

PERCUTANEOUS NEPHROLITHOTRIPSY PRACTICE IN VIETNAM: A SYSTEMATIC SCOPING REVIEW

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ABSTRACT.

Introduction: Percutaneous nephrolithotripsy is safe and effective for managing renal calculi but complex and expensive. Different institutions with different resource readiness as well as approaches might show differences in outcomes. Our systematic scoping review aimed to map the evidence body as well as review effectiveness of the technique in national scale in over three decades of practice. **Methods:** This research was carried out with studies on percutaneous nephrolithotripsy in Vietnam by searching full text articles via following databases as well as search engines: PubMed/MEDLINE, Cochrane Library, Embase, Google Scholar, <http://lienthuvien.yte.gov.vn/> - an online library run by Vietnam's Ministry of Health; and by searching directly in the library of Hanoi Medical University. Study selection process followed the PRISMA flow chart of study search and selection. The data from selected studies were extracted with double check before summarizing and charting the data. **Results:** Preliminary data analysis from 30 selected studies showed that approximately 20 years from the first performance, percutaneous nephrolithotripsy gradually transferred from more resource readiness centers to lesser counterparts. The transference was accomplished to some extent, reflecting on improvement in operation time, surgical conversion rate, stone free rate, as well as on a decrease in the rate of severe

complications. **Conclusion:** This systematic scoping review mapped evidence body in national range regarding percutaneous nephrolithotripsy. It suggests that a more homogeneous research design should be obtained for more precisely picturing clinical practice.

Keywords: *Percutaneous nephrolithotripsy, scoping review, renal stones, Vietnam.*

I. INTRODUCTION

Percutaneous nephrolithotripsy (PCNL) - sometimes used interchangeable with percutaneous nephrolithotomy - is an intervention for managing stones in the kidney and, occasionally, in the ureter. Generally, this technique begins with obtaining a channel from skin to urinary collecting system under the guidance of ultrasonography or fluoroscopy; then a breaking-stone-device (called lithotripter) is introduced indwelling the channel; at the end, fragmented stones will be removed via this access route. As described above, PCNL requires complex and expensive devices such as fluoroscopic system, lasers or ultrasonic or pneumatic or electrohydraulic lithotripter; not to mention experienced surgeons and anesthesiologists. Consequently, different institutions in different parts of the country might have different approaches as well as clinical settings, which might result in differences.

PCNL has gradually become the modality of choice for renal calculi over open surgery [1], and clinical practice in Vietnam is not an

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exemption. Despite the fact that it was proven as a safe and effective intervention [2], PCNL is still a challenge in technique mastering as well as complication controlling [3,4]. That was the primary reason why the technique was first carried out in large institutions and by experienced surgeons. Therefore, in rural and suburb areas, people in need could hardly benefit from the treatment.

Systematic reviews and meta-analysis studies regarding PCNL are available in the literature [2,5]. Nevertheless, studies from high volume institutions worldwide with experienced physicians are frequently included; therefore, they might be unable to reflect the practice of PCNL in a regional scale, especially developing economies. Since the first time PCNL was performed in Vietnam in the late 1990s [6], there has not been any study available to review its application in clinical practice. Hence, we conducted this systematic scoping review with the aim to explore evidence body available, and to broadly review the effectiveness of practicing PCNL in Vietnam.

II. METHODS

2.1. Systematic scoping review

As the design of this study is systematic scoping review, the reporting was checked against the PRISMA Extension for Scoping Reviews (PRISMA-ScR) [7].

Several studies on PCNL from our country that have been published in international peer-reviewed journals were mainly carried out at large institutions, in which the technique was routinely performed [8,9]. Hence, to fully picture the clinical scenario and avoid bias in selection, studies

published in our domestic peer-reviewed journals were also screened. This review was carried out in following steps.

2.2. Identifying research question

The research question was: In nation-wide range, what was the available evidence body of applying PCNL to manage renal calculi?

This research project has also covered the short-term effectiveness and the complication rates of the technique.

