Management of urinary stone disease in general practice: A French Delphi study

Sandra Abergel, Benoit Peyronnet, Philippe Seguin, Karim Bensalah, Olivier Traxer and Yonathan Freund

Department of Family Medicine, Simone Veil Health Science Centre, University of Versailles Saint Quentin en Yvelines, France; Department of Emergency Medicine, Rennes University Hospital, University of Rennes, Rennes, France; Department of Urology, Rennes University Hospital, University of Rennes, Rennes, France; Department of Urology, Tenon Hospital, Pierre and Marie Curie University, Paris, France; Department of Emergency Medicine and Surgery, Pitie-Salpetriere Hospital, Pierre et Marie Curie University, Paris, France

KEY MESSAGES

- Most patients with renal colics can be treated as outpatients.
- A biological and imaging work-up is recommended within 24 hours.
- An aetiological work-up could be performed after the second renal colic.
- A follow-up imaging should be carried out yearly in urolithiasis patients.

ABSTRACT

Background: Recommendations for the management of urolithiasis in primary care are lacking in France. The Delphi method was used to seek consensus from an expert panel regarding outpatient management of urolithiasis.

Methods: We gathered 25 French experts from five clinical specialties: general practice, urology, nephrology, emergency medicine and radiology. The first survey was formulated after an exhaustive literature review. At each of the three rounds, the experts were given the results of the previous round and were asked again to complete the survey. The threshold of 70% of the vote was taken as defining consensus. A final round of validation involving five additional general practitioners was conducted.

Results: Twenty experts participated in the study (five urologists, four nephrologists, four general practitioners, four emergency physicians, and three radiologists, participation rate 80%). According to the survey results, most patients could be treated as outpatients (70.5% of the votes) but a biological (urine dipstick and culture, serum creatinine ± serum β-hcg) and imaging (renal ultrasound ± Kidney-Ureters-Bladder X-ray or low-dose CT san) work-up is recommended within 24 hours. Non-steroidal anti-inflammatory drugs are the analgesics of choice. An aetiological work-up should be performed after the second episode of renal colic. A follow-up imaging should be carried out yearly in urolithiasis patients.

Conclusion: With the use of the Delphi method, we propose a multidisciplinary recommendation for the management of urolithiasis patients in primary care.

Introduction

The prevalence of the urinary stone disease is approximately 10% in Western countries [1] and has increased steadily over the past decades [2]. Urolithiasis is associated with a high recurrence rate (around 50%) [1] and it may affect renal prognosis [3] and lead to end-stage renal failure [4]. Moreover, it is associated with a high cost to society [5].

There are scarce data on the prevalence of this disease in general practice, but several factors suggest that general practitioners will have to increasingly manage patients with urolithiasis, at least in countries without gatekeeping by the GP (e.g. France, Germany, Belgium). The saturation of hospital networks and the growing prevalence of urolithiasis often lead patients...
to consult general practitioners rather than urologists and nephrologists. General practicioners are therefore often in charge of diagnostic and aetiological explorations, therapeutic approach, referral to specialists and follow-up. Moreover, the prevalence of urinary stone disease seems particularly high in obese and diabetic patients, whose medical care is provided mainly by general practitioners.

Guidelines for the management of urinary stone disease in the hospital setting have been made by urologists, emergency physicians and radiologists, but there is a lack of recommendations for management in primary care.

The aim of this study was to generate proposals for the management of urolithiasis in general practice in France, using a Delphi method.

Methods

The Delphi method

In this study, the Delphi method was chosen to generate proposals of recommendations and to assess the feasibility of current evidence-based principles of management in the specific setting of general practice. Briefly, the Delphi method is a method that aims to achieve consensus among a panel of experts on a topic where existing knowledge is poor. The Delphi procedure is made of iterations. Participants are given feedback on group responses and items that did not achieve consensus are discussed. Statements are revised and repeated until consensus is reached among the panel of experts.

Study design

Twenty-five experts were invited to participate in this study owing to their scientific expertise in the management of urinary stone disease: five general practitioners, five urologists, five nephrologists, five emergency physicians and five radiologists, working either in hospital departments or private institutions. All selected experts had taken part in prior academic works or teaching programs in the field of urolithiasis. The study comprised three rounds and was conducted from May to July 2013 over a 48-day period.

