



شیوع عوارض لیتوتریپسی در سنگ‌های سستم بولی نزد مردان مراجعه کننده به شفاخانه طبیان

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چکیده

زمینه و هدف: لیتوتریپسی یک روش مؤثر و حداقل تهاجمی برای تدوای سنگ‌های سستم بولی است که نیاز به جراحی‌های پرخطر را کاهش می‌دهد. با این حال، محدودیت‌هایی مانند کاهش کارایی در سنگ‌های بزرگ‌تر، عود، انتان، خونریزی و باقی ماندن سنگ‌ها همچنان موضوع بحث‌های مداوم است. این مطالعه به هدف بررسی شیوع عوارض لیتوتریپسی در مردان مبتلا به سنگ‌های سستم بولی در هرات، افغانستان انجام شده است.

روش تحقیق: این مطالعه مقطعی توصیفی بر روی ۵۹ مرد مبتلا به سنگ‌های سستم بولی در محدوده سنی زیر ۶۰ سال، طی یک دوره یک‌ساله از ۲۱ مارچ ۲۰۱۸ تا ۲۰ مارچ ۲۰۱۹ در شفاخانه طبیان هرات انجام شد. مردان که به سنگ‌های سستم بولی مبتلا بوده و کاندید لیتوتریپسی بودند، مورد ارزیابی قرار گرفتند و اطلاعات دموگرافیک و طبی آن‌ها ثبت شده و در نهایت تجزیه و تحلیل داده‌ها با استفاده از نرم‌افزار SPSS نسخه ۲۶ انجام شد.

یافته‌ها: بیش‌ترین میزان بروز موارد در دهه سوم زندگی مشاهده شد (۳۸٫۹٪). از نظر توزیع جنسیتی، ۷۷٫۹۶٪ مرد و ۲۲٫۰۳٪ زن بودند. بیش‌تر موارد (۷۶٪) از ولایت هرات بودند. کوچک‌ترین سنگ شناسایی‌شده ۷ میلی‌متر و بزرگ‌ترین آن ۲۰ میلی‌متر بود. میزان موفقیت لیتوتریپسی به ۹۵٪ می‌رسید. از نظر محل سنگ، بیش‌ترین شیوع در کلیه راست ۳۹٪ دریافت گردید. در میان عوارض پس از لیتوتریپسی، خونریزی در ۳۲٪ موارد دیده می‌شد که از این میان، تنها ۳۸٫۳٪ افراد نیاز به انتقال خون داشتند. انتان در ۷۶٪ موارد و اکیموز پوستی ۶/۷٪ مردان دریافت گردید.

نتیجه‌گیری: به‌طور کلی، لیتوتریپسی یک روش حداقل تهاجمی با عوارض کم‌تر، هزینه‌های پایین‌تر و در اغلب موارد بدون نیاز به بستری شدن است که آن‌را به گزینه‌ای مؤثر برای تدوای سنگ‌های سستم بولی تبدیل می‌کند.

واژه‌گان کلیدی: لیتوتریپسی، سنگ‌ها، سستم بولی، عوارض، خونریزی

ارجاع به این مقاله:

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Prevalence of lithotripsy complications in urinary tract stones in patients referring to Tabiban hospital

