

## Stone symptoms and urinary deposits

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**Abstract** There is a general belief among the public and clinicians that urinary stone problem is always associated with symptoms like pain, dysuria and haematuria. Many patients stop medical treatment when they are symptom free and return with excruciating pain, dysuria and haematuria either alone or in combination. The objective of this study was to determine stone activity in an individual patient by assessing the urinary deposits at the time of the visit to the stone clinic and correlate with the presence or absence of symptoms at that time. 418 patients who attended the stone clinic in 2007 with proved urinary stone disease, including stone, colic and crystalluria, were studied. Presence or absence of symptoms at the time of presentation was recorded. Minimum of two samples of urine was collected (early morning and random) to assess the presence and extent (1–5) of urinary deposits namely red blood cells (RBC), pus cells (PC), calcium oxalate monohydrate (COM), calcium oxalate dihydrate (COD), uric acid and phosphate. The scores obtained were correlated with the presence or absence of symptoms by logistic regression. Of the 418 patients studied, 238 had symptoms and 180 had no symptoms. The total score of the deposits of patients with symptoms was 1,215 with a mean of 3.39

per patient against the score of 350 in the patients without symptoms with a mean of 2.99. This difference was not statistically significant. The total values and mean scores of the urinary deposits of all patients grouped together were RBC 561 (3.51), PC 434 (3.29), COM 177 (3.34), COD 237 (3.25), phosphate 113 (3.23) and uric acid 43 (1.95). Comparison of the total values and mean scores of the deposits of the patients with and without symptoms showed the variations as RBC 428 (3.51) versus 133 (3.5) PC 341 (3.38) versus 93 (3.0), COM 143 (3.25) versus 34 (3.78), COD 190 (3.88) versus 47 (1.96), phosphate 76 (3.3) versus 37 (3.1) and uric acid/ammonium urate 37 (1.95) versus 6 (2.0). Of these, the RBC, PC, uric acid and phosphates were not significantly different between the two groups. However, the presence of COD was significantly more in patients with symptoms ( $P < 0.05$ ) and COM was significantly more in patients without symptoms ( $P < 0.05$ ). It is concluded that the presence or absence of symptoms does not alter the presence and extent of urinary deposits significantly in the urinary stone patients. COD was more in symptomatic patients and COM was more in the asymptomatic patients. This contrast could be due to the morphology of the COD crystal which is dipyramidal and produces injury to urothelium whereas COM is dumbbell shaped and produces lesser injury and lesser symptoms.

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### Introduction

The symptoms of urinary stone disease can some times be excruciating and unbearable. There is a general belief among the public and clinicians that urinary stone problem

is always associated with symptoms like pain, dysuria and haematuria. Many patients stop medical treatment when they are symptom free and return with excruciating pain, dysuria and haematuria either alone or in combination. There are patients who present with end stage renal failure because they had no symptoms till date. Many a time, stone has been identified in the urinary system following identification of crystals in the urinary deposits on routine examination [1]. Oxalate was probably the first crystal reported in the literature [2]. It is reported that normal individual may also present crystals in the urine [3]. Some of these may produce symptoms like pain and haematuria. Symptomatic crystalluria may be considered pathological. Some of these may be secondary to metabolic disease and some may be idiopathic. Various crystals have been recognised in human urinary deposits [4]. The objective of this study was to determine stone activity in an individual patient by assessing the urinary deposits at the time of the visit to the stone clinic and correlate with the presence or absence of symptoms at that time.

## Methods

Four hundred and eighteen patients who attended the stone clinic in 2007 with proved urinary stone disease, including stone, colic and crystalluria, were studied. Using a proforma (Table 1), the total symptom score of the patient was calculated at the time of presentation by allotting points ranging from 0 to 5 for each category of symptom, namely colicky pain, dull loin pain, low back ache, low abdominal pain, haematuria, burning sensation and dysuria. The total score would range from 0 to 35. The presence or absence of symptoms at the time of presentation was recorded. Minimum of two samples of urine was collected (early morning and random) to assess the presence and extent (1 to 5) of urinary deposits namely red blood cells (RBC), pus cells

(PC), calcium oxalate monohydrate (COM), calcium oxalate dihydrate (COD), uric acid and phosphate. The higher score of the two was selected for further analysis. The scores obtained were correlated with the presence or absence of symptoms by logistic regression.

