Introduction

Pain management in total knee arthroplasty is aimed to minimize postoperative pain and improve functional outcomes in patients. Although there are many methods used for controlling the pain there has been no consensus on most appropriate or the best protocol. Adductor canal block (ACB) has the unique advantage of providing localized analgesia but it doesn’t provide pain relief to the posterior capsule, it has been postulated that IPACK (interspace between the popliteal artery and the capsule of the knee) combined with ACB will provide better pain relief than ACB alone.

Materials and Methods: 60 Patients were studied in two groups. Group A had those patients with ACB+ ipack and Group B had ACB.

Group A - Patient were subjected to combined ACB block with IPACK.

Group B - Patient in this group were given ACB.

Results: Group B had better outcome as compared to Group A. The mean VAS score for the ACB+IPACK group was less than for ACB alone at end of Day 0 and Day 1 in morning and evening. The ROM for the ACB+IPACK group was better than ACB alone and number of steps walked by patients were more in ACB+IPACK as compared to ACB alone. The statistical difference was significant when Adductor +IPACK group was compared to Adductor group for VAS, ROM and number of steps walked.

Conclusion: ACB+IPACK is better mode than ACB for control of postoperative pain in patient undergoing Total knee replacement. IPACK is relatively safe and combined with adductor canal block decreases posterior pain in TKR patients.

Keywords: IPACK, Adductor canal block, Genicular block, Pain control, Total knee arthroplasty

1. Introduction

The total knee arthroplasty has become a standard successful modality for treatment of advance osteoarthritis of knee joint. Total knee arthroplasty (TKA) has proven to be a successful treatment to improve mobility, pain and quality of life for patients suffering from osteoarthritis. Though there have been advances in technologies and instrumentations in TKR, pain management after the operation is still evolving [1, 2]. Pain management in total knee arthroplasty is aimed to minimize postoperative pain and improve functional outcomes in patients. Proper pain management in perioperative period is important for faster recovery and rehabilitation which influences the desired outcome [3, 4]. Various methods described for pain management after TKR are epidural anesthesia, femoral nerve block, adductor canal block, intra articular cocktail, intraarticular epidural catheter (Caledonion protocol) along with I.V analgesics and combinations of these modalities. Although there are many methods used for controlling the pain there has been no consensus on most appropriate or the best protocol. [5, 6]. Femoral nerve block (FNB) is one of the most commonly used pain-relief methods, which has...
been proven to be effective on relieving the pain, reducing the usage of opioid painkiller, and shortening the hospital stays [7, 8]; but FNB may lead to post-operative quadriceps weakness, which not only limits the patients ambulation and early physical rehabilitation, but also increases the risk of falling [9, 10]. These deficiencies make the rehabilitation results unsatisfactory [11, 12]. Adductor canal block (ACB) is the other analgesia for TKA and has been developed gradually in recent years. ACB attracted extensive attention due to its lower complication of reducing quadriceps strength and similar outcomes of opioid consumption, pain management, opioid adverse events, and ambulation ability when compared with FNB [13-16]. There are studies in literature which compare FNB with ACB and have concluded that ACB is better than FNB also ACB have been combined with intra articular and periarticular local anesthetic injections intraoperatively. Adductor canal block (ACB) has the unique advantage of providing localized analgesia to the peripatellar and intra-articular aspects of the knee joint without reducing the patient’s ability to perform a straight leg raise but ACB does not provide analgesia to the posterior aspect of the knee, which is commonly moderate to severe after surgery. This pain may be decreased by addition of the genicular block, also known as the iPACK block (interspace between the popliteal artery and the capsule of the knee). The aim of this study was to compare effect of combined block of adductor canal block with IPACK (Interspace between the Popliteal Artery and the Capsule of the posterior Knee) and adductor canal block on Total knee replacement in immediate postoperative rehabilitation. It has been postulated that ultrasound-guided local anesthetic infiltration of the Interspace between the Popliteal Artery and the Capsule of the posterior Knee (IPACK) provides posterior knee analgesia and the iPACK would spare the main trunk of the tibial and peroneal nerves and block only the terminal branches innervating the posterior knee joint. IPACK was proposed by research team at St. Francis Hospital and Medical Center in Hartford, Conn., It is an ultrasound-guided infiltration of the interspace between the popliteal artery and the capsule of the knee with a local anesthetic solution that provides an alternative analgesic when combined with a femoral nerve block [17].

