Efficacy of Nephrostomy Tract Infiltration with Bupivacaine Before and After Tubeless Percutaneous Nephrolithotomy: A Randomized Control Study

Thawatchai Mankongsrisuk MD*, Chaiyong Nualyong MD*,
Anupan Tantiwong MD*, Tawatchai Taweemonkongsap MD*,
Teerapon Amornvesukit MD*, Ekkarin Chotikawanich MD*

** Division of Urology, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Objective: *To determine the efficacy and appropriate time of bupivacaine infiltration in the nephrostomy tract of tubeless PCNL.*

Material and Method: *A randomized control study. 69 patients underwent tubeless PCNL between May 2014 and September 2015 at Siriraj Hospital, Mahidol University were enrolled in the study. They were randomized into three groups. Group A, patients had10 ml of 0.5% bupivacaine infiltrated in the access tract of PCNL after completed surgery. Group B,10 ml of 0.5% bupivacaine was infiltrated before started the access. Group C, bupivacaine was not given. Pain score was evaluated using the visual analog scales (VAS)at immediate after the procedure, then every 4 hours until 24 hours.Postoperative morphine requirement was recorded until 48 hours.*

Results: *Patient's demographic data was similar among 3 groups. No difference of pain scores at any time after the procedure. Morphine requirement, amount and time to first dose of post-operative morphine were not different among 3 groups.*

Conclusion: *Local anesthesia infiltration with 0.5% bupivacaine 10 ml at the access tract of tubeless PCNL does not reduce pain intensity and postoperative morphine requirement, neither before nor after the procedure.*

Keywords: *tubeless PCNL, nephrostomy tract infiltration, bupivacaine*

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Percutaneous nephrolithotomy (PCNL) is a standard treatment for large kidney stone. Nephrostomy tube is occasionally required after the procedure. Tubeless PCNL becomes the option regarding to less postoperative pain, less analgesics requirement, shorter hospital stay and quicker recovery with no significant difference in post-operative complications and stone-free rate[1-5]. However, pain and discomfort still exist.

To minimize postoperative pain after tubeless PCNL, local anesthesia has been utilized. Postoperative pain and analgesia requirement was decreased by using local anesthesia infiltrated at skin and nephrostomy tract at the end of the operation[6].

Currently, preemptive analgesia is an attractive concept and known to prevent central sensitization of pain, thereby reducing hyperalgesia. There were several meta-analysis studies about preemptive local anesthesia in many operations, but the result were inconclusive[7,8]. Therefore, we questioned if local anesthesia infiltration is able to reduce postoperative pain in patient underwent tubeless PCNL?

Correspondence to:
Chotikawanich E, Division of Urology, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, 10700, Thailand.
Phone:+66-2-4198010, Fax: +66-2-4112011
E-mail: ekkarin.cho@mahidol.ac.th

Material and Method

There were 90 patients underwent tubeless PCNL at Siriraj Hospital, Mahidol University between May2014 and September 2015. Of these, 69 eligible patients who met the criteria participated the study. Exclusion criteria was shown in Table 1. Patients were randomized into 3 groups. Group A patients had 10 ml of 0.5% bupivacaine infiltrated in the access tract of PCNL after completed surgery. Group B, 10 ml of 0.5% bupivacaine was infiltrated before started the access tract dilation. Group C, bupivacaine was not given.Pain score was evaluated by the nurse who was blinded from this study. The evaluation was achieved using the visual analog scales (VAS) at immediately after the

procedure, then every 4 hours until 24 hours. Postoperative morphine requirement was recorded until 48 hours.

Patient demographic data including age, gender, BMI, history of previous surgery and serum creatinine were recorded. Perioperative outcomes were diagnosis, stone size, complications of stone, renal access, operative time, estimated blood loss, residual stone and length of hospital stay.Stone status after the surgery was evaluated by plain film or ultrasonography at 4 weeks post surgery.

PCNL, all procedures were set in prone position, tract access was performed under fluoroscopic guided. Tract dilation was done using balloon dilator (Nephro Max™, Ultraxx™) and 30Fr Amplatz sheath was utilized. All lithotripsy was done by ultrasonic lithotripter (Swiss Litho Clast Master™). Group A patients were infiltrated with 0.5% bupivacaine 10 mL at skin, access tract, using 22-gauge needle at the end of the operation. Group B patients were infiltrated with 0.5% bupivacaine 10 mL at the skin anddeep to the expected access site, using the same size needle. Group C patients underwent the surgery without bupivacaine infiltration at all.

