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Epidemiological Study: Research of Urolithiasis in Those with Metabolic Syndrome in Western of Algeria

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Abstract **Background and objective:** Closer the links between these two pathologies that have alarmingly propagated into all the world without exception by assessing the epidemiological parameters. **Patients and Methods:** An epidemiological investigation was conducted in the city of Sidi Bel Abbes (western Algeria). Our study was performed on patients files at the endocrinology service during three years [(**12/2006 -11/2009)**] and the methodology of the epidemiological analysis was based in two axes: descriptive (Prevalence & Incidence) and analytic epidemiology (exposed /non exposed: Relative Risk (RR)). **Results:** The epidemiological study of 600 files shows that prevalence of Metabolic Syndrome (MetS) according the NCEP ATP III diagnostic criteria is 42.66% which is 1,7 times higher among women compared to men and that of Urinary Lithiasis (UrL) in the general population is 6.16% whereas in those with MetS is 11.32%. We also noted an increase in the incidence of MetS and its risk factors parallel to that of the UrL. The results show that the Relative Risk of urinary lithiasis is > 1 among patients who have the MetS than those unscathed and this proves that metabolic syndrome is a risk factor of urinary lithiasis; We also noted that the risk is 1,7 times higher among men compared to women. **Conclusions:** Our study shows the emergence in the incidence of MetS and its risk factors over time. This emergence has affected also UrL in those with MetS. It is therefore essential to identify this insidious couple.

Keywords Metabolic syndrome, Urinary lithiasis, Risk Factors, Epidemiology

1. Introduction

Metabolic syndrome is a worrying entity which does not cease increasing not only in the developed countries but in the whole world. It is well established that the subjects reached of this syndrome are three times exposed at the risk to undergo a heart attack or a stroke compared to those which are unscathed [1]. Moreover, it seems that the frequency of all disturbances of the metabolic syndrome coincides with the urinary lithiasis.

As urinary lithiasis, metabolic syndrome or syndrome X is multifactorial. Several epidemiological studies have focused on the search for a pathophysiological relationship between the different components of this syndrome (obesity, hypertension, diabetes, dyslipidemia) and urolithiasis.

In metabolic syndrome, insulin resistance and renal ammoniagenesis defect are the main disorders causing lithogenesis. [2]. The main consequence of renal insulin resistance induced by metabolic syndrome is a deficit in production and excretion of ammonium ions, which leads to lower urinary pH and a decrease in the solubility of uric acid [3-5]. Thus, patients who are overweight or obese, the excessive animal protein intake tend both to lower the urinary pH by increasing the urinary excretion of phosphate and the uricosuria, promoting component of uric acid super-saturation [3, 6].

The first study suggesting this relation was conducted out by Pak and al. the group of Dallas characterized the biochemical profile of patients presenting a idiopathic uric lithiasis, compared to a reference group paired for the age and the BMI, these patients presented a hyperuricemia, an acid urinary pH but curiously a defect of urinary urate excretion [7]. After that, many studies showed an increased incidence of stones with overeating and overweight among both men and women [8, 9].

In Algeria, we are also concerned in the occurrence of metabolic syndrome and urinary lithiasis, but we lack the clinical and epidemiological data.

The objective of this study is to make the links closer between these two pathologies that have alarmingly propagated into all the world without exception by assessing the epidemiological parameters.

