Complex Evaluation of Obese Lithiasis Patient in Perspective of Metaphylaxis

C. Pricop[1,2,4], G. Botnariu[2,3], A. Stan[1], M. Nikolić [2], D. Puia[1,2,4], A. Miron[1], M. Ivanuță[1,4]

[1] Department of Urology, "C. I. Parhon" Hospital, Iași, Romania
[2] "Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[3] Diabetes, Nutrition and Metabolic Disease Department, "St. Spiridon" Emergency Clinical Hospital, Iasi, Romania
[4] "Michel Daudon" Center for Morphological and Spectrophotometric Analysis, Iasi, Romania

ABSTRACT

Introduction and Objectives. The management of lithiasis patients is more complex as it has other associated comorbidities. This program aims to multidisciplinary evaluation of obese lithiasis patients from the perspective of lithiasis metaphylaxis.

Materials and Methods. As the obesity is a significant risk factor for developing the recurrence of kidney stones, we initiated in the Urology Department of the Clinical Hospital "Dr. C. I. Parhon", in collaboration with the Diabetes, Nutrition and Metabolic Diseases Department within the "St. Spiridon" Emergency Clinical Hospital of Iasi, a program that aims to monitor obese lithiasis patients. This program offers valuable recommendations for weight normalization assisted by a dietitian and preventing lithiasis recurrence as a long-term goal. This program is in progress.

Results. Between February and October 2021, we identified 245 overweight / obese patients who had at least one episode of reno-ureteral stones in the last two years. After the clinical, paraclinical, anthropometric, and nutritional analysis, a personalized diet was elaborated. The diet was calculated according to the individual caloric needs and adapted to the specific type of lithiasis. From 245 obese lithiasis patients invited, 144 accepted the urological and nutritional assessment, and of these, only 62 followed the recommendations, and 18 reached the ideal weight. Of the 144 patients monitored, 11 patients had an excess weight up to 10 kg, 20 patients weighed between 10-15 kg, 20 patients weighed between 15-20 kg, 45 patients weighed between 20-30 kg, and 48 patients had a surplus more than 30 kg over the ideal weight.

Conclusions. Although approximately one in three obese lithiasis patients accepted active monitoring and followed the recommendations, taking into account the beneficial impact on general health and comorbidities (hypertension, diabetes, dyslipidemia, etc.), this program is helpful to the obese lithiasis patient.

Key-words: diet, kidney stones, nutrition, obesity.

Correspondence to:
Dr. Andreea Stan M.D.
"C. I. Parhon" Clinical Hospital, Department of Urology
50 Carol I av., code 700503, Iași, Romania
Tel: +40746795109
e-mail: stanandreeaelena@yahoo.com

INTRODUCTION AND OBJECTIVES

Obesity is a disease with long-term effects that affects many people around the globe. In adults, a body mass index (BMI)between 25 and 30 kg/m2 is defined as overweight; but BMI over 30 kg/m2 is considered obesity [1]. The etiopathogenic links between obesity and lithiasis have been analyzed in numerous studies.

It is shown that BMI increases the risk of kidney stones: 25-29.9 kg/m2 (1.3 times), 30-34.9 kg/m2 (1.62 times), over 35 kg / m2 (1.81 times) [2]. At the same time, it was shown that in obese women, there is increased urinary excretion of sodium, uric acid, sulfate, and phosphate. In obese men, there is increased urinary excretion of sodium, oxalate, uric acid, sulfate, and phosphate, compared to the normal population [3].

In patients with visceral obesity detected imagistically, a much higher risk of developing uric acid nephrolithiasis and calcium oxalate has been identified [4]. BMI and increased abdominal circumference have been positively associated with the risk of this condition [5].

We must keep in mind that patients with a tendency to obesity develop more often calcium oxalate stones. On the other hand, people with uric acid stones tend to be overweight [6,7].

MATERIALS AND METHODS

In this ongoing program, we contacted patients who went to the Urological Clinic in Iasi and had at least one episode of kidney stones in the last two years. The program's main objectives are to monitor the weight loss regimen in the lithiasis patient and to harmonize the weight loss recommendations with those of lithiasis metaphylaxis. Patients completed a questionnaire regarding eating habits, fluid intake, treatments for chronic diseases, physical activity. We enrolled 144 patients, and first evaluation was performed biochemical and imaging investigations: complete blood count (CBC), C-reactive protein, renal function, liver function, total cholesterol, triglycerides, glycemia, ionogram, uric acid, urinalysis, and as an imaging examination: reno-bladder ultrasound +/- radiography or intravenous urography. After clinical and paraclinical evaluation, the patient was referred to a dietitian, where anthropometric and nutritional analysis was performed using a body analyzer by magnetic bioimpedance type Beurer, model BF 1000, determining both weights, total visceral fat, segments fat, and the total percentage of water in the body, abdominal circumference, and height. The basal and active caloric requirements, the ideal weight, and the excess weight were also calculated. Last but not least, the patients were evaluated and counselled psychologically for motivational support.

