ORIGINAL ARTICLE

Ortopedia Traumatologia Rehabilitacja
© MEDSPORTPRESS, 2014; 4(6); Vol. 16, 435-439
DOI: 10.5604/15093492.1119621

Reverse Shoulder Arthroplasty – Minimum Age for Surgery, Postoperative Rehabilitation and Long Term Restrictions. A Delphi Consensus Study

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SUMMARY

Background. The aim of this study was to determine if agreement could be obtained on guidelines regarding the ideal minimum age for a reverse shoulder replacement, as well as on post-operative rehabilitation and restrictions imposed on patients having undergone this procedure.

Material and methods. A two-round Web-based Delphi consensus study was undertaken. An international group of experts in the field of reverse shoulder replacement were asked to complete the questionnaire. Consensus was considered as agreement of 60% or higher.

Results. There was substantial disagreement in most parameters examined amongst the 10 participants of the first round. Agreement was achieved for most parameters examined amongst three of the four respondents of the second round.

Conclusions. 1. Amongst respondents of the second round a minimum age of 65 years for reverse shoulder arthroplasty was considered acceptable for most areas examined. 2. Controversial management areas in reverse shoulder arthroplasty have been highlighted and require exploration by further clinical studies.

Key words: reverse shoulder arthroplasty, reverse shoulder replacement, Delphi method

BACKGROUND

Reverse Shoulder Replacement (RSR) is increasingly used for patients with complex shoulder conditions such as shoulder rotator cuff arthropathy and complex proximal humeral fractures. However RSR is associated with a high rate of complications and its ultimate longevity is uncertain. In addition salvage of a failed reverse shoulder arthroplasty is very challenging. Initially RSR was recommended for elderly low-demand patients; however, there have been increasing reports in the literature of this procedure being utilised in younger patients [1]. Understanding the minimum age at which this procedure would be recommended can help guide surgeons in their decisions for surgery and discussions with patients but may also be of value for medico-legal reasons.

Postoperative rehabilitation as well as restriction on activities such as weight lifting in the long term may influence the risk of developing complications following the procedure as well as implant longevity. With postoperative rehabilitation there is always a balance between early mobilisation and minimising the risk of developing complications that such mobilisation may infer.

The main aim of this study was to determine if agreement could be achieved with regard to the minimum age for performing a RSR for different clinical scenarios as well as for the postoperative rehabilitation and restrictions for patients having undergone the procedure, amongst international experts who have previously published on the topic of RSR.

MATERIAL AND METHODS

Literature Review and Panel Selection: 30 experts (practicing shoulder surgeons who have published on the topic of reverse shoulder replacement since the year 2000) were selected by performing a PubMed search using the key words "reverse shoulder replacement" and "reverse shoulder arthroplasty". Only individuals who had published on the topic of RSR post the year 2000 were selected. Experts from as many countries as possible were included in the study (Table 1). The author names generated from this search were then used to obtain contact information for potential participants via the Google search engine. Contact information for 26 of the 30 experts was obtained in this way. A single paragraph email invitation was then sent to the 26 potential participants identified by the Google search asking the recipient if he/she would like to participate.

Round 1: The first round questionnaire was emailed to all experts regardless of whether or not they had replied to the initial email invitation. Access to the survey was in the form of a web link directed to the electronic survey. For those experts who did not complete the questionnaire, a copy of the link (contained within a reminder email) was then sent a total of 4 times with one to two week intervals in between. The questionnaire was then left open for a further 4 weeks after which no further responses were collected. In total the initial round was left open for the period of 3 months.

The first round questionnaire was divided into three sections. Section one consisted of multiple choice questions on the current clinical and academic practice of the panel members (Table 2). Section two consisted of open ended questions (allowing for a detailed answer) on minimum age for RSR in certain clinical scenarios (table 3). Section three consisted of both multiple choice and open ended questions on postoperative rehabilitation and restrictions (table 4). All three sections were aimed at the individual expert opinion and current clinical practice.

Round 2: In this round the answers obtained from round one were analysed to identify areas of agreement and disagreement. The most frequent responses to the questions in round one were then presented to those who participated to the initial round, asking whether or not they would agree with such recommendations. In this round the term "usually" was added to the clinical scenario asking the minimum age, following the advice of one round one participant.

RESULTS

Ten participants completed the first round questionnaire and 4 completed the second round.

