# Bölüm 6

# QUALITY OF LIFE IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY DUE TO RENAL CALCULI

**Mehmet Yılmaz SALMAN**[1]

## INTRODUCTION

Kidney stone disease is an important health problem that impairs quality of life (QoL) with recurrences. Medical and surgical approaches can be used to treat kidney disease. Whereas medical treatment includes dietary management, disease-specific therapies and medical expulsion therapy, surgical approaches include laparoscopic and open operations including retrograde intrarenal surgery (RIRS), extracorporeal shock wave lithotripsy (ESWL), and percutaneous nephrolithotomy (PCNL). PCNL has increased postoperative patient comfort and lower rate of morbidity compared to other surgical options such as open renal procedures. Hence, PCNL has replaced open surgery in majority of urology centers all around the world. Today, patient reporting subjective assessment of treatment effectiveness is as important as objective evaluations with laboratory investigations, imaging modalities etc. Several tools such as SF-36, health related quality of life (HRQoL) and WSQoL are used to assess performance of treatment and patients' QoL. In this chapter, renal calculi, treatment of renal calculi, percutaneous nephrolithotomy (PCNL) and QoL in patients undergoing (PCNL) are addressed.

### Renal Calculi

Kidney stones, also known as renal calculi, are firm, crystalline mineral materials formed within the kidney or urinary tract so as to impair normal renal function (1). Kidney stones are mainly lodged in the kidneys. The history of kidney stones is dated back to 4000 B.B. (2). Kidney stones are mostly of noninfectious etiology and are associated with low fluid intake, certain comorbidities, hot climate and risk factors such as hypertension, gout, nonalcoholic liver disease, obesity, excessive intake of carbohydrates, proteins and sodium (3, 4). Increasing exposure to these risk factors may explain the reasons for increased incidence of kidney calculi. In

[1] Asst. Prof. Medistanbul Hospital, Department of Urology, mdmehmetyilmazsalman@yahoo.com

addition, genetic factors may have a role in the occurrence of these calculi. The prevention of the formation or recurrence of renal calculi remains an important health care problem. Kidney stones are associated with the development of cardiovascular diseases, hypertension and diabetes mellitus (5). It has been proposed that kidney stones may be a systemşic disorder linked to metabolic syndrome (6).

The global kidney stones prevalence and recurrence rates are increasing within the developed countries, up to 12% of men and 7% of women will suffer from kidney stones in their lifetime (7). The annual incidence of kidney stones is approximately 8/1000 adults and peaks around midlife in developed countries (8).

## Types of Renal Calculi

Based on the variations in mineral composition and pathogenesis, kidney stones are usually classified into five types (Figure 1).

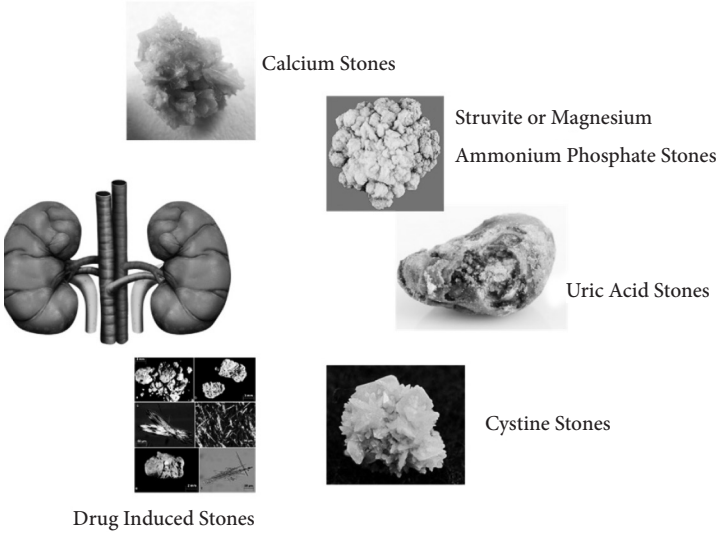


**Figure 1.** Different types of kidney stones

## Treatment Of Renal Calculi

### Medical Treatment of Renal Calculi

Management of renal calculi requires an individualized approach. Whether the patient needs medical or surgical treatment depends on clinical presentation, history and laboratory investigations. Clinically stable patients are eligible for medical treatment. A detailed medical history is received including previous interventions, drug history and family history. Risk factors for the development of kidney stones are assessed.