After analyzing all clinical, paraclinical, anthropometric data, and individual food preferences, a personalized nutritional program was developed for each patient in collaboration with the dietitian. Subsequently, periodic anthropometric reassessments were performed, and patients received a new personalized program calculated and adapted to the new values.
Urinary pH correction was monitored using standardized pH indicator paper provided free of

charge at the first evaluation. Alkalization of urine was performed with Alkasolv® (20 mEq potassium citrate, 11 mEq magnesium citrate, 25 mg vitamin B6) 1-2 sachets/day, and acidification with Acidurin® (Methionine 500 mg and Solidago virgaurea Extract 100 mg) 1-3 tablets/day, depending on urinary pH.

RESULTS

From 144 patients, only 62 strictly followed urological and nutritional. Of the 62 who actively collaborated in the program, 50 came to a second anthropometric reassessment. Twenty patients followed only the diet, eight only carefully monitored the urinary pH. We mention that 54 patients came only to the first evaluation, later withdrawing from the program citing various personal reasons (lack of time, financial impossibility, recommendations too tricky to follow). We mention that from 144 patients, 29.86% (n = 43) had previous failed attempts to lose weight.

The group of patients (n=62) who collaborated with the multidisciplinary team were aged between 32 and 74 years, with an average of 54.51 years, 46.77% being women (n=29), and 53.22 % (n=33) men. The initial weight of the patients ranged from 67.1 kg to 137.4 kg, with an average of 97.73 kg +/- 17.21 kg standard deviation. The excess weight over the ideal weight had an average of 28.67 kg +/- 14.23 kg, the minimum being 1.45 kg and the maximum 74.9 kg.

Image 1 shows the distribution of women and men according to the excess kilograms over the adjusted ideal weight. The largest share of males is between 20-30 kg (n=12), 19.35%, equal to females, but in the group of excess kilograms over 30.

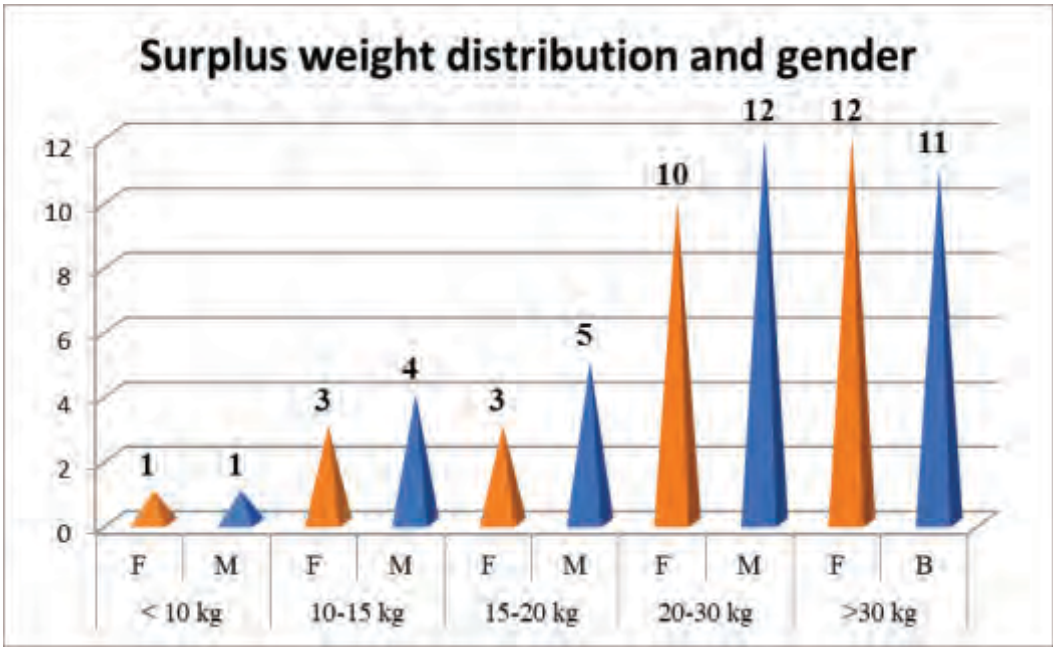


Image 1. F=Women; M=Men

26 patients out of the 62 (41.93%) had failed attempts to lose weight before introducing the program.