2.3. Eligibility of research questions

The research question was formed following Population, Intervention, Comparator, and Outcomes (PICO) framework, which included: (P): Vietnamese patients diagnosed with renal calculi, (I): Percutaneous nephrolithotripsy or percutaneous nephrolithotomy, (C): none, and (O): Effectiveness, complications, the popularity of the technique in nation-wide range.

2.4. Identifying relevant studies

Primary studies addressing the research questions were included through online and offline searching. Keywords used for searching were listed as follows (both English and Vietnamese forms of keywords were used, nonetheless, only English forms are listed here): percutaneous, nephrostomy, nephrolithotripsy, nephrolithotomy, renal stones, urolithiasis, renal calculi, Vietnam.

After searching, duplicates were removed, and the remainder were screened for inclusion and exclusion criteria fulfilment.

2.5. Study selection

2.5.1. Inclusion criteria

Studies were included if they met all the following criteria: regarding PCNL and performed in Vietnam, reporting outcomes of all PCNLs taken place in a specific institution in a specific period, published in

peer-reviewed journals, with available full text, and presented in either English or Vietnamese.

2.5.2. Exclusion criteria

Studies with one of the following criteria were excluded: (1) reporting outcomes of some but not all PCNLs performed in a specific institution in a specific of time, (2) reporting outcomes of all PCNLs in more than 2 institutions, (3) reported as case reports, (4) posters or symposium articles, (5) presented as theses or dissertations, (6) case series from personal experience, and (7) studies of testing new instruments or modified techniques.

As to the first exclusion criterion, papers reporting some but not all PCNLs could not reflect the ability of mastering this technique in a specific institution as a whole. Secondly, PCNL has several modifications in association with which kind of lithotripter, the size of the Amplatz, or which guidance system was used for accessing the collecting system. We decided that papers focusing only on a specific technique in an institution were not appropriate for a broad objective of this national scale scoping review. For the second exclusion criterion, such papers might contain data that could be included in articles from individual institutions. Therefore, it conflicted with our objectives.

2.5.3. Information resources

The resources were used for screening primary studies that were conducted in unlimited period: (1) Online databases: PubMed/MEDLINE, Cochrane Library, Embase, (2) search engine: Google Scholar, (3) <http://lienthuvien.yte.gov.vn/>: A platform run by Vietnam's Ministry of Health that indexes all the articles published in domestic

journals in either medicine or pharmacy, (4) Hanoi Medical University's library: The library of one of the biggest medical schools in Vietnam. Due to geographical disadvantages and COVID-19 pandemic, we were only able to perform offline searching in this library. Content can be searched via its website <http://thuvien.hmu.edu.vn/>.

2.5.4. Search strategy

The searching process was divided into 3 phases. In each phase, there were 2 sub-teams working in the same period; the results then were compared.

