

ORIGINAL ARTICLE

Reduction in Gout Attacks Post Sleeve Gastrectomy in Al-Ahsa Hospital, KSA

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Correspondence to: Hamed Abdullah Alwadaani, Email: hawadaani@kfu.edu.sa**ABSTRACT**

Objective: The objective of this study was to assess the improvements in patients following sleeve gastrectomy as measured by a subsequent reduction in the incidence of gout attacks.

Methods: This retrospective study was conducted at the Bariatric Surgery Department, Al-Moosa Hospital, Al Mubarraz, Saudi Arabia, in 2018. Data for this study were extracted from the records of 3247 patients who had undergone sleeve gastrectomy. The data were analyzed using SPSS version 20.

Result: The study included 36 patients who fulfilled the study's inclusion criteria, with mean age of 39.6 ± 11.6 years, and 26 (72.2%) of them were male. A significant reduction ($p = 0.002$) in weight was observed in both male and female patients after sleeve gastrectomy; similarly, a significant reduction ($p = 0.003$) in uric acid levels was also found in both genders. Post-surgery acute gout attack was observed in five (45.5%) cases in the 1 month following surgery and in only one (9.1%) case after 9 months. Various factors were analyzed for their association with postoperative acute gout attack, but only higher baseline body mass index showed a significant association ($p = 0.001$).

Conclusion: The outcome of the study is that sleeve gastronomy significantly reduces gout attacks in obese patients. Along with this conclusion, it was also observed that age, gender, preoperative uric acid levels, and a higher body mass index are risk factors associated with the incidence of gout attacks.

Keywords: sleeve gastrectomy; acute gout attack; uric acid.

INTRODUCTION

Gout is known to be a common yet complex form of arthritis that can affect anyone and is usually seen to occur in the first metatarsophalangeal joint. Gout was first identified in 2640 BC by the Egyptians¹. It is both an inflammatory and a metabolic disease that is accompanied by severe attack of pain, functional impairment, swelling, and redness, along with reduced quality of life, presenting an economic burden for the individual. Gout is also associated with co-morbidities such as hypertension, type 2 diabetes, ischemic heart disease, kidney disease, and obesity, and it also impacts on mortality. Gout usually occurs when urate crystals accumulate in joints, or when there are recurrent attacks of acute arthritis in which monosodium crystals are present in synovial fluid leukocytes, causing intense pain. These urate crystals are formed when the body has excessively high levels of uric acid in the blood². Gout is mostly diagnosed according to its clinical presentation, namely swelling along with redness of the first metatarsophalangeal joint. Gout is also followed by hyperuricemia, which is defined as a plasma urate level higher than 7.0 mg/dL for males and 6.0 mg/dL for females. Gout and hyperuricemia affect approximately 4% to 21% of the US population³.

The frequency of gout is increasing worldwide, mainly due to population aging, changes in diet and lifestyle, and, most importantly, increasing rates of obesity. Recommendations from The American College of Rheumatology guidelines also suggest that weight loss be included in the management of gout for obese patients. Obesity and overweight have been associated with increased risk of gout. In numerous prospective cohort studies, obesity was observed to be the strongest risk factor for gout and hyperuricemia⁴. Various studies have shown that weight loss is associated with a reduction in serum uric acid levels along

with lower incidence of gouty arthritis. Gout usually occurs earlier in men than in women. Generally, in women, it occurs after menopause, as women reach elevated uric acid levels after menopause. In men, the production of uric acid can increase to three times that in women. According to body mass index (BMI), men with a BMI over 27.5 kg/m² are 16 times more likely to report gout attacks than men with a BMI of <20 kg/m².