For postoperative pain control, intravenous morphine injection was used according to Siriraj postoperative pain protocol, as shown in Fig. 1. Amount of morphine and time from postoperation to its first dose was recorded, and then until 48 hours postoperatively.

Statistical analysis was achieved with SPSS version 13.0. Quantitative data with normal distribution were analyzed using ANOVA test, non-parametric distribution using Kruskal Wallis test, and Chi-square test to compare the other nominal data.

Results

The demographic data of 3 studied groups were well balance as shown in Table 2. Peri-operative data including diagnosis, stone size, complications of stone, renal access, operative time, estimated blood loss, residual stone and length of hospital stay were not significantly different among 3 groups (Table 3).

Pain scores which evaluated by VAS in first 24 hours, the maximum pain of all was at immediately after the procedure and then decreased. After 12 hours postoperatively, the median of VAS pain score was zero for all 3 groups (Table 4).

Among 3 groups, first dose of morphine was required at 60 minutes, 45 minutes, and 40 minutes for group A, B, and C respectively.The timing tended to be longer in patient received bupivacaine after the procedure, however this was not statistically significant. At median time of 4 hours after surgery, all did not intend to use morphine (Table 5).

Discussion

Pain control is an important in postoperative care for every operation. Despite the minimally invasive surgery of PCNL to have less pain, postoperative pain and discomfort is inevitable. Tubeless PCNL has its role in term of less postoperative pain compares to standard PCNL[1-5].

For standard PCNL, there were several studies of post-operative pain management. There are 5 studies of post-PCNL pain control with local anesthesia[9-13]. 3 of 5 studies had significantly less analgesics requirement in the study group. Therefore, local anesthesia at the end of the operation should be considered.

As a forementioned, our study aimed to evaluate the pain intensity of patients underwent tubeless PCNL among groups that received bupivacaine as a local anesthetic agent before and after the procedure, while patient who did not receive any agent was the control group.

Our study had no difference of patient's demographic data and the peri-operative outcomes among the study groups. The median pain score existed in the first 8 hours after the procedure for patients who received bupivacaine both of before and after the procedure, however, there was no statistically difference between them. After that the median pain score reached zero for all groups.The median time of first dose of morphine requirement were 60 minute for patients received bupivacaine after procedure, 45 minute for patients received the agent before procedure, and 40minute for control group. The patients who had bupivacaine after the procedure tended to have longer time for first dose of morphine postoperatively, however, this was not statistically different.

Table 1. Exclusion criteria

Age <18 years
Allergy to bupivacaine or morphine
Bilateral simultaneous PCNL
Percutaneous nephrostomy tract >1
Infected hydronephrosis
Significant bleeding
Perforation of collecting system
Need second-look nephroscopy

Table 2. Demographic data

Parameters	A (n = 24)	B (n = 22) [Mean ± SD]	C (n = 23)	ANOVA Sig.
Age (years)	55.38±11.55	53.32±11.97	51.50±10.75	0.49
Gender				
Male	14	10	9	0.41*
Female	10	12	14	
BMI (kg/m^2)	25.32±4.87	25.10±3.52	27.04±4.82	0.28
History of previous surgery (no: yes)	14:10	9:13	9:14	0.35*

* Chi-square test

Table 3. Perioperative data

Parameters	A (n = 24)	B (n = 22) [Mean ± SD]	C (n = 23)	ANOVA Sig.
Diagnosis (No.)				
Renal pelvis stone	7	4	7	0.87*
Caliceal stone	3	5	3	
Staghorn stone	8	9	7	
Renal pelvis and caliceal stone	6	4	6	
Stone size; max length in diameter (cm)	3.40±1.83	2.82±1.08	2.96±1.52	0.40
Complications of stone				
Hydronephrosis (no: yes)	7:17	8:14	4:19	0.35*
Urinary tract infection (no: yes)	21:3	18:4	17:6	0.49*
Serum creatinine (mg/dL)	1.12±0.40	1.19±0.73	0.93±0.28	0.18
Renal access				
Supracostal	13	6	9	0.18*
Infracostal	11	16	14	
Operative time (minute)	83.92±28.18	74.55±28.49	84.35±35.24	0.49
Estimated blood loss (ml)	4.79±3.28	3.68±1.49	4.26±1.54	0.27
Residual stone (no: yes)	16:8	16:6	13:10	0.51*
Length of hospital stay (mean; day)	5	5	3	0.67**

