



# Effect of body mass index on operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement in patients undergoing percutaneous nephrolithotomy

*Perkütan nefrolitotomi yapılan hastalarda vücut kitle indeksinin ameliyat ve hastanede kalış süresi, taşsızlık, postoperatif komplikasyonlar ve analjezi gereksinimi üzerine etkisi*

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## ABSTRACT

**Objective:** To compare the effect of body mass (BMI) index on operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement in patients undergoing percutaneous nephrolithotomy (PCNL) by comparing three BMI groups.

**Material and methods:** This is a retrospective analysis of 129 patients who underwent PCNL from January 2010 to August 2013. All the patients underwent PCNL by a standard technique. The patients were divided into three groups: patients having a BMI  $\leq 24$  kg/m<sup>2</sup> were included in the normal group, those having a BMI of 24.1–30.0 kg/m<sup>2</sup> were included in the overweight group, and those having a BMI  $>30$  kg/m<sup>2</sup> were included in the obese group. Three groups were compared for operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement.

**Results:** A total of 129 patients including 44 females and 85 males were included with a mean age of 45.00 $\pm$ 1.44 years. The mean age in the normal group was 43.29 $\pm$ 1.69 years, 47.08 $\pm$ 1.29 years in the overweight group, and 43.61 $\pm$ 1.25 years in the obese group. The mean stone size in the normal group was 25.46 $\pm$ 8.92 mm, 28.01 $\pm$ 8.40 mm in the overweight group, and 26.84 $\pm$ 7.41 mm in the obese group. Our results showed no statistically significant difference with respect to mean operative time, mean hospital stay, and stone clearance in the normal, obese, and overweight patients undergoing PCNL. Postoperative complications and analgesia requirement were also similar in all the three groups.

**Conclusion:** There was no effect of BMI on operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement in patients undergoing PCNL. PCNL is a safe and effective procedure for the removal of renal stones in obese patients.

**Keywords:** Body mass index; hospital stay; operative time; PCNL; postoperative analgesic requirement; stone clearance.

## ÖZ

**Amaç:** Perkütan nefrolitotomi (PNL) geçiren hastalarda vücut kitle indeksinin (VKİ) ameliyat ve hastanede kalış süresi, taşsızlık, postoperatif komplikasyonlar ve analjezi gereksinimi üzerine etkisinin karşılaştırılması.

**Gereç ve yöntemler:** Ocak 2010 ile Ağustos 2013 arasında PNL geçirmiş 129 hasta geriye dönük olarak incelenmiştir. Hastaların hepsi standart teknikle PNL ameliyatı geçirmiştir. Hastalar üç gruba ayrılmıştır. VKİ'leri 24 kg/m<sup>2</sup> veya daha düşük olanlar normal gruba, VKİ'leri 24,1-30 24 kg/m<sup>2</sup> olanlar aşırı kilolu gruba ve 30-24 kg/m<sup>2</sup>'den yüksek olanlar obez gruba dahil edilmiştir. Üç grup ameliyat ve hastanede yatış süresi, taşsızlık, postoperatif komplikasyonlar ve analjezi gereksinimi açısından karşılaştırılmıştır.

**Bulgular:** Kırk dördü kadın ve 85'i erkek olmak üzere, yaş ortalaması 45,00 $\pm$ 1,44 yıl olan toplam 129 hasta çalışmaya dahil edilmiştir. Yaş ortalamaları normal grupta 25,46 $\pm$ 1,29 yıl, aşırı kilolu grupta 28,01 $\pm$ 8,40 yıl, obez grupta ise 43,61 $\pm$ 1,25 yıl idi. Ortalama taş büyüklükleri normal grupta 25,46 $\pm$ 8,92 mm, aşırı kilolu grupta 28,01 $\pm$ 8,40 mm, obez grupta ise 26,84 $\pm$ 7,41 mm idi. Sonuçlarımız PNL geçirmiş normal, aşırı kilolu ve obez hastalarda ortalama ameliyat ve hastanede yatış süresi ve taşsızlık açısından istatistiksel olarak anlamlı farklılık olmadığını göstermiştir. Üç grubun tümünde postoperatif komplikasyonlar ve analjezi gereksinimleri de benzer düzeylerdeydi.