The most effective method for weight loss intervention and long-term weight maintenance is bariatric surgery. Bariatric surgery is the most effective tool for achieving marked weight loss due to its safety. It has also been observed that the weight loss is maximal after 1–2 years, and over the years, it has been observed that bariatric surgery restores insulin sensitivity along with improving type 2 diabetes, blood pressure control, obstructive sleep apnea, and quality of life. The basic eligibility criteria for bariatric surgery include a BMI of >40 kg/m² or between 35 and 39.9 kg/m², along with comorbidity and previous unsuccessful weight loss efforts. The bariatric surgery rates are increasing sharply, and the surgical procedure usually results in a weight loss of 20–40 kg along with a 10–15 kg/m² reduction in BMI. It was also demonstrated in many studies that weight loss after bariatric surgery results in reduced serum uric acid levels in people, mostly those with obesity and metabolic syndrome¹. There are few side effects and postoperative complications, which are seen to be common in obese patients; these include venous thromboembolism, anastomotic leak, dumping syndrome, and nutritional deficiencies. In various studies, it was also observed that adoption of a low-purine diet, which is usually recommended for gout, reduced the risk of gout attacks after bariatric surgery. A study suggested that patients who ingested large amounts of seafood had a 51% greater risk of developing gout than

patients who had a smaller amount of seafood in their diet. Therefore, bariatric patients should not eat a large amount of seafood or meat in order to ensure their diet is unlikely to cause gout attacks⁵. Commonly, bariatric patients are instructed to eat a high-protein, low-carbohydrate diet post-operatively and are also restricted from drinking alcohol. Monitoring of serum uric acid levels should begin shortly after the surgery and accordingly treated to prevent an increase in the incidence of gout attacks⁶. Thus, it is recommended that preoperative prophylactic treatment should be given to patients with a history of gout.

METHODOLOGY

Approval for this retrospective study was obtained from the institutional review board of the College of Medicine, King Faisal University, Al-Ahsa, Saudi Arabia, (No#2020/12/41). The sample consisted of the records of 3247 patients who had undergone sleeve gastrectomy at the Bariatric Surgery Department, Al-Moosa Hospital, from January 2015 to December 2018. The inclusion criteria for this retrospective study, which were identical for both groups, were (i) age 20–60 years and (ii) body mass index (BMI) of ≥ 34 for men and ≥ 38 for women. The exclusion criteria were (i) previous sleeve gastrectomy, (ii) peptic ulcer disease or gastric reflux, (iii) active malignancy during the past 5 years, and (iv) myocardial infarction during the past 6 months. The following data were collected from the patients' records: age; gender; BMI; patient compliance; weight reduction at 3-, 6-, and 12-months post sleeve gastrectomy; serum uric acid levels before and at 3, 6, and 12 months after surgery; and other co-morbidities such as diabetes mellitus, hypertension, hyperlipidemia, etc. Values of serum uric acid that exceeded 6.9 mg/dL were considered elevated. The records were also searched for whether patients had complained of gout attack during the year before and the year after sleeve gastrectomy. The duration between the sleeve gastrectomy and the acute gout attack was calculated. The sleeve gastrectomy procedures were performed by a single operator.

Statistical Analysis: Statistical analysis was done using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were obtained, and the Shapiro–Wilk test was used to confirm the normal distribution of the continuous data. Independent t-tests were applied to compare the BMI and the serum uric acid before surgery between those who had acute postoperative gout and those who did not. Exact probability tests were applied to evaluate the association between the record of acute gout attack (Yes vs. No); and the following factors: age group, gender, compliance, other co-morbidities, pre-surgical acute gout attack, and serum uric acid (normal vs. elevated) at the three time-points of 3, 6, and 12 months after surgery. Statistical significance was set at $p < 0.05$.

RESULTS

The study included 36 patients whose ages ranged from 21 to 63 years old, with a mean age of 39.6 ± 11.6 years. Exactly 26 (72.2%) of the patients were male, and 33.3% of the patients had other chronic health problems, including DM (19.4%), HTN (8.3%), and hyperlipidemia (5.6%). Compliance with treatment was reported by 12 (33.3%) of the patients. The body mass index values of the study patients ranged from 33.8 to 60.5 kg/m², with a mean value of 45.6

