1. Introduction

Proximal humeral fractures (PHF) are painful and debilitating injuries, accounting for 5 to 6% of all fractures in adults (Court-Brown & Caesar 2006). PHFs are more common in women than men with the typical mechanism of injury being a fall from a standing height (Mafi et al., 2014). The incidence of PHF increases with age, with the majority of fractures occurring in people aged 65 years and over (Palvanen et al., 2006). PHFs contribute to disability and loss of independence (Lee, Dargent-Molina & Bréart, 2002; Olerud et al., 2011; Slobogean, Noonan & O'Brien, 2010) and are associated with significant patient mortality and increased utilisation of healthcare resources (Maravic, Briot & Roux, 2014). Recovery from PHFs can be a long and often incomplete process that can be hindered by complications (Handoll et al., 2017), including a higher risk of rehospitalisation or further fracture (Clinton et al., 2009). Rehabilitation is regarded as an important contributor to recovery but there is a lack of high-quality evidence available to inform rehabilitation practice (Handoll & Brorson, 2015; Khoriati et al., 2019).

In a previous randomised controlled trial (RCT), it was reported that there was no significant difference between surgical and non-surgical treatment at two-year follow-up in people with displaced PHFs involving the surgical neck (Rangan et al., 2015). However, given the lack of evidence to inform non-surgical management, further research is required to evaluate the most effective non-surgical approach to rehabilitation in people with PHF (Khoriati et al., 2019).

In an effort to evaluate different non-surgical rehabilitation approaches in people with PHF, a Cochrane review (Handoll & Brorson, 2015) compared early (one week) versus delayed (three to four weeks) mobilisation, however most of the data was from one RCT (Hodgson, Mawson & Stanley, 2003). There was a lack of comparable outcome measurement and data obtained from four RCTs so statistical pooling could not be performed. The main RCT (Hodgson, Mawson & Stanley, 2003) in this Cochrane review compared two rehabilitation programmes for 86 patients who sustained minimally displaced two-part PHF. The first group (Group A) of patients underwent early mobilisation (within one week) while the second group (Group B) underwent delayed mobilisation with immobilisation for three weeks. Both groups received the same rehabilitation programme, which consisted of passive exercises and functional exercises. Results showed that at 16 weeks, Group A had a better health-related quality of life in two dimensions of the short form 36 health survey questionnaire (SF-36, Brazier et al., 1992) (role limitation physical: Mean Difference (MD) 22.2, 95% CI 3.4 to 40.9; pain: MD 12.2, 95% CI 3.2 to 21.2). At 52 weeks post injury, Group A continued to have better shoulder function and less pain than Group B though the difference was not deemed to be statistically significant (role limitation physical: MD 5.6, 95% CI -13.75 to 24.95; pain: MD 3.6, 95% CI -8.19 to 15.39).

This Cochrane review (Handoll & Brorson 2015) had limited low quality evidence to suggest that early mobilisation may have a beneficial effect on pain and function following PHF. However, given the prevalence of PHFs and the personal and societal impact, there is an urgent need to develop optimal programmes of rehabilitation following PHF. As a first step towards that, the aim of this study is to identify and describe current rehabilitation practice for people with PHFs in the

UK NHS. This information will provide a foundation to further develop and test rehabilitation strategies in future research.

2. Methods

During May 2020, two reviewers (JR and PM) undertook electronic searches of Google for publicly available information sheets (PIS) from websites of UK NHS Trusts. The following search terms were used:

1) Rehabilitation, proximal humerus fracture, nhs
2) Non-surgical management, proximal humerus fracture, nhs
3) Physiotherapy, proximal humerus fracture, nhs
4) Protocol, proximal humerus fracture, nhs
5) Rehabilitation, shoulder fracture, nhs
6) Non-surgical management, shoulder fracture, nhs
7) Physiotherapy, shoulder fracture, nhs
8) Protocol, shoulder fracture, nhs
9) Patient information, proximal humerus fracture

2.1. Inclusion Criteria

PIS that included detail regarding rehabilitation following a PHF, for example the need for immobilisation, method of immobilisation, time to commencement of passive and active exercise, time to return to driving and time to return to work were retrieved.

2.2. Exclusion Criteria

Where PIS did not provide any detail about rehabilitation following PHF they were excluded from the study. Searching continued until one full search page returned no relevant PIS. Results of the two reviewer's searches were compared and any disagreements were resolved through discussion.