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Article Information	Abstract
Type: Original Received: 10/ 11/ 2024 Accepted: 11/ 03/ 2025 Published: 19/ 04/ 2025 *Present address and corresponding author: Mohammadullah Yaqubi. Department of Surgery, Faculty of Medicine, Herat University, Herat, Afghanistan-Herat, Herat, Afghanistan.  mohamadullah.yaq@gmail.com DOI: https://doi.org/10.58342/ghalibMj.V.2.I.1.3	Background: Lithotripsy is an effective and minimally invasive method for the treatment of urinary tract stones, reducing the need for high-risk surgeries. However, its limitations, such as lower efficacy in larger stones, recurrence, infection, bleeding, and residual stones, remain a subject of ongoing discussion. This study aims to assess the prevalence of lithotripsy complications in urinary tract stones in Herat, Afghanistan. Methods: This cross-sectional descriptive study was conducted on 59 patients with urinary tract stones, aged < 60 years, over one year from March 21, 2018, to March 20, 2019, in Tabiban Hospital, Herat. Patients diagnosed with urinary tract stones and candidates for lithotripsy were evaluated, with demographic information recorded. Data analysis was performed using SPSS version 26. Results: The highest incidence of cases was observed in the third decade of life (38.9%). In terms of gender distribution, 77.96% of the patients were male, and 22.03% were female. Most cases (76%) were from Herat province. The smallest detected stone measured 7 mm, while the largest was 20 mm. The success rate of lithotripsy was 95%. Regarding stone location, the highest incidence was in the right kidney (39%). Among post-lithotripsy complications, bleeding was observed in 20.3% of cases, with blood transfusion required in only 3.38%. Infection occurred in 6.7% of cases, and cutaneous ecchymosis was observed in 6.7%. Conclusion: Overall, lithotripsy is a minimally invasive procedure with fewer complications, lower costs, and, in most cases, no hospitalization, making it a viable treatment option for urinary tract stones.

Key words: Lithotripsy, Stones, Urinary Tract, Complications, Bleeding

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Introduction

Extracorporeal Shock Wave Lithotripsy (ESWL) was introduced in the early 1980s as a completely noninvasive treatment for kidney and urinary tract stones. The U.S. Food and Drug Administration (FDA) approved ESWL in 1984. Dornier was the first company to design a device for the treatment of urinary stones. This method has been proven to be effective and efficient for treating uncomplicated and non-inflammatory stones. ESWL is a minimally invasive procedure used to fragment stones in certain parts of the urinary system, except renal parenchymal and bladder stones. Additionally, ESWL has been used to treat the gallbladder and pancreatic stones ^[1,2].

The Department of Urology at the University of Florida was one of six sites in the United States that studied ESWL complications under the supervision of the world-renowned specialist, Dr. Birdwell Finlayson. Lithotripsy is widely used by physicians and specialists to treat upper urinary tract stones. The success rate for treating stones 1–2 cm in elective patients ranges from 77.4% to 100%. According to a study published in the Oman Medical Journal, the success rate of lithotripsy was 74% for kidney stones and 88% for urinary tract stones. However, lithotripsy may require adjunctive methods in 2.6% of patients, and 32% of patients may require repeat sessions ^[3,4]. Currently, ESWL is considered a highly effective treatment for kidney stones smaller than 2 cm, particularly small renal stones that are easily visualized on radiography, with a success rate ranging from 33% to 91% ^[5]. The best results were obtained when the kidney stone was smaller than 1.5 cm. ESWL is the treatment of choice for medium-sized, uncomplicated ureteral stones ^[6].

Since the introduction of ESWL in the early 1980s, significant changes and advancements have been made in minimally invasive kidney stone treatment, particularly in pediatric patients. Recent studies have reported that ESWL is an effective, safe, and reliable method for the treatment of urinary tract stones in children. It is considered the first-line treatment for kidney stones measuring 1.5–2 cm in children ^[7]. However, for patients with renal colic (RC), initial conservative treatment such as antispasmodic therapy and pain relief is recommended before proceeding with lithotripsy (ESWL or ureteroscopy). Delayed intervention is often associated with recurrent RC, urinary tract inflammation, and azotemia ^[8,9]. If patients experience untreated obstruction for more than four weeks, regardless of stone size and symptoms, there is a significant risk of long-term renal insufficiency ^[6]. Although ESWL offers advantages such as being minimally invasive, cost-effective, and having a low complication rate with short hospitalization time, concerns remain about the potential harmful effects of shock waves on developing kidneys ^[10].

Various kidney injuries have been reported with different lithotripters. Some studies have not found adverse effects, but overall, ESWL is considered the preferred method for managing most urinary stones in children of all ages ^[11].

