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SYMPOSIUM PAPER

Temporary risk identification in urolithiasis

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Abstract We have been using a risk index calculation for urolithiasis, which included most of the identifiable factors promoting calculogenesis. However, it was observed that the frequency of a patient getting stone problem was not uniform in spite of similarity of the risk index in the permanent setting. Also, many of the risk indices could be changed by dietary or lifestyle modifications. The objective of this paper was to calculate the temporary risk index of a patient at the time of each visit and correlate with stone activity during such periods, so that appropriate advice could be given on drugs, diet and lifestyle changes. The temporary risk index score was based on four symptoms, namely pain (0, nil; 1, vague pain; 2, mild; 3, moderate; 4, severe; 5, excruciating), haematuria (0, nil; 1, turbid; 2, cloudy; 3, reddish; 4, occasional frank blood; 5, continuous frank blood), burning sensation (0, nil; 1, minimal; 2, moderate; 3, terminal severe; 4, occasional excruciating; 5, continuous excruciating), and dysuria (0, nil; 1, minimal; 2, moderate; 3, terminal severe; 4, occasional excruciating, 5, continuous excruciating), ultrasonography for back pressure (0, nil; 1, mild; 2, moderate; 3, severe kidney and ureter; 4, unilateral total; 5, bilateral total anuria) and eight urine deposit findings (0, nil; 1, +; 2, 2+; 3, 3+; 4, 4+; 5, plenty), red blood cells, pus cells, whewellite crystals, weddellite crystals, phosphate crystals, uric acid/ammonium urate crystals, crystal clumping and crystal aggregation making a total of 13 parameters. Each parameter was given values ranging from 0 to 5. The total score was calculated and chemotherapeutic regimes were decided base on the score, which varied from 0 to 65. Hundred randomly selected patients who had been visiting the stone clinic for a minimum of five occasions were included in the study. The total scores of temporary risk were correlated with the permanent clinical risk score mentioned earlier. The temporary risk of the 100 patients during the total of 500 visits ranged from 0 to 43 out of 65. The risk score reduced significantly from visit 1 to 5 in all the patients. On correlating the mean index of the five visits with the permanent risk index, the correlation coefficient r value was +0.39 ($P < 0.01$). It was observed that patients go through periods of hyperactivity of stone metabolism and present with symptoms, producing temporary phases of overactivity. It is concluded that temporary risk index is correlatable with the permanent risk index of the patients forming urinary stones. It can be used as a method for scientific prediction regarding future stone formation in any individual. The dose of drugs and need for continuing chemotherapy for patients should be based on the temporary risk index. The blind prescription of drugs should be discouraged.

Keywords Urolithiasis · Risk index · Clinical risk · Temporary risk · Pain · Urine deposit

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Introduction

Assessment of the severity of stone diseases is an issue that confuses clinicians treating stone disease. We have been

using a risk index calculation for urolithiasis [1], which includes most of the identifiable factors promoting calculogenesis. However, it was observed that the frequency of a patient getting stone problem was not uniform in spite of similarity of the risk index in a permanent setting. This leads one to think about a temporary risk index at times of spikes in stone activity. Several basic questions still remain unanswered. What is a stone episode? Does pain or haematuria alone amount to stone incidence? Can passage of stone alone be considered as stone incidence? Is it possible to predict recurrence of stone during the first visit? Is the pain of a stone episode caused by spasm of the ureter produced by crystals or the downward movement of the stone? The spasm produced by crystalluria could be an indication of present activity, whereas pain produced by a moving stone may not indicate present activity as the stone might have formed much earlier than the time of pain. Also, many of the risk indices could be changed by dietary or lifestyle modifications. Many risk indices that are currently in vogue [2–5] assess the index at the time of presentation of the patient and are hopefully indicative of the stone-forming propensity at that time. It may be necessary to perform these tests repeatedly to assess the changes occurring in the potential for calculogenesis of the patients with passage of time or with administration of various treatments. The objective of this paper was to calculate the temporary risk index of a patient at the time of each visit and correlate with stone activity during such periods, so that appropriate advice could be given on drugs, diet and lifestyle changes.

