

The Trends of Urolithiasis Therapeutic Interventions over the Last 20 Years: A Bibliographic Study



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Abstract

Introduction: The clinical and economic burden of kidney stones is a challenge for the healthcare system. There is a limited bibliometric project exploring the literature trends on 'urolithiasis' and its related management.

Methods: A systematic review was conducted to discover the related abstracts regarding each specific issue, investigated year by year from May 2000 to May 2020 (20 years). To make an effective comparison, the statistics resulting from every single study were allocated to two 10-year periods: period 1 (2000 to 2010) and period 2 (2010 to 2020). In this study, we included all English language articles, all non-English articles with English abstracts, and studies in which interventions were used for stone removal, including laser technology. Also, we excluded the studies without a published abstract, an intervention or a laser, animal and in vitro studies, and case reports.

Results: These articles are about ureteroscopy (URS) (n=10360, 33.45%), percutaneous nephrolithotomy (PCN) (n =10790, 34.84%) and extra-corporeal shockwave lithotripsy (ESWL) (n=9846, 31.76%). When evaluating the two time periods, there were 9912 studies available in period one, which increased by ×2.12 times (112.71% rise) to 21 084 studies in period two ($P = 0.001$). The increase was 133%, 103.51%, and 70.4% for URS, PCN, and SWL respectively. A total of 855 studies on Laser application via URS were published on PubMed over a 20-year period. There was an increasing trend toward using laser application via URS over the study period. Also, there were 230 articles published in period one, which increased by nearly 2.71 times (rise of 171.73%) to 625 papers in period two ($P < 0.001$). There was an increasing trend toward using laser application via PCN; 126 papers were published in period one, which increased by nearly 3.05 times (rise of 205.5%) to 385 papers in period two ($P = 0.002$).

Conclusion: The minimal invasive interventions for stone removal, including URS and PCN, increased dramatically in the last decade, and the use of lasers in stone treatment increased significantly in the last decade.

Keywords: Laser; Percutaneous nephrolithotomy; Publications; Renal stone; Therapy; Ureteroscopy; Urolithiasis.



Introduction

The prevalence of urolithiasis is about 20% and its clinical and economic burden makes it an important health issue for healthcare systems^{1,2}; for instance, 4%–8% of end-stage renal disease is caused by urolithiasis.³ According to the number of publication, it seems the prevalence of kidney stone disease (KSD) and its associated intervention has been increasing, which can be explained with improved diagnostic modalities, rising in body mass index (BMI), and nutritional and ecological issues.⁴⁻⁷ Regarding the high recurrence rate of kidney stones, safe and effective treatment of kidney stones is mandatory. The interventions used to remove kidney stones are as follows: Ureteroscopy (URS), percutaneous nephrolithotomy

(PCN), extra-corporeal shockwave lithotripsy (ESWL) and open surgery, but open surgery for kidney stones has come to extinction.^{5,8}

The evolution of modern methods in stone surgery such as flexible ureteroscope, mini PCN and the use of laser technology revolutionizes stone treatment intervention.¹ Technological advances help us to attain better stone-free rates and offer our patients the greatest quality of care.⁹

The advances in laser technology over the past 20 years enable us to use it in the field of urology.¹⁰ Different lasers have been used in a wide variety of procedures including prostate surgery, KSD management, and intervention for urethral or ureteral strictures like ureteropelvic junction obstruction (UPJO).¹¹

Publication trends reveal variations in clinical management and new operating novelties,⁵ although there is a limited bibliometric study exploring the publication trends (2000–2020) on ‘Urolithiasis’ and its related management. This study was done to find out the publication trends about urolithiasis management.

Methods

A bibliographic evaluation of the literature was performed by MeSH terms and keywords in PubMed from May 2000 to May 2020 on therapeutic intervention for urolithiasis and the use of laser applications in urolithiasis.

Inclusion and Exclusion Criteria

In this review we set these conditions as inclusion criteria:

- All English language papers
- All non-English papers were included if their abstracts were available in English
- Studies in which therapeutic modalities were used for stone surgery, including laser technology.

In this review we set these conditions as exclusion criteria:

- The abstract was not available
- Articles in which therapeutic modalities or lasers were not used
- Animal and in vitro studies
- Case series or case reports

Article Selection

The review was done according to the Cochrane Review guideline. Regarding each subject, all related abstracts were found, and it was performed year by year from 2000 to 2020 (20 years).