Lithotripsy is generally a low-risk and safe procedure; however, like any medical intervention, it can be associated with complications. These complications depend on the type of lithotripsy, stone location, patient condition, preprocedure preparation, preoperative testing, number of sessions, patients' intrinsic reactions, blood disorders, medication use, and underlying diseases. Potential complications include pain due to stone movement in the urinary tract, hematuria caused by kidney and urinary tract tissue damage, urinary tract infection (with symptoms such as fever and dysuria), kidney and surrounding tissue injuries (rare, but more likely in patients with underlying conditions), urinary tract obstruction due to stone fragments (often causing colicky pain), hypertension, decreased kidney function, and recurrent stone formation ^[12]. Since lithotripsy treats existing stones but does not prevent new stone formation, post-procedure recommendations include increased fluid intake, regular follow-up of kidney function, ensuring complete stone clearance, and lifestyle and dietary modifications to prevent recurrence ^[13].

Although ESWL is typically an outpatient procedure requiring no hospitalization, stone fragments usually pass through the urine within a few days, causing mild pain. If the stone is large, additional treatment methods may be necessary, in addition to ESWL. Preprocedural evaluations, including patient identification, registration, and explanation of the procedure, are essential. Factors, such as age, medical history, medications, and general health, influence the likelihood of complications. Preoperative tests may include ECG (especially in older patients), routine blood tests, assessment of coagulation factors, such as partial thromboplastin time (PTT), biochemical blood analysis, routine urinalysis, and urine culture ^[14]. Despite the effectiveness of lithotripsy, there are specific contraindications, including pregnancy, uncontrolled urinary infections, unregulated coagulation disorders, cystine and certain calcium-based stones, abdominal aortic or renal artery aneurysms, severe skeletal deformities, obesity, ureteral obstruction with scar tissue, renal cancer, large kidney stones, and patients with pacemakers or uncontrolled hypertension ^[15,16].

Challenges in treating urinary tract stones with lithotripsy include the inability to determine stone hardness before treatment, stone entrapment in the ureter, treatment failure after multiple sessions, the need for general anesthesia in pediatric patients, and the need to discontinue anticoagulants, such as aspirin one

week before lithotripsy. This study aimed to assess the prevalence of lithotripsy complications in patients with urinary tract stones at the Tabiban Hospital in Herat, Afghanistan.

Research Methodology

This cross-sectional descriptive study was conducted on 59 patients diagnosed with urinary tract stones, aged between 1 and 60 years, over a one-year period from 1-1-1397 to 29-12-1397 years at Tabiban Hospital in Herat.

Inclusion and Exclusion Criteria:

- Inclusion Criteria: Patients with urinary tract stones within a specified age range.
- Exclusion Criteria: Patients above 60 years of age, those with underlying diseases, and pregnant women.

Data collection

A structured data collection form was designed to gather the relevant information for this study. The demographic data of the patients were recorded. Prior to performing lithotripsy, necessary clinical examinations were recommended. Post-lithotripsy complications, such as pain, bleeding, residual stones, cutaneous ecchymosis, and the success rate of stone fragmentation, are documented in a separate table.

