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Rehabilitation following shoulder arthroplasty in the UK NHS: a survey of publicly facing information

Running title: Rehabilitation after shoulder arthroplasty

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Rehabilitation following shoulder arthroplasty in the UK NHS: a survey of publicly facing information

Abstract

Introduction: The prevalence of shoulder arthroplasty (SA) is rising but there is limited research evaluating rehabilitation following SA and whether there is an optimal approach remains unknown. The aim of this study was to understand current NHS practice for rehabilitation following SA as a platform for conducting much needed further research.

Methods: Two reviewers independently undertook electronic searches for publicly-available information sheets (PIS) from websites of NHS Trusts that included detail about rehabilitation following SA, for example duration of immobilisation. One reviewer extracted data and a second reviewer verified this.

Ethical Approval: Not required.

Results: 43 PIS from 40 Trusts were identified. 24 referred to more than one type of arthroplasty (Anatomic, Reverse, Hemiarthroplasty), but did not describe different approaches to rehabilitation based on prosthesis type. 25 PIS provided some instruction regarding movement restrictions, which varied considerably. All PIS referred to post-operative immobilisation, typically with a sling, with median duration of four weeks (range 0 to 8). 34 PIS reported commencing passive exercise immediately. Median time to commencing active exercise was four weeks (range 1 to 6) and five weeks (range 1 to 16) for resisted exercise. Median time expected to return to driving was 6 weeks (range 3 to 12) and general work 12 weeks (range 3 to 26).

Conclusion: This study has highlighted significant heterogeneity between rehabilitation approaches following SA, not previously reported in the UK, with a lack of specific rehabilitation PIS for different prosthesis types. Our results will facilitate evaluation of rehabilitation strategies in future research.

Key Words

Rehabilitation; shoulder arthroplasty; shoulder replacement; protocol; survey

Introduction

Shoulder arthroplasty (SA) is a surgical intervention considered for patients with osteoarthritis of the shoulder, rotator cuff tear arthropathy, irreparable rotator cuff tears, and trauma among other indications (Bullock et al., 2019). The type of SA (reverse, anatomic or hemiarthroplasty) depends on multiple factors including age of the patient, functional demand, the presenting pathology, and surgical preference (Bullock et al., 2019). Over 74 000 SA's were undertaken between 1998 and 2017 in the UK NHS, with the prevalence rising year on year (Craig et al., 2019).

Effective post-operative rehabilitation is considered important to complement the surgical procedure and attain optimal clinical outcomes. Despite this, the optimal approach to post-operative rehabilitation, or even whether there is an optimal approach, remains unknown (Edwards et al., 2018).

To date, two randomised controlled trials (RCT) have evaluated different approaches to rehabilitation following SA (Denard & Lädermann, 2016; Hagen et al., 2020). Denard & Lädermann (2016) compared immediate passive motion (sling immobilisation for four weeks with immediate introduction of passive shoulder exercise) versus delayed passive motion (sling immobilisation with no shoulder motion for four weeks) following anatomic SA. These authors reported that immediate passive motion provides more rapid return of function compared with delayed motion as measured by the American Shoulder & Elbow Score (King et al., 1999), but with no difference between the two groups at one-year follow-up (Denard & Lädermann, 2016). Hagen et al., (2020) compared early rehabilitation (immediate passive and active movement) versus immobilisation (no movement for six weeks) after reverse SA. These authors reported no significant differences between the two groups for any postoperative measure, with the exception of the functional domain of the American Shoulder & Elbow Score that favoured the immobilisation group at six months.

In the context of rising prevalence of SA with limited evidence from RCTs informing optimal post-operative rehabilitation, the aim of this study was to identify and describe current UK NHS practice for rehabilitation following SA. This information will provide a platform for developing and testing rehabilitation strategies in a future RCT.

