**INTRODUCTION**

Pain and shivering are one of the most common complications after surgeries under general anesthesia. Effective postoperative pain management is an essential component of enhance recovery after surgery. Persistent uncontrolled pain and shivering may adversely affect the body's endocrine, cardiovascular, immune, neurologic and musculo-skeletal systems. Poorly controlled acute postoperative pain and shivering are associated with increased morbidity, functional and quality-of-life impairment, delayed recovery time, prolonged duration of opioid use, and higher health-care costs.

Septoplasty is one of the commonly performed ENT procedure. Post-operative pain or tenderness occurs on the front of the nose due to stuffiness and swelling. It is associated usually with mild to moderate post-operative pain. Multimodal analgesia is an effective method, to improve peri-operative analgesia with reduced dosage and limited side effects.

There is a wide range of analgesic agents used to control post-septoplasty pain e.g. Non steroidal anti-inflammatory drugs (NSAIDs), opioids, intravenous paracetamol, dexmedetomidine. Among all, paracetamol and ketorolac have been widely used for mild to moderate pain post-operatively. Ketorolac is an NSAID (non-steroidal anti-inflammatory drug), commonly use in peri-operative pain management but should be avoided in bleeding diathesis and renal dysfunction. The analgesic effect of ketorolac is comparable to other analgesic drugs like pethidine, morphine, or pentazocine in previous studies for postoperative pain management.

Intravenous paracetamol (acetaminophen) is commonly used for peri-operative pain management. Phenacetin is an active metabolite of paracetamol and has central analgesic action is via inhibiting cyclooxygenase, doesn’t effect coagulation or renal functions like NSAIDs and its side effects are extremely rare (<1/10,000).

The rationale of this study was to compare the pre-emptive effect of intravenous paracetamol versus intravenous ketorolac in preventing postoperative pain and shivering after septoplasty.

**METHODOLOGY**

It was a prospective comparative study, conducted at Main Operation Theater of Frontier Corps hospital Quetta. The protocol was approved by the institutional ethical committee of Frontier Corps hospital Quetta.

**SUBJECTS AND METHODS**

A total of 90 American Society of Anesthesiologist (ASA-I) patients, aged between 18-45 years, scheduled for septoplasty, were recruited and divided into three equal groups: Paracetamol (PA), Ketorolac (KE) and Placebo (PL). The paracetamol (PA) group (n=30) received 1gm intravenous paracetamol, ketorolac (KE) group (n=30) received 30mg intravenous ketorolac and group placebo (PL) received 100ml normal saline, 20 minutes before completion of surgery. Postoperative shivering and pain was assessed via four-point scale and visual analogue scale (VAS) respectively, in post-anesthesia care unit at 10 and 30 minutes post-extubation.

**RESULTS**

Mean visual analog scale (VAS) score in paracetamol group was 2.7 ± 1.41, ketorolac group was 2.3 ± 1.24 and in placebo group was 3.6 ± 1.44, with a p-value of 0.002. Mean four point shivering score in paracetamol group was 0.3 ± 0.55, ketorolac was 0.7 ± 0.78 and placebo group was 1.4 ± 1.00, with a p-value of <0.001.

**CONCLUSION**

The effect of paracetamol is better than ketorolac in preventing pain and shivering after septoplasty under general anesthesia.

**KEYWORDS**

Ketorolac, Pain, Paracetamol, Pre-emptive, Shivering.
Hospital Quetta, from September to December 2019, 90 ASA-I patients were selected via non-probability consecutive sampling. Inclusion criteria included patients of American Society of Anesthesiology Score (ASA-1), of either gender with age between 18-45 years, scheduled for septoplasty. Patients with ASA Score more than 1, history of allergy to the study drugs and not given consent were excluded from the study.