kg/m² (Table 1). Figure 1 shows the change in the obese patients' weight after sleeve gastrectomy, with a significant reduction in weight for both male and female patients: from 137 to 79.2 kg for male patients and from 118 to 64.2 kg for female patients, with recorded statistical significance ($p = 0.002$). Figure 2 illustrates the change in uric acid level after sleeve gastrectomy, showing a significant reduction in the level for both male and female patients: from 8.6 to 6.3 mg for male patients and from 8.0 to 5.6 mg for female patients, with recorded statistical significance ($p = 0.003$). Considering pre- and postoperative gout attacks among obese patients who underwent sleeve gastrectomy (Table 2), exactly 31 (86.1%) of the patients experienced an acute gout attack during the year before surgery, while only 6 (16.7%) of them experienced an acute postoperative gout attack; these 6 cases occurred within 1 month (5 cases; 45.5%) to 9 months (only 1 case; 9.1%) after surgery. Table 3 shows factors associated with acute postoperative gout attack among obese patients who underwent sleeve gastrectomy.

Table 1: Bio-demographic data of obese post sleeve gastrectomy patients.

Bio-Demographic Data	No	%
Age in years		
<40 years	19	52.8%
>40 years	17	47.2%
Gender		
Male	26	72.2%
Female	10	27.8%
Other co-morbidities		
None	24	66.7%
DM	7	19.4%
HTN	3	8.3%
Hyperlipidemia	2	5.6%
Compliant with treatment		
Yes	12	33.3%
No	24	66.7%
Body mass index		
Range	33.8–60.5	
Mean \pm SD	45.6 \pm 7.1	

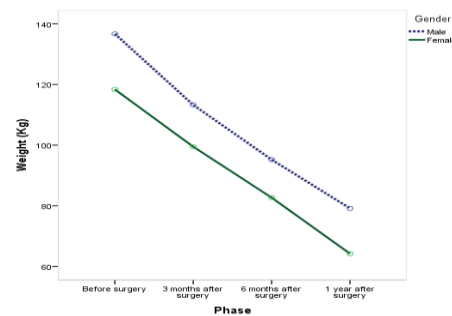


Figure 1: Weight changes by gender before and after surgery among obese patients who underwent sleeve gastrectomy.

Acute postoperative gout attacks were insignificantly higher among young patients (<40 years) than among older patients (>40 years) (26.3% vs. 5.9%, respectively; $p = 0.101$). Also, their incidence was higher among male patients than among female patients (19.2% vs. 10.0%, respectively; $p = 0.506$). Exactly 16.1% of those who had an acute gout attack before surgery also had one after surgery, compared to 20% of those who did not ($p = 0.829$). Expe-

riencing acute postoperative gout attack was associated with higher baseline body mass index (54.4 vs. 43.8 kg/m², respectively), with recorded statistical significance (p = 0.001). Additionally, in table 4 an acute postoperative gout attack was significantly associated with a higher pre-operative uric acid level (9.6 mg vs. 8.2, respectively; p = 0.020).

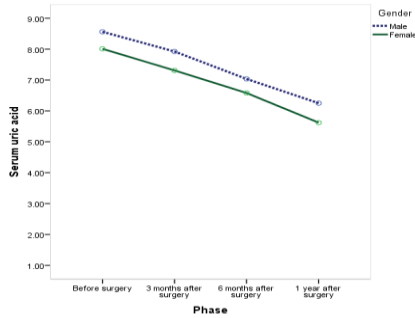


Figure 2: Serum uric acid changes by gender before and after surgery among obese patients who underwent sleeve gastrectomy.

Table 2: Pre- and postoperative gouty attacks among obese patients who underwent sleeve gastrectomy.

Gouty Attacks	No	%
Acute gouty attack the year before surgery		
Yes	31	86.1%
No	5	13.9%
Acute postoperative gouty attack		
Yes	6	16.7%
No	30	83.3%
Time of that attack (months)		
1	5	45.5%
2	2	18.2%
4	2	18.2%
5	1	9.1%
9	1	9.1%

Table 3: Factors associated with acute postoperative gouty attack among obese patients who underwent sleeve gastrectomy.