From 62 patients, 29 (46.77%) have passed the stones spontaneously (1, 2, 3 episodes), and for 52.9% (n=39), an endourological intervention was required (PCNL, ureteroscopy, ESWL) - Table 1.

	Attempted weight loss		Spontaneous elimination of kidney stones		Urologic surgery	
	YES	NO	YES	NO	YES	NO
Number of participants	26	36	29	33	39	23
Percent	41.93%	58.06%	46.77%	53.22%	52.9%	37.09%

Table 1

Most overweight lithiasis patients are aged between 51-60 years, the surplus being between 20-30 kg (10 patients), followed by those aged between 61-70 years and over 30 kg (9 patients) - Image 2.

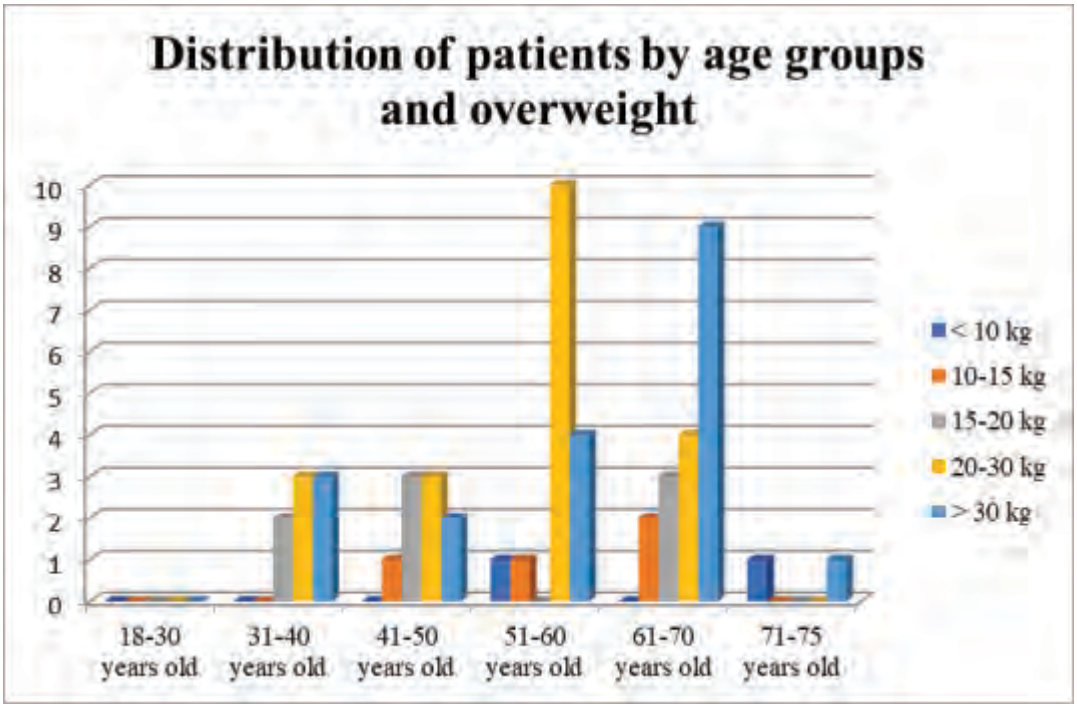


Image 2

The vast majority of patients had calcium oxalate lithiasis in a percentage of 79.03% (n = 49), followed by uric acid lithiasis 19.35% (n = 12) and brushed 1.61% (n = 1). It should be mentioned that the method of determining the composition of the calculi was either by spectrophotometry and morphological analysis performed at the "Michel Daudon" Center for Morphological and Spectrophotometric Analysis in Iasi for 17.36% (n = 25) of them, while for 82.64% by approximating the composition according to the radiological appearance and the urine summary.

Table 2 shows the average values of total cholesterol, serum triglycerides, and urinary pH measured at the first evaluation of patients. Urinary pH values are inversely proportional to the degree of obesity. However, cholesterol and triglyceride values are not affected by weight gain under 30 kg, but above this value, the average exceeds the upper limit.