2. Population and Methods

2.1. Participants

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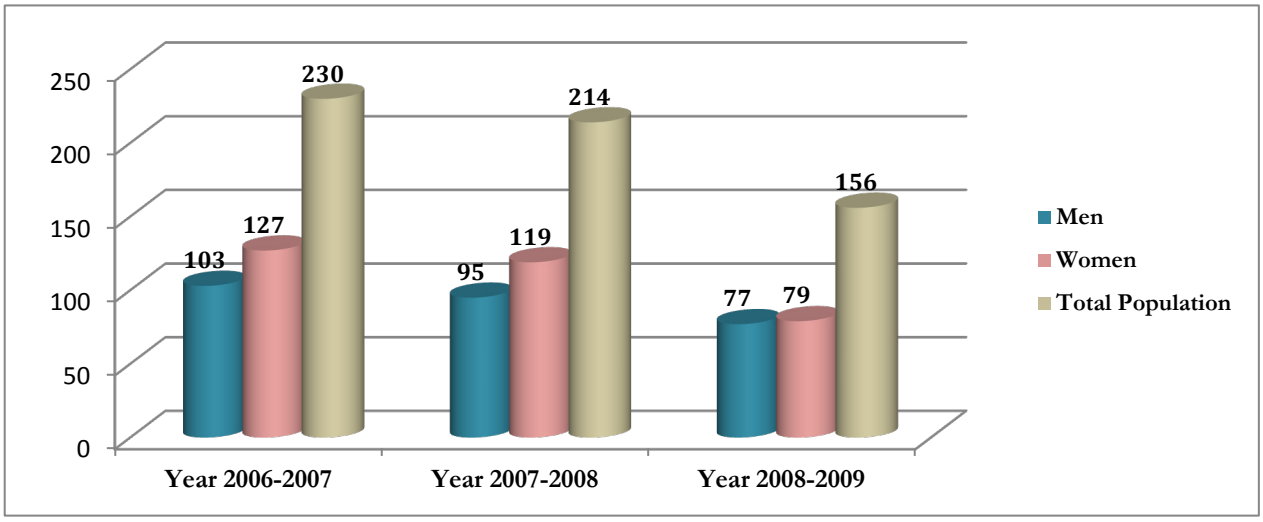

Figure 1. Repartition of study population by Year

An epidemiological investigation was conducted in Sidi Bel Abbes (city in northwestern Algeria). Our study was performed on patients' files at the endocrinology service of the University Hospital Dr HASSANI Abdelkader during three years [(12/2006 - 11/2007) (12/2007 - 11/2008) (12/2008 - 11/2009)].

600 files have been treated to seek subjects with the metabolic syndrome and within this population we searched patients who suffer or have suffered from the urinary lithiasis **(Figure 1)**.

Patients with metabolic syndrome are defined according to the criteria of National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) [10].

2.2. Epidemiological Statistics

"Epidemiology is the study of the distribution and determinants of health-related states in specified populations, and the application of this study to control of health problems." [11]. Epidemiologic studies may be [12] descriptive, organizing data by time, place, and person; or [13] analytic, incorporating a case-control or cohort study.

Our data were seized into Excel database. After coding, they were treated in:

2.2.1-Descriptive epidemiology (Prevalence & Incidence): It describes the distribution of health events and their determinants in the population. It is divided into:

- ✓ Prevalence survey: This is a survey to determine the total number of people presenting the phenomenon (metabolic syndrome, urinary lithiasis, type 2 diabetes, obesity .....) in a population. The prevalence rate is the ratio of the number of cases on the manpower of the population during the investigation period (12/2006 to 11/2009).
- ✓ Incidence survey: This is a survey that estimates the number of new cases of a phenomenon of health in a population during a given period [(12/2006 to 11/2007), (12/2007 to 11/2008) & (12/2008 to 11/2009)].

2.2.2-Analytical epidemiology (exposed /non exposed: RR) They analyze the relationship between exposure to a risk factor and a phenomenon of health. Etiological investigations are always comparative (they compare two different groups).