Factors	Acute Postoperative Gouty Attack				p-Value
	Yes		No		
	No	%	No	%	
Age in years					
<40 years	5	26.3%	14	73.7%	0.101
>40 years	1	5.9%	16	94.1%	
Gender					
Male	5	19.2%	21	80.8%	0.506
Female	1	10.0%	9	90.0%	
Other co-morbidities					
No	5	20.8%	19	79.2%	0.343
Yes	1	8.3%	11	91.7%	
Acute gouty attack the year before surgery					
Yes	5	16.1%	26	83.9%	0.829
No	1	20.0%	4	80.0%	
Compliance with treatment					
Yes	1	8.3%	11	91.7%	0.343
No	5	20.8%	19	79.2%	
BMI					
Mean ± SD	54.4 ± 4.9		43.8 ± 6.1		0.001 *,#
Pre-operative uric acid					
Mean ± SD	9.6 ± 1.7		8.2 ± 1.2		0.020 *,#

p: Exact probability test #: independent t-test * p < 0.05 (significant).

Table 4: Distribution of postoperative uric acid level with respect to history of postoperative acute gouty attack.

Uric Acid Level	Acute Postoperative Gouty Attack				p-Value
	Yes		No		
	No	%	No	%	
Uric acid before surgery					
Elevated	6	100.0%	30	100.0%	
Acid 3 months after surgery					
Normal	0	0.0%	14	46.7%	0.032 *
Hyperuricemia	6	100.0%	16	53.3%	
Acid 6 months after surgery					
Normal	2	33.3%	20	66.7%	0.126
Hyperuricemia	4	66.7%	10	33.3%	
Acid 1 year after surgery					
Normal	4	66.7%	26	86.7%	0.230
Hyperuricemia	2	33.3%	4	13.3%	

p: Exact probability test * p < 0.05 (significant).

DISCUSSION

Gout refers to a metabolic disorder of purines marked by hyperuricemia and the deposition of urate crystals in articular and extra-articular tissues ⁷. The risk factors for gout include obesity and overweight, hypertension, chronic kidney disease, high levels of blood cholesterol, and metabolic syndrome. Obesity is one of the strongest risk factors for developing hyperuricemia and gout ⁸⁻¹¹. Other risk factors for gout include increasing age, genetic factors, alcohol consumption, consumption of seafood and meat, use of diuretics, and medications such as angiotensin-II receptor antagonists and β-blockers ¹². The objective of this research paper was to determine whether bariatric surgery reduces the incidence of gout attacks in highly obese patients. Based on the study outcomes, we observed that surgical procedures for weight loss, such as bariatric surgery, may trigger hyperuricemia followed by acute gout attacks immediately after the surgery, with attacks trailing off in the subsequent months. Our study found that post sleeve gastrectomy surgery, the rate of gout attack was significantly reduced among the participants. In total, 86.1% of the participants experienced acute gout attacks in the year before surgery, but only 16.7% of them experienced acute postoperative gout attacks. Of the patients who experienced acute postoperative gout attack, 45.5% of patients experienced them within a month after surgery, but as time passed by, the number of attacks was reduced. Nine months after the surgery, only one person experienced an acute gout attack, representing 9.1% of the patients who experienced acute gout attack after the surgery. The reduction in the number of acute gout attacks in the postoperative period is related to the uric acid level in the patients. At the preoperative stage, all the patients had elevated uric acid levels. Three months after the surgery, all six of the patients who experienced acute postoperative gout attacks had hyperuricemia, whereas of the patients who did not suffer acute postoperative gout attack, 53.3% had hyperuricemia and the remaining 46.7% had a normalized uric acid level. Six months after the surgery, of the patients who suffered acute postoperative gout attack, 33.3% had a normalized uric acid level, while 66.7% of them still had hyperuricemia. The reduction in the

uric acid level could be a reason why the number of acute gout attacks began to decrease among the patients who suffered acute postoperative gout attacks. By the one-year mark of the patients who suffered acute postoperative gout attacks, 66.7% had a normalized uric acid level, while 33.3% still had hyperuricemia. By that time, only one patient (9.1%) experienced acute gout attacks. The patients who did not suffer any acute postoperative gout attack early after surgery also did not suffer them later on.

