Urinary lithiasis: diagnostic investigation

Participants:
Ernesto Reggio[1]
Alexandre Danilovic[1]
Francisco Tustumi[1]
Wanderley Marques Bernardo[2]

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1. Sociedade Brasileira de Urologia, Rio de Janeiro, RJ, Brasi
2. Coordenador do Programa Diretrizes da Associação Médica Brasileira, São Paulo, SP, Brasil
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The Guidelines Project, an initiative of the Brazilian Medical Association, aims to combine information from the medical field in order to standardize producers to assist the reasoning and decision-making of doctors.
The information provided through this project must be assessed and criticized by the physician responsible for the conduct that will be adopted, depending on the conditions and the clinical status of each patient.

Urolithiasis is a disease prevalent worldwide that affects approximately 15% of the world population. We performed a systematic review of the literature, with no time restrictions, in the Medline database, using the PICO methodology (patients with ureterolithiasis, pregnant, imaging exams, ESWT, radiography, ultrasonography, MRI, computed tomography, sensitivity, specificity, and accuracy, benefit, damage). We selected 18 papers to answer the questions clinics. The details of the methodology and the results of this guideline are set out in Annex 1.

INTRODUCTION

Urolithiasis is a disease prevalent worldwide that affects approximately 15% of the world population[1]. Urinary stones can deposit in renal calyces, the renal pelvis, ureter (proximal, middle, and distal), urinary bladder, and urethra. The risk factors are the male gender, third or fourth decade of life, exposure to heat, genetic factors, metabolic factors, dehydration, among others. The stones are constituted of pure calcium oxalate, calcium oxalate and phosphate, pure calcium phosphate, struvite, uric acid, or cystine[2].

RESULTS

What is the protocol for the radiological investigation of urolithiasis in pregnancy?

When ureterolithiasis is suspected in pregnant women, the method of radiological investigation of choice is the ultrasonography[3](D). It is an exam without adverse effects inherent to the method. But, as inconvenient, it has low sensitivity in pregnancy, it is an operator-dependent examination, and physiological hydronephrosis can be misinterpreted as urinary obstruction[4-6](A) Magnetic resonance imaging can be used as a second option, although it does not have the same diagnostic accuracy that computed tomography[4,7,8](A). Com-

puted tomography, with low doses of radiation, should be used only in selected cases because of the risk of carcinogenesis, especially in the first trimester of pregnancy[9,10](C).

What are the radiological diagnostic methods (accuracy, dose of irradiation, anatomical detailing) for patients in emergency care with clinical manifestations suggestive of renal colic?

Computed tomography

Computed tomography allows a detailed identification of anatomic structures, also enabling the identification of differential diagnoses for renal colic. It also allows the evaluation of the density of the stones. Its sensitivity is approximately 95%, and the specificity about 98%, in cases of renal colic[11,12](B). For computed tomography using low-doses of radiation, a meta-analysis[13](A) has shown a sensitivity of 93.1% (CI 95%: 91.5 to 94.4), specificity of 96.6% (CI 95%: 95.1 to 97.7%), positive predictive value of 19.9 (CI 95%: 12.7 to 31.2), negative predictive value of 0.05 (CI 95%: 0.02 to 0.10) and accuracy of 0.9877.

Ultrasonography

Ultrasonography is an exam with no adverse effects inherent to the method, but it is operator-dependent. It can evaluate the degree of hydronephrosis, absence of ureteric jets, and increased resistivity of the renal artery if done with the help of a Doppler[14](B). In the emergency room, ultrasonography allows for a sensitivity of 72% (CI 95%: 59 to 83%), specificity of 73% (CI 95%: 52 to 88%), positive predictive value of 85% (CI 95%: 71 to 94%), negative predictive value of 54% (CI 95%: 37 to 71%), accuracy of 72% (95% CI: 61 to 82%)[15] (B).

Simple radiography

In relation to computed tomography, it is an exam with much lower ionizing levels. Its sensitivity is 57% and the specificity 76%[16](B).

Magnetic resonance imaging

It provides a detailed assessment of associated anatomic structures. The sensitivity of magnetic resonance imaging is 66 to 72%, with a specificity of 96 to 100%, positive predictive value of 95 to 100%, negative predictive value of 71 to 75,5% accuracy of 80 to 85%[17](B).