In the first round, the questionnaire was prepared by the investigators of this study after an exhaustive literature review conducted independently, and 26 questions were subsequently submitted to the participants. Once all the answers were collected, the results of the first round were presented to the experts in a second questionnaire. Following their feedback, we changed the wording of some proposals and added questions to improve the relevance of the survey. In the second and third rounds, each participant received the results of previous rounds with all outstanding proposals that did not reach consensus. Each participant had the possibility to maintain his answers or to change them in the light of the responses and comments of the other members of the panel.

To validate the feasibility of these recommendations in the setting of family medicine, a final round was conducted involving five general practitioners that were randomly selected: the first five who accepted to participate in the study were included. They were asked whether they agreed or not with each of the recommendations proposed after the former three rounds. To emphasize the scientific basis on which the statements were based, grade of recommendations according to the existing urological guidelines (from grade A to grade C) and level of evidence (when available) were reported in the Tables according to the Oxford Centre for Evidence-based Medicine (from level of evidence 1: evidence obtained from at least one randomised trial; to level of evidence 5: evidence obtained from expert committee reports or opinions).

General practice in France

In France, most general practitioners work in private practice but draw their income from the public insurance funds (i.e. fee-for-service model). They are responsible for long-term care in a population (i.e. prevention, education, care of the disease). In contrast with some other countries, French general practitioners play a role in the emergency care and have to contribute to a night and weekend duty. They are expected to act as ‘gatekeepers’ who refer patients to the hospital or specialists when necessary. However, this system is not regulated and patients are still free to go to the emergency department if they want to. A large part of medical care is free for the patient, being reimbursed by the government.

Statistical analysis

For each question in the three former rounds, the percentage of votes received by each of the proposals was calculated. According to the literature on the Delphi method, the threshold of 70% of the vote was chosen to define a consensus among experts. Thus, all proposals that collected more than 70% of the votes were not resubmitted to the experts. Some part of the questionnaire was not addressed to the radiologists who were asked to answer only about imaging study items. Proposals reaching the threshold of 70% of the votes were incorporated into the recommendations.
However, in case the four general practitioners disagreed with the proposal, it was not included in the recommendation even if it has reached the 70% threshold. When no consensus was found at the end of the third round, the mode proposals (those who collected the most votes) were reported although not considered as recommendations.[16] During the final round, a recommendation was considered applicable if at least three out of the five general practitioners validated it.

Survey data and participants’ characteristics

Out of the 25 invited, 20 experts participated in the first round (response rate = 80%, i.e. five urologists, four nephrologists, four general practitioners, four emergency physicians, and three radiologists). The number of experts remained stable over the three rounds: 95% of the experts present in the first round participated in the following two.

Twenty-six questions and a total of 263 proposals were submitted to the judgment of experts. Of these 263 proposals, the experts were able to reach a consensus in 78.7% of cases, which represent 207 proposals that were either approved or rejected. At least two general practitioners agreed with all the proposals that reached the 70% threshold. Ninety-nine (47.8%) were obtained after the first round, 76 (36.7%) after the second and 32 (15.4%) after the third.

Main recommendations drawn from the survey

Main recommendations are summarized in Table 1.

Diagnosis and referral of renal colic (Tables 2 and 3)

The established consensus has helped formulate a precise diagnostic strategy for suspected renal colic in general practice. Experts considered that urine dipstick must be performed systematically in case of suspicion of renal colic (94.1% of votes, accepted in the first round). It should be associated with urine culture, and the measurement of serum creatinine (70.5% of votes, accepted in the third round) (Table 1). Women of childbearing age should also undergo a measurement of serum β-hcg level (94.1%, accepted in the third round).

Conversely, measurement of C-reactive protein and blood count were not recommended in this initial work-up (70.5% each, consensus in the second round). Regarding imaging studies, experts considered that renal ultrasound with kidney, ureter, bladder X-ray (KUB) and non-contrast low-dose abdominal computed tomography (CT) were equally indicated with a trend in favour of the latter (85% vs. 75%). These examinations should be performed within 24 h of the onset of the acute episode (94.1%, accepted in the third round). Also, severity criteria (clinical, biological and radiological) have been established to distinguish ambulatory patients of patients requiring hospital transfer (Table 2). Briefly, most patients can be treated as outpatients except when the diagnosis is doubtful or when there are clinical or biological signs in favour of acute renal failure or urosepsis.

