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ORIGINAL PAPER

A preliminary survey of practice patterns across several European kidney stone centers and a call for action in developing shared practice

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Abstract

Currently an evidence-based approach to nephrolithiasis is hampered by a lack of randomized controlled trials. Thus, there is a need for common platforms for data sharing and recruitment of patients to interventional studies. A first step in achieving this objective would be to share practice methods and protocols for subsequent standardization in what is still a heterogeneous clinical field. Here, we present the results of a pilot survey performed across 24 European clinical kidney stone centers. The survey was distributed by a voluntary online questionnaire circulated between June 2017 and January 2018. About 46% of centers reported seeing on average 20 or more patients per month. Only 21% adopted any formal referral criteria. Centers were relatively heterogeneous in respect of the definition of an incident stone event. The majority (71%) adopted a formal follow-up scheme; of these, 65% included a follow-up visit at 3 and 12 months, and 41% more than 12 months. In 79% of centers some kind of imaging was performed systematically. 75% of all centers performed laboratory analyses on blood samples at baseline and during follow-up. All centers performed laboratory analyses on 24-h urine samples, the majority (96%) at baseline and during follow-up. There was good correspondence across centers for analyses performed on 24-h urine samples, although the methods of 24-h urine collection and analysis were relatively heterogeneous. Our survey among 24 European stone centers highlights areas of homogeneity and heterogeneity that will be investigated further. Our aim is the creation of a European network of stone centers sharing practice patterns and hosting a common database for research and guidance in clinical care.

Keywords Clinical practice · Metabolic evaluation · Network · Survey · Urolithiasis

Introduction

Nephrolithiasis is a common condition, with an estimated prevalence of 8–9% [1, 2], also characterized by relatively high recurrence rates [3] and placing a significant economic burden on healthcare systems and businesses from time off work. However, evidence-based medicine is underdeveloped in this field, because the conduct of randomized controlled trials in stone patients has been hampered by the phenotypic heterogeneity of the disease and the need for large sample sizes, as well as the long follow-up times needed to accrue a sufficient number of stone recurrence events. As a result, the number of randomized controlled trials available in this field is small [4]. For these reasons, there is a need for more studies on large and phenotypically well-defined cohorts of patients. However, some clinical phenotypes are relatively rare and so a multicenter-based approach is required for more comprehensive and further investigation. We need an observational database, as well as a platform for recruiting patients for in-depth investigation of rarer kidney stone phenotypes and for running randomized controlled trials. To achieve these aims, the first step would be to share diagnostic and therapeutic protocols across centers involved in

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the clinical management of patients with nephrolithiasis. To make a start, we surveyed several known European kidney stone centers to investigate current patterns of practice and to identify areas of homogeneity that could be leveraged to create a common platform for data sharing, but also areas of heterogeneity with differences that could be explored further.

Materials and methods

An online survey was generated using the REDCap platform [5] and distributed to physicians working in European stone centers who had previously expressed interest and attended an international Consensus Conference on kidney stones [6]. The survey was subsequently extended to other centers based on their known research interest in nephrolithiasis. This was achieved by scanning for active European participants (conference speakers and abstract presenters) in International meetings on nephrolithiasis, and with a PubMed search of articles published by European groups. Other centers were also enrolled after referral by participants and among those nephrologists or urologists with significant expertise and practice in the metabolic investigation and treatment of stone disease.

Between June 2017 and January 2018, survey invitations were sent to 28 centers across Europe. Of these, 24 responded. The survey investigated practice patterns, including referral criteria, follow-up schemes, imaging and laboratory modalities, nutritional assessment, special studies, including DEXA scans and acidification tests, and sample biobanking.

Results for the main items in the survey are reported as frequencies and percentages.