	Average total cholesterol	Average triglycerides	Average urinary pH
< 10 kg	240.44 mg/dL	116.45 mg/dL	5.5
Between 10-15 kg	196.17 mg/dL	102.72 mg/dL	5.8
Between 15-20 kg	191.79 mg/dL	177.35 mg/dL	6.25
Between 20-30 kg	187.28 mg/dL	122.01 mg/dL	5.75
> 30 kg	200.93 mg/dL	136.84 mg/dL	5.4

Table 2

During the clinical and paraclinical analyzes, known comorbidities were recorded (diabetes - eight patients or arterial hypertension - 28 patients, gout - three patients), but unknown or neglected pathologies were also identified, such as suspicion of endometrial neoplasm and ovarian neoplasm, irritable bowel syndrome, hypertension and diabetes.

The weight loss rate is directly proportional to the collaboration period, the maximum being 19.6 kg in 19 weeks, meaning a recommended rate of 1 kg/week. The mean weight loss for total patients who complied with the indications is 6.87 kg with a standard deviation of +/- 5.86 kg. 18 patients reached and maintained the ideal weight, following the maintenance program; they came to monthly anthropometric reassessments and communicating the value of urinary pH, weekly.

It should be mentioned that patients who follow the urological and nutritional recommendations maintain their urinary pH within normal limits (5.8-6.2) by diet or with the help of medication (Alkasolv or Acidurin, respectively). Seven patients progressively decreased the doses of antihypertensive and lipid-lowering medication and subsequently, with the opinion of the cardiologist, discontinued these treatments; four patients normalized their blood sugar levels or decreased their dose of insulin / oral antidiabetics, one patient gave up the medication for hyperuricemia, and one patient progressed from stage F3 fibrosis to stage F2.

DISCUSSIONS

Although such a multidisciplinary project is a novelty in the landscape of Romanian medicine, we determined, with regret, that too many patients are unwilling to adherence to a monitored weight loss program, important in renal lithiasis metaphylaxis. The reasons invoked were various, such as lack of time, demanding service, inconsistency with the food lifestyle of family members, or financial

impossibility to purchase the recommended food. Particular situations create difficulties in establishing a coherent strategy that aims to achieve the two significant goals of weight loss and lithiasis recurrence:

· Obese patients with uric acid stones and Type II Diabetes have difficulty accepting the necessary restriction of animal proteins. But meat is the only diabetic food that can be eaten unweighted, which is why this restriction causes some discomfort to the patient.

Unlike calcium oxalate, acidic urine (pH below 5.5) is recognized as the primary abnormality responsible for the appearance of uric acid nephrolithiasis because it becomes insoluble at urinary acid pH [27]. Most uric acid stones are compact, with a core containing anhydrous uric acid crystals surrounded by concentric laminarly arranged uric acid columnar anhydrous crystals [29]. It becomes apparent that alkalizing urine with Alkasolv in these patients becomes a long-term strategic goal.

Another particular situation is that of patients with calcium phosphate or struvite stones, which develop in alkaline urinary pH. The difficulty, in this case, is that the vegetables/salads frequently recommended in weight loss alkalize the urine, which motivates, once again, the monitoring and acidification of urinary pH [8].

Calcium phosphate is found in either the classic form of calcium phosphate (apatite), hydrogen phosphate, calcium dihydrate (brushite), or tricalcium phosphate. Pure calcium phosphate stones are scarce [28]. Apatite is the most common crystal found in kidney stones, frequently present in the form of a powdery mass that fills the gaps between other types of crystals, mainly those of calcium oxalate [29].

We have tried, without success, to find in the specialty literature, information, and recommendations for patients with the special situations mentioned above. This is why dietitians have established a carefully monitored personalized nutritional plan.

It should be mentioned that patients communicate daily to the team the value of urinary pH, both in the morning and in the evening, and the dietitian changes the menu of patients who declare an abnormal urinary pH value in real-time.

Factors that can precipitate the onset of obesity are varied and complex, including primary causes such as genetic predisposition and many secondary variables: chaotic nutrition, lack of physical activity, use of specific pharmacological agents, etc. [9].

Most alarming statistics on global obesity (over two billion people) include overweight and obese people, in other words, those with a BMI over 25. However, over 60% of obesity-associated pathologies and mortality occur at a BMI over 30 [10]. Vidwans et al., in 2017, noted that 16% of people with high BMI also had insulin resistance; this is a significant risk factor (80%) for the subsequent onset of type II diabetes [11].

