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Primary reverse shoulder arthroplasty in patients with metabolic syndrome is associated with increased rates of deep infection

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Background: Metabolic syndrome (MetS) is an abnormal physiological condition that has been increasingly identified as a risk factor for complications after orthopedic surgery. Given the lack of information on the effect of MetS in shoulder arthroplasty (SA), this investigation analyzed the rates of postoperative complications and implant survivorship free from reoperation and revision in patients with and without MetS.

Methods: Between 2007 and 2017, data from 4635 adults who underwent a primary SA were collected and classified based on the presence or absence of MetS. MetS was defined as the existence of type 2 diabetes mellitus and a minimum of 2 of the following diagnoses: hyperlipidemia, hypertension, and body mass index ≥ 30 kg/m^2 within 1 year of surgery. Of the 4635 arthroplasties, 714 were performed in patients with MetS (anatomic total shoulder arthroplasty [aTSA] in 289 and reverse shoulder arthroplasty [RSA] in 425) and 3921 were performed in patients without MetS (aTSA in 1736 and RSA in 2185). Demographic characteristics, complications, reoperations, and revision surgery were compared.

Results: At a mean of follow-up of 4.5 $\pm$ 2.3 years, 67 MetS patients (9.4%) and 343 non-MetS patients (8.7%) had sustained at least 1 postoperative complication ($P = .851$). Rotator cuff failure was the most common complication overall, with 84 cases (1.8%) (15 MetS cases [2.1%] and 69 non-MetS cases [1.8%], $P = .851$), and in both MetS and non-MetS patients, followed by infection, with 68 cases (1.2%) (10 MetS cases [1.4%] and 58 non-MetS cases [1.2%], $P = .913$). For aTSAs, the most common complication was rotator cuff failure (84 shoulders, 1.8%); for RSAs, the most common complication was periprosthetic fracture (52 shoulders, 1.1%). In RSAs, the rates of deep infection (1.9% vs. 0.7%, $P = .04$), instability (3.1% vs. 1.5%, $P = .04$), and deep venous thrombosis or pulmonary embolism (0.5% vs. 0.3%, $P = .03$) were found to be significantly higher in patients with MetS than in those without MetS. Reoperations were observed in 36 MetS patients (5%) and 170 non-MetS patients (4.3%) ($P = .4$). Revisions were performed in 30 MetS patients (4.2%) and 127 non-MetS patients (3.2%) ($P = .19$). The Kaplan-Meier 5-year rate of survivorship free from reoperation, revision, and prosthetic joint infection was equal between groups.

Conclusions: A preoperative diagnosis of MetS in patients undergoing primary SA did not significantly increase the risk of postoperative complications, infection, reoperation, or revision following primary SA. However, in the RSA subgroup, complications were significantly more common in patients with MetS. Individual risk factors may be more appropriate than the umbrella diagnosis of MetS prior to aTSA.

This study received institutional review board approval (no. 20-002824).

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Shoulder arthroplasty (SA) continues to be an increasingly performed procedure for the management of a wide range of glenohumeral disorders.[3,16] In the United States, SA has demonstrated growth rates comparable to or greater than those of total hip and knee replacements, with future projections predicting up to a 9-fold increase by 2030 in both elderly and younger patients.[25,30] As a result, postoperative adverse outcomes, revisions, and significant costs to the health care system can be expected,[10,12,36,31] providing opportunities to identify risk factors that may improve the outcomes of these procedures.[2]

Metabolic syndrome (MetS) is a complex disorder often defined by abnormal components of insulin resistance, hypertension, dyslipidemia, and abdominal obesity.[1,15] This constellation of inter-related biochemical, physiological, and clinical traits has been associated with cardiovascular disease, thromboembolic events, endocrine dysfunction, and changes in health-related quality of life.[6,11,20] MetS has also been suggested to influence the development of osteoarthritis independent of body mass index (BMI).[4,12,13] In the perioperative setting, MetS has been associated with increased all-cause mortality rates and postoperative complications.[7] In orthopedics, MetS has been associated with increased in-hospital complications after ankle fractures[21] and prolonged lengths of stay after cervical fusion.[19] Regarding hip and knee arthroplasty, MetS has been identified as an independent risk factor for short-term complications, wound issues, and readmissions irrespective of obesity class.[8]

