

ORIGINAL PAPERS

# The Use of Tranexamic Acid for Preventing Bloodloss During Percutaneous Nephrolithotomy

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## Abstract

**Introduction:** Percutaneous nephrolithotomy (PCNL) is a minimally invasive method of treatment used for large kidney stones (>20mm). Intra or postoperative bleeding is one of the very serious complications associated with this type of surgical interventions. The aim of this study is to evaluate the efficiency and safety of tranexamic acid in reducing blood loss and transfusion requirements in patients with kidney stones treated by percutaneous nephrolithotomy. **Material and methods:** The data of 47 patients diagnosed with renal lithiasis which underwent percutaneous nephrolithotomy during October 1st 2016 – April 1st 2017 were reviewed. The staghorn versus non-staghorn calculi ratio was 1:2. Most PCNL were completed through a single percutaneous tract; in 3 cases 2 tracts were required. Most procedures were performed under regional anesthesia (89.3%). The patients were divided in two groups: 23 (group 1) received one hour prior to surgery 1 g Exacyl (tranexamic acid) in 250 ml saline solution 0.9% with slow infusion (1 hour); infusion with the same posology was repeated 12 hours postsurgery, while 24 patients (group 2) did not receive tranexamic acid. The clinical data of the patients were compared. **Results:** The mean age of the patients was 52 years, the mean operative time was 73 minutes (69 minutes for the tranexamic acid group and 78 minutes for the control group) and the mean stone burden was 26mm (range 18-57 mm). The overall stone free rate was 87.2%. The mean hemoglobin drop in the tranexamic acid group was significantly lower than that of the control group (1.1 g vs 2.4 g). The transfusion rate was also higher in the control group (6 patients vs. 1 patient). The postoperative complications were represented by postoperative pain (25.5%), fever (12.7%), hematuria (19.1%), urinary sepsis (only one case – 2.1%). **Conclusions:** The use tranexamic acid in percutaneous nephrolithotomy is safe and cheap and is associated with reduced blood loss and a lower transfusion rate. Further studies are required in order to clearly establish the role of the tranexamic acid as an antifibrinolytic agent in preventing blood loss during and after percutaneous nephrolithotomy.

**Keywords:** percutaneous nephrolithotomy, PCNL, tranexamic acid

## Rezumat

**Obiectivul studiului:** Nefrolitotomia percutanată este o metodă de tratament minim invaziv pentru tratamentul calculilor renali de dimensiuni mari (>20 mm). Sângerarea intra sau postoperatorie este una dintre complicațiile importante asociate acestui tip de intervenție chirurgicală. Scopul acestui studiu este de a evalua siguranța și eficiența acidului tranexamic în reducerea sângerării la pacienții cu litiază renală tratați cu ajutorul acestei metode.

**Material și metode:** Au fost analizate retrospectiv datele a 47 de pacienți diagnosticați cu litiază renală la care s-a practicat nefrolitotomie percutanată în perioada 1 octombrie 2016–1 aprilie 2017. Raportul de calculi coraliformi față de cei non-coraliformi a fost de 1:2. Majoritatea NLP-urilor au fost realizate pe un singur traiect; în trei cazuri