Materials and methods

Hundred randomly selected proved idiopathic calcium oxalate stone formers, who had attended the urinary stone clinic regularly for at least five occasions, were selected for the study. The risk status for stone formation at each visit was calculated using a protocol designed for the purpose. The temporary risk index score was based on four symptoms, namely pain (0, nil; 1, vague pain; 2, mild; 3, moderate; 4, severe; 5, excruciating), haematuria (0, nil; 1, turbid; 2, cloudy; 3, reddish; 4, occasional frank blood; 5, continuous frank blood), burning sensation (0, nil; 1, minimal; 2, moderate; 3, terminal severe; 4, occasional excruciating; 5, continuous excruciating) and dysuria (0, nil; 1, minimal; 2, moderate; 3, terminal severe; 4, occasional excruciating; 5, continuous excruciating), ultrasonography for back pressure (0, nil; 1, mild; 2, moderate; 3, severe kidney and ureter; 4, unilateral total, 5, bilateral total anuria) and eight urine deposit findings (0, nil; 1, +; 2, 2+; 3, 3+; 4, 4+; 5, plenty), red blood cells, pus cells, whewellite crystals, weddellite crystals, phosphate crystals, uric acid/ammonium urate crystals, crystal clumping and crystal aggregation making a total of 13 parameters (Table 1). Each parameter was given values ranging from 0 to 5. The total score was calculated and chemotherapeutic regimes were decided based on the score, which would vary from 0 to 65. The total scores of temporary risk were compared with the permanent clinical risk score calculated for each patient during each visit.

Results

The period of the total study ranged from 15 to 37 months in the 100 patients followed up for five consecutive visits. Only patients who had not discontinued the chemotherapy/prophylaxis as per advice were included. The permanent risk, which included 43 parameters, was calculated during each visit. The permanent risk of the 100 patients varied from 23.7 to 52.8%. The 43 parameters included the 13 parameters of the temporary risk index study. The calculated mean permanent risk decreased from 37.2 to 23.7 at the fifth visit. The temporary risk of the 100 patients during the total of 500 visits ranged from 0 to 43 out of 65 (Table 2). The risk score decreased significantly from visit 1 to 5 in all the patients. The mean temporary score during the first visit was 23.2, which steadily decreased in the further follow-up visit to 7.3 at the fifth visit. On correlating the mean index of the five visits with the permanent risk index, the correlation coefficient r value was +0.39 ($P < 0.01$). It was observed that the patients go through periods of hyperactivity of stone metabolism and present with symptoms, producing temporary phases of overactivity. Appropriate treatment by directed medical therapy significantly reduced the various clinical and urine microscopic features of stone formation.

Discussion

The risk of new stone formation in an individual and its recurrence in future are possibly decided by permanent factors such as genetic predisposition, age, sex and possible lifelong metabolic profiles, or temporary factors such as environment, diet, lifestyle changes and possibly medications and increased fluid intake. It is not very easy to predict the future of stone disease, when the patient attends the hospital at the first presentation with urinary stone symptoms. By systematic follow -up, various risk factors have been shown to vary naturally or by therapeutic or dietetic manipulations. It is in this context that various studies have been undertaken by different authors to identify the risk of stone formation. Most of the indices available are temporary risk assessments based on principles of crystallisation and metabolic environment. Different authors [6–11] have

Table 1 Temporary clinical risk index

Date: Reg. No.:
Name of Patient: Age:

	RISK FACTOR	SCORE 0	1	2	3	4	5
1.	Pain	nil	vague	mild	mod	severe	excruciating
2.	Haematuria	nil	turbid	cloudy	red	occasional frank	continuous frank
3.	Burning sensation	nil	minim	mod	terminal severe	terminal excruc	continuous excruc
4.	Dysuria	nil	minim	mod	terminal severe	terminal excruc	continuous excruc
5.	USS - back pressure	nil	mild	mod	severe	unilateral total	bilateral total
6.	Red blood cells	nil	+	2+	3+	4+	plenty
7.	Pus cells	nil	+	2+	3+	4+	plenty
8.	Whewellite crystals	nil	+	2+	3+	4+	plenty
9.	Weddellite crystals	nil	+	2+	3+	4+	plenty
10.	Phosphate crystals	nil	+	2+	3+	4+	plenty
11.	Uric acid / amm urate	nil	+	2+	3+	4+	plenty
12.	Crystal clumping	nil	+	2+	3+	4+	plenty
13.	Crystal aggregation	nil	+	2+	3+	4+	plenty

Minim - minimum mod - moderate minim - minimal excruc - excruciating
+ - 1-3 / hpf 2+ - 4-5 / hpf 3+ - 6-10 / hpf 4+ - 11-20 / hpf
plenty - Over 20 / hpf

