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Triggers of blood transfusion in percutaneous nephrolithotomy.

Ali Akbar Zehri
Aga Khan University

Syed Raziuddin Biyabani
Aga Khan University

Khurram Muthair Siddiqui
Aga Khan University

Amanullah Memon
Aga Khan University

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INTRODUCTION
The risk of transfusion related disease in the post-operative period remains a critical issue. It is an assumption that the open surgery for renal calculi is associated with a greater blood loss and consequently higher transfusion rate. PCNL as monotherapy, sandwich therapy or with adjuvant treatment modalities, is an accepted minimally invasive surgical treatment for renal calculi.1 Blood loss during PCNL is assumed to be less as compared to open surgery. The procedure entails access and manipulation through the pelvicalyceal system with potentials for trauma to the segmental and interlobar renal vessels and thus results in haemorrhage.2 The kidneys are highly vascular organs and are supplied by 20% of the cardiac output. The stones could be infected, the renal function compromised and large stone bulk could prolong the operative time and consequently blood loss. Although technological refinements and increased surgical experience have ensured the procedure’s successful execution, complications including; bleeding, collecting system injuries, adjacent structure injuries, intraoperative technical complications, hypothermia, fluid overload, sepsis, stricture formation, nephroureteral fistula, kidney loss, and even mortality, can still occur.3-4 Renal haemorrhage is one of the most common and worrisome complications of percutaneous renal surgery.5,6 Although most bleeding associated with PCNL can be managed conservatively, approximately 0.8-1% of patients require angioembolization to control intractable bleeding.7,8

The aim of this study was to evaluate the blood loss and the effect of some variables as possible triggers for blood transfusion in patients undergoing PCNL.

METHODOLOGY
From January 1988 to May 2007, 316 patients underwent percutaneous renal surgery at The Aga Khan University Hospital, Karachi, Pakistan. The percutaneous surgery database was retrospectively reviewed to identify patients with postoperative haemorrhage and need for blood transfusion. Patients who had missing data and scanned files were excluded from the study. The details of demographics and clinical data were retrieved. A plain X-ray of kidney, ureters and bladder (KUB), ultrasound or intravenous urography (IVU)/ unenhanced helical computed tomography (CT) of the KUB were performed to image the stones. Serum creatinine and urine culture was performed on all patients. Prior urinary tract infection was analyzed as a factor contributing to the need for blood transfusion. All patients with urinary tract infection received full therapy of antibiotics and demonstrated no bacterial growth pre-operatively. Stone burden was calculated in cm² by the product of longest dimension and the one perpendicular to it.9
Factors predictive of need for transfusion in a multivariate analysis.

A total of 326 procedures were performed in 316 patients. After exclusion of 94 patients on the basis of missing data, 232 procedures were included in the study. There were 167 males and 65 females. The mean age was 41±14 years. Nine patients underwent bilateral PCNL. Ninety six percent of patients underwent the procedure with a single puncture. The most common route of access was lower pole calyx (84%), 14% of patients had middle pole puncture and 2% had upper pole puncture. Twenty eight French (28 Fr.) Amplatz sheath was used in 52.6% of patients, 26 Fr. in 32.3% and 30 Fr. in 15.1% of patients. The mean stone area was 6.1 ± 4.5 cm², whereas 22% of patients had partial staghorn stone, 14.2% complete staghorn stone and rest had multiple stones (63.8%). The mean operative time was 126 ± 48 minutes. Lithoclast was used as stone fragmentation device in 56% and both ultrasound and lithoclast were used in 44% of patients.

The mean ±SD haemoglobin drop for all the procedures was 1.68 ±1.3 gm/dL.

The mean pre-operative haemoglobin concentration in males was 13.86 gm/dl (range: 8.70-16.90) and in females it was 11.65 gm/dl (range: 8.1-14.0).

Female gender (p=0.0001), pre-operative haemoglobin (p=0.002), chronic renal failure (p=0.0001), staghorn stone (p=0.0001), stone fragmentation with ultrasound (p=0.0001) and operative time (p=0.0001) were significant predictors of blood loss on univariate analysis.

Multivariate logistic regression analysis revealed that female gender (p=0.003), staghorn stone (p=0.023), stone fragmentation with ultrasound (p=0.054) and chronic renal failure (p=0.0001) were predictive of blood transfusion (Table I).

