

Efficacy of Local Infiltration of Analgesics via Intra-articular Epidural Catheter vs Adductor Canal Block in Primary Total Knee Arthroplasty Surgery.

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<https://dx.doi.org/10.13005/bpj/2565>

(Received: 09 November 2021; accepted: 23 September 2022)

Pain is believed to be a poorly understood phenomenon, which is mostly regulated by neural, cellular, hormonal & emotional components. Epidural analgesia is used for pain relief in patients undergoing primary total knee arthroplasty, though provides good pain control, many a time is associated with side effects such as hypotension, urinary retention and impaired mobility. The purpose of the current study is to compare the efficacy of ACB to local infiltration of analgesics by Intraarticular Epidural Catheter for primary total knee arthroplasty by comparing visual analog scale, knee flexion, and active SLRT on the day of surgery (POD-0), POD1-3, day of discharge, and 4 weeks after surgery. This study is prospectively randomized, the cases undergoing primary knee replacement were divided into two groups, which includes a minimum of 36 cases in each group. Group-1(36) patients received local infiltration of analgesics via IAEC and Group-2(36) patients received single shot ACB. As far as age, sex, BMI(kg/m²), pre-op VAS, mean pre-op flexion, mean pre-operative varus, mean pre-op KSS(Knee society score), duration of surgery and hospital stay is concerned no significant difference was noticed between the two groups. Group-1(LIA via IAEC) had significantly lower VAS on a postoperative day (POD) 1-3, lower tramadol consumption, better ROM (at POD1-3), superior quadriceps recovery(active SLRT), earlier mobilization day, better KSS (at 4weeks) postoperatively, compared to Group-2(single shot ACB).LIA by IAEC for patients undergoing primary TKA is a better option compared to single shot ACB concerning to pain levels, narcotic usage, range of motion, quadriceps recovery and KSS (Knee society score).

Keywords: Adductor canal block; Epidural catheter; Intraarticular; Knee Arthroplasty; Local infiltration of analgesic.

Primary TKA procedures are usually associated with moderate to severe pain^{1,2,3}. Pain management after TKA is always challenging and is believed to be a poorly understood phenomenon, which is mostly regulated by neural, cellular, hormonal & emotional components. A multimodal

approach is always desirable to combat this complex phenomenon. The suggested efficacy of periarticular analgesics intraoperatively is inconsistent. Epidural analgesia is used for pain relief in patients undergoing primary TKA, though provides good pain control, many a time is

associated with side effects such as hypotension, urinary retention and impaired mobility. Apart from that, the risk of hematoma and infection in the epidural space are rare but dreaded complications associated with epidural analgesia. Hence the current study aims at exploring alternative modalities of analgesia. Many studies have demonstrated that adductor canal block (ACB) can provide adequate analgesia with a multimodal analgesic regimen⁴⁻⁶ with better functional outcomes post-operatively in comparison with a femoral nerve block (FNB)^{7,8}. It has been suggested in many studies that LIA (Local infiltration of analgesics) can provide superior postoperative analgesia and earlier mobilization compared to placebo^{9,10}, intrathecal morphine⁹, epidural analgesia^{11,12} and FNB¹³⁻¹⁶. Moreover, local infiltration of analgesics is cheap and relatively easy to perform than FNB, while providing good analgesia¹⁷⁻²². We, therefore, compared the efficacy of IAEC vs ACB in primary TKA with respect to VAS, ROM, KSS and quadriceps recovery, in a prospective, randomized trial.

MATERIAL AND METHODS

The current study was done on patients undergoing primary total knee replacement at IMS & SUM Hospitals (IEC Letter No DMR/IMS/SH/SOA/792/2019), during the study period of March 2018 to April 2020. This study is prospectively randomized, the cases undergoing primary knee replacement were divided into two groups, which includes a minimum of 36 cases in each group. Group -1(36) patients received intra-articular epidural catheter (IAEC) and Group 2 (36) patients received ACB (adductor canal block). The postoperative pain was assessed in each patient through a pain chart. Patients undergoing primary TKR who satisfy inclusion criteria were included in the study. They were admitted and examined, randomly selected and post-operative pain management will be given according to the modified Caledonian protocol in Group1/LIA by IEAC and Group-2/adductor



