PARIS INTERNATIONAL SHOULDER COURSE 2019

February 14-16

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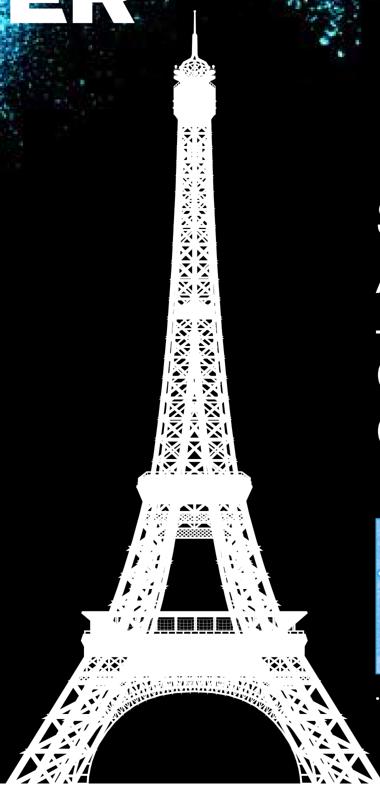
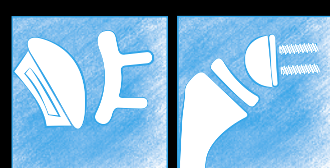


Shoulder Arthroplasty
–
Current Concepts



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Under the direction of
Ph. Valenti
M. Scheibel

PREFACE

CURRENTS CONCEPTS IN SHOULDER ARTHROPLASTY

2019

The Paris International Shoulder Course has become an inescapable event for anyone interested in Shoulder Replacement and is now the world's largest meeting on this subject. In absence but in particular in honor of our kind and charismatic friend « Philippe », we are welcoming you to the 4th edition, PISC 2019.

Our principal goal remains to offer to all levels - from junior trainees to experts in the field - a range of practical information with regard to new techniques and ideas. Particular importance should be given to younger shoulder surgeons, enabling them to increase their knowledge. The goal is to offer better treatment to our patients, and, with this in mind, we will propose a scientific program with up to date information concerning long-term results and latest innovations on shoulder prosthetic arthroplasties. This course belongs to you, and these 3 world-class scientific days will be of great benefit to everyone.

A large conference area will be set up for debates where experienced specialists will be able to share their knowledge and examples of difficult cases.

Importance should be given for technical innovations regarding the pre operative planning of shoulder arthroplasty. Live surgeries with various arthroplasties will be performed by the main experts of the world. And, of course, this event will be, once again, a great occasion to network with your colleagues from all over the world.

We look forward to welcoming you to Paris!

Philippe VALENTI, Markus SCHEIBEL
Chairmen PISC 2019

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INTRODUCTION

Reverse shoulder prostheses are increasingly used in recent years for treatment of glenohumeral arthropathy with deficient rotator cuff such as: rotator cuff arthropathy, rhematoid arthritis, proximal humeral fractures sequelae, irreparable rotator cuff tears, and failed shoulder replacement[39; 42; 48]. Good mid-term and long-term results with restoration of active elevation have been reported[4; 17; 22; 23; 39; 50; 51]. However, early studies showed relatively high rates of complications (24%-50%)[20; 25] and many of these required further surgery[4; 50; 51; 55; 58; 62], therefore preservation of bone has become a major goal. Metaphyseal cementless implants without a diaphyseal stem have been developed to preserve bone and resect only minimal amount of bone[2; 3; 29; 36; 41; 54].

Currently, the information about the long term clinical and radiological outcomes associated with uncemented metaphyseal reverse TSA is limited[2; 3; 29; 36; 41; 54].

The aim of this prospective study is to report the 5-11 years clinical and radiological results with reverse total shoulder replacement with a novel short metaphyseal humeral design without a diaphyseal stem, discuss the design rationale and determine the safety and complication rate of this design.

MATERIALS AND METHODS

Patients

This prospective study included 159 consecutive patients that underwent cementless press-fit reverse TSA (rTSA) with a novel short metaphyseal humeral design without a diaphyseal stem (Verso, Innovative Design Orthopaedics, London, UK (formerly, Biomet Swindon, UK)) for the treatment of glenohumeral arthropathy with deficient rotator cuff by a single surgeon (OL) in our institution between 2005 and December 2011. At the same period, 26 other patients were treated with stemmed press-fit cementless rTSA (Stemmed Verso, Innovative Design Orthopaedics, London, UK (formerly, Biomet Swindon, UK)) due to acute fractures, surgical neck nonunions and revision of stemmed implant with deficient metaphyseal bone.

The indications for surgery were disabling pain and poor function in patients in whom non-operative treatment had failed. We always try conservative treatment first with the deltoid rehabilitation regime. All patients with indication for rTSA were included. All patients gave informed consent, and the study was approved by the Institutional Review Board and Clinical Quality Assurance office.