Medical treatment includes dietary management, disease-specific therapies and medical expulsion therapy (MET).

## Surgical Treatment of Renal Calculi

Several methods are performed for the surgical management of kidney calculi including laparoscopic and open procedures such as extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotomy (PCNL). According to the European Urology Guide, ESWL and RIRS are in general recommended for the treatment of kidney calculi less than 1 centimeter. Endourologic methods (RORS and PCNL) are recommended for stones between 1 and 2 cm, while PCNL is suitable for stones larger than 2 cm (9).

Modern endourologic methods have been subjected to several modifications in order to reduce complications, improve patients' quality of life and increase stone free duration. Among these, micro-PCNL, ultra-mini PCNL and mini-PCNL methods have been described as alternatives to standard PCNL procedure (10).

## Percutaneous Nephrolithotomy (PCNL)

PCNL procedure was described for the first time by Fernstrom and Jahonsson in order to remove renal stones through a nephrostomy tube and since then has been a preferred method for kidney stone disease (11). Hence, PCNL has replaced open surgery in majority of urology centers all around the world (12).

PCNL can be performed safely in both pediatric and geriatric patients. However, some special patient groups require a special approach including patients who underwent open renal surgery previously, morbid obese patients and those with a solitary functioning kidney (13).

## Percutaneous Nephrolithotomy: Technique

PCNL is performed under general anesthesia in order to provide operative comfort for the surgeon and facilitate appropriate positioning of the patient. Damage to other organs and complications can be prevented owing to general anesthesia. Prone position is generally used during PCNL. However, lateral decubitus or supine position may be more suitable ins case of pulmonary diseases and morbid obesity (14).

Proper puncture of the collecting system is mostly performed under guidance of fluoroscopy. Occasionally, USG may be used to monitor access into the kidney. An atraumatic and right access to the kidney is the key of a successful PCNL. It is usually achieved by a subcostal access. Supracostal access offers manipulation of

stones and optimal control in the lower and middle calyx. However, this approach may cause complications such as plevral injury. Next step is stone disintegration. There are some devices available for this purpose including ultrasonic, ballistic, and holmium laser, or a combination of these (15). Holmium laser lithotripsy has been proven to be more effective compared to ballistic lithotripsy in terms of stone clearance and the rate of complications (16). Tubeless PCNL is an alternative method particularly in uncomplicated cases. The advancements in new surgical tools to achieve access to the kidney, drainage systems following the procedure and new lithotripsy techniques have led PCNL to become the preferred method for renal stones greater than 2 cm. Maintenance of available instruments, training and experience of urologists and patient selection are critical to achieve successful operative results avoid complications during PCNL procedures.

## Advantages and Disadvantages of PCNL

PCNL is considered one of the greatest advances in the area of minimally invasive urologic procedures. Renal PCNL procedure has gained popularity owing to the possibility of using reduced calibers and modern, more efficient intracorporeal lithotripters (17). Studies in the literature have reported a stone-free status maintenanced by PCNL and nephrolithotomy in 64.5-98.3% of patients, while this rate was found in only 37% of patients with extracorporeal nephrolithotripsy (17). PCNL is now the preferred method for large stone loads (≥ 2500 mm2), staghorn calculi, and even smaller stones in lower pole calices.

PCNL is pereferred for stones > 2 cm in patients with anatomically normal kidneys. However, although PCNL provides a high success rate, its complication rate can reach up to 83% (14). Ding et al. reported that RIRS was superior over PCNL in stones smaller than 30 mm with lower rates of complications and comparable success (18). In PCNL, the choice of puncture under the guidance of USG or fluoroscopy depends on the anatomy of the calyx and the surgeon expertise. In addition, fluoroscopy guided PCNL poses the risk of exposing to radiation for the patient and surgeon. In addition, unlike USG guided puncture, real time visualization of visceral organs such as liver is not present, adding the risk of causing damage to these vital organs (19).