Treatment of renal colic in general practice (Table 4)

Recommendations about the treatment of urolithiasis are summarized in Table 4. Non-steroidal anti-inflammatory drugs (NSAIDs) remained the first-line therapy of renal colic (100% of votes, accepted in the first round), but no consensus has been established on other analgesic treatments to use in association. Morphine in the management of renal colic should not be used in general practice (17.6% of experts in favour
in the third round). There was no consensus on the role of alpha-blockers as medical expulsive therapy in case of renal colic (31.2% in favour of their use at the end of the third round). Calcium channel blockers and antispasmodics were not retained in the treatment of renal colic in primary care. The main advice that should be given to patients with a proven renal colic is to consult again their general practitioner in case of fever > 38.5°C (88.2%, accepted in the first round), anuria (88.2%, accepted in the first round) or recurrent pain lasting > 7 days (82.3%, accepted in the first round). The experts agreed that patients should be on sick leave in case of renal colic (76.4%, consensus in the second round).

**Aetiological assessment of renal colic**  
**(Supplementary Table 1, available online)**

Regarding the aetiological explorations of urolithiasis, the panel considered that the aetiological biochemical work-up should be performed only after the second episode of renal colic (82.3%, consensus in the third round). It should comprise a stone analysis by infrared spectrophotometry (88.2%, consensus in round 2); a blood test with creatinine, calcium, uric acid, glucose assays (82.3%, consensus in the first round); a 24-hour urine collection to determine total volume of urine, urinary creatinine, calcium, uric acid, urea and sodium (70.5%, accepted in the second round) and a morning urine sample with measurement of crystalluria, pH, density and urinalysis (88.2% of votes, consensus in round 2).

**Follow-up and prevention strategies of urolithiasis**  
**(Supplementary Table 2, available online)**

Experts found an agreement regarding the preventive lifestyle and dietary measures (see Supplementary Table 2, available online). The efficacy of lifestyle changes should be checked between 3 and 6 months after the introduction of these measures (94.1%, consensus in round 3). A follow-up imaging must be performed (70% of votes, consensus in round 3) but the timing and the type of imaging have not been established (mode proposal: KUB + renal ultrasound to carry out yearly, 40% of experts).

**Final round of validation**

A survey with the 5 tables summarizing the consensus obtained during the former three rounds was sent to five general practitioners who were asked whether or not they could validate each of the statements. The proposals that were not validated by the five general practitioners in this final round are marked with an asterisk (*) in Tables 2–4 and Supplementary Tables 1–2 (available online). Out of the 79 statements reported in Tables 2–4 and Supplementary Tables 1–2 (available online), 71 were validated (i.e. considered relevant and applicable) by the five general practitioners (89.9%).
Discussion

Main findings

To our knowledge, this study is one of the first to address the issue of recommendations for the management of urolithiasis in general practice. Given the economic burden and the high prevalence of urolithiasis, [1,5] we believe that guidelines specifically designed for general practitioners could be helpful to improve management and prevention strategies and decrease health costs caused by urinary stones.

This study has highlighted the many controversies existing in the management of urolithiasis in primary care. At the end of the study, experts did not find consensus for 21.3% of the proposals. This could be explained by the small number of studies about urolithiasis management in general practice.

---

Table 3. Referral of renal colic.