After approval of ethics committee, 90 patients (for sample size, data from previous similar studies were taken into consideration\textsuperscript{11}, sample of 90 patients were divided into three equal groups by random allocation. The paracetamol (PA) group (n=30) received 1gm intravenous paracetamol, ketorolac (KE) group (n=30) received 30mg intravenous ketorolac and group placebo (PL) received 100ml normal saline 20 minutes before completion of surgery. All drugs were issued by hospital pharmacy in a sealed box and handed over to anesthetist, who was unaware of the drug formulation. The anaesthesia was induced with propofol 2mg kg\textsuperscript{-1}, nalbuphine 0.1mg/kg and atracurium 0.5mg/kg. It was maintained with isoflurane 1.5% and air 50% in oxygen. Axillary temperature was measured immediately 10 min after induction. An investigator, blinded to the treatment group, graded postoperative shivering using a 4-point scale (table-I) and postoperative pain using a visual analogue scale (VAS) (figure) ranging between 0-10, at 10 and 30 minutes post-extubation in post-anesthesia care unit.

<table>
<thead>
<tr>
<th>Score</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None: no shivering noted on palpation of the masseter, neck, or chest wall</td>
</tr>
<tr>
<td>1</td>
<td>Mild: shivering localized to the neck and/or thorax only</td>
</tr>
<tr>
<td>2</td>
<td>Moderate: Shivering involves gross movement of the upper extremities (in addition to neck and thorax)</td>
</tr>
<tr>
<td>3</td>
<td>Severe: Shivering involves gross movements of the trunk and upper and lower extremities</td>
</tr>
</tbody>
</table>

Table-I: Post-operative 4 point shivering scale.  

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>Shivering</th>
<th>p-value</th>
<th>Pain (VAS)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>Mean ± SD</td>
<td>25.53 ± 3.46</td>
<td>0.36 ± 0.55</td>
<td>&lt;0.001</td>
<td>2.73 ± 1.41</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>30</td>
<td>30</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Ketorolac</td>
<td>Mean ± SD</td>
<td>25.90 ± 4.12</td>
<td>0.73 ± 0.78</td>
<td>2.36 ± 1.24</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>30</td>
<td>30</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Placebo</td>
<td>Mean ± SD</td>
<td>31.96 ± 3.48</td>
<td>1.46 ± 1.00</td>
<td>3.60 ± 1.42</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>30</td>
<td>30</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Results were recorded on a pre-designed structured Performa which were analyzed by using SPSS-16 for categorical variables (i.e. Four Point Shivering scale and VAS and Gender) presented as frequency & percentage. Continuous variables (i.e. age) presented as mean ± SD. Four Point Shivering scale and VAS were compared using one-way ANOVA.

**RESULTS**

A total of 90 patients were selected and divided into three groups. Seventy one (78.9%) patients were male and 19 (21.1%) patients were female. Mean age in paracetamol group was 25.3 ± 3.46, ketorolac group was 25.9 ± 4.12 and placebo group (PL) was 31.9 ± 3.48. Mean VAS score in paracetamol group was 2.7 ± 1.41, ketorolac group was 2.3 ± 1.24 and in placebo group was 3.6 ± 1.44, with a p-value of 0.002. Mean four-point shivering score in paracetamol group was 0.3 ± 0.55, ketorolac was 0.7 ± 0.78 and placebo group was 1.4 ± 1.00, with a p-value of <0.001 (table-II & III).

**DISCUSSION**

Postoperative shivering and pain are the two common problems after surgery, which should be managed adequately to improve patient’s satisfaction and outcome after surgery, as shivering and pain may increase blood pressures, cardiac output, intraocular and intracranial pressures due to increase secretions of catecholamines\textsuperscript{11}. Septoplasty is commonly performed day case procedure, in which pain and bleeding aggravates by shivering. Perioperative pain and shivering may be prevented or treated by different techniques such as intravenous pethidine, clonidine, tramadol, do-
xapram, alfentanil, busipron, dexmedetomidine, ondansetron, pregabalin and dexamethasone.  

Dahl et al, showed in study, the use of analgesic drugs (gabapentin and pregabalin) as protective medication, before different kind of surgeries. The basic principle behind protective medications is that, they reduce the pain after injury.

Table-III: Comparison of shivering score and visual analog scale score among groups.