## Complications of PCNL

Complications of PCNL are mostly minor and include nephrostomy leak and fever (20). Significant complications are shown in Figure 2.

**MAJOR COMPLICATIONS OF PCNL**

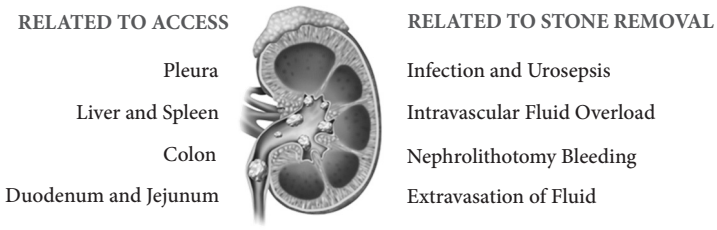


**Figure 2.** Major complications of PCNL

### *Complications Associated With Access*

***Pleura:*** Supracostal access may give more damage to the pleura compared to infracostaş access. Infracostal approach is usually used except for particular indications such as requirement of upper pole access.

***Liver and spleen:*** Liver injury is not frequent during PCNL. Damage to major intrahepatic vessels is the major concern. Angioembolization can be performed in case of severe bleeding.

Splenic injury is also infrequent. Splenectomy may be needed in case of uncontrolled hemorrhage. This can be confirmed by intraoperative USG (19).

***Colon:*** Damage to colon develops in up to 0.2%-1% of patients who undergo PCNL (21). Predisposing risk factors include female gender, previous bowel surgery and a low BMI. Bowel rest and antibiotics are the main treatment methods.

***Jejunum and Duodenum:*** This damage is extremely infrequent with PCNL. In the postoperative period, computed tomography (CT) helps to diagnosis of duodenal injury. Open surgery is the treatment of choice.

### *Complications Associated With Stone Removal*

***Infection and urosepsis:*** One third of the patients undergoing PCNL may experience mild fever. Sepsis is rarely seen if patients are treated with appropriate antibiotics.

***Intravascular Fluid Overload:*** In the case of injury to vessels, prolonged surgery intravascular fluid overload may develop.

***Post PCNL bleeding:*** Post PCNL bleeding is the most significant complication after PCNL. Most of the bleeding is resolved with conservative management. Prolonged intra-operative time and multiple punctures are the main causes of post PCNL bleeding.

***Extravasation of fluid:*** Damage to the collecting system may cause extravasation of fluid during PCNL. The fluid should be aspirated percutaneously if it is noticed in the postoperative period.

## Quality of Life (QoL)

Being ill and suffering from disease is an important, but subjective, condition. Restrictions in daily life and related anxieties due to illness are heterogeneous and specific to person. Thoughts of a physician are limited by the biological aspect of disease and clinical outcomes. Within this context, helping patients includes improving patients' quality of life (QoL). QoL is defined as a concept of economics, political, sociology and science which encompasses an individual's emotional, social and physical well-being (22). The main question is that there is no universal definition of QoL.

## QoL in Medicine (Health Related QoL)

Identification of the criteria for evaluation of QoL in patients has become a necessity as interest in biopsychosocial issues has increased. In the field of medicine, numerous studies of QoL have been conducted with a more integrative understanding of human nature in which subjective states were also subject of interest (23). From the medical view point, not only is objective improvement very important, but subjective quality of life is also equally important.

Attempts to determine QoL more precisely has caused the development of a new concept, which can be implemented in medicine discipline: health related quality of life (24). HRQoL can be defined as "how well persons function in their life and their perceived well-being in physical, mental and social domains of health" (25). It has been stated that Health-related quality of life includes only those factors that are part of an individual's health (26). However, there is no universal definition of both QoL and HRQoL. Therefore, the terms health, HRQoL and QoL are often used interchangeably. In addition, the term HRQoL is not well defined and most definitions of HRQoL do not differentiate the term from health or QoL (26).

## Quality of Life in Patıents With Kidney Stones

In recent years, numerous studies in the literature have investigated QoL in patients with various medical conditions (27). This tendency has been resulted from the need of an integrative approach to measure effectiveness of therapy. Following treatment, subjective assessment of the outcomes has become as important as objective evaluation with laboratory tests etc. The QoL can generally be determined through questionnaires and patient feedback. These questionnaires help to obtain a numerical equivalent regarding health status of the respondent.