| Consensus                                                                 | Validation Round | Grade of recommendation from the existing literature [10,26] | Level of evidence from the existing literature |
|--------------------------------------------------------------------------|------------------|----------------------------------------------------------------|-----------------------------------------------|
| Renal colics without severity criteria may be managed in an ambulatory setting. | 70.5% R1         | None                                                            | 4                                             |
| Renal colics need to be urgently transferred to hospital when severity criteria are present or when diagnosis is doubtful. Signs of severity warranting transfer to hospital | 82.3% R2         | None                                                            | 4                                             |
| Signs of severity related to the patient:                                |                  |                                                                  |                                               |
| - chronic renal failure                                                  | 75% R1           | None                                                            | 4                                             |
| - kidney transplant                                                      | 80% R1           | None                                                            | 4                                             |
| - solitary kidney                                                        | 80% R1           | None                                                            | 4                                             |
| - pregnancy                                                             | 80% R1           | None                                                            | 4                                             |
| Clinical signs of severity:                                              |                  |                                                                  |                                               |
| - fever (temperature > 38.5 °C)                                          | 80% R1           | None                                                            | 4                                             |
| - hypotension                                                            | 75% R1           | None                                                            | 4                                             |
| - oliguria                                                               | 70.5% R2         | None                                                            | 4                                             |
| - anuria                                                                 | 88.2% R2         | None                                                            | 4                                             |
| - abdominal tenderness                                                   | 82.3% R3         | None                                                            | 4                                             |
| Biological and imaging criteria of severity:                             |                  |                                                                  |                                               |
| - acute renal failure                                                    | 85% R2           | None                                                            | 4                                             |
| - positive urine culture (urinary tract infection)                       | 75% R3           | None                                                            | 4                                             |
| - the existence of bilateral obstructing stones locked in excretory pathways | 75% R1           | None                                                            | 4                                             |
| - suspected renal infarction                                             | 70% R2           | None                                                            | 4                                             |
| - urinary extravasation on imaging                                       | 75% R2           | None                                                            | 4                                             |

AUA: American Urological Association  
EAU: European Association of Urology

Table 4. Treatment of renal colic in general practice.

| Consensus                                                                 | Validation Round | Grade of recommendation from the existing literature [10,26] | Level of evidence from the existing literature |
|--------------------------------------------------------------------------|------------------|----------------------------------------------------------------|-----------------------------------------------|
| With suspected renal colic                                               |                  |                                                                  |                                               |
| Non-steroidal anti-inflammatory drugs (NSAIDs) are the first-line therapy | 100% R1          | Grade A (EAU)                                                   | 1[25]                                         |
| The prescription of NSAIDs can be maintained in case of isolated leucocyturia on dipstick.* | 76.4% R3         | None                                                            | 4                                             |
| NSAID prescription should not be maintained in the presence of leucocyturia + nitrite on dipstick. | 70.5% R3         | None                                                            | 4                                             |
| When the diagnosis of renal colic is confirmed, in the absence of severity criteria, and in case of persistent pain the following treatment should be initiated: |                  |                                                                  |                                               |
| NSAIDs                                                                   | 88.2% R1         | Grade A (EAU)                                                   | 1[25]                                         |
| This treatment may be associated with Paracetamol                         | 70.5% R3         | None                                                            | 4                                             |
| and/or Tramadol/Codeine according to pain intensity                      | 70.5% R2         | Grade C (EAU)                                                   | 4[9]                                          |
| Experts do not recommend the use of calcium channel blockers             | 88.2% R1         | None                                                            | 4                                             |
| Experts do not recommend the use of anti-spasmodic medication*           | 76.4% R3         | None                                                            | 4                                             |
| Advice to patients when the diagnosis of renal colic is confirmed:       |                  |                                                                  |                                               |
| - filtering of urine and conservation of passed stones for analysis       | 76.4% R2         | None                                                            | 4                                             |
| - consultation in case of fever >38.5 °C                                  | 88.2% R1         | None                                                            | 4                                             |
| - consultation in case of anuria for 24 h                                | 88.2% R1         | None                                                            | 4                                             |
| - consultation in case of increasing pain                                | 94.1% R2         | None                                                            | 4                                             |
| - consultation in case of recurrent pain lasting >48 hours               | 82.3% R2         | None                                                            | 4                                             |
| - consultation in case of recurrent pain lasting >7 days                  | 82.3% R1         | None                                                            | 4                                             |
| - normal hydration                                                       | 88.2% R2         | None                                                            | 4                                             |
| - normal nutrition                                                       | 76.4% R2         | None                                                            | 4                                             |
| - temperature monitoring every morning                                   | 88.2% R2         | None                                                            | 4                                             |
| - consultation in case of vomiting*                                      | 70.5% R2         | None                                                            | 4                                             |

AUA: American Urological Association  
EAU: European Association of Urology
Diagnostic approach