The investigation exposed / unexposed estimate the relative risk of the disease (RR). Relative risk is the ratio of risk among patients who have the metabolic syndrome on the risk of those unscathed. [14] The interpretation of the relative risk is as follows:

- RR = 1: no relationship between the risk factor and disease
- RR> 1: increased risk of disease (risk factor)
- RR <1: reduced risk of disease (protective factor)

3. Results and Discussion

3.1. Descriptive Epidemiology

3.1.1. Prevalence study

- ❑ The distribution of the population by age shows that **55.63%** of men have an age range [45-74] years Vs **53.84%** women **(Table 1)**.
- ❑ The epidemiological study of 600 files shows that the prevalence of metabolic syndrome according the diagnostic criteria of NCEP ATP III, 2002 is **42.66 %** which is higher among women compared to men (**15.66%** Men Vs **27%** Women).

This prevalence is higher than that noted in the Algerian population by the National Institute of Public Health (NIPH) presented by Dr. Majid Atek, whose prevalence was 26.33% [15].

Another survey, conducted in 2008, at the city of Tlemcen (western Algeria) on a sample of 1088 subjects, shows that

the prevalence of metabolic syndrome according to the criteria of NCEP ATP III was 17.4% [16].

- ✓ The got results note that women are predisposed to MetS than men with a prevalence **1.7 times ≈ (2)** higher among women than men.

Higher prevalence in female than males were reported by many researchers in different countries [17-19].

That was also confirmed by the study conducted by the epidemiologist Atek (NIHP) precise that the prevalence of MetS among women is **1.8 times (≈ 2)** higher that observed in men [15].

- ✓ Moreover, the distribution of different components of metabolic syndrome shows that the highest prevalence is that of Type 2 Diabetes **(76,83%)** followed by Abdominal obesity **(49,16%)**, Hypertension (**49%**) and dyslipidemia (**29,5%**).

There was a remarkable difference in the prevalence of abdominal obesity among both sexes which (**36%** men vs. **60,30%** women). **(Figure 2)**

Abdominal obesity is considered as diagnostic element and pathogenetic factor of MetS [20].

Descriptive cross-sectional study on a representative sample of the population of the health sector of Ain taya (Blida) whose 1,511 individuals shows that the prevalence of abdominal obesity was very high (53.5%) of which 23,2% in men and 68,8% among women. Abdominal obesity among women was much higher compared to men [21].

- ❑ The results shows also that the prevalence of urinary lithiasis in the general population is **6,16%** whereas in those with metabolic syndrome is **11,32%. (Table 2)**

Table 1. Repartition of study population by sex and age

Sex	Age group					Total
	[14-29] No. (%)	[30-44] No. (%)	[45-59] No. (%)	[60-74] No. (%)	[75-90] No. (%)	
Men	45 (16.4)	50 (18.1)	**75 (27.3)**	**78 (28.4)**	27 (9.8)	275 (45.9)
Women	59 (18.1)	70 (21.5)	**98 (30.1)**	**77 (23.7)**	21 (6.5)	325 (54.1)
Total	104 (17.3)	120 (20)	**173 (28.8)**	**155 (25.8)**	48 (8)	600 (100)