**Sonuç:** PNL geçiren hastalarda vücut kitle indeksi ameliyat ve hastanede yatış süresi, taşlardan temizlenme, postoperatif komplikasyonlar ve postoperatif analjezi gereksinimini herhangi bir şekilde etkilememektedir. PNL obez hastalarda taşsızlık sağlayan güvenli ve etkili bir işlemdir.

**Anahtar kelimeler:** PNL; vücut kitle indeksi; operatif zaman; hastanede yatış; taşlardan temizlenme; postoperatif analjezi gereksinimi.

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## Introduction

Renal stone disease is one of the most common urological disorders recognized since ancient times, with a prevalence of approximately 2–3% in the general population.<sup>[1]</sup> The estimated lifetime risk of developing a kidney stone is approximately 12%.<sup>[1]</sup> Pakistan is located in the stone belt region with a very high incidence of renal stones.<sup>[2]</sup> Renal stones were classically removed by open surgery, but the advent of minimally invasive, endoscopic techniques and extra-corporeal shock wave lithotripsy (ESWL) have almost replaced the classically performed open surgery for the removal of renal stones.<sup>[1]</sup> At present, percutaneous nephrolithotomy (PCNL) is accepted as the procedure of choice for renal stones larger than 2 cm.<sup>[3]</sup> Currently, open stone surgery is rare.<sup>[1]</sup> In the western community, an increasingly sedentary lifestyle and high-fat diet have resulted in obesity defined as the body weight more than 120% of the ideal body weight,<sup>[4]</sup> reaching a pandemic status.<sup>[5]</sup> In USA, approximately one-third (34.9%) of adults were obese in 2011–2012.<sup>[6]</sup> Obesity is common in the developing world, including Pakistan. There is an alarming rise in obesity; recent data suggests that more than 1 billion adults are overweight, and at least 300 million of them are clinically obese.<sup>[7]</sup> Obesity is known to be an independent risk factor for surgical and anesthetic complications.<sup>[5]</sup> To date, there is no clear evidence as to how much body mass index (BMI) can affect the outcomes in PCNL. We have compared operative time, hospital stay, stone clearance, and postoperative complications in individuals undergoing PCNL by dividing them into normal, overweight, and obese individuals.

## Material and methods

The study was conducted after the approval of the ethical committee of Shifa International Hospital. This is a retrospective analysis of 129 patients who underwent PCNL from January 2010 to August 2013. All the patients underwent PCNL by a standard technique. An open-end catheter was passed cystoscopically up to the renal pelvis in the lithotomy position under fluoroscopic guidance. The patient was then placed in the prone position. Under fluoroscopic guidance, the pelvicalyceal system (PCS) was punctured using a 23-Fr spinal needle. The glide wire was passed through the spinal needle into the PCS. The tract was dilated using metallic dilators over the glide wire. A 30-Fr amplatz sheath was introduced over metallic dilators into the PCS under fluoroscopic guidance. A 26 Fr nephroscope was then introduced through the PCNL sheath. A pneumatic lithoclast was used to break the stones, and a three prongs grasper was used to extract the stone fragments. A nephrostomy tube was passed in all patients and was removed on the second postoperative day.

The patients were divided into three groups: patients having a BMI  $\leq 24$  kg/m<sup>2</sup> were included in the normal group, those having a BMI of 24.1–30.0 kg/m<sup>2</sup> were included in the overweight group, and those having a BMI  $>30$  kg/m<sup>2</sup> were included in the

**Table 1. Patient characteristics**

Total no. of patients (n)	129	
Males	85	65.89%
Females	44	34.1%
Mean age (years)	45.00 $\pm$ 1.44	
BMI $\leq 24$ kg/m <sup>2</sup> (normal)	47	36.4%
BMI 24.1–30 kg/m <sup>2</sup> (overweight)	56	43.4%
BMI $>30$ kg/m <sup>2</sup> (obese)	26	20.2%

obese group. All the groups were matched for age, gender, and stone size. Patients with uncontrolled diabetes, hypertension, bleeding disorders, or ischemic heart disease were excluded from the study. All patients received 1 g intravenous (IV) or oral paracetamol at 6-h intervals on the first postoperative day and thereafter on pro re nata (PRN)/as needed basis. Pain not getting relieved by paracetamol was resolved by administering IV Nalbuphine 0.2–0.4 mg/kg body weight with 12.5 mg of dimenhydrinate. All patients received 2 g cefoperazone plus sulbactam on induction and post surgery.