Presence and extent (0–5) of urinary deposits namely RBC, PC, COM (whewellite crystals), COD (weddellite crystals), phosphate crystals and uric acid/ammonium urate crystals (Table 2), the extent of crystal clumping, crystal aggregation, presence of persistent urine deposits in early morning urine (EMU) and random samples and combinations of COM + COD, oxalate + uric acid and oxalate + uric acid + others were also recorded and calculated making a score ranging from 0 to 60. The scores thus obtained were converted to percentages. The symptom scores calculated earlier were then correlated with the urine deposit scores to assess correlation coefficient by logistic regression analysis.

## Results

Of the 418 patients studied, 238 had symptoms and 180 had no symptoms. Among the 238 patients with symptoms, 176 had significant urinary deposits and 62 had no deposits. Among the 180 patients without symptoms, 112 had deposits and 68 had no deposits. Among the 418 patients totally studied, 288 had significant urinary deposits. Of these, 206 had symptoms at the time of deposit study and 82 had no symptoms. Of the 130 patients with no significant urinary deposits, 32 had symptoms and 98 had no symptoms. The total score of the deposits of patients with symptoms was 1,215 with a mean of 3.39 per patient against the score of 350 in the patients without symptoms with a mean of 2.99. This difference was not statistically significant.

The percentages of patients with and without symptoms among the three groups of stone, colic and crystalluria

**Table 1** Proforma for calculating symptom score of the patients attending the stone clinic

| Symptom            | Score |         |          |                 |                  |                  |
|--------------------|-------|---------|----------|-----------------|------------------|------------------|
|                    | 0     | 1       | 2        | 3               | 4                | 5                |
| Colicky pain       | Nil   | Vague   | Mild     | Moderate        | Severe           | Agonising        |
| Dull loin pain     | Nil   | Vague   | Mild     | Moderate        | Severe           | Agonising        |
| Low back ache      | Nil   | Vague   | Mild     | Moderate        | Severe           | Agonising        |
| Low abdominal pain | Nil   | Vague   | Mild     | Moderate        | Severe           | Agonising        |
| Haematuria         | Nil   | Turbid  | Cloudy   | Red             | Occasional frank | Continuous frank |
| Burning sensation  | Nil   | Minimal | Moderate | Terminal severe | Terminal excru   | Continuous excru |
| Dysuria            | Nil   | Minimal | Moderate | Terminal severe | Terminal excru   | Continuous excru |

Total symptom score = /35 = %

Excru excruciating

**Table 2** Proforma for calculating urine deposit score of the patients attending the stone clinic

| Urine deposit                  | Score |        |          |      |      |          |
|--------------------------------|-------|--------|----------|------|------|----------|
|                                | 0     | 1      | 2        | 3    | 4    | 5        |
| Red blood cells                | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Pus cells                      | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Whewellite crystals            | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Weddellite crystals            | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Phosphate crystals             | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Uric acid/ammonium urate       | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Crystal clumping               | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Crystal aggregation            | Nil   | +      | 2+       | 3+   | 4+   | Plenty   |
| Persistent deposits EMU/random | Nil   | 1–3E/R | 1–3 both | 4–5E | 4–5R | 5/5 both |
| Combination of COM and COD     | Nil   | 1–3E/R | 1–3 both | 4–5E | 4–5R | 5/5 both |
| Oxalate + uric acid both       | Nil   | 1–3E/R | 1–3 both | 4–5E | 4–5R | 5/5 both |
| Oxalate + uric acid + others   | Nil   | 1–3E/R | 1–3 both | 4–5E | 4–5R | 5/5 both |