In regard to imaging, experts were more inclined to recommend unenhanced low-dose abdominal CT, although ultrasound – KUB X-ray seems an acceptable alternative. This is in accordance with most of the existing guidelines,[9–13] probably because CT can eliminate most of the alternative diagnoses and shows better diagnostic performances.[17] However, in a recent large multicentre randomized trial, Smith-Bindman et al. found that initial ultrasonography for suspected renal colic was associated with lower cumulative radiation exposure than initial CT without significant differences in missing high-risk diagnoses, which emphasizes that controversies regarding this question are still ongoing.[18]

Analgesics

In the primary care setting, NSAIDs remained the first-line therapy to treat suspected renal colics, but no consensus has been found on other analgesics to associate. Indeed, responses for therapeutic issues appeared irrelevant, as the choice of a treatment regimen depends mainly on the severity of the pain and previous intake of analgesic. Moreover, surveyed GPs reported that opioids administration to outpatients remains extremely rare. Experts agreed that in the case of insufficient analgesia with non-opioid treatment, the patient should be transferred to the hospital in emergency for a check-up and analgesia.

Medical expulsive therapy

The experts reached no consensus regarding the prescription of alpha-blockers. These results may reflect some French controversy on the efficacy of alpha-blockers and calcium channel blockers in the expulsion of urinary stone. In the only French randomized controlled trial investigating medical expulsive therapy to date, Vincendeau et al. found no significant differences in both times to stone expulsion and stone-free rate.[19] However, medical expulsive therapy has been shown to be cost-effective previously in the literature[20] and the vast majority of randomized trials and meta-analyses found higher stone-free rates and a shorter time to stone expulsion with the use of alpha-blockers.[9,21]

Limitations

Recently, Macneil et al., published a review addressing the management of urolithiasis in general practice.[22] Most of their statements were comparable to the findings of the present study, except for the use of alpha-blockers and CT scan.

This study had several potential limitations that should be acknowledged. The Delphi method has some variants described in the literature.[16] One of them concerns the development of the first questionnaire. Conventionally, the first round begins with a questionnaire with open answers – the investigator subsequently drafting a structured questionnaire for the following rounds.[16] In our study, we used a structured questionnaire in the first round, based on an exhaustive review of the literature.[16] This study design could have helped to improve the participation rate (80%).

The selection of experts is a key point of a Delphi study. In our study, a significant bias is that most of the selected physicians worked in hospitals while these recommendations are addressed to general practitioners. The purpose of this study design was to increase the relevance of our recommendations by involving every specialist of urolithiasis management. However, the contribution of general practitioners in this study was major and no consensus has been selected for recommendation without the approval of our GPs experts during the study. The threshold of 70% of participants to define consensus has been determined based on the literature but remains empirical.[16] Moreover, the general practitioners involved in the final round were randomly selected, which could be regarded as a shortcoming. Another important drawback is that this study involved only French experts, and may not be generalisable to other countries with different healthcare settings.

The Delphi method has been chosen in the present study due to the lack of evidence in some areas. One of the aims of this report is to stress the need for research in the field of urolithiasis in general practice and, despite the fact that the experts’ committee opinion of this study provided the only data regarding a wide part of the management of urolithiasis patients in primary care, new trials could easily overrule these recommendations. Moreover, that existing evidence seems to have been ignored by experts in the present study (e.g. medical expulsive therapy) emphasizes that a Delphi method should only be used in the absence of scientific evidence.

Conclusion

In our study, the expert group was able to formulate many proposals of recommendations for the management of suspected renal colic in general practice.
including diagnosis work-up, treatment, and follow-up. The consensus also allowed to select which patients can be treated in ambulatory care and which should be transferred to the hospital. This study could be used as a draft to establish future recommendations for the outpatient management of urolithiasis patients in general practice.

Acknowledgements

We would like to thank Julien Letendre for his kind help in this work.