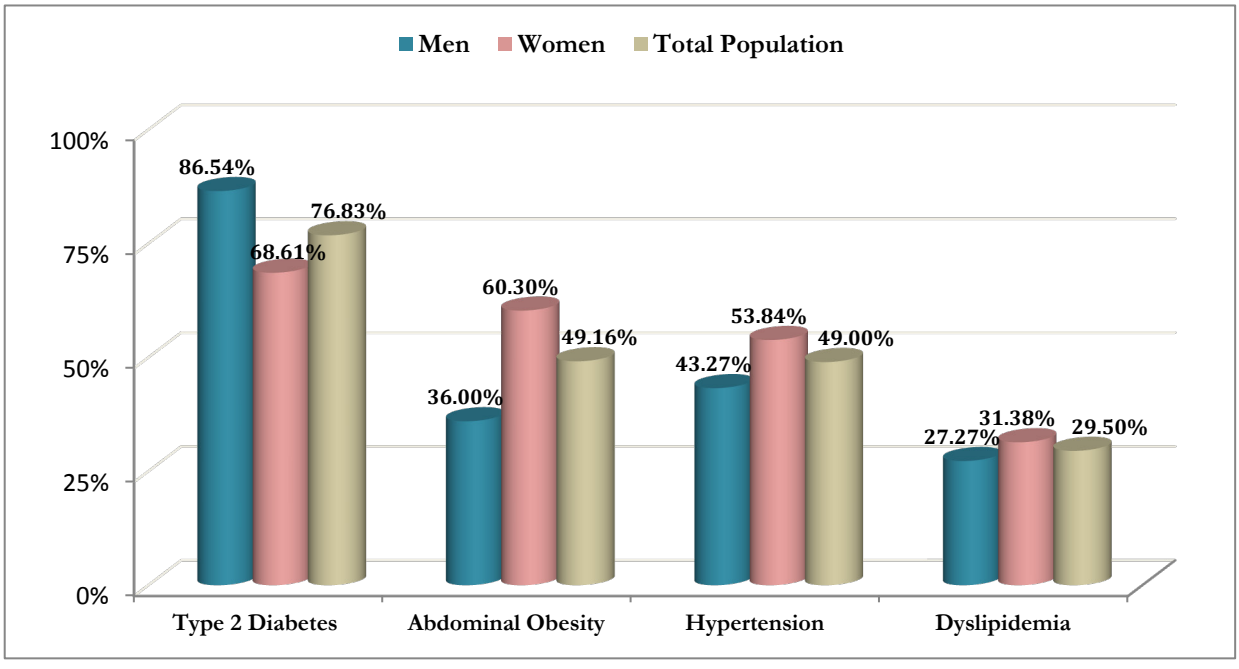

Figure 2. Incidence of different component of Metabolic Syndrome

Table 2. Prevalence of UrL among all population and among population with MetS

	UrL in General population	UrL in MetS Population
Men	3.16 %	5.46 %
Women	3 %	5.85 %
Total	**6.16 %**	**11.32 %**

3.1.2. Incidence study

- We also noted an increase in the incidence of metabolic syndrome parallel to that of the urinary lithiasis during the three years of the survey.

✓ **Year (12/2006 to 11/2007):**

The incidence of metabolic syndrome as well as the urinary lithiasis is presented in **Table 3**.

We note that the incidence of MetS is **1.7 times** higher among women than men while that of UrL in those with MetS is **2** times higher among men than women.

Several studies showed that the incidence of urinary lithiasis is higher in men. Ekane and al. reported a prevalence of UrL in Belgium almost three times higher among men (12%) than women (5%) [22].

The incidence of the risk factors of MetS during the year 2006-2007 is shown in **Table 4**.

✓ **Year (12/2007 to 11/2008):**

For this year, the investigation shows that the incidence of MetS is **1.9 times higher** among women compared to men and that of UrL is higher in men whereas that of UrL in those with MetS is higher in women (**Table 3**).

We note an increase in the incidence of Url in those with MetS which is **4.3 times higher** in this year compared to the previous year. We also note a remarkable difference in the incidence of (abdominal obesity and/or BMI>25) and in that of hypertension between men and women (**Table 4**).

✓ **Year (12/2008 to 11/2009):**

In this year, the incidence of MetS is **1.5 times** higher in women compared to men and that of UrL in those with MetS is also higher among women (**Table 3)**.

During the year 2008-2009, there was an increase in the incidence of various diseases **(Table 4)**.

- The incidence of MetS during the three years show an remarkable increase with **1.4** and till **1.9 times**.

The importance of metabolic syndrome comes from its increasing prevalence worldwide and its association with a remarkable increase in cardiovascular morbidity and mortality [23].

According to the NHANES study, the prevalence of MetS between: 1988-1994 = 24% and from 1999 to 2000 = 27%, p = 0.088 [24].

