

## 10-Year experience with pressfit stemless shoulder prosthesis

Maxim Zagorov<sup>1,2</sup> , Atanas Tabakov<sup>1</sup>, Nikola Grivov<sup>3</sup>, Asen Baltov<sup>3</sup>

<sup>1</sup>Eurohospital, Varna, Bulgaria

<sup>2</sup>MBAL St Sofia, Sofia, Bulgaria

<sup>3</sup>UMBALSM Pirogov, Sofia, Bulgaria

maxim\_zagorov@mail.bg

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**Abstract-** Stemless shoulder arthroplasty has the advantage of reducing stem related complications while allowing for anatomic restoration of proximal humerus independently from the humeral canal and diaphyseal axis and preserving bone stock for future revision. The stem free method has proven to be a reliable treatment option with good clinical function and survivorship in a variety of indications also including young patients.

The aim of this study was to share 10 year experience with a pressfit stemless hemi and total shoulder arthroplasty in a series operated by two shoulder surgeons.

24 cases (21 patients) of stemless shoulder arthroplasty were performed by the two senior authors. The press fit SIDUS stemless shoulder implant (Zimmer Biomet) was used in all cases. Pegged cemented glenoid component was used in all cases of TSA. Mean age was 51,2 yrs. and mean follow up was 48 months.

Shoulder function improved significantly after a mean follow-up of 48 months for active range of motion and the Constant score. Mean Constant score improved from 56,7 points preoperatively to 91 points at final follow up ( $p < 0,05$ ). At final follow up, there was no loosening of the stemless humeral head component. partial medial calcar resorption and remodeling was seen in 4 cases (16,7%). Complications were registered in two cases (8,3%). No implant failure was observed at the humeral side and no revision surgery was performed at final follow up. Survivorship of stemless shoulder arthroplasty in this series at final follow up was 100%.

The use of stemless pressfit shoulder component in both HSA and TSA gains excellent functional and radiological results at midterm with low rate of complications and excellent survivorship in a variety of indications including osteoarthritis, avascular necrosis and selected cases of fracture sequelae which makes it appropriate for both young and older patients with good metaphyseal bone stock.

**Keywords**—stemless shoulder, pressfit, shoulder arthroplasty, Sidus

## 1. INTRODUCTION

Stemless shoulder arthroplasty was introduced more than 20 years ago to reduce stem related complications, shorten surgery time and blood loss, save bone stock and ultimately make revisions easier<sup>1,2,3</sup>. Apart from reducing the risk for intraoperative and periprosthetic fracture and stress shielding, stemless shoulder allows for anatomic restoration of proximal humeral anatomy independently from the humeral canal and dyaphyseal axis. Despite the variability in design, all stemless implants rely on fixation in metaphyseal and/or epiphyseal bone.

Midterm and long term results demonstrate that stemless humeral head replacement for hemi and total shoulder arthroplasty can achieve comparable clinical and radiological results with standard stemmed humeral head replacement<sup>4</sup>.

The stem free method has proven to be a reliable treatment option with good clinical function and survivorship in a variety of indications also including young patients. Magosch et al. demonstrated no loosening and a significant improvement in shoulder function after mean follow up of 11 years with a certain design of stemless shoulder arthroplasty design in a group of patients with mean age of 57 years<sup>5</sup>.

This has led to a steady increase in stemless shoulder arthroplasty and many surgeons currently prefer to use that technique if good metaphyseal bone stock is available<sup>6</sup>.

Indications for stemless arthroplasty are similar to those for stemmed systems while the contraindications for stemless implants are poor metaphyseal bone stock, extensive bone cysts or avascular necrosis, proximal humeral fracture, pseudarthrosis or metabolic bone disease. The aim of this study was to share 10-year experience with a pressfit stemless hemi and total shoulder arthroplasty in a series operated by two shoulder surgeons.

## 2. Materials and methods

Between January 2013 and March 2025 - 24 cases in total (21 patients) of stemless shoulder arthroplasty were performed by the two senior authors. (M.Z., A.B.) The press fit SIDUS stemless shoulder implant (Zimmer Biomet ) was used in all cases. Pegged cemented glenoid component was used in all cases of TSA Fig 1.

All surgeries were performed using standard delto-pectoral approach. Mean age was 51,2 yrs and mean follow up was 48 months. There were 18 male and 3 female patients. HSA was performed in 12 cases (50%) and TSA was performed in the other 12 cases (50%). The distribution in etiology was as follows : OA in 12 cases (50%), AVN in 8 cases (33,3%), and fracture sequelae in 4 cases (16,7%). Prior surgery has been performed in 5 cases (20,8%). Functional results were documented using Constant Score. Standardized digital x-ray examination was performed to assess radiolucent lines around the humeral component as well as the glenoid component, and to assess stress shielding and bony adaptive changes.