Data Analysis

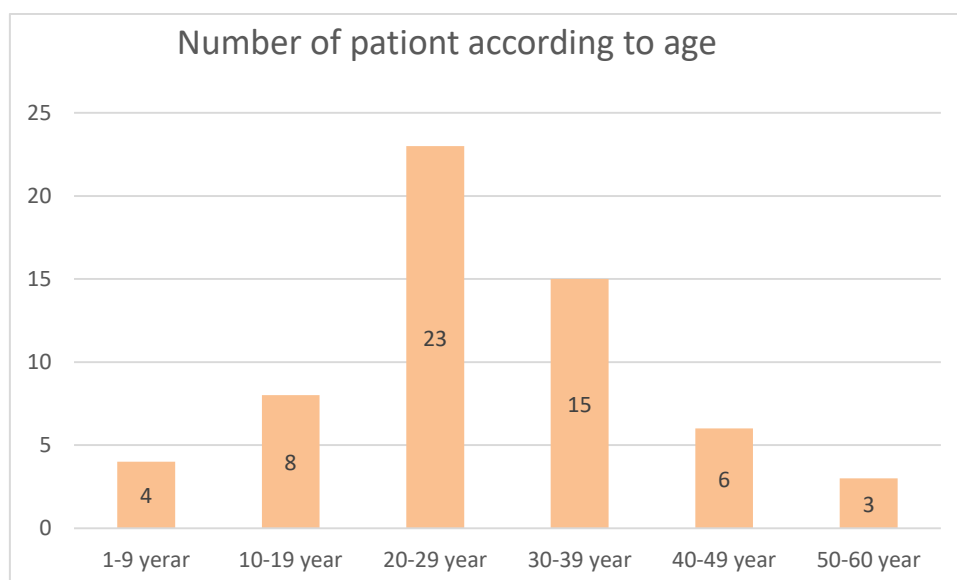
Data were entered and analyzed using SPSS 27. Descriptive statistics were calculated to summarize the variables, and inferential statistical tests were performed to assess frequencies.

Ethical Considerations

The study protocol was reviewed and approved by the Human Ethics Committee of the Bureau of Research and Development of Tabibban Hospital.

Results

Graph 1 shows the participants' Sociodemographic Characteristics. Regarding age distribution, patients were categorized into six age groups. The highest number of cases (38.9%) were observed in the third decade of life (23 patients), followed by 25.4% (15 patients) in the fourth decade. The second decade accounted for 13.5% (eight patients), while the fifth decade accounted for 10.1% (six patients).



Graph 1. Sociodemographic characteristics

The lowest number of cases was in the first and sixth decades, with four patients (6%) and three patients (5%), respectively. In terms of residence, most patients (76%, 45 patients) were from the Herat province,

followed by 16% (10 patients) from Farah. Only 1.6% (one patient each) came from Ghor, Kandahar, and Daikundi provinces (Table 1).

Table 1: Sociodemographic Characteristics

Variable	Category	(N)	(%)
Age Group	<9 years	4	6.0
	10-19 years	8	13.5
	20-29 years	23	38.9
	30-39 years	15	25.4
	40-49 years	6	10.1
	50-59 years	3	5.0
Residence	Herat	45	76.0
	Farah	10	16.0
	Ghor	1	1.6
	Kandahar	1	1.6
	Daikundi	1	1.6
Statistics		Value	
Mean Age		29.89	
Standard Deviation		11.91	

When analyzing stone size, the most observed stone size was 13 mm (20.3%, 12 patients), followed by 12 mm (18.6%, 11 patients), and 11 mm (16.9%, 10 patients). Other sizes included 9 mm (8.4%, 5 patients), 15 mm, and 16 mm (5% each, 3 patients each), and 14 mm, 17 mm, and 20 mm (3.3% each, 2 patients each). The smallest observed stone measured 7 mm (1.6%, 1 patient), and the largest measured 20 mm (3.3%, 2 patients). Regarding the stone location, the right kidney was the most common site (39%, 23 patients), followed by the left kidney (25.4%, 15 patients). Stones in the left ureter were observed in 13.5% (8 patients) and stones in the right ureter were found in 8.4% (5 patients). Stones at the ureterovesical junction were less frequent, with 5% (3 patients) at the right junction and 1.6% (1 patient) at the left junction. The treatment success rate was 95%, and 56 patients responded positively to lithotripsy. However, stone fragmentation was not achieved in three patients (5%). Regarding the bleeding incidence, 72.8% (43 patients) did not experience any bleeding. However, 20.3% (12 patients) had macroscopic bleeding, whereas 6.7% (4 patients) had microscopic bleeding. Furthermore, only 3.38% (2 patients) required blood transfusions, while 96.6% (57 patients) did not. Most patients (93.3%, 55 patients) were treated without infection. However, 6.7% (4 patients) had confirmed infections. Similarly, in terms of cutaneous ecchymosis, 93.3% (55 patients) had no ecchymosis, whereas 6.7% (4 patients) developed ecchymosis after lithotripsy (Table 2).