Results

The geographical distribution of the 24 centers that responded to the survey is reported in Table 1. There was wide heterogeneity in distribution with "stone center belt" going from Italy (eight centers) to UK (two centers) and including Switzerland (four centers), Belgium (one center) and The Netherlands (two centers). However, some major countries (France and Germany) and Eastern European countries were poorly represented. The majority ($n = 17$, 71%) of respondents were nephrologists, the remaining were urologists ($n = 5$, 21%) or other specialists ($n = 2$, 8%), including internal medicine and clinical biochemistry. Eleven centers (46%) reported seeing on average 20 or more patients per month, whereas only three (13%) were seeing less than 10 patients per month. Only five centers (21%) adopted formal referral criteria (which included young age at presentation, recurrent disease or associated risk factors). Centers were relatively heterogeneous as to the definition of an incident stone event (Table 2). For this item, multiple responses were allowed and so each center could implement their own set of criteria to define an incident event. The majority ($n = 17$, 71%) adopted a formal follow-up scheme; of these, 11 (65%) included a follow-up visit at 3 and 12 months, and 7 (41%) further than 12 months. In 19 centers (79%), some kind of imaging was performed systematically, usually ultrasound (16 of those centers, 84%). All centers performed laboratory analyses on blood samples, the majority ($n = 18$, 75%) at baseline and during follow-up. Most of the analyses on blood samples were similar across centers (Table 3). Concerning analysis of urine, centers were asked how they analyze urine and if they differentiate between analysis of spot and 24-h urine samples. All centers performed laboratory analyses on 24-h urine samples, the majority ($n = 23$, 96%) at baseline and during follow-up. There was good agreement across centers for analyses performed on 24-h urine samples (Table 4). However, the modalities of 24-h urine collection and analysis were relatively heterogeneous across centers (Table 5).

Most centers ($n = 19$, 79%) also performed laboratory analyses on spot urine samples, the majority ($n = 20$, 84%)

Table 1 Geographical distribution of participating centers

	Number of centers		
	Nephrologist	Urologist	Other specialist
Italy	6	1	1
Switzerland	4	0	0
Spain	0	2	1
The Netherlands	2	0	0
United Kingdom	2	0	0
Austria	0	1	0
Belgium	1	0	0
Bulgaria	0	1	0
France	1	0	0
Germany	1	0	0

Table 2 Definition of an incident stone event across centers

	Performing centers
New stone formation	22 (92%)
Stone expulsion	14 (58%)
Renal colic	13 (54%)
Urological intervention	12 (50%)
Growth of a previous stone	9 (38%)

Table 3 Analyses of blood samples across centers

Parameters	Performing centers
Calcium	24 (100%)
Creatinine	24 (100%)
Phosphorus	24 (100%)
Uric acid	24 (100%)
Sodium	23 (96%)
Potassium	23 (96%)
Urea	23 (96%)
Parathyroid hormone	22 (92%)
Magnesium	21 (88%)
Chloride	20 (83%)
25(OH) vitamin D	19 (79%)
Bicarbonate	18 (75%)
pH	16 (67%)
1,25 (OH)2 vitamin D	8 (33%)

Table 4 Analyses of 24-h urine samples across centers

Parameters	Performing centers
Calcium	24 (100%)
Citrate	23 (96%)
Creatinine	23 (96%)
Oxalate	23 (96%)
Uric acid	23 (96%)
Phosphorus	22 (92%)
Sodium	21 (88%)
Urea	20 (83%)
Magnesium	19 (79%)
Potassium	19 (79%)
pH	18 (75%)
Chloride	16 (67%)
Ammonium	9 (38%)
Cystine	7 (29%)
Sulfate	7 (29%)
Bicarbonate	4 (17%)

at baseline and during follow-up. The analyses on spot urine samples were similar across centers (Table 6).

Only three (13%) centers reported using computer software for supersaturation calculation. A nutritional work-up was performed in 21 centers (88%) with a combination of methods, most often including a diet diary (10 of those centers, 48%); 22 centers (50%) had a dietitian available. Most centers ($n=19$, 79%) performed DEXA scans based on selected criteria, including hypercalciuria (17 of those centers, 89%), stone composition ($n=7$, 37%), and hypocitraturia ($n=6$, 32%). Sixteen centers (67%) performed acidification tests based on selected criteria, including hypocitraturia and high urine pH; the most used acidification test was the furosemide/fludrocortisone test (12 of those centers, 75%). Regarding stone composition analysis, 58% of centers ($n=14$) reported using IR spectroscopy, 21% ($n=5$) X-ray diffraction and 21% ($n=5$) chemical analysis only. Eight centers (33%) had a biobank in place for storage of whole blood/DNA, serum/plasma, spot and 24-h urines. Most centers ($n=19$, 79%) reported recording patient data on electronic records.