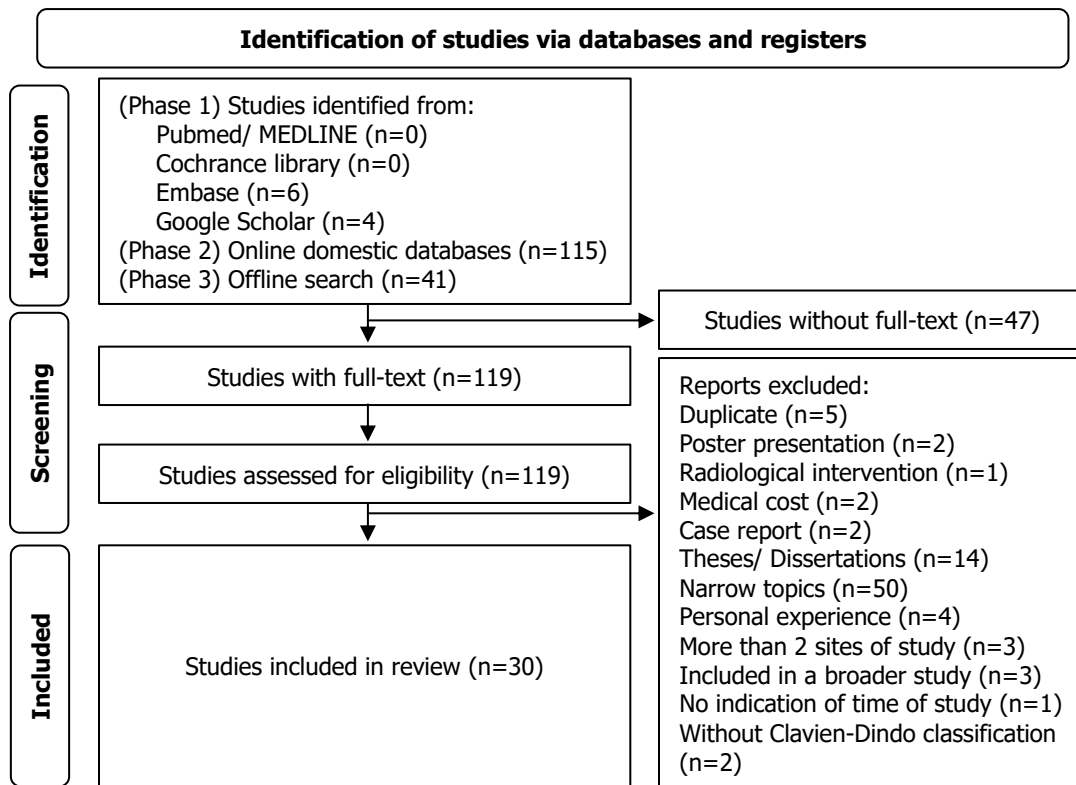
In the first phase, we did an online search on international databases and search engines including PubMed/MEDLINE, Cochrane Library, Embase, Google Scholar. For each of them, we used this specific search term: (Vietnam) AND (percutaneous) AND (nephrolithotripsy OR nephrolithotomy).

In the second phase, studies published in Vietnamese journals were screened. We used keywords (listed above) both in English and Vietnamese form to identify targeted studies in full text. If the full texts were unavailable, the third phase was undertaken.

The third phase was an offline search occurred in the library of Hanoi Medical University. We looked for articles which were printed in offline journals as well as which online full texts were unavailable.

The whole searching process was repeated on August 31st, 2021, to check for updates before finally summarizing and charting the data. No change was detected in the final search.

Searching and selecting studies described in a flow chart adapted from PRISMA flow diagram [10] in Figure 1.