Fig. 1. Intra-articular Epidural Catheter Placement (IAEC)



Fig. 2. Adductor Canal Block (ACB)

canal block. The patients were evaluated clinically and pain management protocol was followed accordingly during their stay after the surgery at our hospital. Pain control was assessed by VAS (Visual Analogue Scale) scores and outcomes in terms of ROM achieved on the day of discharge. All patients undergoing Primary unilateral TKA, patients with osteoarthritis of the Knee and those with TKA done under spinal anesthesia were included in our study. Patients undergoing bilateral TKR, Revision TKR and those with Rheumatoid arthritis, Neuromuscular deficit, History of cardiac disease or arrhythmia requiring special monitoring,

use of general anesthesia, Patients with severe renal insufficiency, uncontrolled diabetes mellitus, bleeding disorders, alcohol or drug abuse, allergy to local anesthetics were excluded from our study. Preemptive analgesia in the form of Celecoxib 200

mg, Pregabalin 75 mg (Omit pre-operative dose was omitted in patients with renal impairment) and Paracetamol 650mg, were given to all patients undergoing primary TKA, all a night before surgery. Combined Spinal and epidural anesthesia

Table 1. Patient Demography

	IAEC(n=36)	ACB(n=33)	P-value
Age(yrs)	69+/-7.08	66+/-6.56	0.081
Gender	M:F=12:24	M:F=11:22	0.609
BMI	26.56+/-4.12	27.48+/-2.86	0.076
Pre-op VAS	7.5+/-2.27	7.7+/-2.34	0.467
Mean Pre-op flexion	100.4	102.0	0.66
Mean Pre-op Varus deformity(degrees)	12.5	13	0.63
Mean Pre-op KSS	32.6	31.4	0.54
Duration of surgery(Minutes)	110.24+/-21.65	120.54+/-25.23	0.124
Hospital Stay(Days)	5+/-0	5.22+/-0.28	0.088

Table 2. Visual Analogue Scale (VAS)

	IAEC	ACB	P-value
POD-0	2.26+/-1.28	3.65+/-2.24	0.018
POD-1	2.5+/-2.2	5+/-3.2	<0.001
POD-2	2.3+/-1.4	4.6+/-1.8	<0.001
POD-3	2.1+/-1.6	4+/-1.9	<0.001
Day of Discharge	1.6+/-1.5	3.4+/-2.1	<0.001

(Epidural only as intra-op backup). Post-operative analgesia was provided by peri-articular injection of 0.2% Ropivacaine solution followed by an infusion administered through a catheter placed under direct vision via a Touhy needle, inserted about 10 cm above the incision into the surgical field by outside-in technique at the end of surgery in group-1(IAEC) and USG guided Adductor canal block by local anesthetic agents in group-2(ACB).

Table 3. Knee Flexion in Degrees

	IAEC	ACB	P-value
POD-3	96.5+/-10.9	84.2+/-16.4	<0.001
Day of discharge	112.6+/-8.4	92.6+/-12.5	<0.001
4weeks post-op	126.8+/-6.3	119.4+/-9.7	<0.001

Table 4. Active Straight Leg Raise Test

	IAEC (n=36)	ACB (n=33)	P-value
Day of discharge	32(88.8%)	15(45.45%)	<0.001
2weeks post-op	34(94.44%)	29(87.87%)	0.496

Table 5. Knee Society Score

Time	IAEC Group	ACB Group	p-value
Pre-operative	32.6	31.4	0.54
6weeks	90.46+/-12.6	79.5+/-10.9	<0.001

No drains were used. Ropivacaine 0.2%, 10 mL bolus was given 8 hourly and 10 ml before removal of the catheter while doing Pod 1 dressings, a top-up dose of 10 ml if severe pain complained in Group1 (IAEC). 0.5% levobupivacaine 20 ml was injected after ensuring the correct placement of the needle under USG guidance in Group2 (ACB).

Intra-articular Epidural Catheter Placement (IAEC) Adductor canal block (ACB)

The patients were made to mobilize on the same day of surgery and Physiotherapy was

continued thereafter. The patients were discharged, once they could move independently and their pain was controlled with oral analgesics.