Total deposit score = /60 = %

**Table 3** Classification of patients based on diagnosis, presence of symptoms and extent of urinary deposits

| Patient group diagnosis | With symptoms | Without symptoms | Positive deposits  | Negative deposits | Total       |
|-------------------------|---------------|------------------|--------------------|-------------------|-------------|
| Stone                   | 76 (31.9%)    | 47 (26.1%)       | 697/82 (30.36%)    | 0/41              | 123 (29.4%) |
| Colic                   | 123 (51.7%)   | 84 (46.6%)       | 1,205/140 (52.48%) | 0/67              | 207 (49.5%) |
| Crystalluria            | 39 (16.3%)    | 49 (27.2%)       | 394/66 (17.16%)    | 0/22              | 88 (21.1%)  |
| Total score             | 775/238       | 0/180            | 2,296/288          | 0/130             | 418         |

**Table 4** Details of scores of symptoms and extent of urinary deposits

| Parameter                      | Score |       |       |        |        |        | Total   | Mean score |
|--------------------------------|-------|-------|-------|--------|--------|--------|---------|------------|
|                                | 0     | 1     | 2     | 3      | 4      | 5      |         |            |
| Colicky pain                   | 325   | 32    | 64/32 | 27/9   | 48/12  | 40/8   | 211/93  | 2.27       |
| Dull loin pain                 | 362   | 24    | 40/20 | 18/6   | 16/4   | 10/2   | 108/56  | 1.93       |
| Low back ache                  | 352   | 19    | 64/32 | 27/9   | 16/4   | 10/2   | 136/66  | 2.06       |
| Low abdominal pain             | 385   | 9     | 24/12 | 18/6   | 12/3   | 15/3   | 78/33   | 2.36       |
| Haematuria                     | 384   | 6     | 32/16 | 9/3    | 16/4   | 25/5   | 88/34   | 2.59       |
| Burning sensation              | 383   | 4     | 28/14 | 27/9   | 12/3   | 25/5   | 96/35   | 2.74       |
| Dysuria                        | 395   | 6     | 12/6  | 18/6   | 12/3   | 10/2   | 58/23   | 2.52       |
| Red blood cells                | 258   | 7/7   | 54/27 | 117/39 | 208/52 | 175/35 | 561/160 | 3.51       |
| Pus cells                      | 286   | 19/19 | 48/24 | 36/12  | 216/54 | 115/23 | 434/132 | 3.29       |
| Whewellite                     | 365   | 11/11 | 14/7  | 12/4   | 60/15  | 80/16  | 177/53  | 3.34       |
| Weddellite                     | 345   | 17/17 | 24/12 | 12/4   | 64/16  | 120/24 | 237/73  | 3.25       |
| Phosphate                      | 383   | 3/3   | 20/10 | 21/7   | 24/6   | 45/9   | 113/35  | 3.23       |
| Uric acid/ammonium urate       | 396   | 12/12 | 8/4   | 9/3    | 4/1    | 10/2   | 43/22   | 1.95       |
| Crystal clumping               | 413   | 1/1   | 2/1   | 0/0    | 0/0    | 15/3   | 18/5    | 3.6        |
| Crystal aggregation            | 412   | 0/0   | 0/0   | 3/1    | 4/1    | 20/4   | 27/6    | 4.5        |
| Persistent deposits EMU/random | 291   | 23/23 | 94/47 | 57/19  | 92/23  | 75/15  | 341/12  | 2.69       |
| Combination of COM and COD     | 348   | 18/18 | 20/10 | 39/13  | 68/17  | 60/12  | 205/70  | 2.93       |
| Oxalate + Uric acid            | 371   | 23/23 | 18/9  | 15/5   | 28/7   | 15/3   | 99/47   | 2.11       |
| Oxalate + Uric acid + Others   | 396   | 11/11 | 14/7  | 3/1    | 8/2    | 5/1    | 41/22   | 1.86       |