Of the 159 patients, 146 were available for long-term follow-up analysis in the short metaphyseal group, and 21 patients of the 26 stemmed Verso prosthesis were available for long term follow-up analysis. The average follow up was 89 months (7 years and 5 months) (range 60 - 138 Months). There were 44 males and 141 females, The mean age at surgery was 74.8y (range 38-93y). 108 patients were operated due to cuff tear arthropathy, 22 for fracture sequelae, 24 for rheumatoid arthritis, 14 patients were after failed RC repair or massive irreparable cuff tear, 3 for osteoarthritis with cuff deficiency or eroded glenoid, 8 for failed anatomical prosthesis with cuff deficiency, and 6 for acute trauma. 14 patients underwent bilateral (staged) rTSA at that period.

50 patients were operated as revision arthroplasty (21 from stemmed implants to stemmed Verso rTSA, 29 to short metaphyseal without a diaphyseal stem rTSA (3 of them from stemmed implant to short metaphyseal without a diaphyseal stem implant).

Description of the implant (Figure 1,2)

The humeral component is a short metaphyseal implant with three tapered thin fins that give immediate metaphyseal press fit fixation when impacted into the cancellous humeral metaphysis with bone graft from the resected humeral head. The implant does not violate the humeral diapysis and does not have a diaphyseal stem. These fins have titanium porous and hydroxyapatite coatings to improve the biologic fixation of the implant. The metaphyseal bone quality or osteoporosis is not a contraindication for the use of this metaphyseal implant, utilising bone graft impaction technique.

The glenoid baseplate has a central tapered screw (hydroxyapatite coated titanium) with the largest core diameter of 9mm and additional 2 anti-rotational screws, superiorly and inferiorly. The glenoid sphere is lateralised 3mm from the glenoid face, this is built in the thickness of the baseplate and the gap between the baseplate and the glenoid sphere. The polyethylene humeral liners have 10° inclined shape, achieved by removing the redundant polyethylene walls inferiorly-medially and respectively on both sides. This provides very low profile medially, that reduces the impingement between the polyethylene liner to the glenoid neck (Figure 1, 2). The humeral cut is performed at 155° angle, with final implant angle of 145° using the inclined liner.

The humeral liners can be dialled in a way that the correct version and offset of the liner can be determined and changed, adapted to each patient even after the definitive metal implants have been implanted.

Figure 1
The Verso short metaphyseal reverse TSA without a diaphyseal stem. The humeral component consists of 3 metaphyseal triple tapered thin fins, the glenoid baseplate consists of tapered central screw and a 10° angled dialable Verso humeral liner

Figure 2
X-rays of the short metaphyseal without a diaphyseal stem reverse prosthesis

Surgical technique

The procedure is performed through the antero-superior approach to the shoulder (Naviaser-MacKenzie approach)[35; 38; 44]. In the revision cases where deltopectoral approach was used in the primary operation, the old skin incision is extended and the antero-superior approach is used subcutaneously[37]. 20mm slice of proximal humeral bone is resected using a guide, in 30° of retroversion. The resected bone is used for bone graft impaction into the humerus. The humeral triple tapered finned component if impacted into the humeral metaphysis. Good initial press fit fixation in conjunction with bone graft impaction technique, was achieved in all patients, regardless of osteoporosis or poor bone quality. The glenoid component is implanted in 10° downward inclination at the inferior border of the glenoid with good initial press fit fixation.

Data was collected prospectively on computerised database. All patients were followed clinically and radiographically. Standardized video recording of range of movements and function was obtained for all the patients preoperatively and at regular intervals after surgery at all the follow-up appointments.

Clinical assessment

Patients demographics including the preoperative diagnosis, previous surgery, and preoperative shoulder function using the Constant Score[7] (pain scores, activities of daily

living (ADL), active range of movement (ROM) and shoulder strength) were obtained. Patient satisfaction was assessed using the Subjective Shoulder Value (SSV21 or SANE59). Operative findings, complications or revision surgery were recorded.
Patients were assessed post-operatively with the Constant score[7; 34], the patient satisfaction score (SSV or SANE score)[21; 34; 59], functional questionnaire regarding return to work, sport and leisure activities[34] and the Video recording at 3 weeks [3, 6, 9, 12, 18, 24] months and yearly thereafter.

Radiographic assessment

All radiographs were assessed by two independent experienced shoulder surgeons.
A true AP view of the shoulder and an axillary view radiographs were critically assessed for displacement, migration or subsidence of the implant, appearance of radiolucent lines, osteolysis, or signs of stress shielding, as well as the Nerot-Sirveaux glenoid notching classification[51]. Bone density was assessed using plain digital radiography in the trabecular bone around the implant as described by Kind et.al[31].

Statistical Methods

Data were collected prospectively and recorded using a dedicated MS Access database. Improvement, or gain, in both functionality (Constant Score) and patient satisfaction assessed by the Subjective Shoulder Value (SSV21 or SANE59) was calculated for each case by comparing the latest observed post-operative value to the corresponding pre-operative value, and the significance of the difference was tested using the paired t-test. Improvement in Constant score was assessed at each time point (pre-op, immediate post-op, 3 weeks then [3,6,9,12] months and annually thereafter.
Statistical analysis was carried out using SAS (Release 8.2 , SAS Institute Inc., Cary, NC, USA, 2001).