* *HMU's library: Library of Hanoi Medical University, Hanoi, Vietnam*

Figure 1: Flow diagram of searching and screening process

2.5.5. Charting data

First author	Duration of study (month)	Site of study	Research methodology	Number of patients	Male/ female ratio	Mean of age	Guidance	Mean of operation time (min)	Mean of hospital stay (day)	Clavien-Dindo classification (%)					Stone free Rate (%)	Surgical conversion rate (%)
										I	II	III	IV	V		
Nguyen	52	Saint Paul hos., Hanoi	Pros	923	2.2	45	US	65	4	0	8.6	1.4	0.1	0.1	78	0
Nguyen	33	175 hos., HCMC	Pros	142	1.6	47.4	Both	74	8.2	12	12	6.3	0	0	86.7	0
Mai	29	198 hos., Hanoi	Pros	289	0.7	47	US	80.5	4.8	0	7.2	1	0	0	92	0
Kieu	15	108 hos., Hanoi	Pros	120	1.4	51	FL	100	6.6	0	35.8	1.7	1.7	0	62.4	2.5
Le	18	103 hos., Hanoi	Pros	103	1.3	48.1	US	37.1	3.6	0	9.2	2	0	0	83.7	4.9
Vu	36	Binh Dan hos., HCMC	Retro	398	1.3	41.7	FL	NA	6.2	0	0.3	1.3	0.5	0	85.2	16.1
Vo	10	Nguyen Tri Phuong hos., HCMC	Pros	22	2.7	50.8	FL	92.3	5	0	9.1	4.5	0	0	86.4	0
Le	20	Nhan dan Gia Dinh hos., HCMC	Pros	36	0.4	49.5	FL	89	6.4	0	0	8.3	0	0	83.3	8.3
Hoang	4	Hanoi medical university hos., Hanoi	Pros	50	1.2	37.4	US	79.4	4.1	8	0	2	0	0	78	0
Dao	8	Vietnam-Sweden hos., Quang Ninh	Pros	20	0.5	53	US	75.5	5.6	5	15	0	0	0	75	0
Do	24	Vietnam - Germany hos., Hanoi	Pros	1065	2.6	45.1	US	67.2	4.6	0	2.4	0.6	0.4	0.1	83	0
Le	7	Hanoi French hos., Hanoi	Retro	36	1.1	45.6	NA	47.6	1.37	0	11.1	0	0	0	94.4	0
Nguyen	15	Quang Ninh general hos., Quang Ninh	Pros	30	1.3	37.4	US	79.4	4.1	0	16.7	0	0	0	78	0
Le	3	Nghe An general hos., Nghe An	Pros	5	1.5	49.2	FL	87.5	6.6	20	20	0	0	0	80	0
Do	48	Vietnam - Germany hos., Hanoi	Retro	78	1.7	43.1	NA	98.9	6.8	0	21.8	16.7	0	0	78.2	7.7
Nguyen	8	Viet Tiep hos., Hai Phong	Pros	25	1.5	46	US	90.9	5.8	0	4.3	0	0	0	92	0
To	9	Lao Cai general hos., Lao Cai	Pros	43	0.7	49.3	US	65.1	6.6	18.6	2.3	0	0	0	79.1	0
Duong	8	Binh Duong general hos., Binh Duong	Pros	73	1.7	43.6	Both	67.3	3.8	0	6.8	1.4	0	0	90.4	2.74
Nguyen	8	Bac Ninh general hos., Bac Ninh	Pros	27	0.9	48.6	US	68.1	7.3	18.5	14.8	3.7	0	0	85.2	0
Ngo	55	Binh Dan hos., HCMC	Retro	650	1.3	53.2	FL	74.4	5.2	13.6	2.7	2.7	0.5	0.3	86.6	0
Vu	7	Vietnam - Germany hos., Hanoi	Pros	30	NA	43.1	US	89.9	NA	0	3.3	3.3	0	0	86.2	0
Nguyen	17	Dong Nai general hos., Dong Nai	Pros	93	1.6	50.9	FL	88.5	6.5	0	7.6	0	0	1.1	87.1	3.2
Doan	9	Bac Giang general hos., Bac Giang	Pros	46	2.3	45.8	US	60.7	4.3	0	20	2.2	0	0	84.4	2.2
Nguyen	24	Hai Duong general hos., Hai Duong	Retro	126	1.1	51.7	US	83.5	6.8	0	6.4	0	0	0	92.4	1.6
Nguyen	14	Dong Nai general hos., Dong Nai	Pros	106	1.7	47	FL	104.2	6.4	0	6.6	0	0	0	72.6	3.8
Duong	8	Dien Bien general hos., Dien Bien	Pros	450	NA	48.3	US	30.3	3.8	0	7.8	0	0	0	90.9	0.2
Le	26	Thanh Hoa general hos., Thanh Hoa	Pros	300	1.7	42.1	US	58.4	4.6	15.3	0	1	0	0	82.4	0
Duong	12	Binh Duong general hos., Binh Duong	Pros	103	2.2	33.8	FL	75	3.8	3.8	2	1	0	0	97.1	0
Ngo	30	Nhan dan Gia Dinh hos., HCMC	Pros	35	0.9	48.9	US	76	5	5.7	11.4	2.9	0	0	78.1	8.6
Pham	13	E hos., Hanoi	Pros	62	1.8	57.2	US	120.8	7.7	0	25.8	0	0	0	74.2	1.6

Data from selected studies was extracted into items by two groups of authors working simultaneously. Results were checked for differences.

Data items are listed as follows: author name, time duration of study, journal reference, site of study, research methodology, subjects: Number of patients, gender ratio, mean of age, ultrasound-guided or fluoroscopy-guided PCNL, length of operation time, length of hospital stay, stone free rate, complications according to Clavien-Dindo classification [11], surgical conversion rate.

In several studies, the authors described complications in words other than directly stated grading following Clavien-Dindo. Therefore, the research team's meetings were held to form agreement for final classification in such studies.