We considered following keywords for retrograde intrarenal surgery (RIRS): “ureteroscopy”, “RIRS”, “retrograde intrarenal surgery”, “urolithiasis”, “kidney stone”, “renal stone”, and “ureteric stone” and following key words for PCN: “percutaneous nephrolithotomy”, “PCN”, “PCNL”, “PNL”, “percutaneous surgery”, “urolithiasis”, “kidney stone”, “renal stone”, and “ureteric stone”.

The following keywords were also considered for ESWL: “extracorporeal lithotripsy”, “ESWL”, “urolithiasis”, “kidney stone”, “renal stone”, and “ureteric stone”

To use lasers in urolithiasis, the keyword “laser” was added to the above keywords. These keywords were searched on PubMed over the last 20 years from 2000 to 2020. The above inclusion and exclusion criteria were considered. To make an effective comparison, the data resulting from every single research were divided into two periods: period one (2000 to 2010) and period two (2010 to 2020). The analysis was conducted with the independent *t* test and Pearson’s correlation coefficient using the Statistical Package for the Social Sciences (SPSS) version 22.

Results

Therapeutic Modalities for Urolithiasis

Throughout the last 20 years, there have been 30996 articles about routine therapeutic modalities for urolithiasis in PubMed, most of which (28792, 92.8%) were in English. Most of the non-English articles (2204, 7.11%) were in French (n=580, 1.87%) and Spanish (n=644, 2.09%). These articles were about URS (n=10360, 33.45%), PCN (n =10790, 34.84%), and SWL (n=9846, 31.76%) (Figure 1). When comparing the two time periods, the total number of papers published in period one was 9912, which was augmented by ×2.12 times (112.71% rise) to 21084 papers in period two (*P* = 0.001). The increase was 133%, 103.51%, and 70.4 % for URS, PCN, and SWL respectively (Figure 2). The number of English/non-English language articles in period one and period two was 9112/800 (about 11.23) and 19680/1404 (about 14.01) respectively.

Laser Applications in the Treatment of Patients With Urolithiasis

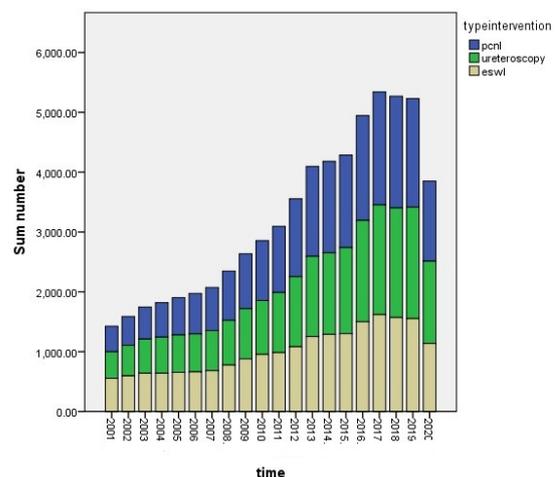


Figure 1 . Number of Publication About Therapeutic Intervention for Urinary Stones From 2001 to 2020.

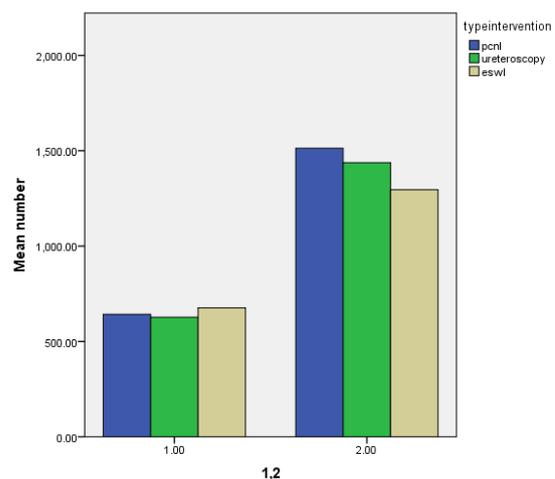


Figure 2. The Comparison Between the Mean Numbers of Publication in Two Periods (1= from 2001 to 2010, 2= from 2010 to 2020).