RESULTS

At most recent follow-up, patients' satisfaction (SSV) improved from 0.8/10 pre op to 8.2/10 post op following rTSA with this short metaphyseal prosthesis without a diaphyseal stem. 93% felt much better and better at 5-11 years post op in all the diagnoses. 98% felt much better and better (86% excellent) at 5-11 years post op in the cuff arthropathy group. Mean Constant Score (for all diagnoses) improved from 15.6±8.6 preop to 59.0±20.4 at last follow-up. Age/sex adjusted Constant score improved from 22.1±12.3 preoperatively to 86.8±30.3 at the last follow-up ($p<0.0001$, paired t-test).
No clinical infections observed in this study. Patients were monitored for infection with CRP, ESR, and intraoperative intraarticular specimen collection. The prophylactic antibiotic treatment was withheld until the specimens were collected. Single dose of Teicoplanin and Gentamycin was used for prophylaxis.
For cuff arthropathy patients (n=108) (including 17 cases of revision of resurfacing with cuff deficiency to short metaphyseal Verso without a diaphyseal stem and 11 cases of revision of stemmed implants to stemmed prosthesis). Constant score improved from 15.9±8.3 points to 60.5±19.9 (age/sex adjusted 23.1 to 90.5); fracture sequelae (n=22) from 11.9±8.2 to 49.9±22.8 (age/sex adj. 15.9 to 70.1); Rheumatoid arthritis (n=24) from 13.9±8.2 to 53.5±18.0 (Age and sex adj. 19.2 to 76.0) and the cases of revision of failed arthroplasty with loosening and deficient cuff (n=8) to metaphyseal finned reverse TSA without a diaphyseal stem from 14.7±8.1 to 49.3±24.3 points post-op (age/sex adj. 21.3 to 73.7); Post failed rotator cuff repair or massive cuff tears (n=14) from 23.3±7.3 to 77.1±3.7 (Age and sex adj. 31.4 to 109.4) For acute trauma (n=6) improved to 46.5±18.3 points and 74.0±25.8 age and sex adjusted. All these gains were statistically significant ($P<0.0001$, Paired t-test, comparing post-op to pre-op)(Figure 3a,b). The Constant score

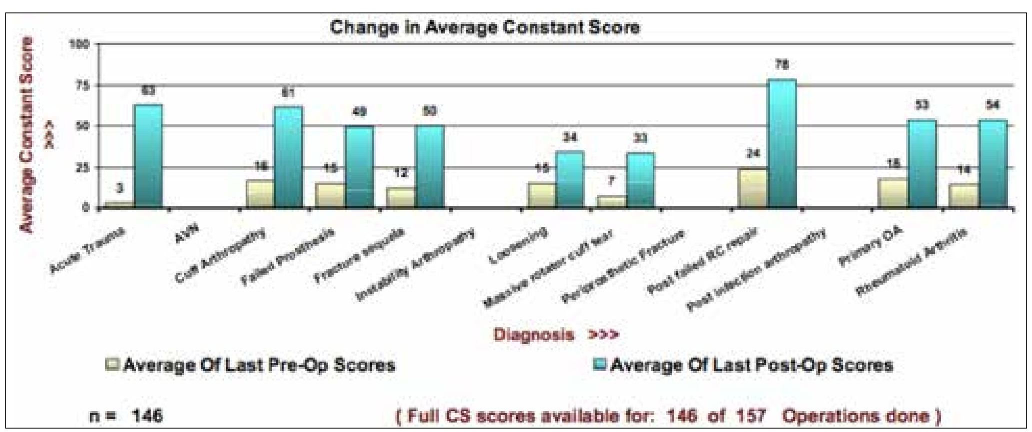


Figure 3a
The preoperative and postoperative follow up Constant scores in different aetiologies (raw score) ($P<0.0001$, Paired t-test)

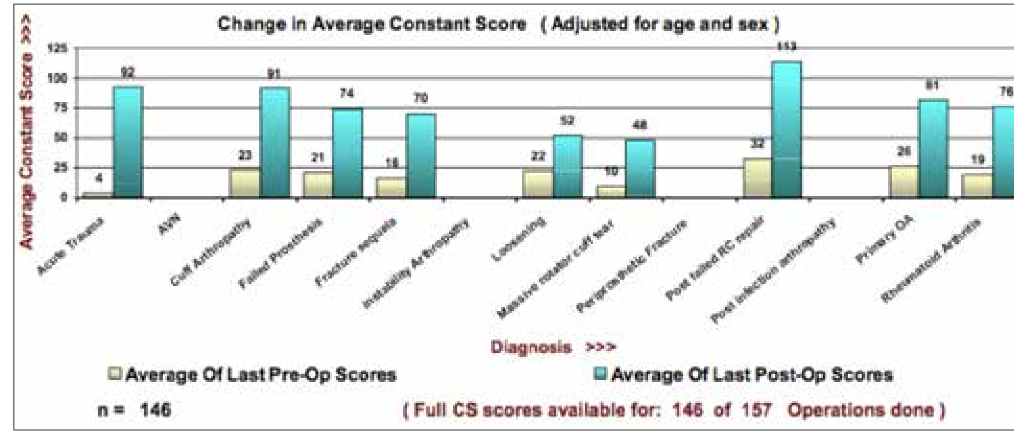


Figure 3b
The preoperative and postoperative follow up Constant scores in different aetiologies (Age & Sex adjusted score) ($P<0.0001$, Paired t-test)