2.5.6. Collating, summarizing, and reporting the results

Data extracted from the selection studies was analyzed to answer research questions. Reporting results followed PRISMA-ScR framework.

2.5.7. Protocol of the review

This systematic scoping review followed a final protocol that was registered in Open Science Framework Registries on June 14th, 2021, with Registration DOI: 10.17605/OSF.IO/FD6MJ.

III. RESULTS

In phase 1, we identified 10 articles. In phase 2, 115 studies were noted, of those 68 full-texts available. The other 47 articles proceeded to phase 3 which was carried out offline in the library of Hanoi medical university, where failed to obtain the full text of 6 papers. Through screening, all the articles identified in phase 1 were excluded because of duplicate (5 articles), poster presentation (2 articles), radiological intervention (percutaneous nephrostomy) (1 article), and treatment cost (2 articles). Of 109 studies collected from phase 2 and phase 3, 30 studies met criteria. Searching and screening process were manifested in Figure 1. All selected 30 studies and their characteristics were listed in Table 1.

Table 1: Studies included in this systematic scoping review

First author	Duration of study (month)	Site of study	Research methodology	Number of patients	Male/female ratio	Mean of age	Guidance	Mean of operation time (min)	Mean of hospital stay (day)	Clavien-Dindo classification (%)					Stone free Rate (%)	Surgical conversion rate (%)
										I	II	III	IV	V		
Nguyen	52	Saint Paul hos., Hanoi	Pros	923	2.2	45	US	65	4	0	8.6	1.4	0.1	0.1	78	0
Nguyen	33	175 hos., HCMC	Pros	142	1.6	47.4	Both	74	8.2	12	12	6.3	0	0	86.7	0
Mai	29	198 hos., Hanoi	Pros	289	0.7	47	US	80.5	4.8	0	7.2	1	0	0	92	0
Kieu	15	108 hos., Hanoi	Pros	120	1.4	51	FL	100	6.6	0	35.8	1.7	1.7	0	62.4	2.5
Le	18	103 hos., Hanoi	Pros	103	1.3	48.1	US	37.1	3.6	0	9.2	2	0	0	83.7	4.9
Vu	36	Binh Dan hos., HCMC	Retro	398	1.3	41.7	FL	NA	6.2	0	0.3	1.3	0.5	0	85.2	16.1
Vo	10	Nguyen Tri Phuong hos., HCMC	Pros	22	2.7	50.8	FL	92.3	5	0	9.1	4.5	0	0	86.4	0
Le	20	Nhan dan Gia Dinh hos., HCMC	Pros	36	0.4	49.5	FL	89	6.4	0	0	8.3	0	0	83.3	8.3
Hoang	4	Hanoi medical university hos., Hanoi	Pros	50	1.2	37.4	US	79.4	4.1	8	0	2	0	0	78	0
Dao	8	Vietnam-Sweden hos., Quang Ninh	Pros	20	0.5	53	US	75.5	5.6	5	15	0	0	0	75	0
Do	24	Vietnam - Gernary hos., Hanoi	Pros	1065	2.6	45.1	US	67.2	4.6	0	2.4	0.6	0.4	0.1	83	0
Le	7	Hanoi French hos., Hanoi	Retro	36	1.1	45.6	NA	47.6	1.37	0	11.1	0	0	0	94.4	0
Nguyen	15	Quang Ninh general hos., Quang Ninh	Pros	30	1.3	37.4	US	79.4	4.1	0	16.7	0	0	0	78	0
Le	3	Nghe An general hos., Nghe An	Pros	5	1.5	49.2	FL	87.5	6.6	20	20	0	0	0	80	0
Do	48	Vietnam - Gernary hos., Hanoi	Retro	78	1.7	43.1	NA	98.9	6.8	0	21.8	16.7	0	0	78.2	7.7
Nguyen	8	Viet Tiep hos., Hai Phong	Pros	25	1.5	46	US	90.9	5.8	0	4.3	0	0	0	92	0
To	9	Lao Cai general hos., Lao Cai	Pros	43	0.7	49.3	US	65.1	6.6	18.6	2.3	0	0	0	79.1	0
Duong	8	Binh Duong general hos., Binh Duong	Pros	73	1.7	43.6	Both	67.3	3.8	0	6.8	1.4	0	0	90.4	2.74
Nguyen	8	Bac Ninh general hos., Bac Ninh	Pros	27	0.9	48.6	US	68.1	7.3	18.5	14.8	3.7	0	0	85.2	0
Ngo	55	Binh Dan hos., HCMC	Retro	650	1.3	53.2	FL	74.4	5.2	13.6	2.7	2.7	0.5	0.3	86.6	0
Vu	7	Vietnam - Gernary hos., Hanoi	Pros	30	NA	43.1	US	89.9	NA	0	3.3	3.3	0	0	86.2	0
Nguyen	17	Dong Nai general hos., Dong Nai	Pros	93	1.6	50.9	FL	88.5	6.5	0	7.6	0	0	1.1	87.1	3.2
Doan	9	Bac Giang general hos., Bac Giang	Pros	46	2.3	45.8	US	60.7	4.3	0	20	2.2	0	0	84.4	2.2
Nguyen	24	Hai Duong general hos., Hai Duong	Retro	126	1.1	51.7	US	83.5	6.8	0	6.4	0	0	0	92.4	1.6
Nguyen	14	Dong Nai general hos., Dong Nai	Pros	106	1.7	47	FL	104.2	6.4	0	6.6	0	0	0	72.6	3.8
Duong	8	Dien Bien general hos., Dien Bien	Pros	450	NA	48.3	US	30.3	3.8	0	7.8	0	0	0	90.9	0.2
Le	26	Thanh Hoa general hos., Thanh Hoa	Pros	300	1.7	42.1	US	58.4	4.6	15.3	0	1	0	0	82.4	0
Duong	12	Binh Duong general hos., Binh Duong	Pros	103	2.2	33.8	FL	75	3.8	3.8	2	1	0	0	97.1	0
Ngo	30	Nhan dan Gia Dinh hos., HCMC	Pros	35	0.9	48.9	US	76	5	5.7	11.4	2.9	0	0	78.1	8.6
Pham	13	E hos., Hanoi	Pros	62	1.8	57.2	US	120.8	7.7	0	25.8	0	0	0	74.2	1.6