Within the shoulder literature, only 2 studies have explored the impact of MetS in patients undergoing SA.[14,24] Both used national inpatient databases focusing on short-term outcomes (Nationwide Inpatient Sample [NIS] and American College of Surgeons National Surgical Quality Improvement Program [NSQIP]). Murphy et al[24] demonstrated elevated perioperative medical complications and surgical-site infections, as well as prolonged hospital stays, in patients with MetS. In contrast, Garcia et al[10] concluded that MetS was not a significant predictor of postoperative complications or an extended length of stay. As a result, there remains a relative paucity of clear and concise data on the outcomes of MetS in patients undergoing shoulder replacement. The purpose of this study was to determine the effect of MetS on the rates of postoperative complications, infection, and implant survivorship free from reoperation and revision. We hypothesized that patients with MetS would be more likely to have increased risks of subsequent complications and infections, as well as lower implant survivorship free from reoperation and revision.

Materials and methods

Data for this retrospective comparative cohort study were acquired from a prospectively recorded institutional total joint registry database. All adults who underwent a primary SA (N = 4635) between January 2007 and December 2017 were identified. MetS was defined using preset criteria consisting of the presence of type 2 diabetes mellitus and a minimum of 2 of the following diagnoses: hyperlipidemia, hypertension requiring medication, and BMI $\geq$ 30 kg/m^2. This definition was selected based on prior published literature used in other database investigations on MetS.[8,11,19,21] A subsequent chart review was performed to identify all patients who met the criteria for MetS within 1 year of surgery. The exclusion criteria included patients aged $<$ 18 years, revision SAs, hemiarthroplasties, malignant diagnoses, or $<$2 years of clinical follow-up. In the case of bilateral SA, only the first shoulder was counted and included in the investigation. The final cohort was then categorized into 714 patients with MetS (anatomic total shoulder arthroplasty [aTSA] in 289 and reverse shoulder arthroplasty [RSA] in 425) and 3921 patients without a diagnosis of MetS (aTSA in 1736 and RSA in 2185). Baseline demographic characteristics and comorbidities are detailed in Table I.

Through a combined retrospective chart review and extraction of data from our institutional total joint registry database, we obtained primary and secondary outcome measures. The primary outcome measures of the study included postoperative surgical complications and implant survivorship free from revision and reoperation. Secondary outcome measures included postoperative infections (superficial or deep) and revision due to prosthetic joint infection. Superficial infections were classified as those limited to the skin and subcutaneous tissue with no extension beyond the fascial planes. Deep infections were defined as infections beyond the superficial fascial planes.

Statistical analysis was completed using SPSS Statistics software (version 25; IBM, Armonk, NY, USA). Baseline characteristics were compared using the Student t test, χ^2, or Fisher exact test as indicated. The McNemar test was performed for paired categorical data and the Wilcoxon signed rank analysis was used for continuous variables. Survivorship free from reoperation, revision, and periprosthetic joint infection was analyzed using Kaplan-Meier analysis. In all cases, $P < .05$ was considered statistically significant.

Table I Baseline demographic and clinical characteristics between MetS and control (non-MetS) groups

	MetS (n = 714)	Non-MetS (n = 3921)	*P* value
Age, yr	70.5 ± 8.9	69.4 ± 10.9	.016*
Sex			.007*
Male	368 (51.5)	1807 (46.1)	
Female	346 (48.5)	2114 (53.9)	
Height, m	1.68 ± 0.10	1.67 ± 0.13	.036*
Weight, kg	97.4 ± 21.5	84.4 ± 20.9	<.001*
BMI, kg/m^2	34.6 ± 6.7	31.7 ± 6.2	.04*
Prior surgery	156 (21.8)	900 (22.9)	.52
Implant			.06
aTSA	289 (40.5)	1736 (44.3)	
RSA	425 (59.5)	2185 (55.7)	

MetS, metabolic syndrome; *BMI*, body mass index; *aTSA*, anatomic total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty.
Data are given as number of patients (percentage) or mean ± standard deviation.
* Statistically significant ($P < .05$).