Methods

Two reviewers (CL, MM) 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, shoulder replacement, nhs
2. physiotherapy, shoulder replacement, nhs
3. protocol, shoulder replacement, nhs
4. rehabilitation, shoulder arthroplasty, nhs
5. physiotherapy, shoulder arthroplasty, nhs
6. protocol, shoulder arthroplasty, nhs
7. patient information, shoulder replacement

Inclusion criteria

PIS that included detail about rehabilitation following SA, for example duration of immobilisation, time to commencement of active exercise, time to return to driving, and time to return to work, were retrieved.

Exclusion criteria

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

Data extraction

One reviewer (CL) extracted data from the information booklets and PIS and populated a pre-determined table agreed by the study team. This extraction was verified by a second reviewer (LP) and any disagreements were resolved through discussion.

Statistical analysis

Descriptive statistics were used to describe the number of PIS that report on the pre-specified parameters, for example duration of immobilisation, and time to commencement of active movement. To facilitate a comparison of parameters between PIS for 'all prosthesis types', 'anatomic only' and 'reverse only', mean, standard deviation (SD), and median (range) values are presented. Where PIS presented a time range, for example four to six weeks, the middle value, i.e. five weeks in this example, was used for the purpose of analysis.

Results

From a total of 152 acute specialist and non-specialist UK NHS Trusts, 43 PIS from 40 Trusts were identified. Of the 43 PIS, 35 reported date of production and 25 of these (71%) were dated 2016 onwards (date range 2004 to 2019).

Type of arthroplasty

Of the 43 PIS, 36 (84%) reported the type of SA they referred to. The breakdown is described in Figure 1.

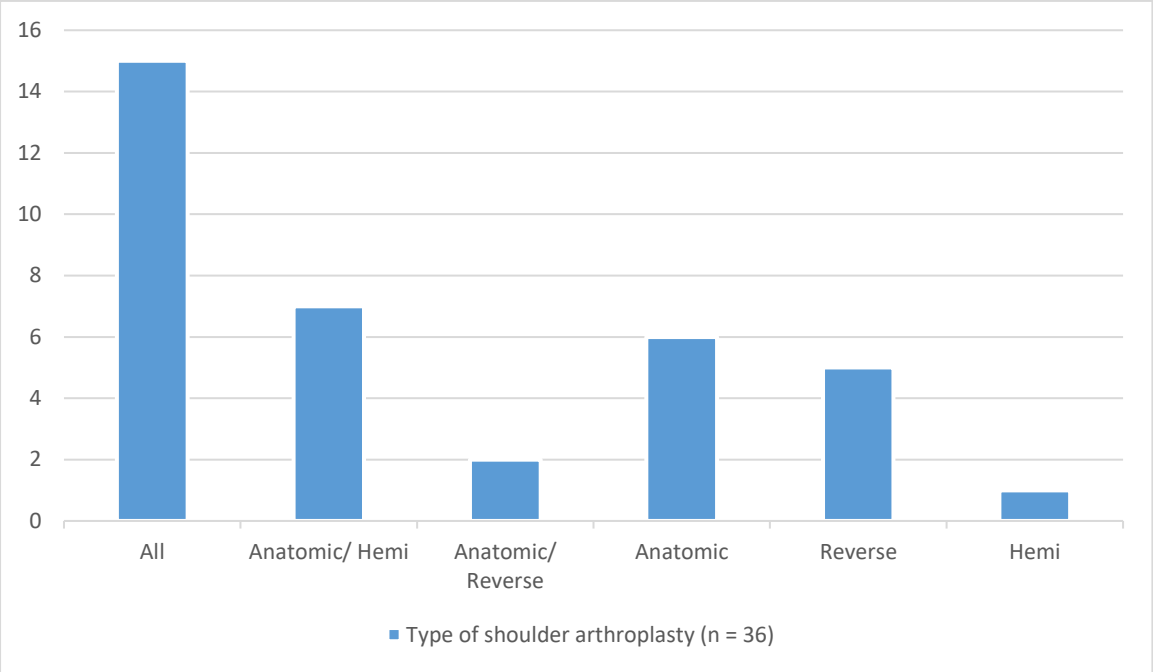

Figure 1 Type of shoulder arthroplasty referred to in PIS (All = Anatomic, reverse and hemiarthroplasty; Hemi = hemiarthroplasty)

Of the 24 PIS that referred to more than one type of SA (All, Anatomic/ Hemi, Anatomic/ Reverse), none described different approaches to rehabilitation based on prosthesis type. Only one PIS referred to movement limitation to external rotation if subscapularis was repaired.