Statistical analysis was done using IBM SPSS Statistics Version 19.0 for Windows. Survivorship of the humeral head component was calculated using Kaplan Meier analysis.



Fig1. TSA with Sidus stemless humeral implant and pegged PE glenoid at 5 years postoperatively

### 3. RESULTS

Functional results. Shoulder function improved significantly after a mean follow-up of 48 months for active range of motion and the Constant score. Mean Constant score improved from 56,7 points preoperatively to 91 points at final follow up ( $p < 0,05$ ). Comparing the functional results of HSA with TSA, we observed no statistical differences for preoperative and postoperative Constant-Murley-score (Table 1).

| Functional result | TSA | HSA | p value    |
|-------------------|-----|-----|------------|
| mean preop CS     | 57  | 49  | $p > 0,05$ |
| mean postop CS    | 94  | 89  | $p > 0,05$ |

Table1

Improvement of parameters of active ROM are demonstrated in table 2.

| Active ROM               | Mean preop | Mean postop | p value    |
|--------------------------|------------|-------------|------------|
| forward elevation        | 89°        | 153°        | $p < 0,05$ |
| abduction                | 78°        | 123°        | $p < 0,05$ |
| ext rotation (0° abd)    | 13°        | 42°         | $p < 0,05$ |
| Int rotation (CS points) | 2,6        | 6,5         | $p < 0,05$ |

Table 2

Radiologic results. Humeral head upward migration occurred in 3 cases (12,5%), 2 cases of HSA and one of TSA. Secondary glenoid erosion was registered in the same 2 cases of HSA (8,3%). AT final follow up, there was no loosening of the stemless

humeral head component. Although no signs of humeral stress shielding were observed, partial medial calcar resorption and remodeling was seen in 4 cases (16,7%)-Fig 2.

No radiolucent lines around the PE glenoid component were observed.



Fig 2. Partial calcar resorption around stemless humeral component at 4 yrs. follow up

#### Complications:

Complications were registered in two cases (8,3%). There was one case of radial nerve palsy, which resolved with conservative treatment and one case of loss of internal rotation power, due to suboptimal subscapularis tendon healing.

No implant failure was observed at the humeral side and no revision surgery was performed at final follow up. Survivorship of stemless shoulder arthroplasty in this series at final follow up was 100%.

## 4. DISCUSSION

The main finding of our study is that pressfit stemless shoulder arthroplasty achieves good to excellent functional results as both HSA and TSA in several indications like primary OA, AVN and fracture sequelae at mean follow up of 48 months with low rate of complications and excellent survivorship. Despite the variety in designs of the stemless shoulder implants currently available on the market, metaphyseal fixation is achieved through screw in or pressfit mechanism. The Sidus stemless implant, used in this study is available on the market from 2012 and relies on pressfit fixation in the humeral metaphysis. In the current literature there is only mid term data regarding this implant. The largest multicenter study in a group of 100 patients demonstrates significant improvements in all outcomes at 5 years follow up in both HSA and TSA with no humeral loosening and 94% survivorship mainly due to glenoid loosening and rotator cuff failure<sup>7</sup>. The postoperative Constant score as well as postoperative active flexion and abduction in this study are comparable with our results. This study also shows slightly better functional result and lower revision rate in TSA than HSA. Despite the tendency for better functional result in TSA compared to HSA in our study, this was

not statistically significant, probably due to the small number of patients and variety of indications.

Berth et al examined the clinical and the radiological results in 82 patients with primary osteoarthritis of the shoulder treated with either a stemless shoulder prosthesis or a stemmed shoulder prosthesis to detect possible differences in the functional outcome and to evaluate radiological properties of the implants. Their results showed that the use of the stemless shoulder prosthesis yielded good outcomes, which, in a mid-term follow-up, were comparable with those provided by a standard anatomic shoulder prosthesis<sup>1</sup>.

A number of recent systematic reviews and metaanalyses demonstrate clinical results comparable or better than traditional stemmed designs with lower rate of intraoperative and periprosthetic fractures. The overall complication rate is comparable to the values observed in our series (8-10%) and overall revision rate is around 5% with long term survivorship of 96,5% for some designs<sup>8,9</sup>.