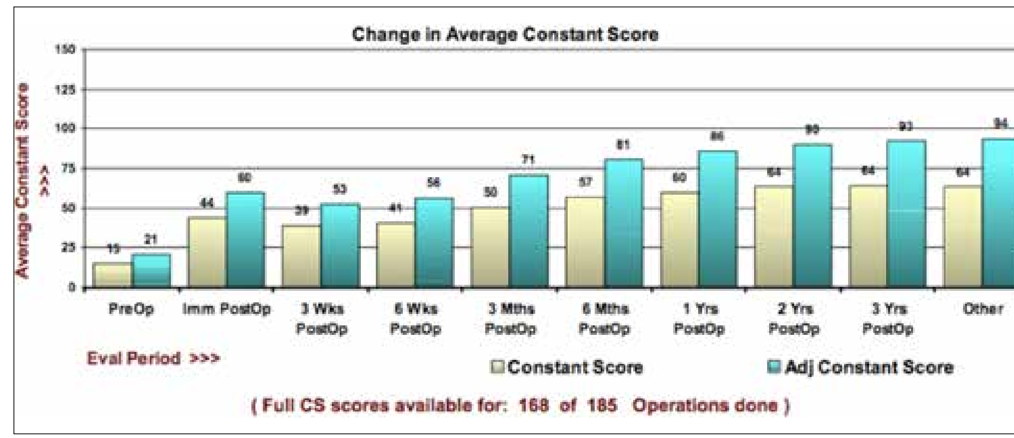


Figure 4
Improvement of Constant score with time

continued to improve over time in this series (Figure 4).
At most recent follow-up, pain scores were rated mild or none in 161 shoulders (95.8%). The mean VAS pain score (from 0 to 15) decreased from 12 to 2.5. The mean active range of movement improved from 53° to 129.5° elevation, 10° to 50.6° external rotation (in adduction with the arm beside the body) and 24° to 67.2° internal rotation (in abduction) (reaching to the waist with the hand behind the back) (Refer Figure 5, 6, 7, 8). Most patients resumed normal or functional daily and leisure activities according to their reply in the questionnaires34.

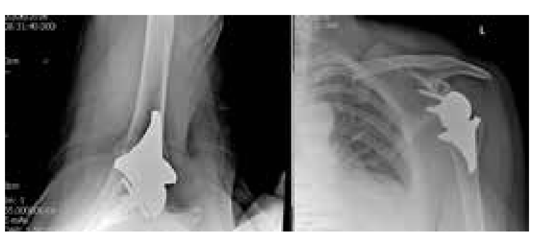
Radiographic analysis

The postoperative radiographic analysis showed no radiolucencies around the humeral or glenoid components, at the latest follow-up. There were no cases of prosthetic humeral or glenoid migration, change in position over time or loosening of the short metaphyseal reverse humeral and the glenoid components. There was no subsidence of the prostheses and no evidence of proximal resorption of bone around the humeral implant to suggest stress shielding. Increased bone density was measured using plain digital radiography in the trabecular bone around the implant[31].
In 38 patients we observed glenoid notching (20.5%), these cases appeared later (>1-2 years) after surgery. 32 of these patients had glenoid notching grade 1 or 2 (Nerot-Sirveaux)[51], and only in 6 cases grade 3 glenoid notching.

A.

B.

C.



D.

Figure 5
79 years old patient, 9.5 years post revision of left CSRA to short metaphyseal without a diaphyseal stem Verso rTSA:
A. Active range of movement at 9.5 years follow-up
B. Preoperative X-rays with resurfacing of the shoulder
C. X-rays at 2.5 years follow-up after revision to Verso rTSA.
D. X-rays at 9.5 years follow-up after revision to Verso rTSA.

A.

B.

C.

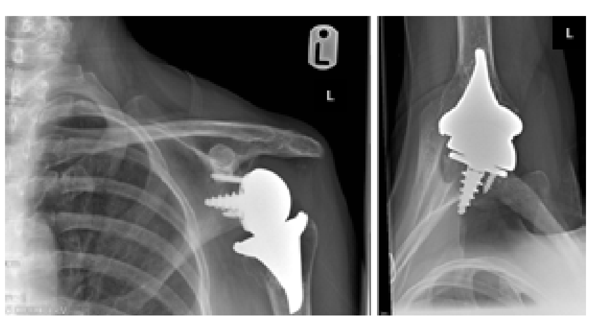
D.