Pre-operative assessment

18 of 43 PIS (42%) descibed a pre-operative assessment, typically for anaesthetic risk. Beyond an assessment of anaesthetic risk, 10 of the 43 PIS (23%) made reference to functional assessment, prehabilitation including advice to exercise and/ or discharge planning prior to the actual surgery.

Post-operative immobilisation

43 PIS (100%) made reference to post-operative immobilisation, typically with a sling. Two PIS (%) made reference to using an immobiliser and one PIS (%) made reference to an abduction brace

40 of 43 PIS (93%) made reference to the duration of immobilisation, with two of these 40 (5%) referring to an individualised approach but without further detail. Of the remaining 38 PIS, 11 (29%), described a time range, e.g. four to six weeks, for the immobilisation rather than a single time point. The mean duration for sling immobilisation was four (SD 1.5) weeks (median 4; range 0 to 8 weeks) (Figure 2).

Of the six PIS that referred specifically to anatomic SA, the mean duration for sling immobilisation was five (SD 1.0) weeks (median 6; range 4 to 8 weeks).

Of the five PIS that referred specifically to reverse SA, the mean duration for sling immobilisation was five (SD 1.7) weeks (median 4; range 2 to 6 weeks).

32 of 42 PIS (76%) provided some instruction with regard to sling use. Most recommended keeping the sling on at all times except for eating, washing and dressing (27/32; 84%).

Movement restrictions

25 of 43 PIS (58%) provided some instruction with regard to movement restrictions. The movement restrictions described by the PIS varied considerably but included avoidance of abduction, external rotation, resisted internal rotation, hand behind back, and weight-bearing.

Two of the 43 PIS (5%) made reference to moving within a 'safe zone'. One PIS described this safe zone as using the hand in front of body only and maintaining the elbow in to the waist, with no external rotation beyond neutral. The second PIS described this safe zone as limiting elevation and abduction to 90 degrees with no external rotation beyond neutral. These two PIS did not distinguish between different prosthesis types.

Commencement of passive exercise

38 of 43 PIS (88%) reported when passive exercise is planned to commence. Of these 38, 34 (89%) reported commencing passive exercise immediately (within three days). Of the remaining four, one PIS reported one week until commencement; one protocol reported two weeks until commencement; one protocol reported three weeks until commencement; and one protocol reported four weeks until commencement.

Of the six PIS that referred specifically to anatomic SA, five (83%) reported when passive exercise is planned to commence. Of these, all reported commencing passive exercise immediately.

Of the five PIS that referred specifically to reverse SA, five (100%) reported when passive exercise is planned to commence. Of these, four (80%) reported commencing passive exercise immediately, and one (20%) reported commencing passive exercise two weeks post-surgery.

Commencement of active-assisted exercise

27 of 43 PIS (63%) reported when active-assisted exercise is planned to commence. Of these 27, 23 (85%) reported plans to commence active-assisted exercise immediately (witin three days). Of the remaining four, one protocol reported one week until commencement; one protocol reported two weeks until commencement; one protocol reported three weeks until commencement; and one protocol reported an individualised approach to commencement but provided no further detail about the factors informing this decision.

Of the six PIS that referred specifically to anatomic SA, five reported when active-assisted exercise is planned to commence. Of these, four (80%) reported commencing active-assisted exercise immediately, and one (20%) reported commencing active-assisted exercise three weeks post-surgery.