Tab. 1. Panel Profile and Country of Residence

Responders	
Round 1	
United States	3
United Kingdom	3
France	3
Sweden	1
Round 2	
United Kingdom	3
France	1

Tab. 2. Panel Experience

Number*	How many reverse shoulder replacements do you perform in a year for causes other than acute fractures?	How many reverse shoulder replacements do you perform in a year due to acute fractures?
<5	1	3
5-10	0	4
10-30	4	2
30-50	1	1
>50	4	0

	Have you taught or lectured on reverse shoulder replacements?	Have you been involved in the design of a reverse shoulder prosthesis?
Yes	7 (70%)	4 (40%)
No	3 (30%)	6 (60%)

Tab. 3. Question Profile, Section Two

Question: What is the minimum age you would use RSR in the following	Median R1	Agreement R2
Un-reconstructable (where open reduction internal fixation is technically not possible) acute proximal humeral fracture	65 years (range: 50-70)	3/4
Massive irreparable supraspinatus tear with degenerative changes of the glenohumeral joint (rotator cuff arthropathy) in a patient who is in significant pain that cannot be controlled by analgesia or nerve blocks	65 years (range: 40-70)	3/4
Massive irreparable supraspinatus tear with NO degenerative changes of the glenohumeral joint in a patient who is in significant pain that cannot be controlled by analgesia or nerve blocks?	65 years (range: never-70)	4/4
Massive irreparable supraspinatus tear and degenerative changes in the glenohumeral joint (rotator cuff arthropathy) in a patient who has treatable pain but who has a pseudo-paralysed arm, where all other non-operative means, such as physiotherapy, have been exhausted?	62 years (range: 45-70)	2/4
Massive irreparable supraspinatus tear with NO degenerative changes in the glenohumeral joint in a patient who has treatable pain but who has a pseudo-paralysed arm, where all other non-operative means, such as physiotherapy, have been exhausted?	65 years (range: 55-75)	4/4

Tab. 4. Question Profile, Section Three

Question: Following RSR when would you begin/is there a	Median R1	Agreement R2
Use of a shoulder sling	21 days (range: 2-45)	3/4
Passive forward elevation	4 days (range: 1-45)	3/4
Active forward shoulder elevation	10.5 days (range: 1-42)	3/4
Passive internal rotation	14 days (range: 1-45)	3/4
Active internal rotation	17.5 days (range: 1-42)	3/4
Passive external rotation	7.5 days (range: 1-45)	3/4
Active external rotation	7.5 days (range: 1-42)	3/4
Maximum weight than can be lifted	19.5 lb or 8.8 kg (range: 1 lb – No limit)	3/4
Limitation on weight bearing	70% no limit*	4/4

The median value from round one is demonstrated along with the level of agreement in round two. * No range available as this is a yes or no answer, ^{R1} round 1, ^{R2} round 2.

Round 1: The demographics of the ten participants that responded to round one are shown in Table 1. Their response to each of the clinical scenarios with regard to the minimum age is shown in Table 3 and their responses with regard to postoperative rehabilitation and restrictions are shown in table 4. For an overview of all round one responses see Table 5.

Round 2: The demographics as well as the responses of the participants that responded to round 2 are shown in Tables 1, 3 & 4. Three of the 4 respondents agreed for most scenarios.

DISCUSSION

This study was undertaken primarily to determine if agreement could reached on the minimum age for performing reverse shoulder replacement and recommendations on postoperative rehabilitation and restrictions. Due to the increasing use of RSR, clear guidelines on the most suitable patients and indications as well as the best postoperative management are clearly needed [2-5]. When initially introduced, RSR was used predominantly in the elderly; however, younger patients are frequently being offered the procedure with little insight into its long term consequences [1,5-8]. The Delphi technique, which uses se-

Tab. 5. Summary of Round One Responses

	Participant:	1	2	3	4	5	6	7	8	9	10
	Question										
1	Minimum age to perform reverse shoulder replacement in un-reconstructable (where open reduction internal fixation is technically not possible) acute proximal humeral fracture:	50	65	65	65-70	70	70*	65	70*	70*	60
2	Minimum age to perform reverse shoulder replacement in massive irreparable supraspinatus tear with degenerative changes of the glenohumeral joint (rotator cuff arthropathy) in a patient who is in significant pain that cannot be controlled by analgesia or nerve blocks:	45	60	65	70	NI	70*	65	60*	65	40
3	Minimum age to perform reverse shoulder replacement in massive irreparable supraspinatus tear with NO degenerative changes of the glenohumeral joint in a patient who is in significant pain that cannot be controlled by analgesia or nerve blocks:	50	60	65	NI	NI	65	65	70*	NI	30
4	Minimum age to perform reverse shoulder replacement in massive irreparable supraspinatus tear and degenerative changes in the glenohumeral joint (rotator cuff arthropathy) in a patient who has treatable pain but who has a pseudo-paralysed arm, where all other non-operative means, such as physiotherapy, have been exhausted:	45	60	65	70*	NI	65	70	70*	60	60
5	Minimum age to perform reverse shoulder replacement in massive irreparable supraspinatus tear with NO degenerative changes in the glenohumeral joint in a patient who has treatable pain but who has a pseudo-paralysed arm, where all other non-operative means, such as physiotherapy, have been exhausted:	55	60	65	65*	NI	65	75	70*	*	60
6	Length of time a shoulder sling should be used following reverse shoulder replacement (in days):	14	28	42	45	2-3	28	21	7-14	21	42
7	When to start passive forward shoulder elevation following reverse shoulder replacement (in days):	7	14	42	45*	IM	1	1	1	3	1
8	When to start active forward shoulder elevation following reverse shoulder replacement (in days):	7	28	42	ROM	*	1	1	1-14*	21	42
9	When to start passive shoulder internal rotation following reverse shoulder replacement (in days):	7	28	42	45	NA	1	1	1-14*	21	28
10	When to start active shoulder internal rotation following reverse shoulder replacement (in days):	14	28	42	ROM	*	1	1	1-14*	21	42
11	When to start passive shoulder external rotation following reverse shoulder replacement (in days):	14	28	42	45	NA	1	1	1-14*	21	1
12	When to start active shoulder external rotation following reverse shoulder replacement (in days):	14	28	42	ROM	NA	1	1	1-14*	21	42
13	Long term maximum weight restriction that can be lifted with the operated arm:	No	30 lb	1 lb	13-15lb	No	No	11 lb	No	No	25 lb
14	Long term restrictions on weight bearing on the operated arm:	Yes	No	No	Yes	No	No	Yes	No	No	No