Figure 6
79 years old patient with cuff tear arthropathy, 8 years post left Verso rTSA:
A. Active range of movement at 8 years follow-up
B. Preoperative X-rays with cuff tear arthropathy
C. X-rays 1 month after Verso rTSA
D. X-rays at 8 years follow-up after Verso rTSA

A.

B.

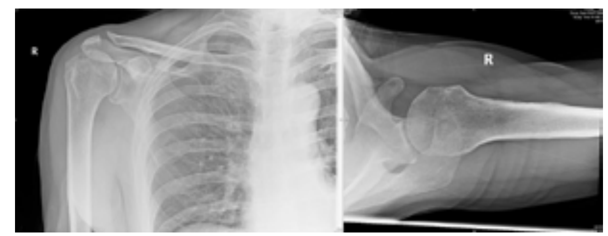
C.



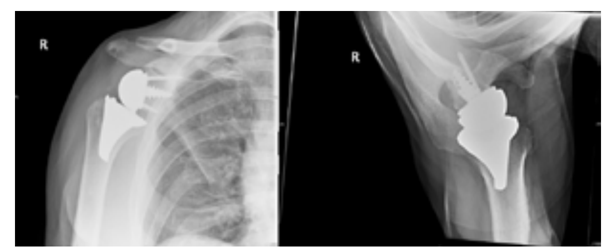
D.

Figure 7
65 years old patient with rheumatoid arthritis,
7 years post left Verso rTSA:
A. Active range of movement at 7 years follow-up
B. Preoperative X-rays with rheumatoid arthritis
C. X-rays 1 year after Verso rTSA
D. X-rays at 7 years follow-up after Verso rTSA

A.



B.



C.

D.

Figure 8
83 years old patient with cuff tear arthropathy,
7 years post right Verso rTSA:
A. Active range of movement at 7 years follow-up
B. Preoperative X-rays with cuff tear arthropathy
C. X-rays 3 months after Verso rTSA
D. X-rays at 7 years follow-up after Verso rTSA

Complications

Two cases had an undisplaced fracture of the humeral metaphysis due to excessive bone impaction in very soft bone and one glenoid rim was cracked during preparation. These were in revision cases. These healed around the implants at three months with conservative treatment. They did not show any lucencies or loosening at the follow-up.

No patient suffered infection and there were no other intra-operative complications.

There were 3 early dislocations; one due to wrong liner version and the patient putting weight on his shoulder in extension of the shoulder (to push himself out of chair) one week post surgery. The others, due to an inferior osteophyte that hinged the liner to dislocate. All were re-operated the osteophyte removed and the liners realigned and made a remarkable recovery.

In one patient, early in the series, the glenoid head disengaged from the baseplate during the first 3 weeks after surgery due to soft tissue interposition between the baseplate and the glenoid sphere that was unnoticed during surgery. The glenoid sphere was reinserted in revision surgery with uneventful recovery.

Two patients developed pathological fracture of acromion, two months after surgery. They made a full recovery with conservative treatment and regained full range of motion and function with no pain within a month later.

Twenty patients sustained traumatic periprosthetic fractures due to falls:

Six patients sustained traumatic fracture of the scapular spine after a fall (2 months post op, 2 years, 2.5, 6, 7 and 8 years respectively). 3 were operated with plating of the spine of the scapula, and 3 were treated conservatively. They made moderate recovery with almost no pain but limited function.

Postoperative acromial fractures have been reported in 1% to 7% of patients following all types of reverse shoulder arthroplasty.[8; 25; 34; 57]

Four patients sustained glenoid periprosthetic fracture following a fall (with well fixed glenoid components), 3 of them as early as 3 months after surgery, one patient refused further surgery, the other was treated conservatively, both with limited outcome. The third patient was revised with good outcome. The forth patient sustained late traumatic glenoid fracture combined with proximal humeral periprosthetic fracture 6.5 years following the arthroplasty and was revised.

Eight patients sustained periprosthetic fractures of the proximal humerus (metaphyseal fractures) following a fall: Six were treated conservatively and all healed with good function and two patients with displaced metadiaphyseal periprosthetic fracture had revision to a stemmed reverse prosthesis and made moderate recovery with no pain and restoration of limited function.

Two patients sustained midshaft fractures at the tip of the stemmed implant; one was revised to a longer stem Verso with strut bone allografts and the other was fixed with a plate.

All these fractures were late traumatic fractures, after the patients sustained a fall!

It is unfortunate that elderly people tend to fall and fracture bones (typically neck of femur and proximal humerus). Our patients returned to full activity following the rTSA. While performing their normal daily activities, they tripped and fell sustaining traumatic fracture of the proximal humerus or the Glenoid. Most of them were treated conservatively.

The incidence of periprosthetic fracture during or after total shoulder arthroplasty (TSA) in the literature is 1% to 3% of all TSAs. The frequency with which this injury occurs may be increasing, linked to the overall increased usage of TSA. The injury occurs in elderly patients who are at risk of falls. The majority of periprosthetic fractures occur postoperatively with low energy events after falls, during activities of daily living[6; 53; 60].