This study finding is in line with the findings of other studies in literature that showed that weight loss through bariatric surgery reduced the serum uric acid level in the patients, thereby reducing gout attacks¹³ focused their study on evaluating the effect of bariatric surgery on serum uric acid levels in people with obesity with or without hyperuricemia, and they monitored the uric acid level in patients for a year after they underwent bariatric surgery. The researchers found that immediately after the surgery, within 1 to 7 days, the serum uric acid decreased significantly by 26% but flared up by 6% at the one-month mark before decreasing again substantially in the months going forward. They observed that the patient groups with a history of previous gout experienced a mean reduction of 39% in the serum uric acid level. This observation was supported by^{14,15}

Our research also found that in the initial few days, up to a month or two, the frequency of acute gout attacks increased in some patients following bariatric surgery, but that frequency trailed off as the months passed by after surgery, and by the one-year mark, the frequency of acute gout attacks was significantly reduced in the patient population. This also goes in line with the literature. A study conducted on 99 morbidly obese patients who underwent bariatric surgery to evaluate the preoperative and postoperative frequency of gout attacks³. The comparison group, which underwent other procedures, consisted of 56 patients. The patients that underwent bariatric surgery showed a significant reduction in the level of uric acid 13 months after the surgery, and the frequency of gout attacks in the bariatric group witnessed within one month after the surgery (23.8%) was reduced significantly to 8% at the 13-month mark.³ thus concluded that the postoperative frequency of gout attacks in bariatric surgery patients was significantly higher than that of gout attacks witnessed in patients undergoing other procedures. However, the frequency of gout attacks decreased substantially between the first postoperative month and the 12-month mark. This finding that weight loss through bariatric surgery eases the symptoms of gout attacks and hyperuricemia in the long term but increases the frequency of early acute gout attacks in the short term after surgery was also supported by^{5,16,17}.

A few researchers have investigated the reason for the gout attack flare-ups following bariatric surgery. Jeong and Jeon (2019) in their study observed that the surgical site can be an indicator of gout flare-ups immediately after surgery. They found that the most common surgical site that led to gout flare-ups was gastrointestinal. Another study found that gastrointestinal surgery, such as bariatric surgery, is related to the development of gout flare-ups following surgery¹⁸. In bariatric surgery, which is gastrointestinal, the length of perioperative fasting lasts longer than that for other types of surgeries on other organs, and a high-purine diet, consisting

of seafood and meat, is allowed later for patients who undergo bariatric surgery than for patients who undergo other types of surgery. Therefore, patients who undergo bariatric surgery increase the likelihood of gout flares by prolonging the fasting period and starvation, which brings down their uric acid level rapidly¹⁸.

Our study found that in the year before the bariatric surgery, 86.1% of patients experienced gout attacks, but in the postoperative period, only 16.7% experienced gouty attacks, and 83.3% of participants did not experience any gout attack after surgery at all. Our finding is in line with other results in the literature that bariatric surgery reduces the incidence of gout.¹⁹ conducted a study to investigate the long-term impact of bariatric surgery on the frequency of gout and hyperuricemia, and they came to the finding that bariatric surgery reduced the frequency of gout in obese patients by up to three percentage points more than other procedures over 15 years. During follow-up, the researchers found out that at the 15-year mark, patients who had undergone bariatric surgery showed reduced incidence of hyperuricemia by 12 percentage points.

Our study also found out that the occurrence of acute postoperative gout attacks was related to a higher body mass index. This finding has received some support in the literature.²⁰ revealed that a reduction in BMI leads to decreased risk and frequency of gout attacks, while an increase in BMI increases the risk and frequency of gout attacks, suggesting that there lies a correlation between obesity and the frequency of gout attacks. However, this finding has opposing views in the literature as well.²¹ made a comparison between a large database of newly diagnosed gout patients in Great Britain and matched controls and found a substantial reduction in the correlation between obesity and recurring gout attacks compared to that between obesity and the risk of gout attacks.²², too, found no association between the risk of recurrent gout attacks and BMI. Another finding of our research was that the frequency of acute postoperative gout attacks was significantly correlated to a higher preoperative uric acid level. This finding is in line with the revelation made in several studies^{18,23} that post-surgical gout flare-ups are positively correlated to a presurgical uric acid level of ≥ 9 mg/dL. This validates the risk factor of a positive correlation between high preoperative levels of uric acid and acute gout attacks after surgery.