Of the five PIS that referred specifically to reverse SA, four reported when active-assisted exercise is planned to commence. Of these, three (75%) reported commencing active-assisted exercise immediately, and one (25%) reported commencing passive exercise two weeks post-surgery.

Commencement of active exercise

18 of 43 PIS (42%) reported when active exercise is planned to commence. The mean time to commencing active exercise was four (SD 1.7) weeks (median 4; range 1 to 6 weeks) (Figure 2).

Of the six PIS that referred specifically to anatomic SA, five (83%) reported when active exercise is planned to commence. The mean duration for commencement of active exercise was four (SD 1.7) weeks (median 4; range 2 to 6 weeks).

Of the five PIS that referred specifically to reverse SA, five (100%) reported when active exercise is planned to commence. The mean duration for commencement of active exercise was three (SD 1.9) weeks (median 3; range 1 to 6 weeks).

Commencement of resisted exercise

14 of 43 PIS (33%) reported when resisted exercise is planned to commence. The mean time to commencing resisted exercise, including isometric exercise, was five (SD 4.0) weeks (median 5; range 1 to 16 weeks) (Figure 2). When the one outlying protocol that reported 16 weeks to commencement of resisted exercise was removed, the mean time to commencing resisted exercise was four (SD 2.2) weeks (median 4; range 1 to 8 weeks).

Of the six PIS that referred specifically to anatomic SA, four (67%) reported when resisted exercise is planned to commence. The mean duration for commencement of resisted exercise was eight (SD 5.9) weeks (median 7; range 2 to 16 weeks).

Of the five PIS that referred specifically to reverse SA, four (80%) reported when resisted exercise is planned to commence. The mean duration for commencement of resisted exercise was four (SD 1.7) weeks (median 4; range 1 to 6 weeks).

Return to work

27 of 43 (63%) reported when return to light work, for example office work, was permited. The mean time to returning to light work was six (SD 2.0) weeks (median 6; range 2 to 12 weeks) (Figure 2). Four of the 27 (15%) did not report a specific time frame to return to light work but instead made reference to an individualised approach but provided no further detail about the factors informing this decision.

29 of 43 (67%) reported when return to general work was permitted. The mean time to return to general work was 15 (SD 5.4) weeks (median 12; range 3 to 26) (Figure 2). 12 of the 29 (41%) did not report a specific time frame to return to general work but instead made reference to an individualised approach in consultation with the clinical team but provided no further detail about the factors informing this decision.

Of the six PIS that referred specifically to anatomic SA, two (33%) reported when return to general work was planned. One protocol described a range of eight to 12 weeks, and one protocol described a range of 12 to 26 weeks.

Of the five PIS that referred specifically to reverse SA, none (0%) reported when return to general work was planned.

Return to driving

37 of 43 (84%) reported when return to driving was permitted. The mean time to return to driving was 7 (SD 1.9) weeks (median 6; range 3 to 12 weeks) (Figure 2) but with many PIS adding the caveat that the stated time was the minimum expected time. Four of the 37 (11%) did not report a specific time frame to return to driving but instead made reference to an individualised approach in consultation with the clinical team but provided no further detail about the factors informing this decision.

Of the six PIS that referred specifically to anatomic SA, five (83%) reported when return to driving was permitted. The mean time to return to driving was 7 (SD 1.7) weeks (median 7; range 6 to 10 weeks).

Of the five PIS that referred specifically to reverse SA, five (100%) reported when return to driving was permitted. The mean time to return to driving was 7 (SD 1.9) weeks (median 6; range 3 to 10 weeks).

Return to sport

28 of 43 (64%) reported when return to sport was permitted. The mean time to return to sport was 14 (SD 3.8) weeks (median 12; range 3 to 26 weeks) (Figure 2).

Of the six PIS that referred specifically to anatomic SA, three (50%) reported when return to sport was permitted. The mean time to return to sport was 13 (SD 3.1) weeks (median 12; range 6 to 26 weeks).