DISCUSSION

The long-term (5-11 years) clinical and radiographic results with this short metaphyseal reverse shoulder prosthesis (without a diaphyseal stem) are very encouraging. All patients had good pain relief and the vast majority of the patients were very satisfied with their shoulder (8.2/10). Good clinical outcome was observed for all the diagnoses with improvement of the Constant Score from 15.6 preop to 59.0 (Age/sex adjusted 86.8) at last follow-up.

Mazis et al. found no deterioration of the deltoid function over time with 6-11 years follow-up with the short metaphyseal without a diaphyseal stem Verso rTSA[19].

The prosthesis fixation is entirely metaphyseal with no stem in the humeral shaft. Good initial press fit fixation achieved in all patients, regardless of osteoporosis or poor bone quality, with the triple tapered finned implant in conjunction with bone graft impaction technique. The titanium porous and hydroxyapatite coatings provide further biologic fixation.

Complications related to the humeral stem with stemmed reverse prostheses accounted for 10%4 -20%62 of complications, including periprosthetic fracture, shaft perforation, disassembly, and loosening[6; 14; 57; 62]. Zumstein et al[62] reported 16 intraoperative humeral fractures and 24 intraoperative complications (67%) related to the humeral stem. Two cases in our series had an undisplaced fracture of the humeral metaphysis intraoperatively. These healed completely around the implants with conservative treatment over three weeks with no effect on the functional outcome. They did not show any lucencies or loosening at the latest follow-up.

Melis et al.[40] found radiological signs of stress shielding in substantial numbers of stemmed reverse prostheses with 5.9% of cemented and 47% in uncemented implants, as well as partial or complete resorption of the greater and lesser tuberosities (greater tuberosity resorption in 69% of cemented and 100% in uncemented implants and lesser tuberosity resorption in 45% of cemented and 76% of uncemented implants)[40]. Similar findings reported with other types of stemmed rTSA as well[52].

Neither lucencies nor resorption of bone around the humeral component suggestive of stress shielding were seen in this series. An explanation may be that as the entire fixation of the prosthesis is metaphyseal (without distal fixation) there is direct load transfer to the humeral metaphysis. This reduces the risk of stress shielding. Furthermore, use of the triple tapered finned humeral component combined with bone graft impaction technique may improve the density and resistance of the metaphyseal bone.

Scapular notching has been observed in more than 50% of cases in most series with reverse shoulder prostheses[5; 11-13; 17; 33; 40; 45; 47; 49-51; 55; 62]. This is a common radiographic finding at early follow-up[5; 11-13; 17; 33; 40; 45; 47; 49-51; 55; 62]. In Boileau et al.[4] series, notching at the inferior aspect of the glenoid was present in 74% of cases, and this extended to or beyond the inferior screw ((Nerot-Sirveaux grade 3) in 30% cases. Glenoid notching is a result of impingement of the medial aspect of the polyethylene humeral cup on the scapular neck inferiorly and posteriorly as well as further osteolysis due to the wear particles[45]. Levigne et al.[32] study confirms that scapular notching after Grammont type reverse shoulder arthroplasty is frequent, 62%, similar to some previously published reports[4; 5; 16; 32; 51; 55; 56; 58; 62]. Their study also confirms what Werner[58] previously reported, that notching occurs early after surgery, as 68% of the latest follow-up notches were already visible 1 year after the operation[58].

Melis et al.[40] reported 88% glenoid notching in series of patients with Grammont type rTSA with follow-up over 8 years. They observed increase in incidence and severity of notching over time with 62% of the notching being Nerot-Sirveaux grade 3 and 4 (49% grade 4).

Favard et al.[17] and Zumstein et al.[62] in meta-analysis, have noted a negative effect of radiographic scapular notching on the clinical outcome: if the notch is large (extending beyond the inferior screw), the Constant score was significantly lower and the risk for loosening was high in their series.

The medialisation the centre of rotation to the level of the glenoid surface and orienting the humeral cup almost horizontally have been the biomechanical solutions found by Grammont[23; 24] to avoid excessive forces on the glenoid component and improve the power of the deltoid. But, the pay off, in return, is scapular notching and polyethylene wear.

Other studies with increased lateralised centre of rotation prosthetic design have showed lower rates of glenoid notching but higher rate of mechanical glenoid failure (12% (7/60)), requiring revision[18; 26]. The use of excessive lateral centre of rotation increases the moment at the baseplate-bone interface on the glenoid and can lead to failure of the fixation. In more recent study by the same group[8], the glenoid fixation design was improved (to reduce the glenoid failures) and the glenoid baseplate placed inferiorly with a tilt to decrease notching. Cuff et al. found low rate of glenoid notching with less glenoid failures (but with 24.1% (27/112) of the patients lost to follow-up)[8].