Post-operative Assessment

- VAS at 12hr, 24hr, 48hr, and 72hrs & at the time of discharge.
- ROM at POD-3, at the time of discharge & at 4wks
- Early Functional Recovery- Active SLRT, Maximum Flexion at the time of discharge.
- Power of Quadriceps muscle

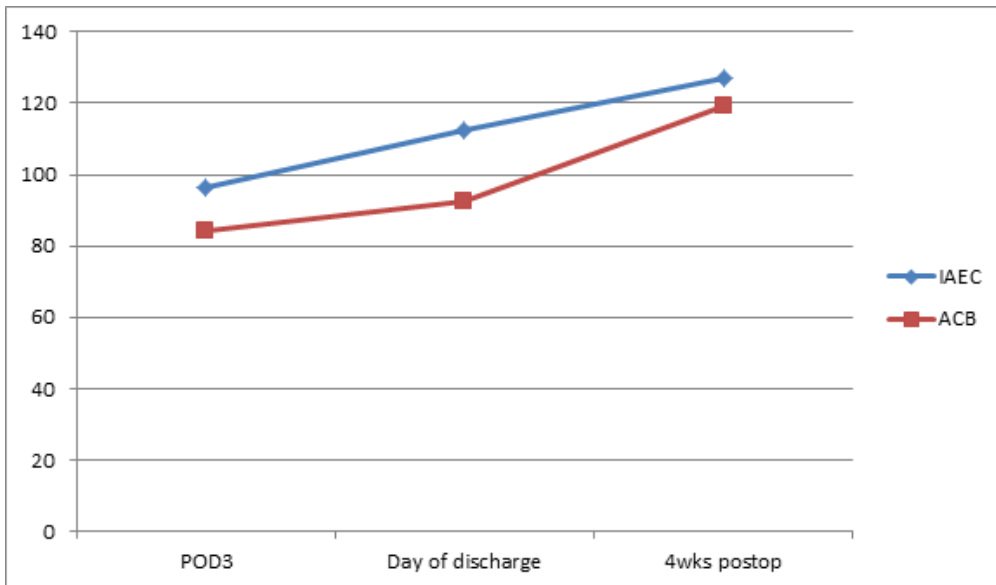


Chart 1. Knee flexion

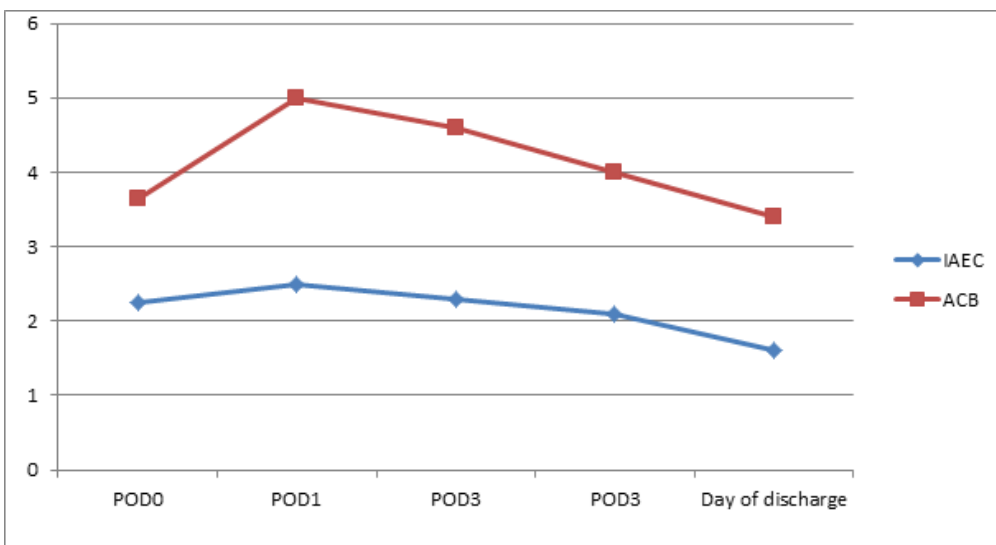


Chart 2. Visual Analogue Score

- Opioid Consumption
- Pt discharged POD
- Follow up of all patients till 6 weeks to rule out any drug-related side effects & complications post-surgery (Infection)

