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Peri-operative complications in PerCutaneous NephroLithotomy

KEYWORDS: percutaneous nephrolithotomy, anaesthesia, complications, peri-operative.

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ABSTRACT *Objective: To identify and quantify the peri-operative anaesthetic complications of Per-Cutaneous Nephro-Lithotomy (PCNL). Methodology: A prospective observational study was done over five months, enrolling 60 patients undergoing PCNL under general anaesthesia. Intra-operative vital parameters, temperature and volume of irrigating fluid, ambient temperature were monitored. Data was analyzed to identify peri-operative complications, determine their incidence and risk factors associated with them. Results: The incidence of hypothermia and acidosis was 60% and 26.7%, respectively. The incidence of hypothermia and temperature of the irrigating fluid had statistically significant association with a p-value of 0.026 (OR 0.22).The incidence of acidosis was significantly associated with the volume of irrigating fluid with a p-value 0.025.The risk of acidosis was increased with hypothermia (p-value 0.02, OR 7.00). Conclusion: Hypothermia was the most common complication observed intra-operatively, followed by acidosis. The most significant risk factor associated with hypothermia was use of cold irrigating fluid.*

INTRODUCTION

Per-Cutaneous-Nephro-Lithotomy (PCNL) is a relatively non-invasive surgical alternative for urolithiasis, performed mostly under general anaesthesia(1). Although considered minimally invasive, PCNL is not bereft its complications(2). While surgical complications of PCNL have been studied, unfortunately, recent literature on the profile of peri-operative anaesthetic complications is scant. Considering the frequency of cases and complications seen, we felt it a useful exercise to study the profile of anaesthesia related complications of PCNL, to further appropriate monitoring techniques and improve peri-operative management.

MATERIALS AND METHODS

A prospective observational study was done between April2010 and August 2010 in sixty ASA Grade 1 and 2 patients aged 18 to 65 years undergoing elective PCNL surgery. ASA grade ≥3 or those undergoing a simultaneous surgical procedure in the same sitting were excluded. Blood pressure, heart rate, nasopharyngeal temperature, saturation, and end-tidal carbon-di-oxide were monitored intra-operatively. Temperature of in travenous fluid (IVF) as well as irrigation fluid(IF) used and ambient room temperature were noted. Temperature of IVF and IF were taken as warm if bags were used from solution warm er and cold if not warmed. Total volume of the IVF and IF were also noted. At end of sur gery, Arterial Blood Gas (ABG) was repeated and changes in haematocrit, electrolytes, and lactates from baseline were noted to assess blood loss, dilutional anaemia, dilutional hypona tremia, and acidosis. The study was approved by the Institutional Fluid Research Board.

RESULTS

Of the 60 patients included into the study, the mean age of the patients were 40 years ± 10.53 years. 70% of the patients were males. 40 out of 60 patients(66.7%) had no co-existing comorbidities. Most common comorbid condition present was hypertension in 14 out of 60 patients(23.3%).None of the patients had Ischaemic heart disease. 16 patients had only one comorbid illness while 4 patients had multiple comorbid illnesses. 40 patients were categorized as ASA grade 1 while 20 patients belonged to ASA grade 2.

Most of the patients woke up within ten minutes of cessation of anaesthesia.(73.3%,ie 44 out of 60 patients). 16.7% of patients(10 patients) took upto 20 minutes for awakening. Two patients (3.3%) woke up only after 20 minutes of anaesthesia. Four patients were not extubated in view of complications. The baseline and per-operative characteristics of the patients included in the study have been given in Table 1.

Table 1: Baseline and per-operative charecteristics of patients:

Baseline and per-operative Characteristics (N=60)	
Demographic data	
Age[Mean(SD)]	39.9(10.53)
Male	42(70%)
Co-morbidities	
Diabetes Mellitus	14(23%)
Hypertension	8(13.3%)
Chronic renal failure	2(3.3%)
Bronchial Asthma/COPD	2(3.3%)
ASA Grade	
Grade 1	40(66%)
Grade 2	20(33%)
Side of surgery	
Unilateral	58(96.67%)
Type of Calculus	
Staghorn Calculus Temperature of irrigating fluid used(%)	16(27%)
Warm	43(72%)
Cold	17(28%)

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Per-operative Characteristics Mean (SD)	
Mean Blood pressure mmHg)	86.27(16.14)
Mean temperature (Celsius)	36.08(.41)
Mean heart rate (bpm)	82.27(16.48)
Mean Haematocrit (%)	38.38(7.68)
Mean Ambient temperature in theatre (Celsius)	22.62(1.18)
Mean duration of surgery (hrs)	2.30(.833)
Mean volume of Intravenous fluid used (litres)	1.52(.84)
Mean volume of Irrigating fluid used (litres)	24(13.87)

COPD-Chronic obstructive pulmonary disease, SD – standard Deviation, ASA- American Society of Anaesthesiologists.