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au fost necesare 2 traiecte de puncție. Majoritatea intervențiilor chirurgicale au fost realizate sub anestezie regională (89,3%). Pacienții au fost împărțiți în 2 grupuri: 23 (grup 1) de pacienți au primit cu o oră înainte de operație o doză de 1 g de Exacyl (acid tranexamic) diluată în 250 ml de soluție salină 0,9% în infuzie lentă și apoi infuzie cu aceeași posologie la 12 ore postoperator în timp ce 24 de pacienți (grup 2) nu au primit acest tip de medicație. Datele clinice ale pacienților au fost comparate retrospectiv. **Rezultate:** Vârsta medie a pacienților a fost de 52 de ani, timpul operator mediu a fost de 73 minute (69 de minute pentru grupul cu acid tranexamic și respectiv 78 de minute pentru grupul control), iar dimensiunea medie a calculilor a fost de 26mm (interval 18-57 mm). Rata globală de stone-free a fost 87,2%. Scăderea în medie a hemoglobinei în grupul cu acid tranexamic a fost mai mică comparativ cu grupul de control (1,1 g vs 2,4 g). De asemenea, rata de transfuzie a fost mai mare în grupul de control (6 pacienți vs. 1 pacient). Complicațiile postoperatorii au fost reprezentate de durere postoperatorie (25,5%), febră (12,7%), hematurie (19,1%), sepsis (un singur caz - 2,1%). **Concluzii:** Utilizarea acidului tranexamic în cadrul nefrolitotomie percutanate este o metodă sigură, ieftină și este asociată cu o reducere a sângerării și a ratei de transfuzie sanguină. Sunt necesare studii suplimentare pentru a stabili clar rolul acidului tranexamic ca agent antifibrinolic în prevenirea sângerării în timpul și după nefrolitotomia percutanată.

**Cuvinte cheie:** nefrolitotomie percutanată, NLP, acid tranexamic

## INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is a minimally invasive method of treatment used for large kidney stones (>20 mm). It remains the standard procedure for large renal calculi according to EAU (*European Association of Urology*) guidelines. The stones are extracted from the kidney by a small puncture wound (about 1 cm) through the skin. Since its introduction this technique has replaced almost completely open surgery for renal lithiasis, who nowadays is used only rarely in selected cases. Although this procedure has much lower complications than open surgery, the complications following this procedure can be serious<sup>1</sup> (Table 1). Morbidity and complications following PCNL are dominated by fever (10.5%) and bleeding (7.8%)<sup>2</sup>.

Tranexamic acid is a synthetic derivative of the amino acid lysine that exerts its antifibrinolytic effect through the reversible blockade of lysine binding sites on plasminogen molecules. Intravenously administered tranexamic acid caused reductions in postoperative blood losses in patients undergoing cardiac surgery. Tranexamic acid is usually well tolerated; diarrhea and nausea are the most frequent adverse events<sup>3</sup>.

Tranexamic acid is used in the treatment of many haemorrhagic conditions. The drug is used in cardio-

vascular, orthopedic, spine and general surgery to reduce postoperative blood loss and transfusion rate. The experience with tranexamic acid in reducing haemorrhagic complications in percutaneous nephrolithotomy is limited.

The aim of this study is to evaluate the efficiency and safety of tranexamic acid in reducing blood loss and transfusion requirements in patients with kidney stones treated by percutaneous nephrolithotomy.

## MATERIAL AND METHODS

The data of 47 patients diagnosed with renal lithiasis which underwent percutaneous nephrolithotomy during October 1<sup>st</sup> 2016 – April 1<sup>st</sup> 2017. Most PCNL were completed through a single percutaneous tract; in 3 cases 2 tracts were required. Most procedures were performed under regional anesthesia (89.3%). The staghorn versus non-staghorn calculi ratio was 2:1. Exclusion criteria were: coagulopathies, back problem disorders, neurological disorders with paresthesia and patient refusal.

The patients were divided in two groups: 23 (group 1) received one hour prior to surgery 1 g Exacyl (tranexamic acid) in 250 ml saline solution 0.9% with slow infusion (1 hour); infusion with the same posology was repeated 12 hours post-surgery, while 24 patients (group 2) did not receive tranexamic acid. The clinical data of the patients were compared.