Glenoid notching was observed in 38 cases in our series (20.5%). In 32 of these patients it was mild glenoid notching ((Nerot-Sirveaux grade 1 or 2). In these patients the glenoid notching seemed to be non progressive with sclerotic margin. Only in 6 cases a Nerot-Sirveaux grade 3 glenoid notching were observed. This low rate compares favourably with most of the published series with 44% to 96% in different series[4; 5; 11-13; 16; 45; 47; 49-51; 55].

The 3 mm lateral offset of the glenoid implant baseplate, may reduces the risk of impingement between the liner and the glenoid neck without increasing substantially moment at the baseplate-bone interface. The use of the 10°-angled dial-able polyethylene liner reduces the neck-shaft angle of the humeral component to 145°. The depth of the dialable liner socket is preserved and only the edges of the liner are removed, hence, reducing the impingement of the liner with the scapula inferiorly, as well as anteriorly and posteriorly in rotations, without increasing the risk of prosthetic instability. The use of the 10°-angled dial-able liner reduces the risk of notching as well as of osteolysis triggered by polyethylene particles[45]. According to Werner[58] and a large French multicentre study by Levigne et al.[32], notching occurs early after surgery and progress in severity with time[17; 33]. The fact that we have seen only 20.5% of glenoid notching so far in this series with this short metaphyseal reverse prosthesis, with a follow up period of 5 to 11 years is very encouraging.

The rate of glenoid component loosening reported in the literature for rTSA range between 2% to 5%[11; 12; 15; 28; 47; 51; 55; 62]. No radiolucent lines were seen around the glenoid component in our series so far, with follow-up of 5 to 11 years. Hopkins et al.[27] assessed the glenoid components of six different reverse shoulder prostheses and compared the primary stability through the minimisation of interface micromotions. The glenoid baseplate of this short metaphyseal rTSA design was the most stable with peak micromotions of less than 48 microns. When the relative displacement of the bone-implant interface (termed 'micromotion') is below a threshold of 150μm, it is assumed that the implant will not induce the generation of unwanted fibrous tissues[46], and micromotions below 50μm are considered low enough to allow bone ingrowth.

Some authors raised concerns that use of the Grammont type reverse arthroplasty may lead to deficient or absent external rotation and internal rotation[4; 20; 30; 39; 61]. This may affect the functional ability of patients to perform their simple daily activities[20].

We have found significant improvement in the rotational movements in our series compared to published series with other reverse prostheses[4; 20; 30; 39; 61]. Karlse et al.[30] described the hinging movement of the rTSA humerus around the centre of rotation compared with the anatomic shoulder that spins around the centre of rotation. Karlse et al.[30] showed that there are limitations of rotation movements with rTSA due to impingement of the hinging humeral cup component around the glenoid head. In the adducted position the contact between the inferior edge of the humeral component and the body of the scapula limits the range of adduction. Similar, with internal and external rotation - limiting the range of rotational motion[30]. Removing the edges of the polyethylene liner increases the range of the humeral component rotational movement before impingement of the liner on the scapula occurs.

Indeed, asymmetric polyethylene wear has been observed on most retrieved humeral reverse prostheses liners [10; 42; 43; 45].

The use of the oblique dial-able liners of this implant (Figure 1) combined with 3 mm lateral offset of the glenoid sphere and insertion of the humeral shell in 30º of retroversion may explain the improved rotation. Furthermore, the humeral liners can be dialled in a way that the correct version and offset of the liner can be determined and changed, adapted to each patient, even after the definitive metal implants have been implanted. Beside, reduction of the impingement on the glenoid, these may position the vectors of action of the most anterior and the most posterior fibres of the deltoid muscle in a more horizontal position and recruit them as internal and external rotators respectively[4].

Reverse TSA are usually implanted in elderly patients, which have tendency to suffer from trips and falls. They therefore, have an increased risk to suffer late traumatic periprosthetic fractures[1; 6; 62].

If a stemmed prosthesis is used, the periprosthetic humeral fracture tends to happen at midshaft of the humerus (at the metal-bone interface stress riser)[1; 6; 62]. Andersen et al.1 concluded that periprosthetic fracture around a humeral stem implant is a difficult clinical problem involving complex decision-making, difficult surgery with frequent complications and high reoperation rate.

Zumstein et al.[62] observed negative impact on the clinical outcome in cases with postoperative periprosthetic humeral shaft fractures after stemmed rTSA that had to be revised with longer stems.

Using short metaphyseal without a diaphyseal stem prosthesis reduces the risk of diaphyseal periprosthetic fracture. If fracture is to happen, it will involve the metaphysis rather than the humeral shaft. Metaphyseal fractures may heal better than diaphyseal ones with conservative treatment as shown in this study.

Indeed, the incidence of intraoperative humeral fracture for primary reverse arthroplasty and in revision of a resurfacing device to a reverse is low. However, the risk is clearly higher when using stemmed implants requiring preparation and reaming the humeral shaft for the prosthesis, compared with no need at all to touch the shaft in stemless/metaphyseal prosthesis!

Furthermore, intraoperative humeral fractures are more of a problem in revision surgery. We are seeing 'exponential' increase in revisions of both anatomic and reverse TSA in recent years![9].