What evaluation is needed for better diagnosis and planning of patients with complex renal lithiasis who must be submitted to surgical treatment, such as percutaneous kidney lithotripsy?

For the best therapeutic planning, patients who are candidates to percutaneous kidney lithotripsy must be submitted to computed tomography for detailing of the anatomical structures, the collecting system, and the stone, in order to plan the puncture pathway[18](D).

The use of intravenous contrast-enhanced computed tomography should be considered in complex anatomical situations, such as malformations or previous kidney surgery, in which it is desirable to know the anatomy of the renal collecting system. Alternatively, excretory urography can be used to evaluate the anatomy of the renal collecting system, but it does not replace the computed tomography since it does not allow the visualization of neighboring organs and their relationships with the kidney.

How should the radiological follow-up of patients submitted to surgical treatment for urinary lithiasis be conducted?

Ultrasound or computed tomography should be performed during the follow-up period to evaluate residual stones or relapse[18](D).

What radiological parameters are necessary to improve indications of eswt for urinary lithiasis?

The main tomographic parameters for the indication of ESWT are size and density of the stone, the distance between the stone and the skin, and location[19](A)[20](B).

SYNTHESIS OF EVIDENCE

The exams for diagnostic investigation of urolithiasis most frequently used are ultrasonography, computed tomography, x-ray of the abdomen and, less frequently, magnetic resonance imaging. Each has advantages and disadvantages regarding diagnostic accuracy, ability to identify anatomical structures, radiation dose, among others. The choice of method of radiological investigation depends on the characteristics of the patients and the purpose of the exam.

APPENDIX I

Clinical question

What is the protocol for the radiological investigation of urolithiasis in pregnancy?

What are the radiological diagnostic methods (accuracy, dose of irradiation, anatomical detailing) for patients in emergency care with clinical manifestations suggestive of renal colic?

What radiological parameters are necessary to improve indications of ESWT for urinary lithiasis?

Structured clinical question

P - Patients with ureterolithiasis and pregnant women
I - Imaging exams
C - Does not apply
O - Does not apply

P - Patients with ureterolithiasis
I - Imaging exams (X-Ray, USG, MRI)
C - Computed tomography
O - Sensitivity and specificity/Accuracy

P - Patients with ureterolithiasis
I - ESWT
C - Does not apply
O - Results of the treatment

Search strategy

("Urolithiasis/diagnosis"[Mesh] OR "Urolithiasis/diagnostic imaging"[Mesh]) AND (pregnant*)

("Urolithiasis/diagnosis"[Mesh] OR "Urolithiasis/diagnostic imaging"[Mesh]) AND ("sensitivity and specificity"[MeSH Terms] OR ("sensitivity"[All Fields] AND "specificity"[All Fields]) OR "sensitivity and specificity"[All Fields])

("treatment outcome"[MeSH Terms] OR ("treatment"[All Fields] AND "outcome"[All Fields]) OR "treatment outcome"[All Fields]) AND ("lithotripsy"[MeSH Terms] OR "lithotripsy"[All Fields] OR ("extracorporeal"[All Fields] AND "shock"[All Fields] AND "wave"[All Fields] AND "lithotripsy"[All Fields]) OR "extracorporeal shock wave lithotripsy"[All Fields]) AND Clinical Trial[ptyp]

Studies retrieved

The scientific database searched was Medline via PubMed. A manual search was conducted on reviews in references (narrative or systematic) and on the selected papers.

Date of last search: 25/03/2019

248 studies
689 studies
441 studies

Eligibility criteria

The selection of the studies and the evaluation of the titles and abstracts obtained from the search strategy in the database consulted were independently and blindly conducted by two researchers with expertise in the development of systematic reviews, in total accordance with the inclusion and exclusion criteria established and described in the PICO. The studies with potential relevance were separated.

According to the design of the studies

We included in our evaluation systematic reviews with meta-analysis of randomized clinical trials, and before and after studies, considering the best evidence available to answer the clinical questions. Narrative reviews were considered for full reading with the purpose of retrieving references which may have had been during the initial search strategy.

Language

We included studies available without restriction to the language.

According to publication

Only studies with texts available in its entirety were considered for critical evaluation.