<table>
<thead>
<tr>
<th>Four Point Shivering Score</th>
<th>Paracetamol</th>
<th>Ketorolac</th>
<th>Placebo</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shivering</td>
<td>20 (22.2)</td>
<td>14 (15.6)</td>
<td>6 (6.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mild</td>
<td>9 (10)</td>
<td>10 (11.1)</td>
<td>9 (10)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1 (1.1)</td>
<td>6 (6.7)</td>
<td>10 (11.1)</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>-</td>
<td>-</td>
<td>5 (5.6)</td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>0.3 ± 0.55</td>
<td>0.7 ± 0.78</td>
<td>1.4 ± 1.0</td>
<td></td>
</tr>
</tbody>
</table>

Visual Analog Scale

| Mild                       | 26 (28.9)   | 25 (27.8) | 15 (16.7) | 0.002   |
| Moderate                   | 3 (3.3)     | 5 (5.6)   | 14 (15.6) |         |
| Severe                     | 1 (1.1)     |           | 1 (1.1)   |         |
| Mean ± SD                  | 2.7 ± 1.41  | 2.3 ± 1.24| 3.6 ± 1.44|         |

In one of the study on Jordanian patients, underwent septoplasty surgery under general anesthesia required more remifentanil dose in the A-118 G gene group in comparison with patients with homozygous for the A allele involving nucleotide 118 of OPRM1. The muopioid receptors genetic variation also associated with different doses of intra-operative intravenous remifentanil infusion.

Ketorolac is a potent nonsteroidal anti-inflammatory drug (NSAID), when administered for acute and chronic pain management. NSAIDS are cyclo-oxygenase inhibitor and they effectively reduced postoperative pain. They provide preemptive analgesia, like lornoxicam is used effectively in the management of post-septoplasty pain. Maximum plasma concentrations are achieved in 45-50 minutes with peak analgesic effects in 1-2 hours following intramuscular injection. The efficacy of ketorolac, in emergency management, has been demonstrated and it has no sedative effect as it is a non-opioid medication, which is a main concern in management of emergency department. The mechanism to prevent shivering in NSAIDS is either through reduction of perioperative pain or by inhibiting the release of vasoconstrictor and pyrogenic cytokines. Unlike opioids, ketoroloc neither has respiratory depressant effect nor it has other side-effects such as nausea, pruritis and constipation etc. According to Khezri et al, there was no significant difference between meperidine and ketorolac groups in terms of prevalence of shivering, although both groups were different from the placebo group (p<0.04).

Among recent randomized controlled trails, 12 out of 14 were in favor of using intravenous paracetamol for perioperative analgesia. Its routes of administration can be oral, rectal, intramuscular and intravenous. Mode of excretion occurs through liver via conjugation. Its peak of action is achieved at 1 hour and duration of action is of 4-6 hours.

Kela et al, compared paracetamol and tramadol and found comparable results i.e. 10.0% of paracetamol group and 13.3% out of total cases in tramadol group suffered nausea and vomiting. Aghamir et al, compared tramadol and propacetamol in open urological procedures and found propacetamol effective in mild to moderate pain but not adequate for severe pain while Akcali et al, on extracorporeal shockwave lithotripsy patients, compared the efficacy of tramadol, paracetamol and lornoxicam and found same efficacy in all three drugs. Cattabriga et al, in study on postoperative median sternotomies, compared tramadol and paracetamol and found paracetamol, more effective than tramadol.

Kossick et al, reviewed multiple studies and concluded that for pediatric surgical patients 15 years of age and younger, ketorolac was not found to improve discharge times, decrease the incidence of unplanned hospital admissions, or cut down on total opioid consumption.

In the study Heo et al, compared the analgesic efficacy of 8 g of propacetamol and 180 mg of ketorolac as a PCA dose. Despite the relatively low dose of propacetamol, as compared to that of ketorolac, the analgesic efficacy of the propacetamol group was comparable to that of the ketorolac group in postoperative patients using patient-controlled analgesia with fentanyl. This suggests that propacetamol is effective when used for the management of postoperative pain and combined with fentanyl PCA.

CONCLUSION

The effect of paracetamol is better than ketorolac in preventing pain and shivering after septoplasty under general anesthesia.

CONFLICT OF INTEREST

The study has no conflict of interest to be declared by any author.
REFERENCES