Results

Complications

Perioperative complications were observed in 410 cases (8.9%) across the entire cohort of 4635 shoulders included in this study. With respect to timing, 108 complications (26.3%) occurred within 30 days; 194 (47.3%), within 90 days; 273 (66.6%), within 1 year; and 371 (90.5%), by 5 years. Complication rates were equal between the MetS group (n = 67, 9.4%) and non-MetS group (n = 343, 8.7%) ($P = .851$) (Table II). Rotator cuff failure was the most common complication, observed in 84 shoulders (1.8%); this was followed by infection (n = 66, 1.4%) and periprosthetic fracture (n = 65, 1.4%). For MetS cases specifically, rotator cuff failure was the most common complication (n = 15, 2.1%), followed by instability (n = 15, 2.1%) and periprosthetic fracture (n = 11, 1.5%). For the non-MetS patients, rotator cuff failure was the most common complication (n = 69, 1.8%), followed by infection (n = 58, 1.4%) and periprosthetic fracture (n = 54, 1.4%). With respect to infections, no significant differences were found between patients with MetS (n = 10, 1.4%) and those without MetS (n = 56, 1.4%) ($P = .913$). Deep infections were observed in 9 patients (1.3%) with MetS and 37 (0.9%) without MetS ($P = .41$), and superficial infections were observed in 1 patient (0.1%) with MetS and 21 patients (0.5%) without MetS ($P = .23$).

Given the differences in complication profiles between total shoulder arthroplasty (TSA) and RSA, a subanalysis was performed comparing complications by implant type (Table III). There were 181 TSA complications (3.9%), of which the most common were rotator cuff failure (n = 84, 1.8%), infection (n = 29, 0.6%), and aseptic component loosening (n = 23, 0.5%). There were no differences in the overall complication rate between the MetS cohort (n = 25, 8.7%) and non-MetS cohort (n = 156, 9.0%) ($P = .91$) or with respect to the individual complication types. There were 229 RSA complications (4.9%), which was significantly higher in comparison to the TSA cohort ($P = .014$). Within the RSA subgroup, the most common complications were periprosthetic fracture (n = 52, 1.1%), instability (n = 46, 0.9%), and acromial or scapular spine fracture (n = 41, 0.9%). There were no differences between the overall MetS cohort (n = 42, 9.9%) and non-MetS cohort (n = 187, 8.6%) as a whole ($P = .34$). However, with respect to the individual complication types, we found that the rates of deep infection (1.9% vs. 0.7%, $P = .04$), instability (3.1% vs. 1.5%, $P = .04$), and deep venous thrombosis (DVT) or pulmonary embolism (PE) (0.5% vs. 0.3%, $P = .03$) were significantly higher in patients with MetS than in those without MetS.

Survivorship free from revision, reoperation, and prosthetic joint infection

At a mean follow-up of 4.5 years (range, 2-13 years), reoperations occurred in 206 shoulders (4.4%), with no difference between patients with MetS (n = 36, 5%) and those without MetS (n = 170, 4.3%) ($P = .4$). Revisions, requiring replacement of 1 or more components, occurred in 157 shoulders (3.4%), with no difference between patients with MetS (n = 30, 4.2%) and those without MetS (n = 127, 3.2%) ($P = .19$). Revision for prosthetic joint infections occurred in 47 cases (1%), with no difference between patients with MetS (n = 7, 1%) and those without MetS (n = 40, 1%) ($P = .92$) (Table IV).

The rate of 5-year survivorship free from reoperation was 92.8% (95% confidence interval [CI], 90.4%-95.4%) in the MetS group and a 95.0% (95% CI, 94.1%-95.9%) in the non-MetS group. There was a significantly higher rate of early reoperation in shoulders with MetS ($P = .016$) but no observed difference at 5 years ($P = .11$) (Fig. 1). Survivorship free from revision followed a similar pattern, with

Table II Rate of perioperative surgical complications after primary shoulder arthroplasty in patients with and without MetS

Outcomes	MetS (n = 714)	Non-MetS (n = 3921)	*P* value
Rotator cuff failure	15 (2.1)	69 (1.8)	.54
Infection	10 (1.4)	58 (1.4)	.913
Deep	9 (1.3)	37 (0.9)	.41
Superficial	1 (0.1)	21 (0.5)	.23
Periprosthetic fracture	11 (1.5)	54 (1.4)	.73
Intraoperative	2 (0.3)	16 (0.4)	>.999
Postoperative	9 (1.3)	38 (1)	.4
Acromial or scapular spine fracture	3 (0.4)	38 (1)	.19
Instability	15 (2.1)	40 (1)	.02*
Neural palsy or neuropathy	5 (0.7)	35 (0.9)	.82
Aseptic component loosening	2 (0.3)	33 (0.8)	.15
Glenoid	2 (0.3)	25 (0.6)	.41
Humerus	0 (0)	8 (0.2)	.22
DVT or PE	6 (0.8)	15 (0.4)	.12
Coracoid fracture	0 (0)	1 (0)	>.999
Total complications	67 (9.4)	343 (8.7)	.851

MetS, metabolic syndrome; *DVT*, deep venous thrombosis; *PE*, pulmonary embolism.
Data are given as number of patients (percentage).
* Statistically significant ($P < .05$).