Apart of reducing the stem related complications, a major advantage of the stemless humeral component is the ability to restore the proximal humeral anatomy independently from the humeral shaft axis. It is well known that all parameters of proximal humeral anatomy like inclination, retroversion, head size and posteromedial offset are highly variable and sometimes difficult to restore with the current generation of modular stemmed implants<sup>10,11</sup>. Being anchored in the metaphysis alone, irrespective of the canal offset, the stemless shoulder replacement can be extremely useful in cases of fracture sequelae type 1 and 2 according to Boileau with mild proximal humerus deformity, especially valgus collapse of the humeral head, AVN and locked posterior dislocation and some cases of posttraumatic osteoarthritis, precluding the need for greater tuberosity osteotomy<sup>12,13</sup>.(Fig.3)



Fig. 3 – Stemless HSA after fracture sequelae type 1

Good quality of the metaphyseal bone stock of the humerus and younger age is often cited as proper indication for the stemless component, but there is no clear criteria in the published literature regarding gender or age cut-off. A recent study by Goldberg et al demonstrated that stemless humeral implant could be safely employed in patients of more advanced age<sup>14</sup>. Apart from the subjective thumb test, certain radiographic and CT measurement like  $DTI < 1,4$  or metaphyseal density  $< 20$  HU can predict suboptimal bone quality for stemless metaphyseal fixation<sup>15</sup>. Furthermore, bone grafting of solitary metaphyseal lesions (e.g. cysts in AVN) has been shown to provide adequate stemless component fixation and survivorship, potentially expanding indication for implantation of stemless humeral component<sup>16</sup>.

The bone remodeling in the calcar area, that we observed in 16% of our cases is probably design dependent since it is well reported in pressfit stemless shoulder arthroplasty in the midterm follow up<sup>17</sup>. Although no influence on clinical results has been reported so far, this phenomenon and its influence on the bone preserving concept of the stemless prosthesis is prompt to long term observation<sup>18</sup>. However the preservation of metadiaphyseal bone stock and the lack of diaphyseal anchorage make stemless components easier for further revision in comparison with their stemmed counterparts<sup>8,9</sup>.

All aspects of proximal humeral anatomy are dependant on a single metaphyseal bone cut in stemless shoulder arthroplasty. Studies demonstrate that poor restoration of proximal humerus anatomy is registered in almost 2/3 of the stemless shoulder arthroplasty cases with medialisation of the center of rotation due to medialized cut and overstuffing of the joint being the most common mistake. Since it has been shown that even 3 D planning is not very helpful in executing the cut at the right level, identifying the anatomic neck and careful measurement of head height seems to be of utmost importance of performing the metaphyseal cut at the right level and orientation to replicate correct soft tissue tensioning and muscle-tendon balance of the shoulder joint<sup>19</sup>. Recently Halm - Pozniak et al. from the Affinis group have demonstrated that non anatomical positioning of the stemless humeral component with medialization of the center of rotation more than 3mm can lead to more complications, more common calcar resorption and greater tuberosity osteopenia and ultimately significantly lower survivorship at 10 years follow up, despite no significant influence on clinical result<sup>20</sup>. Thereafter the calcar resorption or remodeling that we have documented in 16% of our patients at mid term might be a sign of poor restoration of proximal humerus anatomy and underlines the necessity of precision when performing the metaphyseal cut at the level of the anatomic neck. Despite the lack of revision at this point, the influence of these phenomena on long-term survivorship should be evaluated. We think that the possible lateralization of the joint line following implantation of a glenoid component should also be taken into account with slight lateralization of the metaphyseal cut, although this is limited by the insertion of the posterosuperior rotator cuff.

## 5. CONCLUSION

The use of stemless pressfit shoulder component in both HSA and TSA gains excellent functional and radiological results at midterm with low rate of complications and excellent survivorship in a variety of indications including osteoarthritis, avascular necrosis and selected cases of fracture sequelae which makes it appropriate for both young and older patients with good metaphyseal bone stock. Despite some bone remodeling and adaptive changes stemless shoulder arthroplasty has the potential to preserve the bone stock and make potential future revision arthroplasty easier. Correct metaphyseal cut and proper restoration of the proximal humerus anatomy seems to be essential for long term survivorship of the stemless shoulder arthroplasty.

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## Authors

**Maxim Zagorov** is a member of the **Bulgarian Orthopedic and Traumatology Association (BOTA)**. He is the current president of Bulgarian Association for Arthroscopy and Sports Traumatology (BAAST). He works as an orthopaedic surgeon at Eurohospital, Varna and St. Sofia Hospital, Sofia.