2.6. Distributions of regions and starting years of studies

Of the 30 articles included in this review, starting in 2016 and 2017, there were a significant increase of publications from a variety of institutions that were conducted as shown in Figure 2. Before that point of time, publications were mainly conducted by experienced centers located in metropolitans such as Hanoi or Ho Chi Minh City.

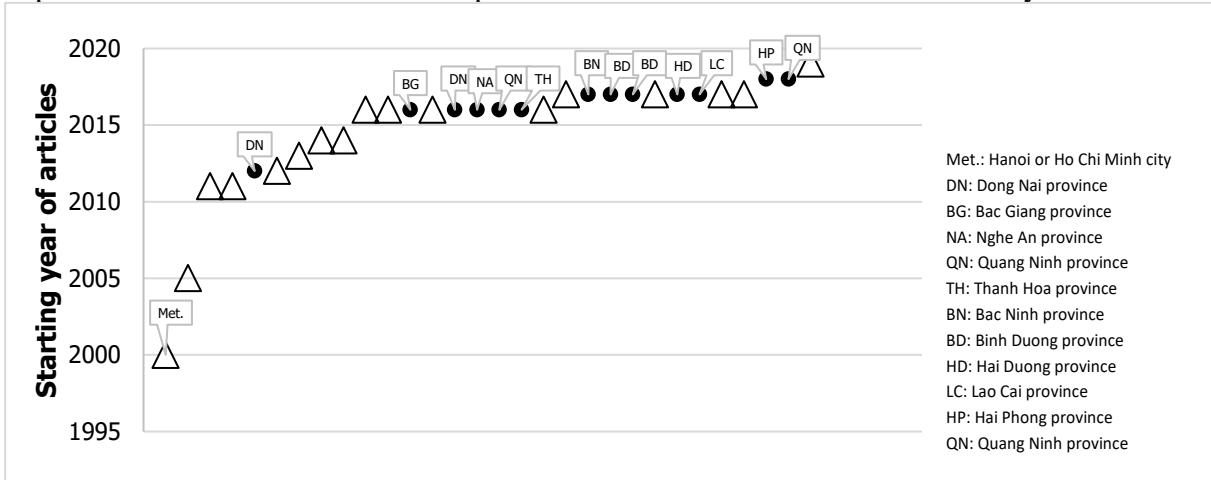


Figure 2: Distribution of starting year of publications

2.7. Short-term results and complications

Because of the year of 2016 was considered as the point when PCNL transferred to other institutions from more experienced centers, the research team decided to take 2016 as the cutting point. Hence, there were two groups of studies, before 2016 and from 2016 forward, for analyzing data.

In general, studies conducted from 2016 forward showed that there was an improvement in many aspects of operation. The trend was manifested as downtrend in operation time as well as in surgical conversion rate and uptrend in stone free rate as shown in figure 3. In addition, severe complications appeared to be less unlikely to happen in the group of from 2016 forward as shown in Figure 4.