Medical discipline-specific questionnaires have been developed, while some are at the design and development stages, including validity and reliability studies. First described by K. Penniston et al. in 2013, the Wisconsin Stone Quality of Life Questionnaire (WISQoL) is used in order to assess QoL in patients with renal calculi (28). This questionnaire was confirmed by a multicenter study conducted in American and Canadian clinics in 2017 (28). The results of the kidney stone disease treatment are determined not only by patient selection tactics, but also by an comprehensive approach in the preoperative and postoperative period, taking QoL into account.

In a study by Protoshchak et al., QoL of the patients was evaluated by SF-36 questionnaire and WISQoL questionnaire, which includes 28 questions in four subdimensions of social influence, health effect, emotional influence and impact on vital activity. The factors affecting WISQoL were determined as age, male gender and stone size up to 1 cm (29).

In a study by Bensalah et al. evaluating various factors relating to QoL in a population of patients with kidney stones, the most important factors were found as age, the number of surgical procedures and body mass index (BMI) (30).

In another study by Arafa and Rabah, SF-36 and HRQoL questionnaires were used to assess QoL in patients who undergoing lithotripsy for renal calculi. They found that post-lithotripsy patients have a favorable QoL compared to the healthy control group (31).

In a study by Diniz et al., the QoL of patients with painful recurrent symptoms due to renal colic was significantly impaired (32).

## Quality of Life in Patients Undergoing Percutaneous Nephrolithotomy Due To Renal Calculi

QoL has been assessed in numerous studies using several measurement tools. Examples of these measurements are given below.

Staios et al. evaluated QoL in 22 patients who underwent PCNL with SF-36 QoL questionnaire before and 6 months after the procedure. In that study, significant QoL findings were reduction in symptoms interfering with performance at work (40%) and improved general health (33%) (33).

Pérez-Fentes et al., evaluated short- and long-term effects of PCNL procedure on QoL in 40 patients. QoL was measured with SF-36 questionnaire 2 weeks before surgery, 3rd postoperative month and after a year. A year after the procedure the effects of PCNL on bodily pain was positively significant. Social function was also close to statistical significance (34).

Zhang et al., compared outcomes and postoperative QoL among 60 patients with kidney stones who underwent mini-percutaneous nephrolithotomy (mPCNL). Wisconsin Stone QOL (WSQOL) scale was used to evaluate QoL. It was concluded that mPCNL with ureter catheter is a safe and useful form of mPCNL, which can provide better QoL and is more cost effective compared with standard and partial tubeless PCNL (35).

Gadelmoula et al. investigated QoL in addition to other clinical outcomes in patients who underwent PCNL and shock wave lithotripsy for high-density moderate-sized renal stones. There was no statistically significant difference between the two techniques in terms of QoL, which was measured using SF-8 Health Survey scoring (36).

Di Mauro et al. assessed disease-specific and health related QoL regarding RIRS and mPCNL procedures for kidney stones up to 2.5 cm in 60 patients. The RIRS group reported higher anxiety and depression scores compared with the mPCNL group. In addition, social and vitality scores were higher with mPCNL (37).

## Conclusion

PCNL method can be used in kidney stones > 2 cm, making it the preferred method for the management of renal calculi. Complication rate is low and success rate is high with PCNL compared to the other surgical methods. PCNL is being subject to several modifications to further increase success rate and decrease complications. This method is promising for future clinical practice with ongoing developments and refinements of the method.