Table 2: Clinical Characteristics, and Complications

Variable	Category	n	%
Stone Size	7 mm	1	1.6
	8 mm	6	10.1
	9 mm	5	8.4
	10 mm	1	1.6
	11 mm	10	16.9
	12 mm	11	18.6
	13 mm	12	20.3
	14 mm	2	3.3
	15 mm	3	5.0
	16 mm	3	5.0
	17 mm	2	3.3
	18 mm	1	1.6
	20 mm	2	3.3
Stone Location	Right Kidney	23	39.0
	Left Kidney	15	25.4
	Right Ureter	5	8.4
	Left Ureter	8	13.5
	Right Ureterovesical Junction	3	5.0
	Left Ureterovesical Junction	1	1.6
Treatment Outcome	Successful Treatment	56	95.0
	Unsuccessful Treatment	3	5.0
Bleeding	No Bleeding	43	72.8
	Macroscopic Bleeding	12	20.3
	Microscopic Bleeding	4	6.7
Blood Transfusion	Required	2	3.38
	Not Required	57	96.6
Infectious Complications	No Infection	55	93.3

	Infection Present	4	6.7
Skin Ecchymosis	No Ecchymosis	55	93.3
	Ecchymosis Present	4	6.7

Discussion

Our findings indicate that although lithotripsy is considered a minimally invasive method for treating kidney and urinary tract stones, it is not without complications. In our study, 4 patients (6.7%) developed urinary tract infections (UTIs) after lithotripsy. However, a study conducted by Senocak et al. reported a post-lithotripsy infection rate of 8.5%, which differs from our findings^[17]. Proper pre-procedural preparation, including urine culture and prophylactic antibiotics, has been shown to reduce post-lithotripsy infections. In contrast, a study by Wagenius et al. reported an infection rate of 2.4%, which was 4.3% lower than our findings^[18]. This difference could be attributed to better preprocedural examinations and improved patient preparation in their study.

Bleeding is another common complication of lithotripsy. In our study, 12 patients (20.3%) experienced macroscopic bleeding, while 4 patients (6.7%) had microscopic bleeding. Research conducted in South Korea has reported an incidence rate of perinephric hemorrhage between 0.28% and 1.4%, which is significantly lower than our findings^[19]. The difference in bleeding rates may be due to factors such as stone size, stone location, the clinical expertise of healthcare personnel, patient compliance post-lithotripsy, and advanced lithotripsy technology. However, a study conducted by Wang et al. reported perinephric hematoma rates as high as 30.9%, which are significantly higher than our results. This discrepancy could be related to the availability of modern diagnostic tools, as their study may have lacked advanced imaging for postprocedural assessment^[20].

Regarding treatment success, 95% of our patients (56 cases) achieved successful stone fragmentation, whereas 5% (3 cases) required repeated sessions. In comparison, a study by Sohail et al. reported a stone clearance rate of 86.29%, with 5.58% of patients having residual stones smaller than 4 mm^[21]. These findings are consistent with those of the present study, confirming the effectiveness of lithotripsy. Additionally, Nielsen et al. reported a 2.9% incidence of residual stones requiring double-J stent placement, which is comparable to the 5% rate of residual stones requiring additional sessions or stenting in our study^[22].

In terms of stone location, our study found that 39% of patients (23 patients) had stones in the right kidney, followed by 25.4% (15 patients) in the left kidney. Ureteral stones were observed in 8.4% (right ureter) and 13.5% (left ureter) of cases, while 5% of cases had stones at the right ureterovesical junction and 1.6% at the left ureterovesical junction. These findings were compared to those of a 2019 study of 106 patients conducted by Jiao et al. in China, which found no significant differences in patient characteristics such as age, sex, BMI, stone location (right or left), renal pelvis or proximal ureter, upper or lower calyx, and stone diameter among the studied groups^[9]. Their study also reported 100% successful lithotripsy without conversion to open surgery, which is in complete agreement with the results of our study.