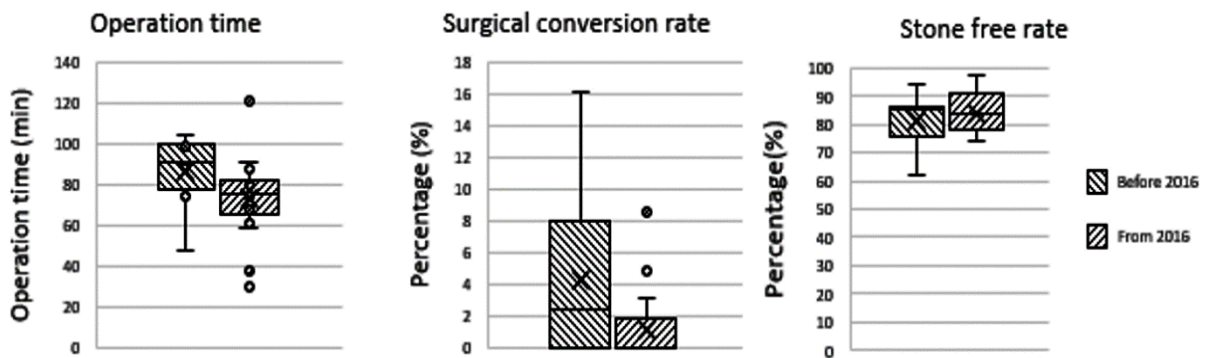


Figure 3: Short-term results from two groups of studies

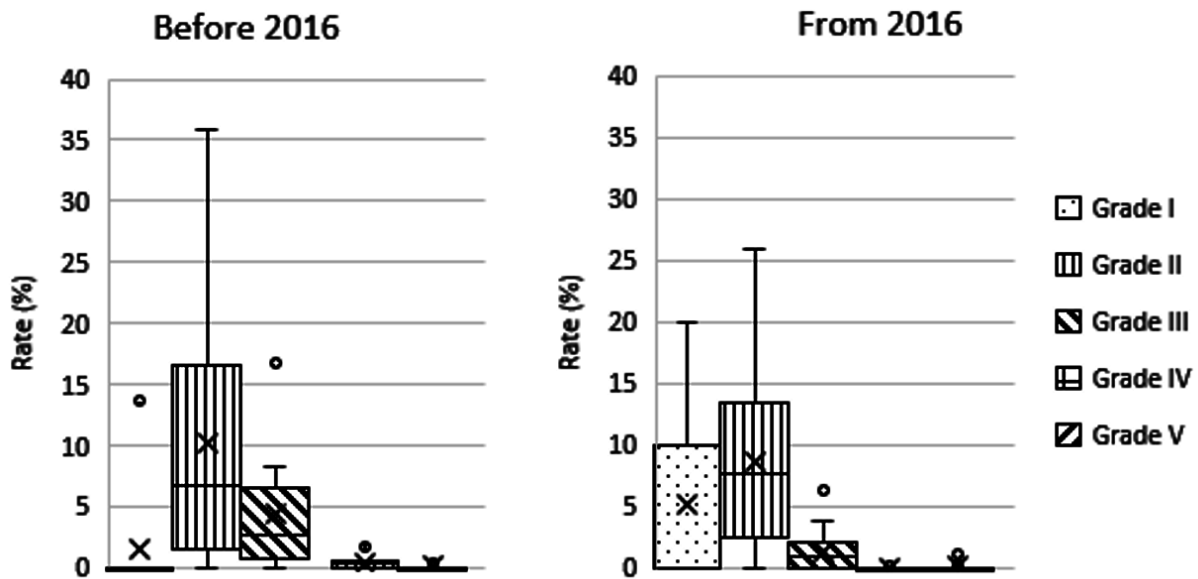


Figure 4: Complication rate according to Clavien-Dindo classification

IV. DISCUSSION

Percutaneous nephrolithotripsy is considered as a standard treatment for renal stones larger than 2 cm [12]. However, with the enhancement of the mastering technique, the indications of PCNL are now even broader, making it more common in practice. The application of the technique makes open surgery for renal stones less preferable. In Vietnam, it is estimated that approximately 36% of hospitalized patients admitted due to urolithiasis [13]. Although it was first performed more than 20 years ago in Vietnam[6], there is no review on its effectiveness and complication rates. Especially, when the cure is now routinely performed in limited resource institutions.

It was said that from the 2010s, PCNL was gradually transferred from high volume centers in metropolitans such as Hanoi or Ho Chi Minh City to other institutions in the same areas. Available evidence body showed that in around the year of 2016, approximately two decades since the first performance, PCNLs were gradually

transferred from highly experienced centers to more limited resource readiness counterparts. Studies from a variety of institutions were undertaken to report application of PCNL in those clinical settings since that point of time.

Preliminary data analysis from this study indicated that the transference was partly successful. Improvement in short-term results as well as severe complication rates advocated that less resource readiness institutions, to some extent, mastered the technique and controlled subsequent complications.

Dealing with complications is an unpleasant, but hardly avoidable, part of applying any novel technique. Authors of papers included in our study struggled as well. Their experience was case study for other institutions, including those who had been routinely applying this surgery in practice. In several articles, authors mentioned and described complications they had encountered incompletely. This also reflected in our meetings for reaching an

agreement on final complication classification. Such experience was believed to be an invaluable lesson when discussed in greater details.