Table 5 Modalities of 24-h urine collection

	Performing centers
Number of collections at baseline	
One	14 (58%)
Two or more	10 (42%)
Number of collections at follow-up	
One	15 (65%)
Two or more	8 (34%)
Type of collection	
Plain only	12 (50%)
Plain + acidified	4 (17%)
Antibacterial agents	4 (17%)
Other	4 (16%)

Table 6 Analyses of spot urine samples across centers

Parameters	Performing centers
pH	16 (67%)
Sediment	14 (58%)
Calcium	11 (46%)
Creatinine	11 (46%)
Urine culture	11 (46%)
Dipstick examination	9 (38%)
Phosphorus	7 (29%)
Citrate	6 (25%)
Oxalate	6 (25%)
Sodium	6 (25%)
Uric acid	6 (25%)
Urea	5 (21%)
Chloride	4 (17%)
Cystine	4 (17%)
Potassium	4 (17%)
Magnesium	3 (13%)
Ammonium	0
Sulfate	0
Bicarbonate	0

Discussion

Our pilot survey involving a large number of referral centers for the diagnosis and treatment of nephrolithiasis is the first to try to obtain information on practice patterns across Europe; similar efforts have been recently reported in the United States [7]. However, our data could be biased by inclusion (by design) of only those centers with well-known expertise in the field of kidney stones, although we did make efforts to identify the majority of European centers with known relevant expertise. Notwithstanding this potential limitation, several important insights were obtained. From our study, it seems that relatively few renal centers in Europe have nephrologists with expertise or interest in kidney stones.

Since kidney stones are often the result of abnormal handling of lithogenic substances by the kidney or abnormalities of mineral metabolism, acid–base and electrolyte balance, the metabolic evaluation and medical management of nephrolithiasis, which is often complex and rarely straightforward, should be performed involving someone with good knowledge of metabolism and renal physiology. This is especially true when considering the evidence that chronic kidney disease, hypertension, diabetes and cardiovascular disease are important associations and complications of kidney stones, conditions well known to nephrologists in the more holistic care of their patients; thus, nephrologists, who are ideally placed to evaluate and help manage patients with nephrolithiasis, should take back a role in the management of this condition [8–10].

Our findings also show that for most demographic, clinical, laboratory and imaging parameters, there is an acceptable agreement across centers, in part due to the recent availability of international guidelines endorsed by major scientific societies [11, 12]. This finding, together with the high frequency of centers recording data on electronic records (79%), suggests that a common data platform across centers could easily be put in place.

Another interesting aspect emerging from our survey is the high percentage of centers (around 90%) performing a nutritional evaluation, despite this being demanding in both time and resources, but which is important, since dietary habits and lifestyle play a major role in the development of kidney stones, and it is also an opportunity to help modify cardiovascular risks factors, including weight and compliance with a treatments [13]. Another aspect that needs further investigation is the paucity of centers reporting the use of software for relative supersaturation calculations, which have been found to be useful in predicting stone development and recurrence [14, 15].

Our survey has also highlighted areas in which there seems to be variability among centers, especially concerning methods of collection and analysis of 24-h urine samples, as well as the definition of an incident stone event. Overall, these findings could be used to perform observational and interventional studies for data that are collected in a similar and standardized way across centers, and to set up collaborative working groups to improve the consistency of data collection across centers. Establishing new standards for clinical practice in stone management could result from this approach.

Finally, this survey and report highlights the clinical problem of renal stone disease and provides a "snap shot" of how it is currently managed in several European centers; it is also a "call to arms" for this often under-recognized non-fatal condition, but which that has significant individual and wider socioeconomic impact. Therefore, we call on other European centers to express their interest in being part of a kidney stone network in partnership with our urological colleagues that is aimed at sharing common protocols and data as the basis for more clinical and scientific research in kidney stone disease for our patients.

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Compliance with ethical standards

Conflict of interest All authors declare no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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