Of the five PIS that referred specifically to reverse SA, three (60%) reported when return to sport was permitted. The mean time to return to sport was 12 (SD 2.8) weeks (median 12; range 6 to 26 weeks).

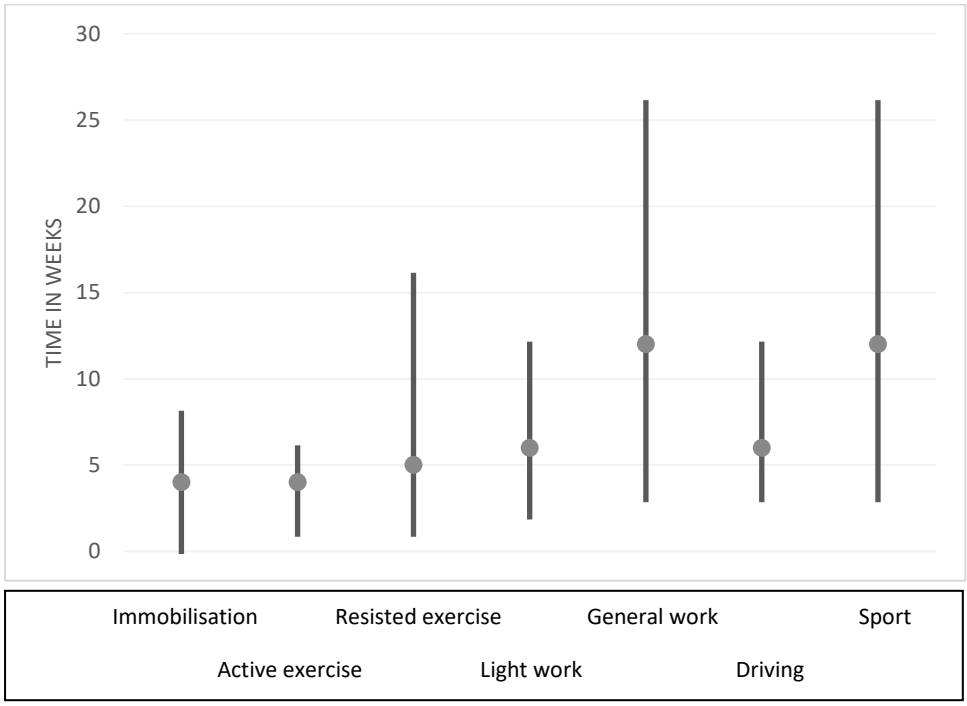

Figure 2 Duration that rehabilitation parameter is maintained or introduced (median/ minimum/ maximum);

Discussion

In this review of rehabilitation PIS following SA, we found that most PIS did not describe different approaches to rehabilitation based on prosthesis type. Length of immobilisation, time to introduction of active movement, and return to activity was variable across the different PIS. On average, immobilisation following SA was four weeks. Most PIS described initiating passive movement immediately. The average time to commencing active exercise was four weeks, and five weeks for resisted exercise. Median time to return to general work was 12 weeks and six weeks for driving. The reasons for the variability in recommendations across the different PIS were not apparent.

In contrast to previously published RCTs, the typical NHS approach to rehabilitation described in this review would be regarded as early or accelerated, rather than standard or usual care (Denard &

Lädermann, 2016; Hagen et al., 2020). Denard & Lädermann (2016) describe an immediate rehabilitation programme as including four weeks of sling immobilisation with passive movement of the shoulder only during this period following anatomic total SA with release and repair of the subscapularis tendon. Hagen et al (2020) describe an early rehabilitation programme as including six weeks of sling immobilisation with introduction of passive movement seven to 10 days after surgery with gradual progression to active/ assisted movement following reverse total SA. With reference to their primary outcome measure of range of movement (ROM), Denard & Lädermann (2016) reported superior ROM in the early post-operative phase in the immediate rehabilitation group in comparison to the delayed group, but this difference was no longer apparent from three-months post-surgery. Hagen et al (2020) reported no differences between the early versus immobilised group with reference to their primary outcome measure, the composite American Shoulder & Elbow Score.