Throughout the last 20 years, 1364 articles were published on the usage of lasers in the management of patients with urolithiasis, most of which (1276) (93.5%) were in English (Figure 3). Most of the non-English articles (88) (6.45%) were in French (43) (3.08%) and Spanish (35) (2.56%). These articles were about URS (n = 855) (62.68%) and PCN (n = 509) (37.31%), and when evaluating the two time periods, 325 articles were available in period one, which were augmented by $\times 3.12$ times (212% rise) to 1014 articles in period two ($P = 0.001$), (Figure 4). The number of English/non-English language articles in period one and period two was 304/23 (about 13.21) and 962/52 (about 18.5) respectively.

Ureteroscopy

There were 10360 papers about URS in PubMed over these 20 years, most of which (9600) (92.6%) were in English. Of the non-English papers (750, 7.23%), most of them were in French (n = 209) (2.01%) and Spanish (n = 221) (2.13%). There was an increasing trend toward URS (Figure 5) for English language papers from 2925 articles in 2000-2010 to 6696 papers in 2010-2020 ($p < 0.001$). When evaluating the two time periods, 3111 papers were available in period one, which increased by $\times 2.3$ times (133% rise) to 7249 articles in period two ($P = 0.001$) (Figure 5).

Laser Application Via Ureteroscopy

A total of 855 studies on Laser application via URS were published on PubMed over a 20-year period [803 (93.9%) articles in the English language and 52 (6.1%) ones in the non-English language]. There was an increasing trend toward using lasers via URS over the study period. There were a total of 230 articles in 2000-2010, which were augmented by almost 2.71 times (rise of 171.73%) to 625 articles in period two ($P < 0.001$). The number of English/non-English language papers in period one and period

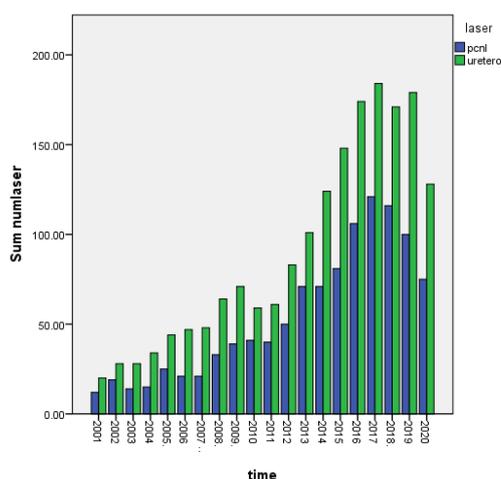


Figure 3. Laser Application in the Treatment of Patients With Urolithiasis Per Year.

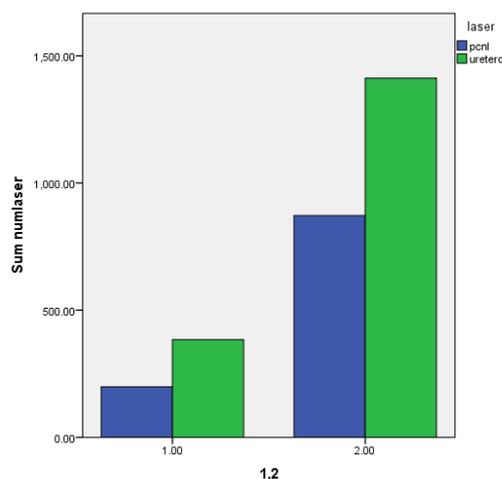


Figure 4. Laser Application in the Treatment of Patients With Urolithiasis in Different Periods (1=2001-2010, 2=2010-2020)

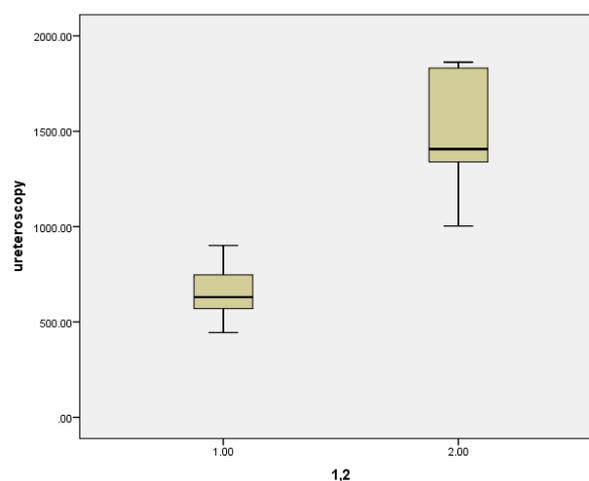


Figure 5. Significant Difference Between Publications About URS in Different Periods (1=2001-2010, 2=2010-2020).

two was 206/24 (8.58) and 597/28 (21.32) respectively.