2.3. Data extraction

One reviewer (JR) extracted data from the PIS and populated a predetermined spread sheet agreed by the study team. This extraction was verified by a second reviewer (PM) and any disagreements were resolved through discussion.

2.4. Statistical Analysis

Descriptive statistics were used to describe the number of PIS that report on the pre-specified parameters, for example duration of immobilisation, time to commencement of passive, active-assisted and active movement exercises.

Where PIS presented a time range, for example length of immobilisation – two to four weeks, the middle value, i.e. three weeks in this example, was used for the purpose of this analysis. These middle values were then used to calculate the overall median values.

3. Results

From a total of 152 acute specialist and non-specialist UK NHS trusts, 17 PIS from 17 different trusts were identified. The majority of PIS were produced by Foundation Trusts with 3 being produced by Teaching Hospital Trusts. Of the 17 PIS, nine reported date of production and six of these (67%) were dated 2017 onwards (date range 2010-2019).

3.1. Immobilisation

All 17 PIS (100%) advised on a period of immobilisation. All PIS recommended the use of a sling and seven of these PIS (41%) specified a collar and cuff sling. Some PIS recommended an alternative method of immobilisation: four (24%) advised plaster cast, two (12%) advised the use of a brace and one (6%) advised a splint. Some PIS (5/17, 29%) referred to a time range for immobilisation. The median duration for immobilisation was two weeks (range 0-6). Two (12%) PIS did not report a specific duration of immobilisation stating ‘a number of weeks’ and ‘the first few weeks’.

Five PIS (29%) included more detail regarding immobilisation, four (80%) of which stated to keep the sling on in bed at night. Three (60%) of these reported removing the sling for exercises, one (10%) of which specified elbow range of movement exercises. Three (60%) of these PIS also reported allowing the sling to be removed for personal hygiene.

3.2. Movement restrictions

Seven of the 17 PIS (41%) advised on a degree of movement restriction. Five (71%) of these advised against raising the arm, mainly specified as above shoulder height. Three (43%) PIS advised against putting the arm into sleeves or clothing and two (29%) advised against any support under the elbow, for example not to rest it on cushions or pillows.

3.3. Commencement of passive exercise

Seven PIS (41%) reported on the commencement of passive exercises. Of those that reported commencing passive exercise, two (29%) were not specific in the time frame, stating that ‘the doctor or physio will tell you when’ and ‘when the consultant thinks you are ready’. One of the seven (14%) referred to a separate advice sheet for shoulder exercises which was not available under the study search terms. Of the four PIS which stated a time frame for commencement of passive exercises, the median was two weeks (range 0-4).

3.4. Commencement of active assisted exercise

Only four of the seventeen PIS (24%) reported on commencement of active assisted exercises. The median time was four weeks (range 1-6).

3.5. Commencement of active exercise

Only three of the seventeen PIS (18%) reported on commencement of active exercises. The median time to commencement of active exercises was nine weeks (range 6-12).

3.6. Commencement of resisted exercise

There was only one PIS (6%) that reported on commencement of resisted exercise, which was six weeks.

3.7. Return to work

Three PIS (18%) reported on return to work. One reported that return to work could be commenced 'as soon as able to perform normal duties'. The other two reported on a time frame of return to light work, the median of which was 7.5 weeks (range 6-12).

3.8. Return to driving

Two PIS (12%) reported on return to driving but neither specified a time frame. One stated not to drive while in the sling and the other reported that a return to driving can commence once the sling has been removed and you are confident in safely controlling your vehicle.

3.9. Return to sport

None of the PIS reported on a return to sport.

4. Discussion

In this review of rehabilitation PIS following PHFs, the preferred method of immobilisation was collar and cuff. The median time to commencement of passive exercises was two weeks. The median time to commencement of active assisted exercises was four weeks and the median time to commencement of active exercises was nine weeks and six weeks for resisted exercise. A majority of PIS did not describe rehabilitation or guidance beyond introduction of active movement. Median time to return to work was seven and a half weeks with insufficient data to calculate the median time for return to driving and return to sport (Figure1).