Critical evaluation

Relevance - clinical importance

This guideline was prepared by means of a clinically relevant question in order to gather information in medicine to standardize approaches and assist in decision-making.

Reliability - Internal validity

The selection of the studies and the evaluation of the titles and abstracts obtained from the search strategy in the databases consulted were independently and blindly conducted, in total accordance with the inclusion and exclusion criteria. Finally, studies with potential relevance were separated. When the title and the summary were not enlightening, we sought for the full article. Only studies with texts available in its entirety were considered for critical evaluation.

Results application - External validity

The level of scientific evidence was classified per type of study according to Oxford[21] (Table 1).

TABLE 1: GRADES FOR RECOMMENDATION AND LEVELS OF EVIDENCE

A: Experimental or observational studies of higher consistency.
B: Experimental or observational studies of lower consistency.
C: Uncontrolled case/study reports.
D: Opinion deprived of critical evaluation, based on consensus, physiological studies or animal models.

The selected evidence was defined as a randomized controlled clinical trial (RCT) and submitted to an appropriate critical evaluation checklist (Table 2). The critical evaluation of RCTs allows to classify them according to the Jadad score[22], considering Jadad trials < three (3) as inconsistent (grade B) and those with score ≥ three (3 , consistent (grade A), and according to the Grade[24] score (strong or moderate evidence).

When the evidence selected was defined as a comparative study (observational cohorts, or non-randomized clinical trial), it was subjected to an adequate critical assessment checklist (Table 3), allowing for the classification of the study according to the Newcastle Ottawa Scale[23], which considered consistent cohort studies with scores ≥ 6, and inconsistent < 6.

TABLE 2. PROCESS FOR CRITICAL EVALUATION OF RANDOMIZED CONTROLLED TRIALS

Study data Reference, study design, Jadad, level of evidence	Sample size calculation Estimated differences, power, significance level, total number of patients
Patient selection Inclusion and exclusion criteria	Patients Recruited, randomized, prognostic differences
Randomization Description and blinded allocation	Patient follow-up Time, losses, migration
Treatment protocol Intervention, control, and blinding	Analysis Intention to treat, analyzed intervention and control
Outcomes considered Primary, secondary, measurement instrument for the outcome of interest	Results Benefits or harmful effects in absolute data, benefits or harmful effects on average

Method of extraction and result analysis

For results with available evidence, the population, intervention, outcomes, presence or absence of benefits and/or harmful effects, and controversy will be specifically defined whenever possible.

The results will be presented preferably in absolute data, absolute risk, number needed to treat (NNT) or number needed to harm (NNH) and, eventually, in mean and standard deviation values (Table 4)

TABLE 4 - SPREADSHEET USED FOR DESCRIBING AND PRESENTING THE RESULTS OF EACH STUDY

Evidence included
Study design
Selected population
Follow-up time
Outcomes considered
Expression of results: percentage, risk, odds, hazard ratio, mean

Application of evidence - Recommendation

The recommendations will be elaborated by the authors of the review, with the initial characteristic of synthesis of evidence subject to validation by all authors who participated in creating the Guideline.

The global synthesis will be based on the evidence described. Its strength will be estimated (Oxford[21]/ Grade[24]) as 1b and 1c (grade A) or strong, and as 2a, 2b and 2c (grade B) or moderate weak, or very weak.

Conflict of interest

There is no conflict of interest related to this review that can be declared by any of the authors.

Final declaration

The Guidelines Project, an initiative of the Brazilian Medical Association in partnership with the Specialty Societies, aims to reconcile medical information in order to standardize approaches that can aid the physician's reasoning and decision- making process. The information contained in this project must be submitted to the evaluation and criticism of the physician , responsible for the conduct to be followed, given the reality and clinical condition of each patient.

TABLE 3 - PROCESS FOR CRITICAL EVALUATION OF COHORT STUDIES

Representativeness of the exposed and selection of the non-exposed (Max. 2 points)	Exposure definition (Max. 1 point)	Demonstration that the outcome of interest was not present in the beginning of the study (Max. 1 point)	Comparability on the basis of the design or the analysis (Max. 2 points)	Outcome assessment (Max. 1 point)	Adequate follow-up time (Max. 2 points)	Scores and level of evidence

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