovery treatment, minimizing the use of hospital resources. The sooner rehabilitation starts, the less amount of physiotherapy the patients need.[21] In the present study, the HBRP starts right after the PHF diagnosis, thus 29% of the patients did not need any physiotherapy supervision at all, and a reduced number of patients (17.7%) needed standard physiotherapy at 3 months follow-up. This is important for older patients for whom recovering their independence and remain living in their home is paramount. Patients needing standard physiotherapy received less monitored sessions: if these patients had received 2 to 4 more monitored sessions, maybe they would have not needed standard physiotherapy.

More recently, in spite of the elective activity cease during the SARS-CoV-2 pandemic lockdown, we still had to treat patients with PHF, while physiotherapy and rehabilitation services were closed. We kept doing the same treatment management except for the weekly visits to the physiotherapist. Instead, we did telephone follow-ups and asked about doubts with the exercises. In a lockdown scenario, these home-based tools are definitively better than the alternative, which is no rehabilitation treatment at all. With this work we encourage trauma surgeons to carry out HBRPs together with their rehabilitation teams, and be prepared for future lockdowns due to the SARS-CoV-2 pandemic: we have to be more pro-active in our patients' rehabilitation process, as minimal function recovery will provide great autonomy. Self-explanatory short videos and/or a booklet with exercises might help in the recovery of fractures or other joint disorders.

The ideal home-based (tele)rehabilitation should be easy to follow and to comply with, effective, and with high adherence rates. We must consider that older patients can struggle with apps, but almost anyone with a smartphone can watch videos from YouTube. Also, videos are easy to record, but apps are difficult to build. A booklet with images and explanations will always be helpful. The protocols should include exercises similar to in-hospital therapy. Start with illustrative booklets and videos with

clear instructions. Once the HBRP is effective, more sophisticated technological tools (apps, sensors, tablets, …) can be introduced.

To our knowledge, this is the first article presenting a HBRP for a fragility fracture with the clinical objective of restoring global function and independence. Our study has several limitations: As there is no control group, we cannot compare the degree of satisfaction nor effectiveness with standard physiotherapy for PHF. At our institution, standard physiotherapy starts 3 months after the PHF, which in older patients might mean a change of their lifestyle. All patients were treated by the same surgeon (the first author), with a precise fracture clinic follow-up. At these visits, patients were instructed on the exercises, corrected, and encouraged. We do not know if this same program would have the same degree of satisfaction with other treating surgeons. On the other hand, this HBRP includes early mobilization which might also have some effect on an earlier recovery and influence on the patient´s degree of satisfaction which cannot be distinguished from the HBRP´s benefit. We could not assess exercise compliance as we do not use wearables. In some cases, the questionnaire was administered almost 3 years after the PHF, which might introduce recall bias, especially in older patients. The subjective degree of exercise compliance gives an idea of the patients´ involvement in their own recovery, but it is not accurate. Telecommunications grade students built up the app for us, with no further maintenance: we do not know if a more sophisticated app would have been more appealing for our patients.

Conclusions

Patients were very satisfied with the HBRP for the non-surgical treatment of PHF, and the preferred tools were the booklet and videos. Supervised sessions with physiotherapists might help in the efficacy and adherence to HBRP. If standard physiotherapy is not available, the HBRP can be a valid treatment option for PHF management in older patients treated non-surgically.

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