The variability in recommendation for rehabilitation following SA has also been reported in a systematic review of proposed rehabilitation guidelines (Bullock et al., 2019). Currently, the only clear consensus appears to be the recognition that high-quality research is needed to better inform practice and optimise clinical outcomes for patients following SA (Bullock et al., 2019; Kirsch & Namdari, 2020). Other areas of rehabilitation following orthopaedic surgery, e.g. rehabilitation following rotator cuff repair, have evolved over a number of years (Littlewood et al., 2019; Sheps et al., 2015; Sheps et al., 2019). Whether there is now further opportunity to develop rehabilitation approaches, following SA, to enhance clinical outcomes and/ or reduce post-operative restrictions, e.g. sling immobilisation, is a question to be addressed.

Unexpectedly, most PIS included in this review did not describe different approaches to rehabilitation based on prosthesis type. Prior thinking has been that for anatomic SA, the focus of post-operative rehabilitation should be on the rotator cuff with the aim of restoring head centering on the glenoid to prevent wear and/ or loosening of the prosthesis, as well as maximising function (Kirsch & Namdari, 2020). In contrast, with reverse SA, where the rotator cuff is absent, the focus of post-operative rehabilitation has been on deltoid retraining (Kirsch & Namdari, 2020). Of the PIS that did make specific reference to prosthesis type, i.e. anatomic or reverse, there was limited evidence suggesting some differences between the PIS, for example in the timing of introduction of active and resisted exercise. However, the number of these PIS retrieved was too low to enable a meaningful analysis.

Although there is a clear need for RCTs evaluating rehabilitation following SA to guide clinical practice and optimise clinical outcomes, it is also apparent that the quality of the publicly available PIS developed by NHS Trusts is variable. Although description of optimal rehabilitation strategies in terms of duration of immobilisation and time to return to driving, might not be possible with confidence, it is realistic to expect that NHS Trusts produce such patient facing documentation that is fit-for-purpose in terms of addressing the questions that a person considering SA might have. Currently it is apparent that most PIS are written by clinician's from a clinician's perspective, including detailed anatomical descriptions, and specifics of surgical procedure for example. NHS Trusts should be mindful of this when developing and updating PIS and strive to engage patients in a meaningful way during production of such patient-facing materials.

Strengths and Limitations

This study retrieved a large number of PIS from a range of NHS Trusts across the UK. Two reviewers undertook the searches and data extraction, in line with current best practice. Of the 43 PIS retrieved, 35 reported date of production and 25 of these were dated 2016 onwards (date range

2004 to 2019). However, this means that 18 of the 43 PIS could be greater than five years old meaning that any changes in practice associated with, for example, rising prevalence of reverse total shoulder arthroplasty, might be missed. Although we retrieved PIS from 40 NHS Trusts it is unclear how well these Trusts reflect the population of 152 NHS Trusts. It is possible that Trusts who present their processes in PIS might be systematically different from those who don't. Hence, the described typical rehabilitation approach might not fully reflect the entire population.

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 based 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 where average data is reported.

Conclusion

This study has informed understanding of NHS approaches to rehabilitation following SA. It is apparent that typical NHS practice, as described in this review, does not align with international practice. Current NHS practice would be regarded as adopting an accelerated philosophy in comparison to standard care. This study has also highlighted the lack of specific rehabilitation strategies for different prosthesis types with significant heterogeneity between UK NHS Trusts. One reason for this inconsistency could be the lack of high-quality RCTs informing current rehabilitation strategies and evaluating whether there is an optimal approach. Understanding of current NHS practice will facilitate evaluation of rehabilitation strategies in future NHS based research, for which there is an urgent need.

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