Metabolic syndrome may precede or precipitate other changes in target organs, such as the liver, producing non-alcoholic steatohepatitis; this pathology has also been associated with nephrolithiasis risk. S. Kim conducted a cohort study of 208578 Korean adults, of whom 112324 men (53.9%) and 96254 women (46.1%) demonstrated a positive relationship between fatty liver and age, BMI, blood glucose level, uric acid, total cholesterol, LDL-cholesterol, triglycerides, TGP, TGO, GGT, insulin resistance, and plasma C-reactive protein levels. Out of a total of 1054887.6 people followed, 16442 were identified with nephrolithiasis. Men with fatty liver had a higher risk of developing urolithiasis; subjects under 50 were more prone to the association between the 2 pathologies [12]. The same hypothesis was supported by In Chul Nam and colleagues, concluding that patients suffering from non-alcoholic steatohepatitis have a higher risk, with 19% developing kidney stones in a study of 1.812 patients underwent abdominal-pelvic computed tomography to identify liver parenchyma and the presence of urolithiasis [13].

In our statistics, out of the 144 patients, at the first paraclinical evaluation: 27 people had blood glucose above 110 mg/dL, two patients had hepatocyte lysis, and 51 patients had dyslipidemia.

Both obesity-induced metabolic syndrome and

insulin resistance are risk factors for the development of urolithiasis. Moreover, the financial resources invested in treating obese patients with kidney stones are higher, as the recurrence is higher and the treatment more difficult to perform [26].

Obese patients have an increased risk of suffering from a lithiasis episode. A study by Semins et al. performs a retrospective analysis of a database for five years of all patients diagnosed or treated for a renal lithiasis episode. Of the 95598 people, 3257 had urolithiasis, and obesity was associated with most patients [14]. Rendina et al. [15] performed renal ultrasonographs on patients with significant abdominal circumference and found kidney stones in 220 patients out of 2132. Similar to these results, in a long-term study (mean 19 years), on a study of 4000 Japanese without kidney stones, Yoshimura and colleagues showed that increased BMI was associated with 258 participants with kidney stones [16]. A recent study, published in the Investigative and Clinical Urology Journal in 2021, demonstrates the link between Basal Metabolic Rate (BMR - the caloric requirement for the preservation of vital functions), which is directly proportional to body weight, and 24-hour urinary metabolic profile. In patients with elevated BMR, there is increased urinary excretion of constituents that may precipitate and form stones, such as calcium or uric acid [17].

In one study, Daudon compared the composition of the stones with comparable anthropometric data for more than 2,000 patients, concluding that high BMI poses a risk for developing uric acid stones [18].

Evan et al. stated that the incidence of lithiasis composition in the general population is about 80% calcium oxalate, associated with calcium phosphate. Uric acid stones are about 9%, struvite 10%, and cystine 1% [19].

Analysis of over 400 stones from obese patients showed that calcium oxalate monohydrate (66%) and uric acid (63%) were the most common significant components, followed by calcium oxalate dihydrate (31%) [6].

Patients who form uric acid stones are generally obese. Obese patients have a frequency of 53.1% for uric acid stones compared to 42.7% for calcium oxalate stones [20].

Obesity is most commonly linked to eating habits. Starting from this hypothesis, Trinchieri and collab. analyzed dietary changes in postmenopausal female patients, and increased caloric intake was associated with urolithiasis, increased BMI and reduced physical activity [7]. On the other hand, adopting diets to prevent high blood pressure by increasing the intake of fruits and vegetables decreases urinary supersaturation with salts that can cause kidney stones [21]. One of the main reasons for initiating this program.

Obesity is also associated with low urinary pH, demonstrated by numerous studies known as a risk factor for uric acid precipitation. A study by Maalouf et al. demonstrates the inverse relationship between BMI and urinary pH [22]. In another study by Pigna et al., visceral obesity is associated with decreased urinary pH [23]. Not only obese but also overweight people had a decrease in urinary pH, according to another study published by Shavit et al. in 2015 [24].

Patients suffering from obesity frequently have hypocitraturia (54%) and hyperuricosuria (43%) compared to normal-weight people [6]. Taylor and Curhan [25] and Powell et al. [3] demonstrate the increased excretion of oxalate, uric acid, phosphate, sodium, sulfate, and cysteine in obese patients compared to normal weight.

CONCLUSIONS

A monitoring program for obese lithiasis patients proves to be helpful to those who understand the harmfulness of obesity while offering the possibility of identifying silent, neglected comorbidities, as well as improving the therapeutic strategies of associated pathologies.

By constantly monitoring the evolution of these patients, we have serious reasons to believe that in a reasonable time, the risk of lithiasis recurrence will be significantly reduced, as well as the negative impact of associated comorbidities.

The evaluation of the benefits of this program from

a urological perspective will be done after five years to establish, statistically as possible, the risk of lithiasis recurrence in the obese patient who becomes a normal weight.

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