Our research also found that gender and age are risk factors associated with increased incidence of gout attacks immediately after bariatric surgery. In our study, we observed that 26.3% of gout attacks that took place immediately after the bariatric surgery were among patients younger than 40 years of age. Our study also found a higher occurrence of acute postoperative gout attacks among male patients. These findings also coincide with findings in the literature.²⁴ stated that gout is essentially a male disease, rather than a female disease. Male patients younger than 65 years of age have a fourfold greater likelihood of experiencing gout attacks²⁴. However, as age increases, the frequency of gout attacks is more equally distributed among the sexes. In women, female hormones lower the level of uric acid, which then rises after a woman goes through menopause. In patients aged above 65 years, the frequency of gout attacks and hyperuricemia is found in the ratio of one woman to every three men⁶.

In the literature, gout is often found to be correlated with other comorbidities such as hypertension, diabetes mellitus, cardiovascular disease, and renal impairment, among others. According to ²⁵, the treatment of these comorbidities may have some influence on the development of gout. More than 75% of patients with malignant hypertension, 25% of patients with untreated hypertension, and 50% of patients on diuretics have hyperuricemia ²⁶. On the other hand, 40% of patients with gout have hypertension ²⁷. According to ²⁸, many medications used for hypertension management affect uric acid levels. According to ²⁹, patients with cardiovascular disease are at high risk of hyperuricemia. Additionally, medications used for cardiovascular disease may affect uric acid levels and contribute to the development of hyperuricemia and gout. Uric acid levels and diabetes are observed to be inversely related. People with prediabetic conditions are at higher risk of hyperuricemia and gout, but people with established a condition of diabetes may be at a lower risk of the same. This inverse relationship is stronger for type 1 diabetic patients than for type 2 diabetic patients ³⁰⁻³² found a positive correlation between hyperlipidemia and hypercalcemia, and they also found that both are more common in men than women. In contrast to the general consensus in the literature, we did not find any noticeable correlation between postoperative gout attacks and the influence of comorbidities in our study. This could be because 66.7% of the sample population in our study did not have any comorbidities. Of the six patients who suffered postoperative gout attacks, five did not have any comorbidities. This shows that the presence of comorbidities might not have any direct influence on the frequency of gout attacks after bariatric surgery. Unfortunately, hardly any studies in the literature have investigated the correlation between the presence of comorbidity and acute gout attacks after bariatric surgery. More investigation in this regard through future studies may be required to arrive at a definite conclusion.

Our study is not without limitations. The first limitation is that the study was conducted on a small population group of 36 patients. Studying a larger population group might have given a more conclusive picture. Secondly, even though our study was successful in establishing the correlation of gender and age with gout, it was not able to establish a correlation between gout attacks and comorbidities, primarily because a large percentage of the sample population did not have any comorbidities. Thirdly, our study did not explore whether ethnicity is a risk factor for gout. According to ³³, a higher prevalence of gout is observed in black Americans than in white Americans. Our study did not consider the races of participants; therefore, it remains unclear whether the patients who suffered acute gout attacks after bariatric surgery belonged to a high-risk race group.

CONCLUSIONS

Gout is a common form of arthritis associated with several risk factors, such as hypertension, diabetes mellitus, hyperlipidemia, obesity, cardiovascular disease, age, gender, and preoperative uric acid level, among others. The objective of our study was to investigate whether bariatric surgery reduced the incidence of gout attacks in obese patients. We observed that, immediately after bariatric surgery, the frequency of gout attacks increased before trailing off as the months passed, especially after the one-year mark. Our

finding is supported by the literature. Therefore, we can conclude that bariatric surgery reduces gout attacks in obese patients.

We also observed that age, gender, preoperative uric acid level, and higher body mass index are the risk factors associated with gout attacks. However, we were unable to establish a correlation between the incidence of acute postoperative gout attacks after bariatric surgery and the presence of comorbidities. The sample size of our study population was also small, and we did not factor in the potential influence of ethnicity on postoperative gout attacks following bariatric surgery, which should be investigated in future research studies.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by Ethics Committee of College of Medicine, King Faisal University, Saudi Arabia.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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