Lithotripsy was performed using ultrasonic or ballistic fragmentation. Double J stenting was done at the end of surgery in 3 patients; two more patients received a double J stent for lumbar fistula. The longest stone diameter was measured on a plain X ray; abdominal ultrasound or computed tomography was used to mea-

Table 1. PCNL complications

PCNL complications	
Bleeding (transfusion rate)	7%
Bleeding (embolisation rate)	0.4%
Urinoma	0.2%
Fever	10.8%
Sepsis	0.5%
Thoracic complications	1.5%

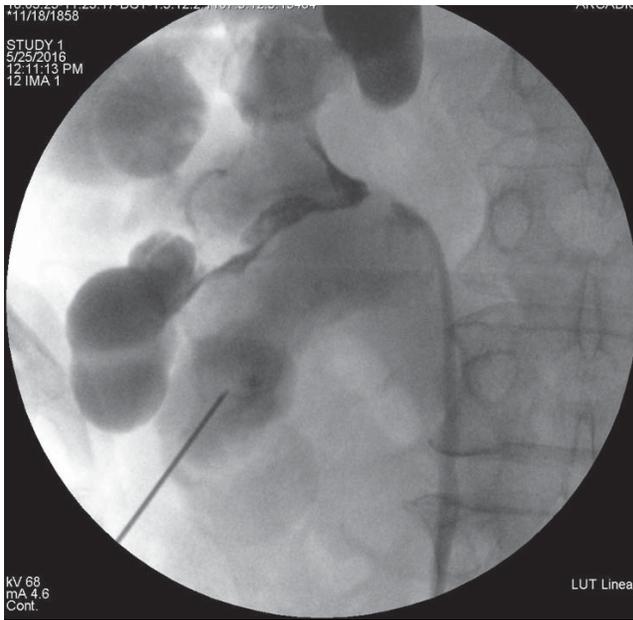


Figure 1.



Figure 3.

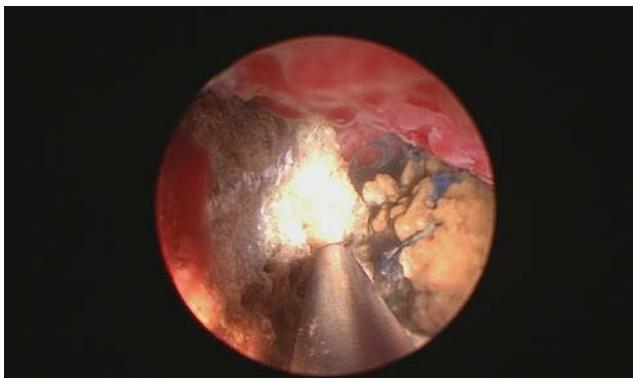


Figure 2.



Figure 4.

sure the size of radiolucent stones. All the patients were worked up with an intravenous urography or contrast computed tomography; those with positive urine cultures received appropriate antibiotic therapy.

Postoperative evaluation at 2 days included plain X ray and abdominal ultrasound. Postoperative evaluation at 1 month included abdominal ultrasound, plain X ray or computed tomography to look for residual fragments.

Most of the PCNL-s (89.3% - 42 patients) were performed under spinal anesthesia because of the advantages of better postoperative pain relief, fewer episodes of nausea and vomiting, more benign postoperative recovery and because of the intersurgical communication with the patient.

All patients were premedicated with 3 mg Midazolam. 1 hour prior to surgery 23 patients received 1 g Exacyl (tranexamic acid) in 250 ml saline solution 0.9% with slow infusion (1 hour); infusion with the same posology was repeated 12 hours post-surgery.

The patients were placed in sitting position on the operating table. Under aseptic conditions, a dural puncture was made at L2-L3 interspaces with a 25-26 gauge spinal needle and hyperbaric Marcaine 0.5 % was administrated in subarachnoidal space.

## RESULTS

The mean age of the patients was 52 years, the mean operative time was 73 minutes (69 minutes for the



Figure 5.

tranexamic acid group and 76 minutes for the control group) and the mean stone burden was 26 mm (range 18–57 mm).