We acknowledge the contribution of the following experts who answered the surveys: Philippe Cornet, Department of Family Medicine, Paris Descartes University, Paris, France. Michel Daudon, Department of Physiology and Nephrology, Tenon Hospital, Pierre et Marie Curie University, Paris, France. Gilbert Dhumerelle, Department of Family Medicine, Paris Diderot University, Paris, France. Bertrand Dore, Department of Urology, La Miletrie University Hospital, Poitiers, France. Mohamed El Khebir, Department of Emergency Medicine, Samu 60, Beauvais Hospital, Beauvais, France. Jean-Philippe Haymann, Department of Physiology and Nephrology, Tenon Hospital, Pierre et Marie Curie University, Paris, France. Olivier Lehmann, Department of Family Medicine, Paris Descartes University, Paris, France. Isabelle Tostivint, Department of Nephrology, Pitie-Salpetriere University, Paris, France. Christian Saussine, Department of Emergency Medicine, Cochin Hospital, Paris-Descartes University, Paris, France. Joelle Lehmann, Department of Family Medicine, Paris Descartes University, Paris, France. Raphaele Renard-Penna, Academic Department of Radiology, Pitie-Salpetriere Hospital, Pierre et Marie Curie University, Paris, France. Laurence Rocher, Department of Radiology, Bicetre Hospital, Paris Sud University, France. Olivier Saint-Lary, Department of Family Medicine, Simone Veil Health Science Centre, University of Versailles Saint Quentin en Yvelines, France. Aline Santin, Department of Emergency Medicine, Cochin Hospital, Paris-Descartes University, Paris, France. Christian Saussine, Department of Urology, Strasbourg University Hospital, Strasbourg, France. Isabelle Tostivint, Department of Nephrology, Pitie-Salpetriere Hospital, Pierre et Marie Curie University, Paris, France. Albert Trinh-Duc, Department of Emergency Medicine, Agen Hospital, Agen, France. Cecile Vigneau, Department of Nephrology, Rennes University Hospital, University of Rennes, Rennes, France. Josué Ouaknine, Family Medicine, Paris, France. Gérard Sitruk, Family Medicine, Paris, France. Chantal Albert, Family Medicine, Paris, France. Jacques Yacoubovitch, Family Medicine, Paris, France. Tanguy Meteron, Family Medicine, Rennes, France.

Declarations of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper’s results.

References

[1] Croppi E, Ferraro PM, Taddei L, et al.; GEA Firenze Study Group. Prevalence of renal stones in an Italian urban population: a general practice-based study. Urol Res. 2012;40:517–522.

[2] Stamatelou KK, Francis ME, Jones CA, et al. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney Int. 2003;63:1817–1823.

[3] Rule AD, Krambeck AE, Lieske JC. Chronic kidney disease in kidney stone formers. Clin J Am Soc Nephrol. 2011;6:2069–2075.

[4] Alexander RT, Hemmelgarn BR, Wiebe N, et al. Kidney stones and kidney function loss: a cohort study. Br Med J. 2012;345:e5287.

[5] Lotan Y. Economics and cost of care of stone disease. Adv Chronic Kidney Dis. 2009;16:5–10.

[6] Scales CD Jr. Practice patterns in the management of urinary lithiasis. Curr Urol Rep. 2013;14:154–157.

[7] Daudon M, Traxer O, Conort P, et al. Type 2 diabetes increases the risk of uric acid stones. J Am Soc Nephrol. 2006;17:2026–2033.

[8] Greiver M, Williamson T, Barber D, et al. Prevalence and epidemiology of diabetes in Canadian primary care practices: a report from the Canadian Primary Care Sentinel Surveillance Network. Can J Diabetes. 2014;38:179–185.

[9] Türk C, Petrik A, Sarica K, et al. EAU Guidelines on Diagnosis and Conservative Management of Urolithiasis. Eur Urol. 2016;69:468–474.

[10] El Khebir M, Fougeras O, Le Gall C, et al. 2008 update of the 8th Consensus Development Conference of the Francophone Society of Medical Emergencies of 1999. The treatment of adult renal colic by the emergency services and in emergency rooms. Prog Urol. 2009;19:462–473.

[11] Coursey CA1, Casalino DD, Remer EM, et al. ACR Appropriateness Criteria® acute onset flank pain—suspicion of stone disease. Ultrasound Q. 2012;28:227–233.

[12] van Lieshout J, van Koningsbruggen PJ, Boukes FS, et al. Summary of the practice guideline ‘Urolithiasis’ (first revision) from the Dutch College of General Practitioners. Ned Tijdschr Geneeskd. 2008;152:2448–2451.

[13] Croppi E, Cupisti A, Lombardi M, et al. Diagnostic and therapeutic approach in patients with urinary calculi. G Ital Nefrol. 2010;19:282–289.