Percutaneous Nephrolithotomy

There are 10790 studies about PCN in PubMed over a 20-year period [9629 (89.24%) articles in the English language and 1161(10.7%) ones in the non-English language]. There was an increasing trend toward PCN over the study period, and there were a total of 3555 papers in 2000-2010, which increased by nearly 2.03 times (rise of 279%) to 7235 papers in period two ($P < 0.001$) (Figure 6). The number of English/non-English language articles in period one and period two was 3095/460 (6.7) and 7043/192 (36.6) respectively.

Laser Application Via Percutaneous Nephrolithotomy

A total of 509 studies on laser application via PCN were available on PubMed over a 20-year period [English articles (473, 92.9%) and non-English articles (36,

7.1%]). There was an increasing trend in the rate of laser application via PCN over the study period, and there were a total of 126 articles in 2000-2010, which increased by nearly 3.05 times (rise of 205.5%) to 385 papers in period two ($P = 0.002$) (Figure 7). The number of English/non-English language articles in period one and period two was 110/16 (6.87) and 363/22 (16.5) respectively.

Extra-corporeal Shockwave Lithotripsy

There were 9846 studies about ESWL in PubMed over a 20-year period [9033 (91.7%) articles in the English language and 813 (8.3%) ones in the non-English language]. There was an increasing trend in the ESWL over the study period, and there were a total of 3838 articles in 2000-2010, which were augmented by almost 1.56 times (rise of 56.5%) to 6008 papers in period two ($P < 0.001$) (Figure 8). The number of English/non-English language papers in period one and period two was 3092/746 (4.14) and 5941/67 (88.67) respectively.

Discussion

This is a bibliometric study aiming to look at articles published over the last 20 years (2000–2020) in the field of urolithiasis management. The results of this study revealed that among modalities used to treat kidney stones, the total number of published papers about surgical interventions for urolithiasis such as PCN or RIRS increased significantly over the last 20 years. It is implied that the prevalence of urolithiasis increased over the last 20 years.¹² The advances in imaging modalities,¹³ increased incidence of obesity,¹⁴ diabetes, hypertension,¹² diets rich in animal protein and sodium, and insufficient liquid consumption all contribute to it.

Our study showed that the trend of publication is toward minimal invasive surgeries such as RIRS and PCN, and the use of lasers in the management of urolithiasis is growing. The innovation in minimally invasive surgeries

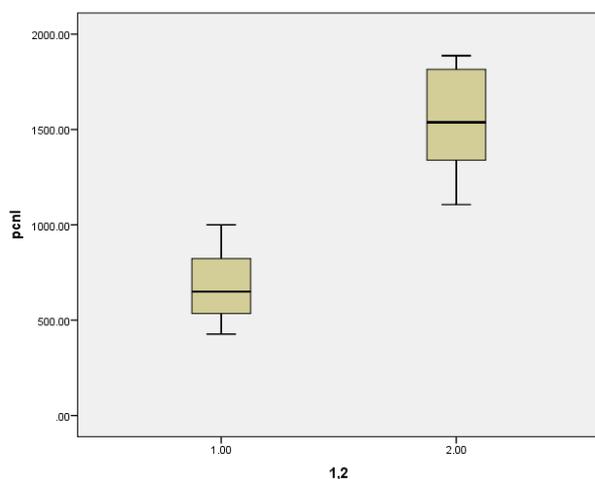


Figure 6. Significant Difference Between Publications About PCN in Different Periods (1=2001-2010, 2=2010-2020)

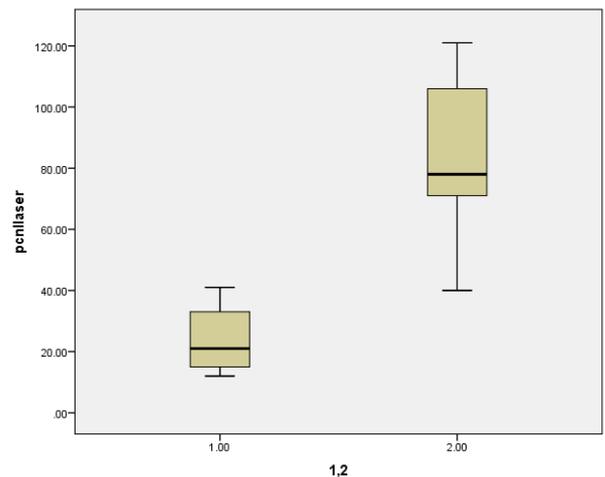


Figure 7. Significant Difference Between Laser Applications Via PCN in Different Periods (1=2001-2010, 2=2010-2020).