RESULTS

As far as age, sex, BMI (kg/m²), pre-op VAS, mean pre-op flexion, mean pre-op varus,

mean pre-op KSS (Knee society score), duration of surgery and hospital stay is concerned, no significant difference was noticed between the two groups (Table I). The visual analog scores suggested that the average pain scores were significantly lower in the IAEC group as compared to the ACB group[chart-2] (Table2). The active knee flexion at POD#3, at the time of discharge and 4 weeks after surgery, was greater in the IAEC group[chart-1] (Table 3). The active SLRT showed

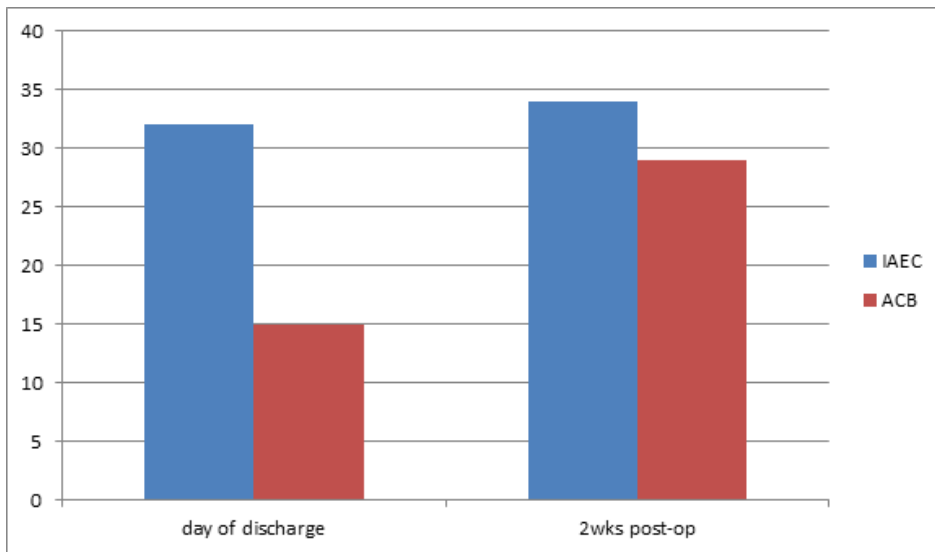


Chart 3. Active Straight Leg Raise Test

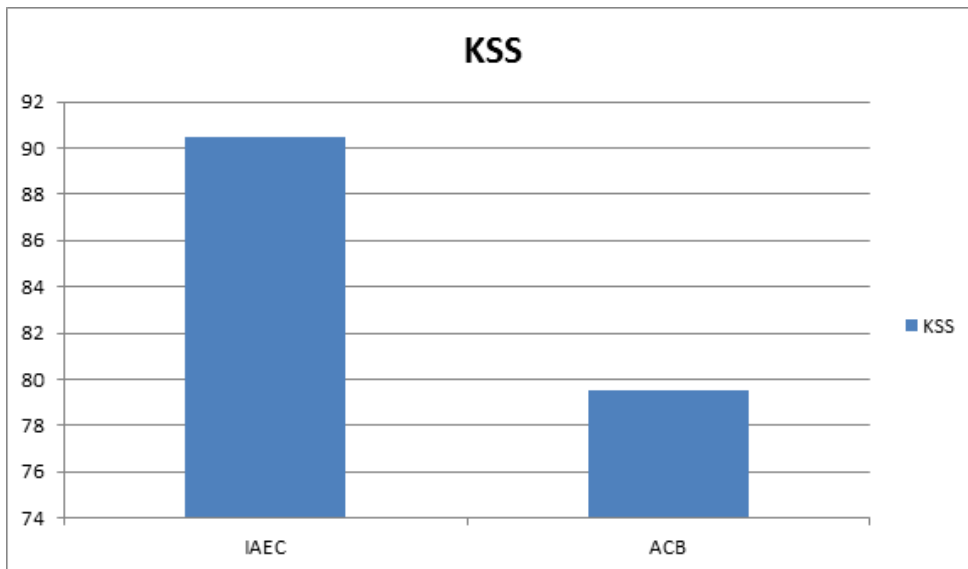


Chart 4. Knee Society Score at 6wks

significantly superior at the day of discharge in the IAEC group ($p < 0.001$) compared to the ACB group, but at 2 weeks following surgery, there was no significant difference ($p > 0.05$) between the two groups [chart-3] (Table-4). The average knee society score (KSS) at 6 weeks follow-up was significantly higher in the IAEC group (90.46 ± 12.6) compared to ACB group (79.5 ± 10.9) [Table 5] (Chart-4). All the data were analyzed using SPSS20 software.

DISCUSSION

ACB can be delivered as single-shot injections or by continuous adductor canal catheter infusion and was initially recommended as 'pure sensory' nerve blocks without associated motor weakness. Single-shot ACB has been recommended as an efficient measure to control pain and improved rehabilitation.²³⁻²⁹ Among the other modalities like, sciatic nerve block or femoral nerve block (FNB), ACB has been associated with a lower incidence of motor weakness following surgery, thus aiding faster recovery and rehabilitation. Many studies have suggested the use of ACB over FNB to avoid motor weakness and to achieve faster recovery and rehabilitation.^{30-33,8} Toftdahl *et al*¹⁴ in their study have shown that peri- and intra-articular analgesia following total knee arthroplasty has superior analgesic effects and achieved faster rehabilitation as compared to continuous FNB. Andersen *et al*¹² found that peri and intra-articular infusion of ropivacaine improved analgesia as compared to epidural infusions. In their study, Smith *et al*³⁷ reported lower VAS for patients receiving intra-articular bupivacaine infusion as compared to periarticular liposomal bupivacaine injection. Many studies have suggested that intraoperative periarticular injection following primary total knee arthroplasty has significantly reduced the amount of postoperative analgesia required^{10,34,18,35} with relatively lower pain scores^{10,4,35}. The visual analog scale suggested that