**Table 5** Differences in the primary urinary deposits between the patients with and without symptoms

| Deposit                  | Score symptomatic group |      | Score asymptomatic group |      | Statistical significance |
|--------------------------|-------------------------|------|--------------------------|------|--------------------------|
|                          | Value                   | Mean | Value                    | Mean |                          |
| Red blood cell           | 428/122                 | 3.51 | 133/38                   | 3.5  | NS                       |
| Pus cell                 | 341/101                 | 3.38 | 93/31                    | 3.0  | NS                       |
| Whewellite               | 143/44                  | 3.25 | 34/9                     | 3.78 | $P < 0.05$               |
| Weddellite               | 190/49                  | 3.88 | 47/24                    | 1.96 | $P < 0.05$               |
| Phosphate                | 76/23                   | 3.3  | 37/12                    | 3.1  | NS                       |
| Uric acid/ammonium urate | 37/19                   | 1.95 | 6/3                      | 2.0  | NS                       |

patients and the percentages of patients with and without significant urinary deposits in each category are detailed in Table 3. It is seen that the colic patients had highest number of patients with symptoms and crystalluria patients had least number with symptoms. On calculating the extent of positive deposits in the three groups of patients, it is seen that the stone patients had maximum average score of deposits (4.57) compared to colic patients (4.39) and crystalluria patients (3.27).

The total values and mean scores of symptoms of the patients and the urinary deposits are depicted in Table 4. The main clinical score ranged from 1.93 for dull loin pain to 2.74 for burning sensation indicating that burning sensation produced the most severe degree of suffering for the patients. The total values and mean scores of the urinary deposits of all patients grouped together were RBC 561 (3.51), PC 434 (3.29), COM 177 (3.34), COD 237 (3.25), phosphate 113 (3.23) and uric acid 43 (1.95). Comparison of the total values and mean scores of the deposits of the patients with and without symptoms (Table 5) showed the variations as RBC 428 (3.51) versus 133 (3.5) PC 341 (3.38) versus 93 (3.0), COM 143 (3.25) versus 34 (3.78), COD 190 (3.88) versus 47 (1.96), phosphate 76 (3.3) versus 37 (3.1) and uric acid/ammonium urate 37 (1.95) versus 6 (2.0). Of these, the RBC, PC, phosphates and uric acid were not significantly different between the two groups. However, the presence of COD was significantly more in patients with symptoms ( $P < 0.05$ ) and COM was significantly more in patients without symptoms ( $P < 0.05$ ).

## Discussion

Urinary crystals have been identified to be representing the extent of urinary stone formation [5]. Metabolic correction of identified abnormalities has been reported to produce clearance of crystal extent in the urine [6, 7]. Crystalluria has been reported to be significant in recurrent stone formers [8]. Recently the importance of recognising the extent of crystalluria in follow up of urinary stone patients

has been stressed [9]. In the present paper, it is seen that many patients without symptoms attended the stone clinic and had the urinary deposits done on their early morning and random samples. Many patients had the dose of chemotherapy or chemoprophylaxis adjusted based on the urine deposit findings.

From the observations of the study, the following points appear clear for the clinicians treating patients with urinary stone disease. First, presence of symptoms recognisable by the patient may not be the only indication for initiation, presence or progression of stone disease. Second, the absence of symptoms may not indicate relief from the stone forming tendency. Third, patients should never stop treatment because they do not have obvious symptoms. Fourth, repeated examination of the urinary deposits should be made the hall mark for follow-up visits for all patients. Fifth, pathological crystalluria is an entity which requires appropriate directed chemotherapy. Sixth, drug dosage adjustments should be made based on the presence of symptoms, extent of pathological urinary deposits and presence of actual stones, with or without pain, infection, back pressure or bleeding. Seventh, dietetic adjustments should be advised based on the urine deposit findings of crystals rather than blindly. Last, but not the least, all the clinical laboratory technicians should be trained to identify, quantitate and report size, aggregation and clumping of different types of common and uncommon crystals.

## Conclusion

It is concluded that the presence or absence of symptoms does not significantly alter the presence and extent of urinary deposits in the urinary stone patients. COD was more in symptomatic patients and COM was more in the asymptomatic patients. This contrast could be due to the morphology of the COD crystal which is dipyramidal and produces injury to urothelium whereas COM is dumbbell shaped and produces lesser injury and lesser symptoms.

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