Three groups were compared for operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement. The operative time (in min) was calculated from the first attempt to puncture the PCS to the placement of the last stitch. Hospital stay (in days) was calculated from zero postoperative day to the day of discharge. Stone clearance was measured in terms of percentage of the primary stone removed using ultrasound, computed tomography (CT) scan, or a kidney, ureter, and bladder (KUB) X-ray, which was performed for initial diagnosis. The postoperative complications include bleeding requiring transfusion, respiratory tract infections (presence of cough, sputum, and fever with radiological evidence of chest infection on X-ray of the chest), sepsis (pulse more than 100, fever more than 38°C, respiratory rate more than 24, and total leukocyte count (TLC) more than 12000/mm<sup>3</sup>). Postoperative analgesic requirement was measured in terms of the mean number of doses of paracetamol and nalbuphine per patient during hospital stay.

## Statistical analysis

The data was collected through chart review and entered on specified performa. Data was analyzed on the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) ver. 16.

## Results

A total of 129 patients including 44 females and 85 males were included with a mean age of 45.00 $\pm$ 1.44 years (Table 1). Forty-seven (36.4%) patients had a BMI of  $\leq 24$  kg/m<sup>2</sup> and were included in the normal group, 56 (43.4%) had a BMI from 24 to 30 kg/m<sup>2</sup> and were included in the overweight group, and 26 (20.2%) with a BMI  $>30$  kg/m<sup>2</sup> were included in the obese

group. The mean age in the normal group was  $43.29 \pm 1.69$  years,  $47.08 \pm 1.29$  years in the overweight group, and  $43.61 \pm 1.25$  years in the obese group. The mean stone size in the normal group was  $25.46 \pm 8.92$  mm,  $28.01 \pm 8.40$  mm in the overweight group, and  $26.84 \pm 7.41$  mm in the obese group (Table 2). Detailed results are shown in Table 3.

### Mean operative time

There was no significant difference in the mean operative time in the three groups, i.e., normal versus overweight ( $128.40 \pm 48.61$  vs.  $126.62 \pm 59.75$  min,  $p$ -value=0.8703), normal versus obese ( $128.40 \pm 48.61$  vs.  $129.42 \pm 58.86$  min,  $p$ -value=0.9368), and overweight versus obese patients ( $126.62 \pm 59.75$  vs.  $129.42 \pm 58.86$  min,  $p$ -value=0.9344).

### Mean hospital stay

No significant difference in the mean hospital stay was observed in the three groups, i.e., normal versus overweight ( $3.00 \pm 1.04$  vs.  $3.00 \pm 1.17$  day,  $p$ -value=1.000), normal versus obese ( $3.00 \pm 1.04$  vs.  $3.03 \pm 1.82$ ,  $p$ -value=0.9287), and overweight versus obese patients ( $3.00 \pm 1.17$  vs.  $3.03 \pm 1.82$ ,  $p$ -value=0.9286).

### Stone clearance

Intraoperative stone clearance was almost equal in the three groups, i.e., normal versus overweight ( $91.18 \pm 10.83\%$  vs.  $89.62 \pm 11.00\%$ ,  $p$ -value=0.4720), normal versus obese

( $91.18 \pm 10.83\%$  vs.  $90.23 \pm 11.89\%$ ,  $p$ -value=0.7299), and overweight versus obese patients ( $89.62 \pm 11.00\%$  vs.  $90.23 \pm 11.89\%$ ,  $p$ -value=0.8204).

### Post operative complication

There was no significant difference in postoperative complication in the three groups. No blood transfusion was performed in any group. One patient in each group developed urosepsis. Two patients in the normal group, four in the overweight group, and five in the obese group developed respiratory tract infection.

### Postoperative analgesia requirement

There was no statistically significant difference with respect to postoperative analgesia requirement in the three groups.