Table III Rate of perioperative surgical complications after primary shoulder arthroplasty in patients with and without MetS by implant type

	aTSA				RSA			
	MetS (n = 289)	Non-MetS (n = 1736)	All TSAs (n = 2025)	*P* value	MetS (n = 425)	Non-MetS (n = 2185)	All RSAs (n = 2610)	*P* value
Rotator cuff failure	15 (5.2)	69 (4.0)	84 (1.8)	.33	0 (0.0)	0 (0.0)	0 (0.0)	NA
Infection	2 (0.7)	27 (1.6)	29 (0.6)	.42	8 (1.9)	31 (1.4)	39 (0.8)	.51
Deep	1 (0.3)	21 (1.2)	22 (0.5)	.35	8 (1.9)*	16 (0.7)*	24 (0.5)*	.04*
Superficial	1 (0.3)	6 (0.3)	7 (0.2)	>.999	0 (0.0)	15 (0.7)	15 (0.3)	.15
Periprosthetic fracture	2 (0.7)	11 (0.6)	13 (0.3)	.92	9 (2.1)	43 (2.0)	52 (1.1)	.84
Intraoperative	0 (0.0)	3 (0.2)	3 (0.1)	>.999	2 (0.5)	13 (0.6)	15 (0.3)	.76
Postoperative	2 (0.7)	8 (0.5)	10 (0.2)	.6	7 (1.6)	30 (1.4)	37 (0.8)	.65
Acromial or scapular spine fracture	0 (0.0)	0 (0.0)	0 (0.0)	NA	3 (0.7)	38 (1.7)	41 (0.9)	.14
Instability	2 (0.7)	7 (0.4)	9 (0.2)	.62	13 (3.1)*	33 (1.5)*	46 (1.0)*	.04*
Neural palsy or neuropathy	3 (1.0)	15 (0.9)	18 (0.4)	.73	2 (0.5)	20 (0.9)	22 (0.5)	.56
Aseptic component loosening	1 (0.3)	22 (1.3)	23 (0.5)	.24	1 (0.2)	11 (0.5)	12 (0.3)	.7
Glenoid	1 (0.3)	22 (1.3)	23 (0.5)	.24	1 (0.2)	3 (0.1)	4 (0.1)	.51
Humerus	0 (0.0)	0 (0.0)	0 (0.0)	NA	0 (0.0)	8 (0.4)	8 (0.2)	.37
DVT or PE	0 (0.0)	5 (0.3)	5 (0.1)	NA	6 (1.4)*	10 (0.5)*	16 (0.3)*	.03*
Coracoid fracture	0 (0.0)	0 (0.0)	0 (0.0)	NA	0 (0.0)	1 (0.0)	1 (0.0)	NA
Total complications	25 (8.7)	156 (9.0)	181 (3.9)	.91	42 (9.9)	187 (8.6)	229 (4.9)	.34

MetS, metabolic syndrome; *aTSA*, anatomic total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *NA*, not applicable; *DVT*, deep venous thrombosis; *PE*, pulmonary embolism.
Data are given as number of patients (percentage).
* Statistically significant ($P < .05$).

survival rates of 94.3% (95% CI, 92.2%-96.5%) in the MetS group and 96.3% (95% CI, 95.5%-97.1%) in the non-MetS group, with a significantly higher risk of early reoperation in the MetS group ($P = .004$) and no difference at 5 years ($P = .04$) (Fig. 2). The rates of survivorship free from revision due to prosthetic joint infection were similar

Table IV Rate of postoperative reoperation, revision, and revision due to prosthetic joint infection after primary shoulder arthroplasty in patients with and without MetS

Outcomes	MetS (n = 714)	Non-MetS (n = 3921)	*P* value
Reoperation	36 (5)	170 (4.3)	.4
Irrigation and débridement	4	17	.63
Open reduction–internal fixation	2	12	.71
Subscapularis repair	0	7	NA
Resection	0	2	NA
Manipulation under anesthesia	0	2	NA
Hardware removal	0	1	NA
Scar revision	0	1	NA
Capsular reconstruction	0	1	NA
Revision	30 (4.2)	127 (3.2)	.19
Prosthetic joint infection	7 (1)	40 (1)	.92

MetS, metabolic syndrome; *NA*, not applicable.
Data are given as number of patients (percentage).