[14] Hunter D. Consensus methods for medical and health services research. Br Med J. 1995;311:376–380.

[15] Phillips B, Ball D, Sackett D, et al. Oxford levels of evidence. Available at: www.cebm.net/index.aspx?o=1025 [Accessed November 2015].

[16] Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. J Clin Epidemiol. 2014;67:401–409.

[17] Pernet J, Abergel S, Parra J, et al. Prevalence of alternative diagnoses in patients with suspected uncomplicated renal colic undergoing computed tomography: a prospective study. CJEM. 2015;17:67–73.

[18] Smith-Bindman R, Aubin C, Bailitz J, et al. Ultrasoundography versus computed tomography for suspected nephrolithiasis. N Engl J Med. 2014;371:1100–1110.

[19] Vincendeau S, Bellissant E, Houlgatte A, et al. Tamsulosin hydrochloride vs. placebo for management of distal ureteral stones: a multicentric, randomized, double-blind trial. Arch Intern Med. 2010;170:2021–2027.
[20] Bensalah K, Pearle M, Lotan Y. Cost-effectiveness of medical expulsive therapy using alpha-blockers for the treatment of distal ureteral stones. Eur Urol. 2008;53:411–418.

[21] Pearle MS, Goldfarb DS, Assimos DG, et al. Medical management of kidney stones: AUA Guideline. 2014. Available at: www.auanet.org/education/guidelines/management-kidney-stones.cfm [Accessed November 2015].

[22] Macneil F, Bariol S. Urinary stone disease - assessment and management. Aust Fam Physician. 2011;40:772–775.

[23] Giesen LG, Cousins G, Dimitrov BD, et al. Predicting acute uncomplicated urinary tract infection in women: a systematic review of the diagnostic accuracy of symptoms and signs. BMC Fam Pract. 2010;11:78.

[24] Niemann T, Kollmann T, Bongartz G. Diagnostic performance of low-dose CT for the detection of urolithiasis: a meta-analysis. AJR Am J Roentgeno. 2008;191:396–401.

[25] Holdgate A, Pollock T. Non-steroidal anti-inflammatory drugs (NSAIDs) versus opioids for acute renal colic. Cochrane Database Syst Rev. 2005;2:CD004137.

[26] Pak CY, Poindexter JR, Adams-Huet B, et al. Predictive value of kidney stone composition in the detection of metabolic abnormalities. Am J Med. 2004;115:26–32.

[27] Kocvara R, Plascura P, Petrik A, et al. A prospective study of non-medical prophylaxis after a first kidney stone. BJU Int. 1999;84:393–398.

[28] Norman RW, Bath SS, Robertson WG, et al. When should patients with symptomatic urinary stone disease be evaluated metabolically? J Urol. 1984;132:1137–1139.

[29] Borghi L, Meschi T, Amato F, et al. Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study. J Urol. 1996;155:839–843.

[30] Argyropoulos A, Farmakis A, Doumas K, et al. The presence of microscopic haematuria detected by urine dipstick test in the evaluation of patients with renal colic. Urol Res. 2004;32:294–297.

Appendix

Summary of the literature review.

| Main findings from the literature review                                                                 | References |
|----------------------------------------------------------------------------------------------------------|------------|
| In patients with acute flank pain, microscopic haematuria is in favour of the presence of urolithiasis but | [30]       |
| could be missing in up to 20% of patients with ureteral stones                                           |
| Urine dipstick (leukocyte esterase and nitrites) has good diagnostic performances to rule out urinary   | [23]       |
| tract infection in patients with suspected urinary stones                                               |
| Both renal ultrasound + KUB and non-contrast abdominal CT are supported by level 1 evidence to detect    | [18,24]    |
| urinary stones in the acute setting                                                                    |
| There is very little evidence regarding the severity criteria urging referral to hospital in patients    | [22]       |
| with renal colic                                                                                        |
| Randomized controlled trials have proved the benefit of NSAID over all other types of analgesics in case |
| of renal colic                                                                                        |
| Fluid intake to ensure diuresis > 2L/24 hours decrease the rate of stones recurrence                     | [29]       |
| There is very little evidence regarding the follow-up needed for urinary stone formers                  | [22]       |