Further elaboration

P4: Q5- In case of CTA: 70 years old; Q6- In case of isolated irreparable supraspinatus tear, a pseudo-paralysed arm is usually not present. In case of pseudo-paralysed arm: 65 years old; Q7- Use a pendulum in the first 45 days, then continue with passive forward elevation.

P5: Q10- It depends on the approach; Q8- It depends on the indication.

P6: Q1- 70, but may reach 65 or lower if the present encouraging results are maintained; Q2- the residual cuff is likely to be functional so alternatives are available; Q13 – within reasonable limits – no fixed weight. For crutches, etc., advise against full weight support on operated side.

P8: Q1- 70 but young if cuff is in poor condition; Q2- If <60 try an alternative, in severe cases there is no age limit; Q3- If <60 try alternative, in severe cases there is no age limit; Q4 – Normally no pain, no reverse. If it is pain free, pseudoparalytic arm and younger than 70, surgery should be avoided; Q5- same as for question 4; Q8,9,10,11,12- day after surgery in Shoulder Cuff Tear Arthropathy (CTA), after 2 weeks in fracture cases.

P9: Q1- from 58 to 92 years old but nowadays only over 70 years old; Q5- Difficult to decide without seeing the patient.

[ROM] when all range of movement has been restored, [NI] not indicated, [IM] immediate, [NA] no answer, [P] participant, [Q] question, * further elaboration.

veral rounds of questionnaires until a consensus is reached or until it is obvious that no consensus can be obtained, was selected as the best method of gauging the views of experts for three reasons. Firstly, in the form of an electronic questionnaire, it removes obvious logistical and geographical restrictions, allowing for a larger number of experts to be panelled [9]. Secondly, it provides an anonymous platform and thus an equal opportunity to all participants to express their views regardless of rank or status. Thirdly, it is a well-known method of gathering and achieving consensus on issues where there are very few or no evidence-based guidelines [5,6,9-14].

Despite the low response rate, this study was able to achieve some consensus on ideal age and rehabilitation. In the Delphi methodology the response rate is not significant because the participants are experts in the area examined. A larger panel may have increased the reliability of our results; however, the optimum number of participants for achieving agreement is considered six to 12 [15]. Our study has exposed divergent views amongst experts in the field of RSR both with regard to minimum age for the procedure and post-operative rehabilitation. For example, when asked what would be the minimum age to perform reverse shoulder replacement in a massive irreparable supraspinatus tear with no degenerative changes of the glenohumeral joint in a patient who is in significant pain that cannot be controlled by analgesia or nerve blocks, three of the ten respondents stated that the procedure was not indicated, while the remaining panellists advised an age of only 30 to 70. Postoperative rehabilitation was also disputed, with some expressing no need for limiting weight lifting in the operated arm while others advocated a limit of only 1 lb. The consensus rate did improve amongst the remaining 40% of panellists with 75% agreement on the majority of questions.

CONCLUSIONS

1. Amongst respondents of the second round a minimum age of 65 years for reverse shoulder arthroplasty was considered acceptable for most areas examined.
2. Controversial management areas in reverse shoulder arthroplasty have been highlighted and require exploration by further clinical studies.

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Liczba słów/Word count: 1810 **Tabele/Tables:** 5 **Ryciny/Figures:** 0 **Piśmiennictwo/References:** 15

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Otrzymano / Received *29.04.2014 r.*
Zaakceptowano / Accepted *01.07.2014 r.*