Figure 1 Kaplan-Meier survival curve for survivorship free from reoperation for any indication following shoulder arthroplasty in patients with and without metabolic syndrome.

between groups (99.0% [95% CI, 98.1%-99.9%] in MetS group and 98.8% [95% CI, 98.4%-99.2%] in non-MetS group, $P = .85$) (Fig. 3).

Discussion

MetS remains a public health epidemic associated with elevated perioperative mortality rates, complications, and socioeconomic costs.[6,7] With up to one-third of all US adults affected by MetS, the rising demand for SA will likely result in the need for managing patients with this complex disorder. In this study, 15.4% of patients undergoing primary SA at our institution had a concurrent diagnosis of MetS. In contrast to our hypothesis, a preoperative diagnosis of MetS did not significantly affect rates of postoperative complications (MetS, 9.4%; non-MetS, 8.7%), infections (MetS, 1.4%; non-MetS, 1.4%), reoperations (MetS, 5%; non-MetS, 4.3%), or revision surgery (MetS, 4.2%; non-MetS, 3.2%). However, when we evaluated individual complications in the RSA subgroup, MetS was associated with a significantly higher rate of deep infection (1.9% vs. 0.7%, $P = .04$) and instability (3.1% vs. 1.5%, $P = .04$).

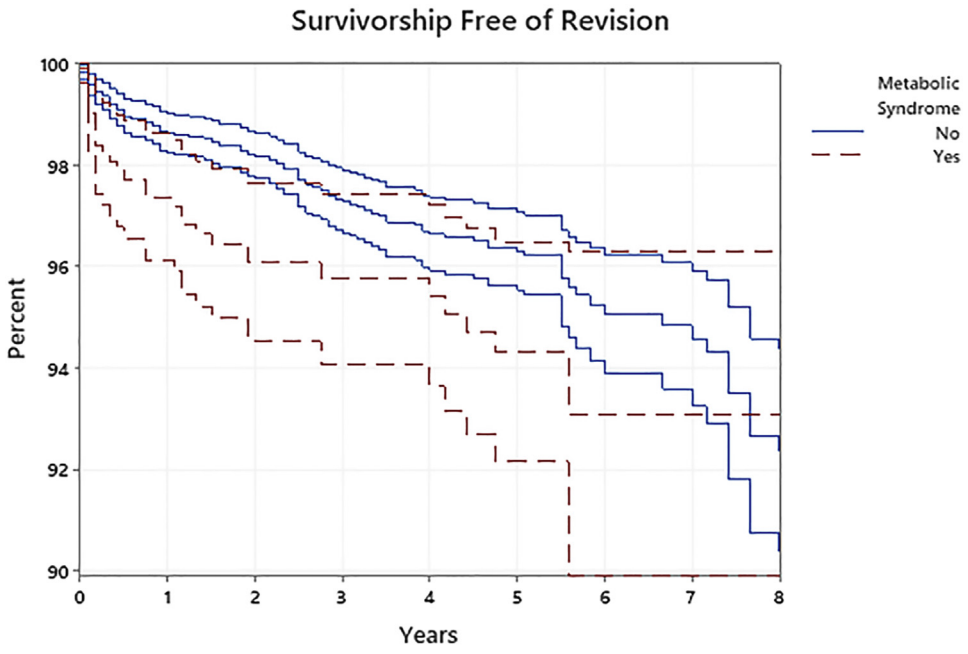

Figure 2 Kaplan-Meier survival curve for survivorship free from revision for any indication following shoulder arthroplasty in patients with and without metabolic syndrome.

