ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

JOHNS HOPKINS MEDICINE

Glenoid Component Removal Methods in Revision Reverse Total Shoulder Arthroplasty

Piotr Lukasiewicz MD PhD[1, 2], Punyawat Apiwatanakul, MD,[1] James H Padley, MD,[1] Edward McFarland MD[1]

From the [1]Department of Orthopaedic Surgery, Division of Shoulder Surgery The Johns Hopkins University, Baltimore, MD

[2]Department of Trauma Surgery and Emergency Medicine, Medical University of Lublin, Poland

Faculty Disclosure Information

Piotr Łukasiewicz – Medical Inventi (consultant)
Edward McFarland – Stryker Corporation (consultant)

Remaining authors – nothing to declare

Introduction

Since FDA approval of reverse total shoulder arthroplasty (rTSA) over 20 years ago, popularity of the procedure has been steadily growing

The increasing prevalence of rTSA has led to increasing numbers of failures over time

When performing revision surgery of the glenoid side of the rTSA it is important to have a plan for removal of the components without causing damage to the glenoid bone. This requires a knowledge of the components on the glenoid side of the RTSA, how to remove the sphere and how to remove the glenoid baseplate

Unfortunately, in our practice of revisions rTSA, we noticed that there is a paucity of attention to these challenges by the manufactures in that often there are no instructions in their literature about how to safely remove the glenosphere or the baseplate

Purpose

The goal of this study was to elucidate the methods for removing the sphere and baseplates of rTSA in the literature

Specifically, we aimed to determine how many RTSA systems provide for removal of the glenoid sphere and the glenoid baseplate:

1. a written guide about how to remove the glenoid side baseplate and the glenoid sphere
2. have a design for easy removal of the components
3. had instruments designed to assist in removal of the glenoid sphere and baseplate.

These three goals are critical for performing revision of rTSA by avoiding glenoid side complications during revision surgery and considering the effects of the removing these components on potential subsequent successful revision surgery.

Methods

An online search was conducted between June and December 2024 to identify rTSA systems currently on the market.

Manufacturers were contacted to determine if there were more than one system which was produced by them or it there were previous versions of the current systems which were still available.

To be included the RTSA system had to meet one of three criteria:
- Any printed information about removal of the glenoid sphere or baseplate;
- Instruments noted for removing the glenoid sphere or baseplate;
- Design features making removal of the glenoid sphere or baseplate.

Methods

Of the systems found, the first goal was to determine if there was any information on the website or educational literature for that rTSA system regarding extraction of the components on the glenoid side of rTSA

The design of the implants was then evaluated specifically to determine if it was amenable to removal of the glenoid components

The design characteristics of the baseplates sought included:
- whether the central fixation was with a screw, a peg or both
- number of peripheral screws and whether they were compressive screws or locking
- type of surface on the glenoid side of the baseplates
- geometry of the baseplate as either flat or convex
- whether there was a traditional morse taper with a male trunnion on the glenoid sphere or on the baseplate

In all systems the design of the baseplate was noted in all implant designs, specifically how the fixation to the glenoid and to the glenoid sphere were designed.

For each system it was determined if there were instruments designed for removal of the glenoid sphere from the baseplate

Results

The search identified 60 rTSA systems in the literature or identifiable from the companies

Of these 60 a total of 41 (68%) rTSA systems by 30 companies or joint companies with current available specifications and surgical techniques met inclusion criteria and 19 (32%) systems did not meet inclusion criteria

Surgical instructions were available for 38 (93%) systems
within these:
Instructional material for removal of the glenosphere was available in 27 (66%) systems
Instructional material for removal of the baseplate was available in 20 (49%) of systems

Results

Information regarding dedicated instruments for glenosphere removal was available for 21 (51%) designs:
- 7 (17%) systems included a glenosphere extractor/distractor device
- 2 (5%) offered a sphere extraction hook
- 2 (5%) offered arch spurs extractor and a mallet
- remaining systems offered original designs such as removal fork, glenosphere jackscrew, loosening adapter, glenosphere removal tool, extraction cap, glenosphere extraction handle, removal handle operated with a mallet and a threaded morse taper disassembly tool. One system offered a choice between a thread like extractor or a hook

Information regarding dedicated instruments for baseplate removal was available for 13 (32%) designs:
- 5 (12%) systems offered baseplate extractors,
- 4 (10%) systems used baseplate remover with a slap hammer or slap hammer extractors
- 4 (10%) other designs were baseplate revision tool, metaglene extractor and slide hammer, extraction adapter, disimpaction tip.