The variability of the findings in this survey is consistent with a survey of senior physiotherapists involved in treating PHF patients from different UK hospitals within trauma and orthopaedic centres (Hodgson 2006). This 2006 survey found a lack of consistency with regards to periods of immobilisation following PHF. 57% of the centres surveyed (73/127) reported that they always used immobilisation, and 20% (26/127) reported that they sometimes used immobilisation. 56% (56/127) of the centres surveyed reported a three week immobilisation and 81% (103/127) routinely referred on for physiotherapy, though the survey did not gather data on the nature of the physiotherapy and whether or not movement or exercises were recommended prior to referral to physiotherapy. Considerable variation was shown to exist between and within hospitals with immobilisation recommendations varying from one to seven weeks. Commencement of rehabilitation was found to range from one to six weeks following PHF. Recommendations from Hodgson (2006) were

based on one study by the same author (Hodgson, Mawson & Stanley, 2003) and advised immediate passive exercises, a progression of passive exercises at two weeks and active exercises at eight weeks. Sling immobilisation was advised for eight weeks and commencement of strengthening and functional exercises at eight weeks

Handoll et al., (2015) drafted a rehabilitation protocol to compare surgical versus non-surgical treatment following PHF. Due to lack of evidence-based guidance to inform rehabilitation following PHF, prior to their RCT (Handoll et al., 2015) a consensus with shoulder physiotherapists and other experts in this field was undertaken to develop the draft rehabilitation protocol that was representative of accepted good practice. In patients with a stable PHF, the RCT rehabilitation protocol suggested use of sling for three weeks. Phase one and two involved progressive neck and lower arm movements and sling immobilisation with no indication to the specific duration of each of these first two phases. Phase three, from approximately three weeks, included commencement of passive (pendulum) exercises. Active assisted exercises were allowed depending on the x-rays showing evidence of healing. From six weeks (phase four), progression of active-assisted to active exercises and light functional activities was advised. Resisted exercises were encouraged at phase five however there was no clearly defined time frame for this stage of rehabilitation. For phase six, again no specific time frame reported, an orthopaedic review was required prior to the commencement of advanced strengthening exercises and progression to pre-injury activity level. The authors anticipated that many patients will have returned to their baseline functional level by phase six and added that full recovery may take several months (Handoll et al., 2015).

The two rehabilitation protocols suggested by Hodgson (2006) and Handoll et al. (2015) show considerable variability. To date there is limited evidence to suggest whether or not an accelerated rehabilitation approach is effective in patients with PHF. Similar research comparing early/accelerated rehabilitation to delayed rehabilitation following rotator cuff repair has been reported (Houck et al., 2017 ; Littlewood et al., 2019 ; Mazuquin et al., 2018 ; Sheps et al., 2015; Sheps et al., 2019) and it has been found that early mobilisation might speed up recovery following rotator cuff repair. In this context, there is an urgent need to carry out high-quality research to better inform practice and optimise clinical outcomes for patients following PHF.

Limitations

In this review of PIS following PHFs, none of the seventeen PIS included in this review described different approaches to rehabilitation based on fracture type. This may be significant due to the difficulty in immobilising the bone fragment proximal to the fracture site. The increasing complexity of a three- or four-part fracture will increase the possibility of mobility proximal to the fracture.
Prolonged immobilisation may be beneficial for reducing this possibility but it may also result in increased levels of pain and a decrease in the ultimate range of motion and function (Khoriati et al., 2019).

It is possible that NHS Trusts who publicly present their processes in PIS might be different from those who don't. Hence, the described typical rehabilitation approach might not fully reflect the entire NHS. Out of 152 UK NHS Trusts only 17 had produced PIS for patients with PHF. Of the 17 PIS found, only nine reported date of production and six of these were dated 2017 onwards. Given the lack of production date for eight of the PIS, it is unclear how old they are and to what degree they reflect contemporary practice in the respective NHS Trusts.

Furthermore, such a review of PIS is necessarily limited by the breadth and depth of information reported in the PIS. It was apparent that such information was variable, and often reference was made to decision making on the patient's status. Although limited detail was provided in relation to such an individualised decision-making process, it is likely that such nuance would be missed in a descriptive review of this nature.

5. Conclusion

This study has informed understanding of NHS approaches to rehabilitation following PHF and highlighted the limited and variable information available to patients following a PHF in the UK NHS. Variability in quality and content of information and approaches to rehabilitation risks not achieving optimal clinical outcomes. Given how common and burdensome PHF is, there is a clear and urgent need for high-quality research to inform the optimal rehabilitation approaches.

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