## REFERENCES

1. Deepika MR, Ravisankar P, Priya JD, et al. Renal Calculi: A Comprehensive Review. Indian Journal of Research in Pharmacy and Biotechnology, 2018; 6(1): 30-34.
2. López M, Hoppe B. History, epidemiology and regional diversities of urolithiasis. Pediatr Nephrol. 2010;25(1):49-59. doi:10.1007/s00467-008-0960-5
3. Aune D, Mahamat-Saleh Y, Norat T, et al. Body fatness, diabetes, physical activity and risk of kidney stones: a systematic review and meta-analysis of cohort studies. Eur J Epidemiol. 2018;33(11):1033-1047. doi:10.1007/s10654-018-0426-4
4. Wijarnpreecha K, Lou S, Panjawatanan P, et al. Nonalcoholic Fatty Liver Disease and Urolithiasis. A Systematic Review and Meta-Analysis. J Gastrointestin Liver Dis. 2018;27(4):427-432. doi:10.15403/jgld.2014.1121.274.nac
5. Sigurjonsdottir VK, Runolfsdottir HL, Indridason OS, et al. Impact of nephrolithiasis on kidney function. BMC Nephrol. 2015;16:149. doi:10.1186/s12882-015-0126-1
6. Courbebaisse M, Prot-Bertoye C, Bertocchio JP, et al. Lithiase rénale de l'adulte : des mécanismes au traitement médical préventif [Nephrolithiasis of adult: From mechanisms to preventive medical treatment]. Rev Med Interne. 2017;38(1):44-52. doi:10.1016/j.revmed.2016.05.013

7. Spivacow FR, Del Valle EE, Lores E, et al. Kidney stones: Composition, frequency and relation to metabolic diagnosis. Litiasis renal: composición, frecuencia y su relación con diagnósticos metabólicos. Medicina (B Aires). 2016;76(6):343-348.
8. Alatab S, Pourmand G, El Howairis Mel F, et al. National Profiles of Urinary Calculi: a Comparison Between Developing and Developed Worlds. Iran J Kidney Dis. 2016;10(2):51-61.
9. Skolarikos A, Straub M, Knoll T, et al. Metabolic evaluation and recurrence prevention for urinary stone patients: EAU guidelines. Eur Urol. 2015;67(4):750-763. doi:10.1016/j.eururo.2014.10.029
10. Akçay M, Tepeler A, Tosun M, et al. Current Minimal Invasive Surgery Treatment for Kidney Stones. Bezmialem Experience. Bezmialem Science, 2016;4:38-42. DOI: 10.14235/bs.2016.638
11. Fernström I, Johansson B. Percutaneous pyelolithotomy. A new extraction technique. Scand J Urol Nephrol. 1976;10(3):257-259. doi:10.1080/21681805.1976.11882084
12. Amiel J, Choong S. Renal stone disease: the urological perspective. Nephron Clin Pract. 2004;98(2):c54-c58. doi:10.1159/000080253
13. Sofikerim, M. Percutaneous Nephrolithotomy: Indications and Technique. Erciyes Medical Journal / Erciyes Tip Dergisi. 2008;30(1): 30-36
14. Michel MS, Trojan L, Rassweiler JJ. Complications in percutaneous nephrolithotomy. European urology, 2007;51(4), 899–906
15. Giusti G, Piccinelli A, Taverna G, et al. Miniperc? No, thank you!. Eur Urol. 2007;51(3):810-815. doi:10.1016/j.eururo.2006.07.047
16. Tipu SA, Malik HA, Mohhayuddin N, et al. Treatment of ureteric calculi--use of Holmium: YAG laser lithotripsy versus pneumatic lithoclast. J Pak Med Assoc. 2007;57(9):440-443.
17. Türk C, Petřík A, Sarica K, et al. EAU Guidelines on Interventional Treatment for Urolithiasis. Eur Urol. 2016;69(3):475-482. doi:10.1016/j.eururo.2015.07.041
18. Ding J, Huang Y, Gu S, et al. Flexible Ureteroscopic Management of Horseshoe Kidney Renal Calculi. Int Braz J Urol. 2015;41(4):683-689. doi:10.1590/S1677-5538.IBJU.2014.0086
19. Ganpule AP, Vijayakumar M, Malpani A, Desai MR. Percutaneous nephrolithotomy (PCNL) a critical review. Int J Surg. 2016;36(Pt D):660-664. doi:10.1016/j.ijsu.2016.11.028
20. Tefeki A, van Rees Vellinga S, de la Rosette J. The CROES Percutaneous Nephrolithotomy Global Study: Final Report. J Endourol. 2012;26(12):1536-1539. doi:10.1089/end.2012.1550
21. Mousavi-Bahar SH, Mehrabi S, Moslemi MK. Percutaneous nephrolithotomy complications in 671 consecutive patients: a single-center experience. Urol J. 2011;8(4):271-276.
22. Ruževičius J. Quality of Life and of Working Life: Conceptions and Research. Proceedings of the 17th Toulon-Verona International Conference Excellence in Services (pp.317–334). Liverpool: Liverpool John Moores. 2014.
23. Malibary H, Zagzoog MM, Banjari MA, et al. Quality of Life (QoL) among medical students in Saudi Arabia: a study using the WHOQOL-BREF instrument. BMC Med Educ. 2019;19(1):344. doi:10.1186/s12909-019-1775-8
24. Molla S, Yitayal M, Amare G. Health-Related Quality of Life and Associated Factors Among Adult Patients with Heart Failure in Wolaita Zone Governmental Hospitals, Southern Ethiopia. Risk Manag Healthc Policy. 2021;14:263-271. doi:10.2147/RMHP.S288326
25. Hays RD, Reeve BB. Measurement and Modeling of Health-Related Quality of Life. In: Killewo J, Heggenhougen HK, Quah SR, editors. Epidemiology and Demography in Public Health. San Diego: Academic Press;. 2010, p. 195–205.
26. Karimi M, Brazier J. Health, Health-Related Quality of Life, and Quality of Life: What is the Difference?. PharmacoEconomics, 2016; 34(7), 645–649.