## Discussion

Obesity is known to be associated with poorer surgical outcomes and increased operative morbidity and mortality.<sup>[4]</sup> PCNL in obese patients poses the similar treatment challenge because they cannot easily tolerate the prone position, and the thicker subcutaneous fat renders the nephroscope too short, thus leading to operative difficulties, longer operative time, longer hospital stay, poorer stone clearance, and increased risk of postoperative complications.<sup>[5]</sup>

Sergeyev et al.<sup>[8]</sup> found a significantly longer length of hospital stay for the group with a BMI  $<25$  kg/m<sup>2</sup>; however, there was no difference in the stone-free rate, postoperative fever, or change in hemoglobin in different BMI groups. To overcome the shorter length of sheath, Giblin et al.<sup>[9]</sup> employed larger and longer amplatz access sheaths and a 30-F gynecologic laparoscope. There was complete stone clearance and no additional perioperative morbidity. Bagrodia et al.<sup>[10]</sup> in USA and El-Assmy et al.<sup>[11]</sup> in Egypt also found no significant differences among groups

**Table 2. Comparison of three BMI groups with respect to demographic data**

	BMI $\leq 24$ kg/m <sup>2</sup> (normal)	BMI 24.1–30 kg/m <sup>2</sup> (overweight)	BMI $>30$ kg/m <sup>2</sup> (obese)
No. of patients	47	56	26
Mean age (years)	$43.29 \pm 1.69$	$47.08 \pm 1.29$	$43.61 \pm 1.25$
Mean stone size (mm)	$25.46 \pm 8.92$	$28.01 \pm 8.40$	$26.84 \pm 7.41$

**Table 3. Results of the patients**

	Normal	Over weight	p	Normal	Obese	p	Over weight	Obese	p
Mean operative time (min)	$128.40 \pm 48.61$	$126.62 \pm 59.75$	0.8703	$128.40 \pm 48.61$	$129.42 \pm 58.86$	0.9368	$126.62 \pm 59.75$	$129.42 \pm 58.86$	0.9344
Mean hospital stay (days)	$3.00 \pm 1.04$	$3.00 \pm 1.17$	1.0000	$3.00 \pm 1.04$	$3.03 \pm 1.82$	0.9287	$3.00 \pm 1.17$	$3.03 \pm 1.82$	0.9286
Stone clearance	$91.18 \pm 10.83$	$89.62 \pm 11.00$	0.4720	$91.18 \pm 10.83$	$90.23 \pm 11.89$	0.7299	$89.62 \pm 11.00$	$90.23 \pm 11.89$	0.8204
Sepsis	1	1	0.9003	1	1	0.6667	1	1	0.5643
Blood transfusions	nil	nil		nil	nil		nil	nil	
RTIs	2	4	0.8752	2	5	0.0957	4	5	0.2113
Mean no of doses of paracetamol	$5.85 \pm 2.61$	$5.39 \pm 2.11$	0.3250	$5.85 \pm 2.61$	$6.61 \pm 5.11$	0.4021	$5.39 \pm 2.11$	$6.61 \pm 5.11$	0.1288
Mean no of doses nalbuphine	$2.27 \pm 1.58$	$2.55 \pm 1.76$	0.3851	$2.27 \pm 1.58$	$3.03 \pm 2.25$	0.0961	$2.55 \pm 1.76$	$3.03 \pm 2.25$	0.2969

RTIS: respiratory tract infections

with respect to stone-free and complication rates, operative time, length of hospital stay, or need for multiple accesses. Stone-free rate and complication rates were found to be independent of BMI by Tomaszewski et al.<sup>[12]</sup> and Pearle et al.<sup>[13]</sup>

On the other hand there are reports of longer operative time, poorer stone clearance, and increase risk of postoperative complications in obese patients undergoing PCNL. Faerber and Goh found a longer hospital stay (3.5 days vs. 4.4 days) and a higher rate of complications (16% vs. 37%) in the morbidly obese group than the normal weight group.<sup>[14]</sup> Fuller et al.<sup>[15]</sup> in a retrospective analysis of 5803 patients found a significantly longer operative time, an inferior stone-free rate, and a higher re-intervention rate; however, there was no difference with respect to the length of hospital stay or the transfusion rate and complication rates in obese patients.

Our results showed no statistically significant difference with respect to mean operative time, mean hospital stay, and stone clearance in normal obese and overweight patients undergoing PCNL. Postoperative complications and analgesia requirement were also similar in all the three groups. This is similar to most of the recently published literature. Older studies showed a poorer outcome; however, the improvement of instruments, experience, and better surgical techniques has made the procedure safe and effective for obese patients as well.

In conclusion, there was no effect of BMI on operative time, hospital stay, stone clearance, postoperative complications, and postoperative analgesic requirement in patients undergoing PCNL. PCNL is a safe and effective procedure for the removal of renal stones in overweight and obese patients.

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