the average pain scores were significantly lower in the IAEC group, compared to the ACB group (chart-2). In our study, VAS on IAEC placement patients was significantly lower on the day of surgery, POD 1-3 and on the day of discharge when compared with the ACB patients (Table 2). Acute pain, even if of short duration, if not addressed appropriately may result in sensitization of the nervous system, causing

chronic pain^{36,37}. This could be the reason why low pain levels were recorded in the IAEC group as compared to the ACB group at the time of discharge. The active knee flexion at POD-3, at the time of discharge and 4 weeks post-surgery, was significantly greater in the IAEC group as compared to the ACB group [chart-1] (Table 3). Because of better pain relief in the IAEC group, encouraged early mobilization and facilitate physiotherapy following the surgery. The number of patients, who were able to do active SLR, was significantly higher in the IAEC knee compared with the ACB knee at the time of discharge [chart-3] (Table-4). Although the difference was not significant at 2 weeks post-op. Average knee society score (KSS) at 6 weeks follow-up was significantly higher in the IAEC group compared to the ACB group [Table 5] (Chart-4). In their study Feibel *et al*³⁸ showed an increased incidence of falls following surgery in patients receiving continuous femoral nerve block. Adductor canal block can also result in motor deficit because of the proximal spread of the drugs.^{23,26} But the incidence is very low. In the current study, none of our patients had experienced falls, at any time following the procedure.

CONCLUSION

The current study suggests that Local infiltration of analgesics by IAEC (Intraarticular Epidural Catheter) for patients undergoing primary TKA is a better option compared to single shot adductor canal block, as far as pain levels, opioid usage, range of motion, quadriceps recovery and KSS (Knee society score) is concerned. Because of better pain relief in the IAEC group, it encouraged early mobilization and facilitates physiotherapy following the surgery. Moreover, IAEC is a rather easier procedure to perform, when compared to that of single shot ACB, which requires an experienced anesthesiologist.

ACKNOWLEDGEMENT

The authors are highly grateful to the Chairman and the Dean, IMS & SUM Hospital, Siksha O Anusandhan (deemed to be) University for providing the necessary facility during the period of study.

Conflict of Interest

The Authors declare there is no conflict of interest.

Funding Source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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