Another possible complication of lithotripsy is cutaneous ecchymosis. In our study, 4 patients (6.7%) developed ecchymosis, which closely aligns with a 2014 study by Sandhya R. Rao et al. suggested a similar prevalence for post-lithotripsy ecchymosis^[16].

Conclusion

In conclusion, although lithotripsy remains an effective and minimally invasive option for treating urinary stones, complications such as infection, bleeding, and ecchymosis still occur, with variable rates across different studies. The differences in findings may be attributed to variations in patient selection, preprocedural evaluations, lithotripsy techniques, and healthcare infrastructure. However, our results are consistent with those of global studies, confirming the safety and efficacy of lithotripsy in most cases.

Conflict of Interest statement

The authors declare that they have no conflicts of interest.

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Authors' Contributions

Mohammad Jawed Jawad, Abdul Azim Amiri, Mohammadullah Yaqubi, and Bashir Ahmad Azar conceptualized the manuscript. Mohammad Jawed Jawad, Abdul Azim Amiri, Mohammadullah Yaqubi, and Bashir Ahmad Azar wrote the original draft. Mohammad Jawed Jawad, Abdul Azim Amiri, Mohammadullah Yaqubi, and Bashir Ahmad Azar reviewed and edited the manuscript.

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References

1. Abe T, Akakura K, Kawaguchi M, Ueda T, Ichikawa T, Ito H, et al. Outcomes of shockwave lithotripsy for upper urinary-tract stones: a large-scale study at a single institution. *J Endourol* 2005;19:768–73. <https://doi.org/10.1089/end.2005.19.768>.
2. Chiang Y-T, Chen S-M, Tsui H-M, Juang H-H, Lin C-W, Chiang M-H, et al. Ultrasound-guided extracorporeal shock wave lithotripsy with minimal x-ray exposure prevented genitourinary tract injury patients with urolithiasis in Taiwan. *Sci Prog* 2023;106:00368504231220988. <https://doi.org/10.1177/00368504231220988>.
3. Finlayson B. Physicochemical aspects of urolithiasis. *Kidney Int* 1978;13:344–60. <https://doi.org/10.1038/ki.1978.53>.
4. Bhatti KH, Gomha F, Shaat A, Rahman KMA, Albodour A, Smain AM, et al. Efficacy and safety of supine percutaneous nephrolithotomy in obese patients. *J Ayub Med Coll Abbottabad* 2024;36:45–9. <https://doi.org/10.55519/JAMC-01-12496>.
5. Torricelli FCM, Danilovic A, Vicentini FC, Marchini GS, Srougi M, Mazzucchi E. Extracorporeal shock wave lithotripsy in the treatment of renal and ureteral stones. *Rev Assoc Med Bras* 2015;61:65–71. <https://doi.org/10.1590/1806-9282.61.01.065>.
6. Ghalayini IF, Al-Ghazo MA, Khader YS. Evaluation of emergency extracorporeal shock wave lithotripsy for obstructing ureteral stones. *Int Braz J Urol* 2008;34:433–42. <https://doi.org/10.1590/S1677-55382008000400005>.
7. Gunlusoy B, Degirmenci T, Kozacioglu Z, Arslan M, Ceylan Y, Nergiz N, et al. Factors affecting the complications of pneumatic lithotripsy for the treatment of ureteral stones with different localizations: a multivariate analysis of complications. *Urol Int* 2013;91:357–62. <https://doi.org/10.1159/000350243>.