Table I: Factors predictive of need for transfusion in a multivariate logistic regression analysis.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Confidence interval</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td>Gender (female)</td>
<td>1.799 - 9.577</td>
<td>.003</td>
</tr>
<tr>
<td>Staghorn stone</td>
<td>1.165 - 7.553</td>
<td>.023</td>
</tr>
<tr>
<td>Stone fragmentation (using ultrasound and pneumatic lithotripsy)</td>
<td>0.670 - 2.681</td>
<td>.054</td>
</tr>
<tr>
<td>CRF</td>
<td>0.000 - 17.731</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

Age, hypertension, presence of urinary infection, Diabetes mellitus, calyx of puncture, tract size, size of Amplatz, multiple puncture, serum creatinine, ischemic heart disease, did not correlate with bleeding. Of the technical factors, the experience of the operating endourologist, the calyx of access, number of attempts required for a successful puncture, and return of haemorrhagic urine from the puncture needle did not correlate with the degree of bleeding. Overall blood transfusion rate for all patients who underwent percutaneous nephrolithotomy was 14.2%. The trans-fusion rate was 27.7% in females and 9% in males (p=0.001).

DISCUSSION

Significant bleeding is an uncommon but dreadful complication of PCNL. The incidence of significant haemorrhage requiring blood transfusion after PCNL had been variably reported between 2-45%.11-16 Commonly known factors that cause bleeding after PCNL include multiple punctures, hypertension, diabetes, presence of chronic renal failure, prolongation of operation, number of tracts, stone type. Factors which are associated with less bleeding include atrophic parenchyma, previous surgery, previous nephrostomy tube placement and tract dilatation with balloon dilatation. The largest series looking at variables affecting haemorrhage has revealed stone size as the single most important factor predicting bleeding after surgery requiring transfusion and intervention.12 The
incidence of blood transfusion was 12.3% but significant haemorrhage requiring intervention and need for percutaneous embolization was 1.4%.17 Two studies from Pakistan have reported the overall blood transfusion rate of 6.8% and 4% respectively. They however, have not addressed the issue of the factors triggering blood transfusion in their patients.18,19 In these patients the blood transfusion rate was 14.2%. In the current series only one patient required angioembolization for control of haemorrhage.

In the current work, in female population, the transfusion rate was 18.7% higher as compared to males. Female gender has not been found to be a significant factor in any of the other studies. One explanation could be the low pre-operative haemoglobin in our female patient population, which consequently affect the trigger for transfusion.

The stone size and the presence of staghorn stones is considered to be an important risk factor for transfusion. The reason suggested is that larger stone burden requires prolonged maneuvering within the pelvicalyceal system which in turn leads to increased incidence of injury to the parenchyma.20,21 Thirty six percent of these patients had either partial or complete staghorn stones. This may account for the slightly higher transfusion rate in the current series. Similar results shown by Turna et al., that staghorn stones, the presence of diabetes, the use of multiple tracts, and large stones were associated with increased bleeding during PCNL on multivariate analysis.22

Surgical expertise is expected to be a relevant factor but in this study, 91% of the procedures were performed by two surgeons who had done a minimum of 70 procedures therefore, this variable was not evaluated.

Majority of the patients were treated with a single and lower polar puncture. These factors are therefore not significant in this analysis. Nine patients, treated by two punctures, did not require a blood transfusion.

The limitations of this study, in addition to being retrospective study design, include the lack of inclusion of cortical width as a study variable. However, since unenhanced single-slice CT was used as an imaging modality in a number of patients, accurate measurement of the cortical thickness was not considered reliable with this modality.

The presence of renal insufficiency was a risk factor for transfusion in our group. There is a general tendency of bleeding in patients with renal failure, the cause of which has been reported as decreased platelet aggregation,23 and low levels of the Von Willibrand factor. Though this was a significant risk factor in our patients, this has not been consistently found to cause increased risk for bleeding after PCNL in the studies quoted earlier.

CONCLUSION

The transfusion rate in this group of patients is 14.2%. Multivariate analysis identified chronic renal failure, female gender, the presence of staghorn calculi and stone fragmentation using ultrasonic device as predictive of blood transfusion. Other factors such as age, hypertension, previously treated urinary tract infection, Diabetes mellitus, ischemic heart disease, size of the Amplatz, multiple punctures, were not significant and did not correlate with bleeding.

REFERENCES