Of 60 patients, although 39 patients(65%) had a drop in blood pressure at some point of time intraoperatively, only 5 patients had perisitent hypotension. Most common complication that occured intraoperatively was noted to be hypothermia (60%) followed by acidosis (26.7%) . (Table 2)

Table 2: Outcome Measures - perioperative complications (n=60)

Perioperative complications(n=60)	p-value
Hypothermia	36(60%)
Hypotension	
Induction to prone	34(57%)
Prone to end of surgery	1(2%)
End of surgery to extubation	4(6%)
Bradycardia	7(12%)
Acidosis	16(27%)
Bleeding requiring intraoperative transfusion	6(10%)
Pleural tear(hydrothorax)	1(2%)
ICU admission	5(8%)

ICU-Intensive care unit

When patients with hypothermia were compared with those with no hypothermia, there was no association of hypothermia with the mean duration of surgery, awakening time or the volume of irrigating fluid (Table 3). However of 36 patients who developed hypothermia, 22 patients had been irrigated with cold fluids whereas only 3 out of the 24 patients who were irrigated with warm fluid developed hypothermia. With a p-value of 0.026 and an Odds Ratio (OR) of 0.22, this result was statistically significant; indicating that the risk of hypothermia was increased when cold irrigating fluid was used as opposed to warm fluid. The ambient temperature inside the operating theatre was similar, with a mean temperature of around 22°C in those who had hypothermia as well as those who did not. p- value 0.193 . Though the total volume of Intravenous fluids administered was higher in those who developed hypothermia when compared to those who did not, this observation was not statistically significant. p- value 0.148.

Table 3: Risk Factors in patients with hypothermia

	Hypothermia (N=36)	No Hypothermia (N=24) P value	p-value
Mean duration of surgery (hours)	2.45	2.06	0.08
Cold saline irrigation(No:)	22	3	0.03
Awakening time			
1-10 min	2	2	0.82
11-20 min	1	1	
21-30 min	5	5	
Not extubated	28	16	
Volume of irrigating fluid(L)	29.42	23.08	0.083
Ambient temperature of theatre(°C)	22.46	22.87	0.193
IV Fluid infusion(L)	1.65	1.33	0.148
Acidosis (No :)	14	2	0.02

IV – intravenous, L-Litres

Among the 16 patients who developed acidosis, 14 also had hypothermia. This association was significant with a p-value of 0.02 and an Odds Ratio of 7.00. The mean volume of irrigating fluid was significantly higher and statistically significant in those patients who developed acidosis (33.5 litres), as compared to those who did not develop acidosis (24.4 litres).(p-value 0.025) . However there was no association of acidosis with patient's co-morbidities, volume of IV fluid infused (1.65 litres in acidosis group vs 1.33 litres in the non-acidosis group) or duration of surgery (2.39 hrs in acidosis group vs 2.26 hrs in the non acidosis group.

The mean duration of surgery in those who received blood transfusion intra-operatively was 2.94 hrs and in those who did not receive blood was 2.22 hrs. This association was statistically significant with a p-value of 0.04. In the patients who received blood transfusion intra-operatively, the baseline haematocrit was 26.5% and in those patients who did not receive a transfusion, it was 39.7%.This association was statistically significant with a p-value of <0.01. There was no statistically significant association between the incidence of blood transfusion and the size of the calculi (2.98 cm vs 2.64 cm) (p-value of 0.55).The mean blood loss was 380ml $\pm$ 78 ml) and the average drop in haematocrit in our study was 4.14 % + 0.64.