This systematic scoping review was limited by its size because of the heterogeneity of the studies, therefore, not fully picturing the clinical practice. In other words, results from not only excluded articles but some of included ones had been reported in various ways. Such as, for complication classification, some of them did not follow Clavien-Dindo system, others did not thoroughly describe. Moreover, several papers did not report operation time, or long-term stone free rate. Another limitation of this study is that offline search was conducted only one library, therefore, further studies doing search at more libraries might reveal a clearer practice context. However, this work might hopefully raise some awareness about obtaining a more homogeneous research design in a national scale, to improve next reviews in the future.

V. CONCLUSION:

This is the first systematic scoping review on the practice of PCNL in Vietnam. The biggest limitation of this study was that it could not screen all potential papers published on all domestic journals because of geographical disadvantage as well as incomplete domestic indexing system. Diversity of reporting results among papers was also an obstacle. Nonetheless, this study showed a partly successful transference of the technique to limited resource institutions. A systematic review without the above limitations could help precisely in picturing clinical practice. Peri-operation, short-term, and long-term results in institutions with various resource readiness or in regions of

Vietnam with different practical approach should be considered for inclusion. This study is expected to be helpful for policy makers as well as related associations in improving clinical practice, and scientific activities in national range.

ACKNOWLEDGEMENTS

This study is dedicated to unconditional effort of all research members. It is also a present for Mrs. Thuy T. Nguyen and Mr. Hoang D. Le for priceless and unnamed support.

ABBREVIATIONS

PCNL: Percutaneous nephrolithotripsy or Percutaneous nephrolithotomy
Hos.: Hospital
HCMC: Ho Chi Minh city
NA: Not available
Retro: Retrospective research
Pros: Prospective research
US: Ultrasound
FL: Fluoroscopy

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