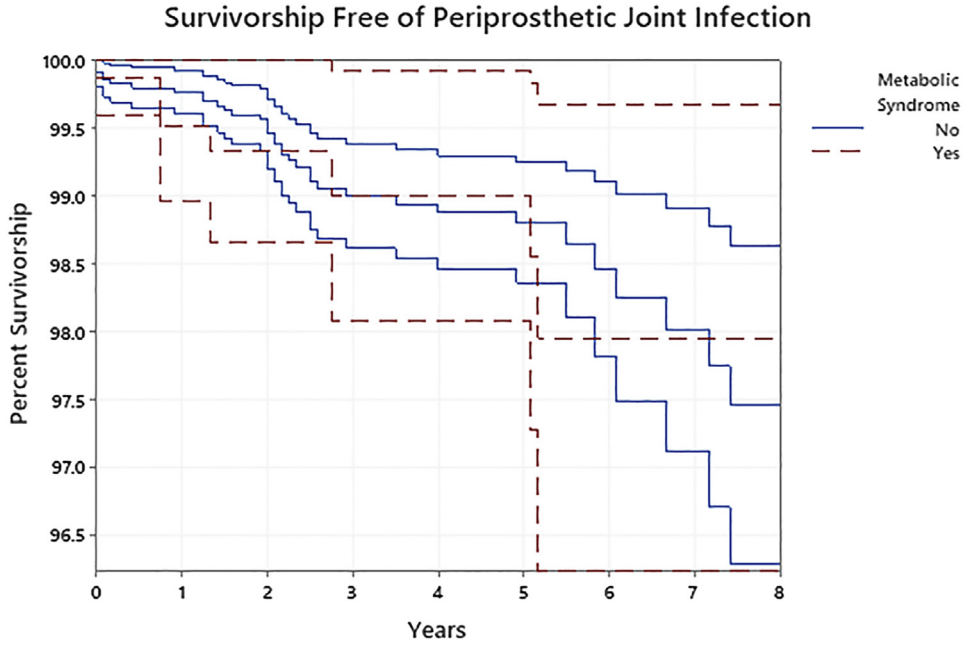

Figure 3 Kaplan-Meier survival curve for survivorship free from prosthetic joint infection following shoulder arthroplasty in patients with and without metabolic syndrome.

Given the increasing prevalence of MetS, several studies have been performed evaluating perioperative outcomes. Murphy et al[24] investigated in-hospital outcomes of patients with MetS by use of the NIS database. They reported a prevalence of MetS of 10.8% among shoulders treated between 2002 and 2011. MetS was found to be a risk factor for in-hospital adverse events, longer hospital stays, and non-homebound discharges. Garcia et al[10] similarly evaluated short-term outcomes of patients with MetS and obesity undergoing primary SA by use of the American College of Surgeons NSQIP database from 2005 to 2013. They reported no significant difference in postoperative complications or extended lengths of stay. Although both of these investigations raise awareness of MetS in SA, both report

secondary data analyses of administrative databases, which limit the clinical information available. Specifically, the NIS database used by Murphy et al was limited to a 20% sample of hospitals nationwide with follow-up until the time of discharge. The NSQIP database used by Garcia et al is a prospectively collected database and provides slightly improved follow-up but is limited to short-term reporting of outcomes, up to 30 days postoperatively. In our cohort, only 26.3% of complications were present by 30 days and 47.3% were present by 90 days postoperatively, which leaves the potential for the prior studies to miss complications that accumulate over time with additional follow-up.[29]

When complications were compared by implant type, our investigation did observe a slightly increased risk of complications with RSA compared with TSA (4.9% vs. 3.9%, $P = .014$). Of note, both rates were largely lower than the historical rate of surgical complications of 15%[6] and the more contemporary rate of 11%.[5] Regardless, elevated complications in RSA vs. TSA have recently been described by Botros et al,[5] who reported a 6.2 times higher odds of perioperative implant-related complications and 2 times increased odds of red blood cell transfusion with RSA compared with TSA by use of the NIS database. They demonstrated that instability and dislocation comprised the majority of perioperative implant-related complications. In our study, deep infection (1.9% vs. 0.7%, $P = .04$), instability (3.1% vs. 1.5%, $P = .04$), and DVT or PE (0.5% vs. 0.3%, $P = .03$) were observed at higher rates in RSA cases with MetS vs. those without MetS. These findings were supportive of our hypothesis that MetS may serve as a potential risk factor for complications; however, comparable findings were not observed in TSA cases.