TOTAL TEMPORARY RISK FOR STONE FO RMATION = / 65 = %

Table 2 Details of mean temporary risk index scores during visits

Parameter	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Total
Pain	3.7	2.3	2.9	1.7	0.9	11.5
Haematuria	0.3	0.1	0	0.2	0	0.6
Burning sensation	0.9	0.3	0	0	0	1.2
Dysuria	2.1	1.7	1.3	0.9	0.7	6.7
USS	1.4	1.4	0.7	0.9	0.7	5.1
Red blood cells	3.7	2.9	2.5	2.3	1.7	13.1
Pus cells	3.3	3.1	2.7	2.3	1.9	13.3
Whewellite	2.1	1.7	1.3	1.1	0.7	6.9
Weddellite	2.9	2.1	1.7	1.2	0.2	8.1
Phosphate	0.6	0.2	0	0	0	0.8
Uric acid/ammonium urate	1.2	0.7	0.6	0.6	0.5	3.6
Crystal clumping	0.5	0.1	0	0	0	0.6
Crystal aggregation	0.5	0.2	0	0.1	0	0.8
Total	23.2	16.8	13.7	11.3	7.3	72.3

tried to assess the role of the various indices detailed earlier. However, most of them have limited value in prognosticating stone disease. Whilst certain authors insist on repeated assessments for assessing risk [12], others believe that single spot analysis will be sufficient to identify the propensity to stone formation [13–15]. It is in this context that the present paper discusses the clinical and urine deposit aspects of the patients during follow-up, which can help in deciding treatment options for the patients.

Pain in urinary stone disease has confusing messages. It is usual to grade pain by severity, as has been done in the present study, as vague, mild, moderate, severe and excruciating. It is well known that a stone, moving down the ureter will produce typical colic. Whilst this pain is a good indication of the downward movement of the stone, severe colic can be produced by crystals moving down the ureter. This is recurrent and harmful to the patient. In many situations, it will be difficult to distinguish between these two types of pain. Presence of the first type of pain indicates the effect of the stone and the latter type of pain indicates the cause of the stone. In calculating risk of stone formation, this distinction will need to be realised.

The study of urinary deposits is very important in the assessment of stone activity. Presence of blood in urine may indicate injury to the urothelium by a moving stone or due to the sharp edges of crystals moving down. Whilst the former indicates the effect, the latter indicates the cause of stone formation. The reports of most laboratories usually do not mention about the presence of many significant crystals, particularly whewellite [calcium oxalate monohydrates (COM)], which appear as dumbbell crystals. Many COM crystals have been reported as RBCs. In many situations, ammonium urate crystals were reported as pus cells. In most patients, who have colic due to moving stones, there is

associated crystalluria. The correlation between the movement of an already formed stone and the presence of significant crystalluria in the urine at the time of colic needs further evaluation. It is not clear how long prophylaxis has to be continued, be it empirical or directed medical therapy. The size of the crystals and the presence of crystal aggregation and clumping are relevant to the assessment of the extent of stone disease. These are unfortunately never routinely done in most of the clinical laboratories. Routine assessment of urinary deposits can identify the crystal-forming propensity of the individual. Such identification can guide the decision on the dose of appropriate chemoprophylaxis.

Measurement of stone recurrence requires at least 2 years of reliable reassessments. Because of the difficulty in performing a perfect assessment of the stone activity, surrogate methods for end points have been used, namely 24-h urine and blood findings. To assess the effect of chemotherapy, chemoprophylaxis or dietetic prophylaxis of stone patients, we considered the following surrogate end points: presence and extent of symptoms such as pain, haematuria, dysuria, dull loin pain and colic; urinary findings such as presence and extent of RBCs and pus cells and presence and extent of crystals namely calcium oxalate monohydrate, calcium oxalate dehydrate, uric acid, ammonium urate, cystine and crystal aggregation and clumping. Considering the other risk indices discussed, the difference in the present attempt is the assessment of the urine deposit findings periodically to assess the effects of drugs and thus the identification of the risk of stone formation.

Conclusions

It is concluded that temporary risk index is correlated with the permanent risk index of the patients forming urinary stones. It can be used as a method for scientific prediction of future stone formation in any individual. The dose of drugs and the need to continue chemotherapy in patients should be based on the temporary risk index. Blind prescription of drugs should be discouraged.

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