- We note also a big increase in the incidence of UrL in those with MetS compared to the previous years which is **1.6 times** higher and till **6.9 times**.
- And even in the different components of MetS parallel to that of MetS and UrL which

✓ Type 2 Diabetes: **1.08 times** higher and till **1.1 times**

Several recent studies showed a correlation between the lithiasic disease and the type 2 diabetes [24-26].

In 2001, Daudon and Jungers reported a high prevalence of uric acid stones in lithiasic diabetic compared to lithiasic non-diabetic [27].

✓ Obesity: **1.04 times** higher and till **1.2 times**.

Studies showed an increase in the incidence of urinary lithiasis with overeating and overweight in men as among women [28, 29].

Multiple groups have investigated urine chemistries to better characterize the links between BMI and urinary stone disease. Ekeruo and colleagues [30] for example, noted that obese (BMI >30) urinary stone formers most commonly had evidence of hypocitraturia (54%) and hyperuricosuria (43%) compared with non-obese stone formers. Taylor and Curhan [31] and Powell and colleagues [6] similarly investigated urine chemistries, showing increased urinary excretion of oxalate, uric acid, phosphate, sodium, sulfate, and cysteine in obese versus non-obese patients.

✓ Hypertension: **1.14 times** higher and till **1.2 times**.

In the study of Borghi and al., the risk factors of lithiasis found among hypertensive patients are overweight and the presence of urinary anomalies, in particular the hypercalciurie, the hyperoxalurie, the hyperuricurie and the emission of urine supersaturated out of calcium oxalate [32].

✓ Dyslipidemia: **1.11 times** higher and till **1.3 times**.

A recent study by Inci and colleagues [33] found that total cholesterol levels were significantly higher in stone formers compared with patients who do not form stones, with the association noted to be particularly prominent for calcium oxalate and uric acid stone formers.

3.2. Analytic Epidemiology

- The results show so that the Relative Risk of urinary lithiasis is > 1 among patients who have the MetS than those unscathed and this proves that metabolic syndrome is a risk factor of urinary lithiasis. **(table 5&6)**

$$\mathbf{RR} = \frac{\text{Incidence rate of UrL in group with MetS (Exposed)}}{\text{Incidence rate of UrL in group without MetS (Unexposed)}}$$

Metabolic syndrome has become the subject of increased urologic research because of continued observations that it is associated with an increased risk of urinary stone disease. West and colleagues [34] examined the association between the number of metabolic syndrome traits and risk of urolithiasis using a national sample of patients in the United States. Prevalence of kidney stones increased with the number of traits, from 3% with 0 traits to 9.8% with 5 traits.

Taylor and colleagues, [8] in an analysis of 3 large prospective cohorts of nearly 250,000 individuals, showed that the RR of incident kidney stone formation for people weighing more than 100 kg, compared with those weighing less than 68.2 kg, was 1.44 in men, 1.89 in older women, and 1.92 in younger women. Using a BMI cutoff of 30, the RRs were 1.33, 1.90, and 2.09, respectively.

- We also noted that the risk of urinary lithiasis is **1,7 times** higher among men with MetS compared to women with MetS.

Table 3. Incidence of MetS and UrL in general population and in those with MetS

	Men	Women	All Population
Year 2006 - 2007			
MetS	**16.08%**	**27.39%**	**43.47%**
UrL in General population	**2.17%**	**1.73%**	**3.91%**
UrL in MetS Population	**02%**	**01%**	**03%**
Year 2007 – 2008			
MetS	**13.55%**	**25.70%**	**39.25%**
UrL in General population	**3.27%**	**2.80%**	**6.07%**
UrL in MetS Population	**5.95 %**	**7.14 %**	**13.09 %**
Year 2008 – 2009			
MetS	**17.94%**	**28.20%**	**46.15%**
UrL in General population	**4.48%**	**5.12%**	**9.61%**
UrL in MetS Population	**9.72%**	**11.11%**	**20.83%**