Results

Table I – Characteristics of included 41 rTSA systems

Fixation of the baseplate to the glenoid		
a central peg design	20	49%
peg and a central screw	9	22%
central screw	6	14%
helical blade or keel	3	7%
choice between peg or central screw	3	7%
Number of peripheral screws for baseplate fixation		
2 screws	8	20%
3 screws	2	5%
4 screws	28	68%
6 screws	3	7%
Baseplate geometry variation		
circular flat	18	44%
circular convex	11	25%
oval flat	1	2%
oval convex	11	25%
Glenosphere to baseplate assembly		
morse taper alone		
male side of the Morse taper on the baseplate side	12	30%
male side of the Morse taper on the glenosphere side	3	7%
morse taper + central screw		
male side of the Morse taper on the baseplate side + central screw	17	41%
male side of the Morse taper on the glenosphere side + central screw	6	14%
fixation with screw only was present	2	5%
peg adapter and screw	1	2%

Discussion

Glenoid side failures of rTSA are the primary cause of rTSA failure long term, and as these failures increase over time, treatment requires knowledge of how to remove these components

Shoulder revision procedures are technically demanding and are associated with high complication rates

Planning of the revision case should be conducted with care no less than planning of the implantation. Apart from the mentioned surgical instructions, analysis of the equipment availability for given steps of the procedure is important in careful procedure planning.

Discussion

Limitations of our study include:
- While this study presents information about the removal of glenoid side components of rTSA, it is not a study of the frequency of difficulties in clinical practice
- The study is not inclusive of all systems on the market currently or in the past
- Systems with augmented baseplates and custom glenoid implant options were not included in the analysis
- The removal techniques only considered implants that are intact
- Only instructions in English were considered in this study

Conclusion

This study found that:

- Written instructions on how to remove glenoid components in failed rTSA are not available for all implant systems;
- Not all implant systems are designed for easy removal of the glenoid sphere from the baseplate nor the baseplate from the glenoid;
- Not all systems have instruments designed for removal of the glenoid components of rTSA.

Clinicians should familiarize themselves with these issues when considering revision of the glenoid side of rTSA.

References

- Flatow EL, Harrison AK. A history of reverse total shoulder arthroplasty. Clin Orthop Relat Res. 2011 Sep;469(9):2432-9. doi: 10.1007/s11999-010-1733-6. PMID: 21213090; PMCID: PMC3148354.
- Wright TW. Revision of humeral components in shoulder arthroplasty. Bull Hosp Jt Dis (2013). 2013;71 Suppl 2:77-81. PMID: 24328586.
- Best MJ, Aziz KT, Wilckens JH, McFarland EG, Srikumaran U. Increasing incidence of primary reverse and anatomic total shoulder arthroplasty in the United States. J Shoulder Elbow Surg 2021;30(5):1159–1166.
- Ernstbrunner L, Andronic O, Grubhofer F, Camenzind RS, Wieser K, Gerber C. Long-term results of reverse total shoulder arthroplasty for rotator cuff dysfunction: a systematic review of longitudinal outcomes. J Shoulder Elbow Surg. 2019 Apr;28(4):774-781. doi: 10.1016/j.jse.2018.10.005. Epub 2019 Jan 21. PMID: 30674426.
- Ravi V, Murphy RJ, Moverley R, Derias M, Phadnis J. Outcome and complications following revision shoulder arthroplasty : a systematic review and meta-analysis. Bone Jt Open. 2021 Aug;2(8):618-630. doi: 10.1302/2633-1462.28.BJO-2021-0092.R1. PMID: 34382837; PMCID: PMC8384442.