By using prosthesis without a stem we reduce the risk of intraoperative humeral fracture if revision will be necessary.

There are limitations to the use of stemless/short metaphyseal without a diaphyseal stem reverse implants, as they are not suitable for treatment of cases with acute fractures, fracture nonunions or revision of stemmed prostheses. For these cases a stemmed implant should be used.

CONCLUSIONS

The bone preserving short metaphyseal rTSA design without a stem shows encouraging long-term results with excellent pain relief and shoulder function, restoration of good active range of motion and high patients' satisfaction scores. These good clinical outcomes are maintained over time for over 11 years. Radiographically, no implant loosening, subsidence or stress shielding observed. The design of this implant seems to result in low incidence of glenoid notching (with low grade of notching) and improved rotational movements compared to the Grammont type prostheses.

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39/ STANDARD VERSUS BONY INCREASED-OFFSET REVERSE SHOULDER ARTHROPLASTY. A RETROSPECTIVE COMPARATIVE COHORT STUDY RUNNING TITLE: BIO VS. STANDARD RSA

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INTRODUCTION

Several problems after reverse shoulder arthroplasty (RSA), including scapular notching, lack of improvement in rotation, instability, and loss of shoulder contour, have been attributed to the medialized glenoid design.10; 24 To address these problems, some authors have proposed increased glenoid lateralization via either bone grafting (bony increased offset (BIO-RSA)) or prosthetic lateralization of the sphere or baseplate.3; 12

Reported advantages of increased lateralization include decreased scapular notching and improved external and internal rotation.3 However, lateralization may have negative consequences such as decreased mechanical advantage of the deltoid and the need for graft healing in the case of a BIO-RSA. To date, only a few comparative studies with small sample sizes have compared a BIO-RSA to a traditional RSA without bone graft (tRSA).1; 11 The aim of this study was to compare the clinical and radiological results of tRSA to BIO-RSA. The hypothesis was that patients with BIO-RSA would have decreased scapular notching and improved range of motion (ROM) and functional outcome.

MATERIALS AND METHODS

Study design, study population, and data collection

A retrospective review was performed of RSAs performed at a single institution between November 2009 and October 2013 in order to compare tRSA to BIO-RSA. Data was collected in a prospective fashion and reviewed retrospectively following institutional review board approval (CERC-VS-2016-07-1 BLIND FOR REVIEW PURPOSES). Inclusion criteria were a primary RSA with a minimum follow-up of 2 years. Patients with fracture sequelae, history of infection, or presence of neurological problems such as Parkinson's disease, or glenoid bone loss were excluded. Bone loss was excluded because inclusion would have prevented analyzing the effect of lateralization. Effectively, the goal of the study was to compare standardized surgeries with either no or 10 mm of glenoid lateralization. The flow chart in Figure 1 resumes the patient selection.

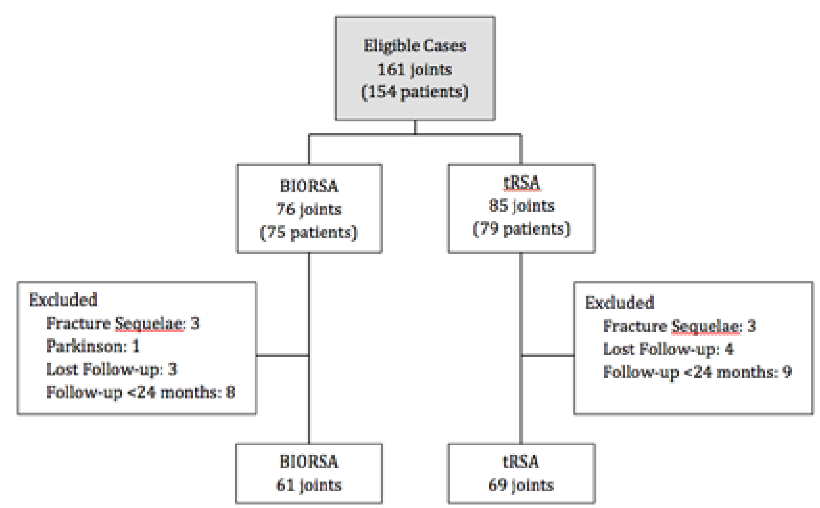

Figure 1
Flow chart of the study

This retrospective study has some limitations. We did not analyze the body mass index (BMI) and the previous indication of the RTSA. Padegimas et al.[16] found a higher risk of instability in patients with a higher BMI and in revisions of RTSA

CONCLUSION

Unstable RTSA is not so rare and represents a difficult challenge for the shoulder surgeon. One or two or more causes have to be identified before the revision. Bilateral radiographs, CTScans and biologic exams must be systematic. Closed reduction is rarely a success and open reduction with revision of some or all the components of the prosthesis is often mandatory. The restoration of an appropriate humeral length and lateralization of the prosthesis to increase the tension of the deltoid are crucial to stabilize the shoulder.

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