* Chi-square test
** Kruskal Wallis test; Median (P10,P90)

The finding in this study was different from the previous one from Shah et al, they revealed postoperative local anesthesia infiltration decreased pain intensity after tubeless PCNL. The difference between two studies was the dilator, we used balloon dilator to dilate the access tract, while another used telescopic metal dilator. Tissue injury during the access tract dilation was less when using the balloon dilator. There was a meta-analysis study compared 4 dilators in PCNL that revealed telescopic metal dilators associated with more blood loss and more operative time, compared to balloon dilator[14]. However, there was no study which compared postoperative pain between these 2 dilators.

Conclusion

Local anesthesia infiltration with 0.5% bupivacaine 10 ml at the access tract of tubeless PCNL does not reduce pain intensity and post-operative morphine requirement, neither before nor after the

Table 4. VAS pain score

Parameters	A (n = 24)	B (n = 22) [Median (P10, P90)]	C (n = 23)	ANOVA Sig.
VAS score at immediate post-operation	3 (0,9.5)	2.5 (0,7.7)	2 (0,7.6)	0.965
VAS score - 4 hour	2 (0,7)	2.5 (0,9.1)	2 (0,7)	0.864
VAS score - 8 hour	1 (0,4)	1.5 (0,7.7)	0 (0,6.8)	0.433
VAS score - 12 hour	0 (0,2)	0 (0,3.7)	0 (0,6.8)	0.914
VAS score - 16 hour	0 (0,7)	0 (0,2.7)	0 (0,3.8)	0.647
VAS score - 20 hour	0 (0,2)	0 (0,3.7)	0 (0,6.6)	0.652
VAS score - 24 hour	0 (0,5)	0 (0,3)	0 (0,3.2)	0.806

VAS: Visual analog scale

Table 5. Morphine requirement

Parameters	A (n = 24)	B (n = 22) [Median (P10, P90)]	C (n = 23)	Asymp. Sig.
Time to first dose of MO (minutes)	60 (0,260)	45 (0,204)	40 (0,308)	0.707
First dose of MO (mg)	2 (0,4)	2 (0,4)	2 (0,2.8)	0.468
MO usage from 0 to 4 hours	2 (0,4.5)	2.25 (0,9.55)	2 (0,6.9)	0.506
MO usage from 4 to 8 hours	0 (0,2.25)	0 (0,2)	0 (0,2.6)	0.776
MO usage from 8 to 12 hours	0 (0,0.5)	0 (0,2)	0 (0,3)	0.377
MO usage from 12 to 16 hours	0 (0,2)	0 (0,0.7)	0 (0,0)	0.237
MO usage from 16 to 20 hours	0 (0,0)	0 (0,1)	0 (0,1.2)	0.578
MO usage from 20 to 24 hours	0 (0,1)	0 (0,0)	0 (0,2)	0.577
MO usage from 24 to 48 hours	0 (0,1.5)	0 (0,0.7)	0 (0,0)	0.237
Total MO usage (mg)	3.5 (0,11.5)	5 (0,11.25)	2 (0,11.6)	0.661

MO = Morphine

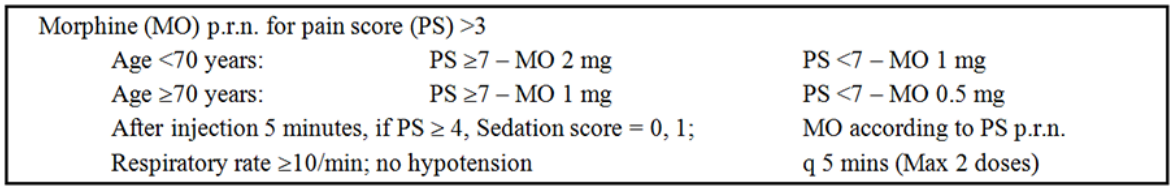

Fig. 1 Postoperative order for pain – adult, Siriraj Hospital

procedure.