Part of this observation may be due to some inherent differences between the RSA and TSA groups. Focusing on deep infections, revision for deep infection has been investigated and found to occur at an elevated rate in RSA patients as compared with TSA patients, even when adjusted for sex, age, diagnosis, and year of surgery.[22] Moreover, previous non-arthroplasty surgery is a risk factor for deep infection in primary SA patients,[35] which often is more common in RSA patients. With respect to instability, recent data have suggested that this complication is fairly unique to RSA,[26] which would support the minimal numbers observed in our TSA group. Previously described risk factors for DVT and/or PE in SA include higher BMI and diabetes, among others.[33] However, at present, there are no investigations that suggest higher DVT and/or PE rates in RSA vs. TSA. As such, this may be an undescribed finding; however, given the small numbers of complications in general, there is also potential for undersampling and data fragility.

There remain no data evaluating the effect of MetS on survivorship regarding reoperation, revision, and infection. A similar study by Ledford et al evaluating total hip arthroplasties at the same institution in patients with MetS showed significantly decreased survivorship free from reoperation, revision, and infection in patients with a preoperative diagnosis of MetS (C.L., unpublished data, February 2021). However, unlike after total hip arthroplasty, MetS did not have a significant effect on survivorship after primary SA. This is in contrast to our hypothesis that MetS would lead to higher rates of reoperations and revisions.

Although MetS is a grouping of individual diagnoses, obesity and diabetes mellitus individually have previously been associated with worse outcomes following SA.[23,27] With respect to obesity and SA, previous investigations have demonstrated increased rates of postoperative complications and revision surgery in patients with BMI > 50 kg/m^2,[34] as well as BMI > 35 kg/m^2.[16,34] However, Savin et al[28] recently reported a retrospective age-matched analysis demonstrating no difference among 5 BMI groups with respect to complications, reoperations, patient-reported outcome scores, and range of motion. This was further supported by a recent meta-analysis by Klein et al[15] that also showed no difference in complications between patients with a BMI < 30 kg/m^2 and those with a BMI > 30 kg/m^2.

Similarly to BMI, multiple studies have evaluated the effect of diabetes on outcomes following primary SA. Collectively, these studies have demonstrated increased risks of a prolonged hospital stay, non-routine discharge, and 90-day readmission.[9,17,18] These effects are more pronounced among patients with insulin-dependent diabetes mellitus who demonstrate increased risks of postoperative complications and blood transfusions,[9] suggesting worse outcomes with poorer control. One reason for the lack of difference in our study may be related to preoperative glycemic control. Within our institution, all patients with a history of diabetes are evaluated with a preoperative hemoglobin A_{1c} (HbA_{1c}) level. Currently, in our practice, elective SA is delayed until glycemic control is achieved as measured by an HbA_{1c} level $< 8\%$. Theoretically, tighter glycemic control may mitigate the potential risks associated with diabetes and its subsequent contribution to the MetS complication profile. However, Statz et al[32] performed a retrospective review of 406 SAs and demonstrated no difference in complications, reoperations, revisions, or infections with increased HbA_{1c} level as a continuous variable or as a dichotomous variable with a cutoff of 7.0%.

Overall, the evaluation of obesity and diabetes individually has failed to demonstrate a significant increase in longer-term complications, reoperations, revisions, and infections. When evaluated collectively in the setting of MetS, these findings are supported by our study, which found no association between MetS and postoperative complications, reoperations, or revision surgery after primary SA. The lack of correlation in our investigation could be due to several reasons. Most clearly, it could be that there is no actual correlation between MetS and SA. Alternatively, methodologic limitations of our investigation could have led to the inability to identify any correlations.

First, this is a retrospective analysis and subject to selection bias, as well as lack of randomization, and it did not capture any patients who were otherwise deemed unfit for surgery. We attempted to control for this through use of a prospectively collected institutional database and use of a comparative control group. Second, we used previously published and preset criteria used in other orthopedic studies to define MetS, but major variations in the exact definition of MetS still exist. We attempted to limit this by using previously published criteria within the orthopedic literature; however, even in this subset of studies, there continues to be variability that could confound this investigation. Third, the current database did not have any detailed preoperative information about the management of MetS and its comorbid conditions, as well as whether patients were adherent to any treatment, if present.

Conclusion

In this investigation, MetS was identified in 15.4% of patients undergoing primary SA and did not significantly alter the rate of postoperative complications or survivorship free from reoperation or revision surgery. However, in the RSA subgroup, complications were significantly more common in patients with MetS. Individual risk factors may be more appropriate than the umbrella diagnosis of MetS prior to aTSA.

Disclaimer

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