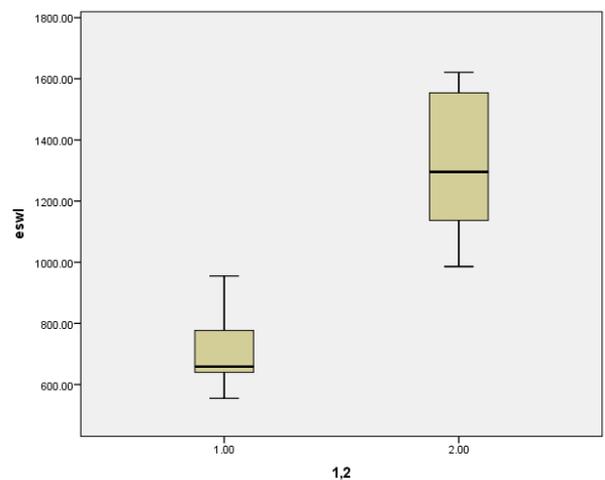


Figure 8. Significant Difference Between the Uses of ESWL in Different Periods (1=2001-2010, 2=2010-2020).

such as flexible instruments, laser and miniaturization of PCN was partly explained by this trend of publication.¹ Moreover, it emphasizes an increasing acceptance of the minimally invasive PCN methods for KSD surgery, like mini PCN that uses the holmium laser for stone removal.¹⁵ The URS has increasingly been used due to its safety and effectiveness in complex renal stones, bleeding diathesis, pediatrics, obesity, and pregnancy.¹⁶⁻¹⁸ Local and international fellowships, especially in minimal invasive surgery, lead to increased use of less invasive surgeries such as PCN or RIRS compared to ESWL.¹⁹ The rapid stone-free rate was reached with minimal invasive surgery compared with ESWL without increasing complications significantly; this is another reason for this growth of papers about the surgical management of urolithiasis.²⁰ Additionally, fewer advances in ESWL technology, unlike PCN or URS, lead to decreased use of ESWL with time.¹ Although the ‘publication’ trend is a positive point for

the invasive techniques, the authors do not infer that urologists desire minimal invasive surgical techniques compared to ESWL.

Besides intervention, our review also revealed that published articles on laser application for KSD removal have surged over the last two decades, showing that the laser has an important role in changing the landscape of surgical trends. The advances in the field of endourology are partly explained by the evolution of the holmium laser.⁷

Today, there is a debate about what kind of minimal invasive surgery is appropriate for the management of urolithiasis. Given the continuous progressions, the therapeutic applications of URS have been extended.²¹⁻²³ It is specified in the European Association of Urology (EAU) guidelines: "URS as a possible first line intervention for intra-renal stones 1-2 cm"²⁰. The main drawback of URS is its cost but advances in laser technology and miniaturization of PCN make some centers use minimally invasive PCN methods such as ultra-mini and mini PCN rather than URS to treat stones of 1-2 cm.¹⁵ Although PCN is still recognized as the standard intervention for stones >2 cm, there is strong approval for URS in this scenario.^{7,24,25} Our study showed that the publication in the field of URS is more rapidly growing than the publication in the field of PCN. However, we do not infer that urologists prefer URS compared to PCN.

Our study has some limitations. Given the fact that PUBMED is the most famous database for bibliometric studies as opposed to other sources such as Scopus, there are numerous journals that may not be indexed on PubMed.²⁶ Therefore, these articles might miss in our study. On the other hand, papers with a non-English language abstract or without an abstract were omitted. The last thing is that we do not consider the citation index in our study.

Conclusion

This bibliometric study revealed that the number of publications about urolithiasis intervention increased dramatically in the last decades. The trend of most articles was about URS and PCN and the use of lasers on urolithiasis increased significantly in the last decades. On the other hand, articles about ESWL were the least-growing ones in the last decade.

Key Points of the Study

The number of publications about urolithiasis intervention increased dramatically in the last decades. The trend of most articles is about RIRS and Laser; on the other hand, articles about ESWL were the least-growing ones in the last decade.

Ethical Considerations

Not applicable.

Conflict of Interests

The authors had no conflict of interest.

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