8. Peng C-X, Lou Y-K, Xu L, Wu G-H, Zhou X-L, Wang K-E, et al. Efficacy of emergency extracorporeal shock wave lithotripsy in the treatment of ureteral stones: a meta-analysis. *BMC Urol* 2023;23:56. <https://doi.org/10.1186/s12894-023-01226-5>.
9. Jiao B, Luo Z, Xu X, Zhang M, Zhang G. Minimally invasive percutaneous nephrolithotomy versus retrograde intrarenal surgery in surgical management of upper urinary stones-A systematic review with meta-analysis. *Int J Surg* 2019;71:1–11. <https://doi.org/10.1016/j.ijsu.2019.09.005>.
10. Basuguy E, Önen A, Azizoğlu M, Okur MH, Aydoğdu B, Arslan S. Effectiveness of extracorporeal shock wave lithotripsy in urolithiasis patients under 2 years of age. *Cir Cir* 2023;91:620–6. <https://doi.org/10.24875/ciru.22000548>.
11. Türk C, Knoll T, Petrik A, Sarica K, Straub M, Seitz C. Guidelines on urolithiasis. *Eur Assoc Urol* 2011. <https://doi.org/10.1159/000049803>.
12. Nasu Y, Kurashige T, Kumon H. Common and uncommon complications related to ESWL. *Treat. Urolithiasis*, Springer; 2001, p. 153–66. https://doi.org/10.1007/978-4-431-68517-3_12.
13. Mezentsev V. Meta-analysis of the efficacy of non-steroidal anti-inflammatory drugs vs. opioids for SWL using modern electromagnetic lithotripters. *Int Braz J Urol* 2009;35:293–8. <https://doi.org/10.1590/S1677-55382009000300005>.
14. Nielsen TK, Jensen JB. Efficacy of commercialised extracorporeal shock wave lithotripsy service: a review of 589 renal stones. *BMC Urol* 2017;17:1–5.
15. Reynolds LF, Krocak T, Pace KT. Indications and contraindications for shock wave lithotripsy and how to improve outcomes. *Asian J Urol* 2018;5:256–63. <https://doi.org/10.1016/j.ajur.2018.08.006>.
16. Rao SR, Ballesteros N, Short KL, Gathani KK, Ankem MK. Extra corporeal shockwave lithotripsy resulting in skin burns—a report of two cases. *Int Braz J Urol* 2014;40:853–7. <https://doi.org/10.1590/S1677-5538.IBJU.2014.06.19>.
17. Senocak C, Ozcan C, Sahin T, Yilmaz G, Ozyuvali E, Sarikaya S, et al. Risk factors of infectious complications after flexible uretero-rensoscopy with laser lithotripsy. *Urol J* 2018;15:158–63.
18. Wagenius M, Jakobsson J, Stranne J, Linder A. Complications in extracorporeal shockwave lithotripsy: a cohort study. *Scand J Urol* 2017;51:407–13. <https://doi.org/10.1080/21681805.2017.1347821>.

19. Kim T-B, Park H-K, Lee K-Y, Kim K-H, Jung H, Yoon S-J. Life-threatening complication after extracorporeal shock wave lithotripsy for a renal stone: a hepatic subcapsular hematoma. *Korean J Urol* 2010;51:212. <https://doi.org/10.4111/kju.2010.51.3.212>.
20. Wong CH-M, Ko IC-H, Tang ES-F, Yuen SK-K, Leung DK-W, Kong AW-Y, et al. Risk factors of hematoma after SWL for renal calculi: analysis from RCTs and a literature review. *Int Urol Nephrol* 2024:1–10. <https://doi.org/10.1007/s11255-024-04205-3>.
21. Sohail N, Albodour A, Abdelrahman KM. Percutaneous nephrolithotomy in complete supine flank-free position in comparison to prone position: A single-centre experience. *Arab J Urol* 2017;15:42–7. <https://doi.org/10.1016/j.aju.2016.10.001>.
22. Nielsen TK, Jensen JB. Efficacy of commercialised extracorporeal shock wave lithotripsy service: a review of 589 renal stones. *BMC Urol* 2017;17:1–5. <https://doi.org/10.1186/s12894-017-0249-8>.