



UPDATE IN RADIOLOGY

Diagnostic management of renal colic<sup>☆</sup>



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**Abstract** Renal colic is a common reason for presentation to emergency departments, and imaging has become fundamental for the diagnosis and clinical management of this condition. Ultrasonography and particularly noncontrast computed tomography have good diagnostic performance in diagnosing renal colic. Radiologic management will depend on the tools available at the center and on the characteristics of the patient. It is essential to use computed tomography techniques that minimize radiation and to use alternatives like ultrasonography in pregnant patients and children. In this article, we review the epidemiology, clinical and radiologic presentations, and clinical management of ureteral lithiasis.

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Manejo diagnóstico del cólico renal

**Resumen** El cólico renal es un motivo frecuente de consulta en los Servicios de Urgencias y la imagen diagnóstica se ha convertido en una herramienta fundamental del diagnóstico y manejo clínico. La ecografía y, fundamentalmente, la tomografía computarizada sin contraste permiten diagnosticarlo con un rendimiento elevado. El manejo radiológico va a depender de la disponibilidad del centro y de las características de la población. Es imprescindible usar técnicas de baja dosis de radiación en la tomografía computarizada y técnicas alternativas como la ecografía en embarazadas y niños. En este artículo hacemos una revisión epidemiológica, clínica, radiológica y del manejo clínico de la litiasis ureteral.

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Introduction

Renal colics (RC) are the most frequent clinical manifestation of renal lithiasis and a common cause for seeking Hospital Emergency Services (HES). Diagnosing and treating them early reduce complication which is derived from

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maintained urinary obstruction, such as renal function deterioration and infection accompanied by septic shock risk. Diagnostic imaging plays an important role in clinical management when trying to confirm lithiasis, stage the extent of obstruction in the collector system, assess the probability of spontaneous expulsion and identify complications or alternative diagnoses.<sup>1-3</sup> In addition, it makes it easier to select the best therapeutic option, which can be a medical treatment, extracorporeal lithotripsy or nephrolithotomy, endoscopically or percutaneously. The number and size of the calculi as well as their composition influence the selection,<sup>2</sup> in such a way that uric acid lithiases respond to medical treatment and extracorporeal lithotripsy is not effective in cases of cysteine, brushite or calcium oxalate monohydrate lithiases. Radiological techniques are also useful to follow the calculus until it is expelled and then to decide whether to maintain medical treatment or complement it with an endourological procedure. The options include simple radiography, intravenous urography (IVU), ultrasound, computed tomography (CT) and magnetic resonance images (MRI). A swift and precise diagnosis has made it possible to use CT without contrast as the first option for patients with acute lumbar pain suggesting RC, a recommendation endorsed by scientific societies such as the *American College of Radiologists* and the *American Urological Association*.<sup>2,3</sup> Such a recommendation, along with the progressive availability of CT scanners in ER, has promoted a rapid increase in the number of examinations, which in patients with suspicion of RC got multiplied by a factor of 10 in 11 years.<sup>4</sup> As a consequence, there has been a parallel rise in the collective radiation dose, which has not entailed a parallel improvement of the "patient-based indicators", such as the increase in the percentage of lithiasis diagnoses, relevant alternative disease or the percentage of hospitalized patients.<sup>4</sup> In order to minimize the doses of radiation it is recommended to use low-dose techniques<sup>2</sup> that allow us to reduce such doses up to 70%, according to personal preferences and the technological availability of the scanner. Results with studies using ultra-low doses have been recently published with a range below that of abdominal radiography,<sup>5</sup> yet availability of this technique is still limited, as shown by a recent study where only 2% of the CT were performed with doses lower than 3 millisieverts (mSv).<sup>6</sup> Also patients with ureteral lithiasis undergo image examination before, during and after treatment, a situation that gets itself more complicated due to a certain trend to have lithiasis relapses. Therefore, the examination is highly likely to be repeated once or twice along the process, with the subsequent cumulative effect of the dose in a population that due to its average age of around 40 years is radiosensitive suggestive of caution with the doses.<sup>7,8</sup> Consequently, the *European Association of Urology* recommends ultrasound as the first imaging modality to be used in RC.<sup>9</sup>

The goal of this article is to review the utility of imaging diagnostic techniques for the clinical diagnosis and management of renal colics.

## Epidemiology

The incidence of urolithiasis in Spain is 0.73%, which amounts to some 325,000 new cases every year.<sup>10</sup> RC is the

most frequent complication of renal lithiasis, with an incidence between 0.9 and 3 cases/1000 inhabitants/year<sup>11,12</sup> and it usually affects patients between 20 and 60 years old, with a maximum incidence between 40 and 60 years old men predominantly.<sup>12-14</sup> It is estimated that up to 12% of men and 6% of women will experience one or more RC episodes in their lives,<sup>12</sup> with a recurrence rate of 50%.<sup>15</sup> One in four patients with RC has a family history of RC a situation that multiplies the risk of lithiasis by three.<sup>16</sup>

Depending on the size and location of the calculus, expulsion can take a few hours or even several weeks, a period of time in which successive episodes of colic pain may occur. Some calculi will not be expelled spontaneously and will require intervention; also relapse is common after the index event.<sup>17</sup>

## Clinical context

RC is triggered by partial or complete ureteral obstruction, usually due to an impacted lithiasis that raises pressure significantly. The classic clinical presentation of ureteral lithiasis is intense, unilateral, sudden colic pain. It is initially located in the lumbar fossa usually irradiating toward the inguinal and genital areas to later evolve when the calculus descends in such a way that in the middle ureter it can simulate appendicitis or diverticulitis, depending on its location—right or left. As the calculus comes closer to the bladder, the symptoms of vesical irritation predominate, such as polakisuria and tenesmus. It is usually accompanied by digestive symptoms such as nausea, vomiting or constipation due to ileus reflux.<sup>12,16,18</sup> In approximately 90% of the patients hematuria occurs yet the lack of it does not exclude RC<sup>12,15</sup>; even half of the patients with aneurisma of the abdominal aorta can have it.<sup>19</sup> With the typical pain accompanied by hematuria, clinical diagnosis is possible and the imaging tests do not strictly be necessary since they will not change the therapeutic decisions.<sup>20-22</sup> Nevertheless, most of today's guidelines and recommendations indicate an immediate imaging test—ideally CT without contrast in all patients who come into the ER with RC, even with typical presentation.<sup>2,3</sup> This recommendation that can have defensive nuances, seems to be justified by the fact that it is necessary to rule out other processes, in addition to the fact that it confirms ureteral lithiasis and the need for immediate treatment if the calculus is large. However interventions on the urinary tract are not free from complications and medical treatment is considered to be an option, at least during the first 2 weeks. The probability of spontaneous expulsion with medical treatment of a calculus smaller than 5 mm is 65%, and 47% if it is between 5 and 10 mm, irrespective of its location. Based on its location, distal lithiases are expelled more often and before the proximal ones.<sup>23</sup> When a calculus has not been expelled in 4–6 weeks, it is not likely to be expelled and hence indicative of intervention.<sup>12</sup>

Performing systematically irradiating radiological tests is more under discussion in higher-risk populations. In children 3% of the studies are performed with CT without contrast when suspicion of RC<sup>8</sup> yet today the need for using it systematically because of its greater radiosensitivity is questionable. Another risk group is that of patients with known nephrolithiasis and previous colic episodes, in whom an

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