Table 4. Incidence of different risk factors of MetS

	Men	Women	All Population
Year 2006 - 2007			
(Fasting Glucose (FG) ≥ 1,26g/l) and/or TreatmenT (TRT)	**38.26%**	**37.82%**	**76.08%**
Abdominal obesity and/or Body Mass Index (BMI) >25	**24.78%**	**32.60%**	**57.38%**
Systolic Blood Pressure (BP)/Diastolic Blood Pressure and/or TRT	**19.13%**	**29.13%**	**48.26%**
Dyslipidemia and/or TRT	**11.73%**	**13.91%**	**25.64%**
Year 2007 – 2008			
(FG ≥ 1,26g/l) and/or TRT	**38.78%**	**34.57%**	**73.35%**
Abdominal obesity and/or BMI>25	**14.95%**	**33.17%**	**48.12%**
Systolic BP/Diastolic BP and/or TRT	**17.75%**	**27.57%**	**45.32%**
Dyslipidemia and/or TRT	**12.61%**	**17.75%**	**30.36%**
Year 2008 – 2009			
(FG ≥ 1,26g/l) and/or TRT	**42.94%**	**39.74%**	**82.68%**
Abdominal obesity and/or BMI>25	**23.71%**	**36.53%**	**60.24%**
Systolic BP/Diastolic BP and/or TRT	**23.71%**	**31.41%**	**55.12%**
Dyslipidemia and/or TRT	**13.46%**	**20.51%**	**33.97%**

Table 5. Distribution of patients compared with the exposure (MetS) and the disease (UrL)

	Group With Mets (Exposed)		**Groupe without MetS (Not Exposed)**	
	Lithiasics	**Not Lithiasics**	**Lithiasics**	**Not Lithiasics**
Men	**14**	**80**	**19**	**162**
Women	**15**	**147**	**18**	**145**
All	**29**	**227**	**37**	**307**

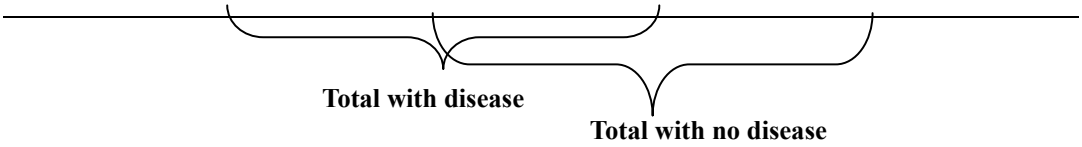

Table 6. Incidence rate of UrL in exposed and unexposed Groups

	Group exposed (With MetS)	Group unexposed (Without MetS)
Men	**0.14**	**0.10**
Women	**0.09**	**0.11**
All	**0.11**	**0.10**

Many studies showed that Stone disease typically affects adult men more commonly than adult women. Men are affected two to three times more often than women [35-37].

4. Conclusions

Our study shows the emergence in the incidence of MetS and its risk factors over time which there was an increase of **1.2 times**.

Moreover, the results show that women are more predisposed to Metabolic Syndrome than men (**1.7 times ≈ (2)** higher among women than men).

This emergence has affected also Urinary Lithiasis and especially in those with metabolic syndrome which there was an increase of **1.5 times** and till **6.9 times**.

We note that the incidence of urolithiasis in men is higher compared to women in the general population while in the population affected by the metabolic syndrome, in women is higher compared to men. This can be explained by the fact that women are more predisposed to Metabolic Syndrome.

Our study show that metabolic syndrome is a risk factor for urinary lithiasis. The different components of syndrome X (type 2 diabetes, hypertension, visceral obesity and dyslipidemia) coincide with urolithiasis. It is therefore essential to identify this insidious couple and to recognize and seek the metabolic syndrome in the management of urolithiasis.

Prevention of urinary lithiasis related to metabolic syndrome is based on the prevention of metabolic syndrome plus the commonly recommended measures to urolithiasis patients.

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