27. Heldwein FL, Sánchez-Salas RE, Sánchez-Salas R, et al. Health and quality of life in urology: issues in general urology and urological oncology. Arch Esp Urol. 2009;62(7):519-530.
28. Penniston KL, Antonelli JA, Viprakasit DP, et al. Validation and Reliability of the Wisconsin Stone Quality of Life Questionnaire. J Urol. 2017;197(5):1280-1288. doi:10.1016/j.juro.2016.11.097
29. Protoshchak VV, Paronnikov MV, Sivakov AA, et al. Quality of life of patients with kidney stones. Urology reports (St. - Petersburg). 2020;10(2), 115-124.
30. Bensalah K, Tuncel A, Gupta A, et al. Determinants of quality of life for patients with kidney stones. J Urol. 2008;179(6):2238-2243. doi:10.1016/j.juro.2008.01.116
31. Arafa MA, Rabah DM. Study of quality of life and its determinants in patients after urinary stone fragmentation. Health Qual Life Outcomes. 2010;8:119. Published 2010 Oct 19. doi:10.1186/1477-7525-8-119
32. Diniz DH, Blay SL, Schor N. Quality of life of patients with nephrolithiasis and recurrent painful renal colic. Nephron Clin Pract. 2007;106(3):c91-c97. doi:10.1159/000102995
33. Staios D, Andrews HO, Shaik T, et al. Quality of life after percutaneous nephrolithotomy for caliceal diverticulum and secluded lower-pole renal stones. J Endourol. 2007;21(5):515-519. doi:10.1089/end.2006.0432
34. Pérez-Fentes DA, Gude F, Blanco B, et al. Percutaneous nephrolithotomy: short- and long-term effects on health-related quality of life. J Endourol. 2015;29(1):13-17. doi:10.1089/end.2014.0081
35. Zhang Y, Wei C, Pokhrel G, et al. Mini-Percutaneous Nephrolithotomy with Ureter Catheter: A Safe and Effective form of mPCNL Offers Better Quality of Life. Urol Int. 2019;102(2):160-166. doi:10.1159/000494212
36. Gadelmoula M, Elderwy AA, Abdelkawi IF, et al. Percutaneous nephrolithotomy versus shock wave lithotripsy for high-density moderate-sized renal stones: A prospective randomized study. Urol Ann. 2019;11(4):426-431. doi:10.4103/UA.UA_63_19
37. Di Mauro D, La Rosa VL, Cimino S, Di Grazia E. Clinical and psychological outcomes of patients undergoing Retrograde Intrarenal Surgery and Miniaturised Percutaneous Nephrolithotomy for kidney stones. A preliminary study. Arch Ital Urol Androl. 2020;91(4):256-260doi:10.4081/aiua.2019.4.256