The overall stone free rate was 86.5%. The postoperative complications were represented by postoperative pain (26.8%), fever (13.4%), hematuria (15.8%), urinary sepsis (2 cases – 2.4%). The mean hemoglobin drop in the tranexamic acid group was significantly lower than that of the control group (1.1 g vs 2.4 g). The transfusion rate was also higher in the control group (6 patients vs. 1 patient).

## References

1. Seitz, C., et al. Incidence, prevention, and management of complications following percutaneous nephrolitholapaxy. *Eur Urol*. 2012; 61: 146
2. Kamphuis GM1, Baard J, Westendarp M, de la Rosette JJ. *World J Urol*. Lessons learned from the CROES percutaneous nephrolithotomy global study. 2015 Feb;33(2):223-33 Epub 2014 Aug 7
3. Dunn CJ1, Goa KL, Drugs. 1999 Jun;57(6):1005-32. Tranexamic acid: a review of its use in surgery and other indications
4. Fergusson DA, Hébert PC, Mazer CD, Fremes S, MacAdams C, Murkin JM, et al. A comparison of aprotinin and lysine analogues in high-risk cardiac surgery. *N Engl J Med* 2008;358:2319-31
5. Christopher Kim, Sam Si-Hyeong Park, and J Roderick Davey. Tranexamic acid for the prevention and management of orthopedic surgical hemorrhage: current evidence. *J Blood Med*. 2015; 6: 239–244
6. Henry DA1, Carless PA, Moxey AJ, O'Connell D, Stokes BJ, Fergusson DA, Ker K. Anti-fibrinolytic use for minimising perioperative allogeneic blood transfusion. *Cochrane Database Syst Rev*. 2011 Mar 16;(3)
7. Ker K., Edwards P, Perel P, Shakur H, Roberts I. Effect of tranexamic acid on surgical bleeding: systematic review and cumulative meta-analysis. *BMJ*. 2012 May 17;344
8. Crescenti A1, Borghi G, Bignami E, Bertarelli G, Landoni G, Casiraghi GM, Briganti A, Montorsi F, Rigatti P, Zangrillo A.; Intraoperative use of tranexamic acid to reduce transfusion rate in patients undergoing radical retropubic prostatectomy: double blind, randomised, placebo controlled trial. *BMJ*. 2011 Oct 19
9. Kumar S., Randhawa MS, Ganesamoni R, Singh SK. Tranexamic acid reduces blood loss during percutaneous nephrolithotomy: a prospective randomized controlled study. *J Urol*. 2013 May; 189(5):1757-61. Epub 2012 Oct 30.

## DISCUSSIONS

Tranexamic acid was successfully used in many surgical procedures: cardiovascular, orthopedic, general surgery, spine surgery<sup>4,5</sup>.

The use of tranexamic acid has limited and usually minor complications<sup>6</sup>. A meta-analysis conducted by Ker and al. concluded that tranexamic acid reduces blood transfusion in surgery, although thromboembolic events and mortality remains uncertain<sup>7</sup>.

In urological surgery, the tranexamic acid was used before in prostate surgery (transurethral resection of the prostate or radical prostatectomy) with encouraging results. Crescenti and al. reported for radical retropubic prostatectomy an absolute reduction in transfusion rate 21% and a relative risk of receiving transfusions for patients treated with tranexamic acid of only 0.62 with no statistical differences in thromboembolic events between the two groups<sup>8</sup>.

The experience with tranexamic acid in preventing blood loss during percutaneous nephrolithotomy is limited.

Kumar et al reported promising results in a prospective randomized controlled study in 2013; the mean hemoglobin drop, transfusion requirements and operative time were significantly lower in patients who received tranexamic acid<sup>9</sup>.

## CONCLUSIONS

The use tranexamic acid in percutaneous nephrolithotomy is safe and is associated with reduced blood loss and a lower transfusion rate. Further studies are required in order to clearly establish the role of the tranexamic acid as an antifibrinolytic agent in preventing blood loss during and after percutaneous nephrolithotomy.