What is already known on this topic?

There is only one study to date that evaluated this topic. The conclusion shows that nephrostomy tract infiltration with bupivacaine at the end of tubeless PCNL can reduce postoperative pain intensity and analgesics requirement.

What this study adds?

This study was conducted to investigate the appropriate time for nephrostomy tract infiltration with bupivacaine, at the beginning, at the end of the operation and no bupivacaine. The result shows that local anesthesia infiltration with bupivacaine at the access tract of tubeless PCNL does not reduce pain intensity and postoperative morphine requirement, neither before

nor after the procedure.

Potential conflict of interest

None.

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เปรียบเทียบผลในการระงับความปวดหลังผ่าตัดในผู้ป่วยที่ได้รับการผ่าตัดส่องกล้องเข้าไปในไตผ่านผิวหนังบริเวณเอวและสลายนิ่วโดยไม่ใส่สายระบายปัสสาวะบริเวณเอวหลังผ่าตัดระหว่างการไม่ฉีดยาชาฉีดยาชาก่อนผ่าตัดและฉีดยาชาหลังผ่าตัด

ธวัชชัย มั่นคงศรีสุข, ไชยยงค์ นวลยง, อนุพันธ์ ตันติวงศ์, ธวัชชัย ทวีมั่นคงทรัพย์, ธีระพล อมรเวชสุกิจ, เอกรินทร์ โชติกวาณิชย์

วัตถุประสงค์: เพื่อศึกษาผลของการฉีดยาชาบริเวณแผลในการผ่าตัดส่องกล้องเข้าไปในไตผ่านผิวหนัง บริเวณเอวและสลายนิ่วโดยไม่ใส่สายระบายปัสสาวะบริเวณเอวหลังผ่าตัด และเวลาที่เหมาะสมในการฉีดยาชา

วัสดุและวิธีการ: ผู้ป่วย 69 รายที่เข้ารับการผ่าตัดส่องกล้องเข้าไปในกรวยไตผ่านผิวหนังบริเวณเอวและสลายนิ่วถูกแบ่งเป็น 3 กลุ่มแบบสุ่ม กลุ่มแรกได้รับการฉีดยาชา 0.5% บิวพิวาเคน 10 ซีซีหลังการผ่าตัด กลุ่มที่สอง ได้รับการฉีดยาชา 0.5% บิวพิวาเคน 10 ซีซี ก่อนการผ่าตัด และกลุ่มสุดท้ายไม่ได้รับการฉีดยาชา ภายหลังการผ่าตัด คะแนนความปวดจะถูกประเมินทุก 4 ชั่วโมง จนถึง 24 ชั่วโมง รวมทั้งประเมินปริมาณมอร์ฟีนที่ใช้ในช่วงเวลาต่าง ๆ จนถึง 48 ชั่วโมงหลังผ่าตัด จากนั้นนำผลที่ได้จากผู้ป่วยทั้ง 3 กลุ่มมาเปรียบเทียบกัน

ผลการศึกษา: ข้อมูลพื้นฐานของผู้ป่วยทั้ง 3 กลุ่มไม่มีความแตกต่างกัน รวมทั้งไม่พบความแตกต่างของคะแนน ความปวดหลังผ่าตัดที่เวลาต่าง ๆ ในช่วง 24 ชั่วโมงแรก นอกจากนี้ปริมาณมอร์ฟีนที่ใช้ในช่วงเวลาต่าง ๆ และปริมาณมอร์ฟีนที่ใช้ทั้งหมดหลังผ่าตัดของผู้ป่วยทั้ง 3 กลุ่มไม่แตกต่างกัน

สรุป: การฉีดยาชาบริเวณแผลในการผ่าตัดส่องกล้องเข้าไปในไตผ่านผิวหนังบริเวณเอวและสลายนิ่ว โดยไม่ใส่สายระบายปัสสาวะบริเวณเอวหลังผ่าตัดไม่ช่วยลดความปวดและปริมาณมอร์ฟีนที่ใช้หลังผ่าตัด ไม่ว่าจะฉีดก่อนหลังหลังการผ่าตัด