DISCUSSION

The most common intra-operative complication we encountered was hypothermia and the second most common complication was acidosis. Although Roberts et al had identified the association of hypothermia with PCNL surgeries(3), neither hypothermia nor acidosis featured as a major complication in earlier studies. In 2007, Michel et al presented a total complication rate of up to 83%, in which neither hypothermia nor acidosis were listed(4). Bleeding requiring transfusion was the most common complication in that series. Others included insignificant bleeding, pain and fever. Recent studies projected most common major complications of PCNL as fever (4.1%) and bleeding requiring transfusion(2.7%)(5) . Seitz et al in their meta-analyses also found haemoglobin fall and transfusion and septicaemia as common complications(6).

We found a 60% incidence of hypothermia when using cold irrigating fluid, which was statistically significant. The volume of irrigating fluid used and duration of surgery in patients with hypothermia also showed a trend towards significance. Although ambient room temperature is considered the single most important factor influencing perioperative hypothermia, in this study ambient room temperature was similar in both patient groups. Additionally, we also took adequate measures to aggressively warm all patients with forced air warmer immediately after induction of anaesthesia. The adverse effects of hypothermia could include delayed emergence, postoperative shivering, cardiovascular complications, wound healing, infection and bleeding(7). We also found a 26.7% incidence of acidosis

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which is higher than earlier reports. This was found to be significantly associated with use of large volume irrigation fluid. There was no statistical significance with the total volume of intravenous fluids. Hypothermia was also found to be significantly associated with acidosis. However there was no significant relation with duration of surgery. Absorption of irrigating fluid can also lead to other serious complications, but we did not encounter any.

We also found a 65% incidence of intra-operative hypotension (n=39), which is comparable to earlier studies (8). However, we also observed that hypotension occurred most immediately after induction of anaesthesia till start of surgical stimulus. 34 out of the 39 patients had a drop in blood pressure reading during this time, which subsequently normalised with beginning of surgery. Such mild hypotensive episodes are common and can be attributed to intravenous and inhalational anaesthetic agents, as well as a lack of surgical stimulus (9). This therefore cannot be considered as a major complication of PCNL surgery perse as it could occur during any surgery under anaesthesia. On the other hand, hypotension due to the PCNL procedure would be expected to occur after the commencement of surgery and be present till the end of surgery. The incidence of such persistent hypotension in our study was 8.3%. These patients had significant hypotension and only 1.7% of these reached back to normal preoperative levels for extubation. Although hypertension has been reported as a major cardiovascular event during PCNL, we did not find any significant hypertension in patients at the end of the procedure (8).

The incidence of bleeding reported with PCNL varies between 0.5% - 8.5% with median blood losses being reported around 498.6 mL (10, 11). In our study, estimated mean blood loss was 380 ml +78 ml and average drop in haematocrit was 4.14 %, comparable to other studies (12, 13). Bleeding requiring transfusion has been reported between 7%-23% (13, 14). 10% of our patients received intra-operative transfusion. Rate of bleeding requiring interventions has been reported to be less than 1% (5).Though 5% of the cases to be abandoned because of excessive bleeding, none needed any intervention other than blood transfusion. There are reports relating blood transfusion o duration of surgery and calculus size (13, 14). Although we found statistically significant association between blood transfusion and duration of surgery as well as baseline haematocrit value, there was none with calculi size.

Another reported major complication is pleural tear(4). One patient developed hydrothorax after supracostal puncture and none after subcostal route, which is comparable to literature(4). The incidence of bowel perforation, namely colonic injuries, has been reported to be 0.3-0.8% (8). In our study, none of the patients had any visceral organ injury.

A major limitation of our study was the predominance of ASA Grade I patients, which itself could have affected the incidence of general complications. A relatively small sample size could also have contributed to the fewer complications. In our study, blood loss could not be estimated accurately because the loss is always mixed with irrigation fluid. Intra-operative replacement of blood loss was guided by visual assessment of loss and patients' vital signs. As anaesthesia directly is not expected to be associated with sepsis, the patients were not followed up on the culture reports, thereby unable to comment on sepsis.

In conclusion, we find common intra-operative complications during PCNL to be hypothermia, followed by acidosis. The most significant risk factor associated with hypothermia was cold irrigating fluid. The presence of hypothermia and increased use of intravenous Normal Saline contributed to higher incidence of acidosis. Electrolyte imbalances and cardiovascular changes were not observed as major complications. Though most patients hypotensed after induction of anaesthesia, persistent intra-operative hypotension in our study occurred only with significant surgical bleeding.

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