2. Materials and Methods

This study was conducted at Sunshine hospital from July 2016 to December 2016. This study was conducted as a single blind randomized controlled trial (RCT) at a single institution. Approval was provided by a human research ethics committee. The study included patients from single arthroplasty surgeon. This was a prospective study with sample size of 60 patients in each group. Patients undergoing primary unilateral TKA were invited to take part in the study and informed consent was obtained from patients willing to participate. Inclusion criteria was unilateral cases, Serum Creatinine below 1.5. Exclusion criteria were Bilateral cases (same sitting as well as staggered cases) Rheumatoid arthritis, inflammatory arthropasty, revision cases, Bedridden/ non ambulatory after the surgery were excluded. Preliminary statistical analysis showed that a minimum of 60 patients in each group. Sealed opaque envelopes were made based upon random numbers generated by computer. These envelopes were only accessible to the anesthesiologist who provided the Block injection material for each participant patients and the data collection team was blinded to the group to which the patients were randomized. The anesthesiologist who prepared the treatment solution was aware of the allocation and surgeon was not aware of the treatment and both were not involved in data collection or data analysis. Randomization was not stratified by surgeon. The anesthesiologist also informed the scrub nurse of the group allocation, who then prepared the appropriate solution to be given. Post-operatively, patients and the Data collection team were blinded to the treatment administered in operation theatre.

Group A - Patient undergoing total knee replacement unilateral were subjected to combined Adductor canal block (ACB) with IPACK. All cases of adductor canal block were given 20 ml of 0.2% ropivacaine and for IPACK 20 ml of 0.2% ropivacaine.

Group B - Patient in this group were given adductor canal block which comprised of 20 ml of 0.2% ropivacaine. Adductor canal block was given by standard method described in literature.

2.1 Technique for IPACK: The knee was bent in 90 degree flexion and needle was inserted from medial aspect, though one can give from lateral aspect also, our Anesthetist was comfortable to give medially. (Picture 1) With the Ultrasoundography the popliteal vessels were identified and and Needle was inserted in the space between the vessels and the posterior capsule. (Picture 2) The needle is inserted along the entire space between the vessels and capsule and 20 ml of 0.2% ropivacaine is given along the entire space and simultaneously the needle is withdrawn while the local anaesthesia is still being given. (Picture 3)
All patients undergoing the study were subjected to same amount of I.V NSAIDS, I.V paracetamol, and Tramadol in perioperative period.

2.2 Surgical Technique
Total knee arthroplasty was performed under spinal anesthesia combined with sedation and by a medial parapatellar approach in all cases. Single surgeon operated all cases. Tourniquet was used in all cases and released before closure. The patella was debulked and denervated in all patients. Surgical drains were not used in any patient.

2.3 Measurement of Outcome
Outcome was measured with VAS score at 8 pm night same day of operation and next day again in morning 8 am and night 8 pm and on day 2 mornings. Range of movement was measured on Day 1 after the dressing in morning along with VAS score. Number of steps walked by the patient on Day 1 morning was recorded.

2.4 Statistical analysis
Outcome was compared statistically by student T test

3. Observation and Results

Table 1: Sample Size

<table>
<thead>
<tr>
<th></th>
<th>IPACS+adductor</th>
<th>Adductor</th>
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<tbody>
<tr>
<td>Male</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Female</td>
<td>38</td>
<td>42</td>
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<tr>
<td>Total</td>
<td>60</td>
<td>60</td>
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Table 2: Descriptive Statistics

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<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
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</thead>
<tbody>
<tr>
<td>IPACS +ACB Age</td>
<td>60</td>
<td>66.6000</td>
<td>±8.82254</td>
</tr>
<tr>
<td>ACB age</td>
<td>61</td>
<td>63.3279</td>
<td>±6.24959</td>
</tr>
<tr>
<td>ACB Female</td>
<td>42</td>
<td>62.3488</td>
<td>±6.71489</td>
</tr>
<tr>
<td>ACB male</td>
<td>18</td>
<td>65.6667</td>
<td>±4.27028</td>
</tr>
<tr>
<td>IPACS+ACB Female</td>
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<td>66.1842</td>
<td>±8.98303</td>
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<tr>
<td>IPACS +ACB male</td>
<td>22</td>
<td>67.3182</td>
<td>±8.69804</td>
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Table 3:

<table>
<thead>
<tr>
<th></th>
<th>Adductor</th>
<th>Adductor+IPACK</th>
<th>P Value</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td></td>
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<tr>
<td>VAS Day 0</td>
<td>2.91±0.64550</td>
<td>1.433±0.6474</td>
<td>0.000</td>
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<tr>
<td>VAS Day 1 -8 am</td>
<td>3.18±0.72467</td>
<td>2.05±0.4323</td>
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<tr>
<td>VAS Day 1-8 pm</td>
<td>3.45±0.76460</td>
<td>2.55±0.7274</td>
<td>0.000</td>
</tr>
<tr>
<td>ROM Day 1</td>
<td>62.2500±8.25</td>
<td>71.833±9.52</td>
<td>0.000</td>
</tr>
<tr>
<td>Distance walked Day 1</td>
<td>7.133±1.434</td>
<td>8.51±1.85</td>
<td>0.000</td>
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</tbody>
</table>

The total patients included in each group were 60 (Table 1) and baseline variables of Age and sex were comparable in both groups. The mean VAS score for Adductor block group was 2.91, 3.18, 3.45 at end of Day 0 and Day 1 in morning and evening whereas the Adductor +IPACK group the mean VAS score was 1.433,2.05,2.55 at end of Day 0 and Day 1 in morning and evening, (Table 2) The ROM for Adductor group was 62.25 degrees and distance walked in steps was 7.13 steps whereas the Adductor +IPACK group has mean ROM of 71.833 and steps walked was 8.51. (Table 2).

The statistical difference was significant (P value < 0.0001) when Adductor +IPACK group was compared to Adductor
group for VAS, ROM and number of steps walked. (Table 3)

Statistics tool: SPSS 16.0

4. Discussion

Pain management is integral part of postoperative management of Total knee arthroplasty (TKA) patients. There are different modalities of pain management for postoperative TKA patients. There is only one study in literature by Elliot et al showing ACB+IPACK reduces the stay as well as improves the physical therapy response. Pain scores, opioid consumption, physical therapy performance, and time to discharge were recorded in this study and they concluded that, ACB/IPACK group had non-inferior VAS scores with slightly higher opioid consumption compared with the FNB/IPACK group. However, the ACB/IPACK group had significantly better ambulation distance and the group also had more discharges on POD1 and POD2, and all patients in this group were discharged by POD [18].

In our study of 2 groups adductor block (ACB) against ACB+IPACK, we found that ACB+IPACK had significant more ROM and better ambulatory distance as compared with adductor alone. In our study VAS score of ACB+IPACK was better on day 0 as well as day one as compared to adductor alone.

Intraarticular injections were not in both groups to avoid any bias due to site of injection, the variation in the needle diameter. The main complain of patients with only adductor block on Day 1 was pain in posterior region of knee joint. There are multiple other modalities for pain management after knee replacement. Also there is no consensus on the best method to control pain management. According to previous studies, some studies suggest local infiltration of injection (LIA) is superior to Femoral nerve block on pain management [19]. Some studies report an equal outcome between the two methods [20,21] while other studies demonstrate LIA is inferior to FNB on pain control [22,23]. Ashraf et al [24] conducted a RCT to compare intra-articular analgesia with single shot FNB after TKA and they demonstrated better pain control and less opiate consumption in patients that received LIA. While, Ali et al [25] suggest that continuous intra-articular analgesia after TKA has no relevant clinical effect on VAS pain and does not affect analgesic consumption, ROM, or leg-raising ability. A study presented by Jaeger et al [26] comparing ACB with FNB in patients undergoing TKA, demonstrated that both groups showed preserved quadriceps strength, similar pain scores and opioid consumption. A recent study comparing continuous ACB with placebo infusion following TKA demonstrated reduced opioid consumption in the first 48h with ACB [27].

In our study we had better pain control as well as better ROM and ambulatory distance for ACB+IPACK as compared to ACB alone on Day 1. As the adductor canal block gives relief from pain of knee joint anteriorly and medially but it doesn’t cover the posterior capsule as the deep small genicular nerves are not covered by adductor alone. The benefit of adding IPACK is the entire posterior space between capsule and popliteal vessels can be given the local anaesthesia of 15 ml and it adds up to the pain relief of the posterior capsule significantly. As it is given under Ultrasound guidance it avoids any injury to popliteal vessels which may happen while local infiltration of cocktail used theoretically.

The drawback of our study was that obese patient were excluded and patient having creatinine above 1.5 were excluded so that we could follow our post-operative protocols of analgesia for all the patients in the both groups (opioids, Paracetamol and NASID were given to all patients at the particular time). The study follow up was only for short term till day 1 evening.

Authors opinion is that combined multimodal approach of pain management should be done to have effective pain management in perioperative period. It should include the adductor block with IPACK combined with some form of intraarticular injections or epidural catheter insertion.

5. References


