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Efficacy of intraoperative periarticular injection versus post-operative epidural analgesia in total hip arthroplasty: A randomised control study

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Abstract
Background: Total Hip Arthroplasty is the most common surgery done for various arthritic conditions of the hip. Early mobilisation is the key factor for a successful rehabilitation after it. Management of post-operative pain thus has become a pivotal role after hip arthroplasty. Intraoperative periarticular injection has shown superior results in the case of Total Knee Arthroplasty [1]. The present study aimed at comparing the efficacy of intraoperative periarticular injection with cocktail in Total Hip Arthroplasty with commonly used post-operative epidural infusion.
Methods: A Randomised control study was done in 48 subjects grouped into two. Periarticular injection (PAI) group received intraoperative periarticular injection cocktail and epidural infusion (EA) group received post-operative epidural infusion. Outcomes were measured in terms of Visual Analogue Score (VAS) for pain at rest and activity in 0-24 hrs, 24-48 hrs, 48-72 hrs, along with the distance walked by the patient on the second and third post-operative day. The number of days taken by each patient to walk 100 meters at a stretch was also compared. For the secondary outcomes the side effects and need for rescue analgesia in both the groups were measured.
Results: VAS for pain was less in PAI group both in rest and activity which was statistically significant. The functional outcome was better in PAI group compared to EA. Need for rescue analgesia was less in PAI, but the side effects in both groups showed no statistical significance.
Conclusion: The intraoperative periarticular injection in Total Hip Arthroplasty is superior to the post-operative continuous infusion of epidural analgesia.

Keywords: Periarticular injection cocktail, epidural analgesia, total hip arthroplasty, VAS score for pain

Introduction
Total Hip Arthroplasty (THA) is the most cost-effective intervention in the modern Orthopaedics in terms of increased Quality Adjusted Life Expectancy [2]. Many modalities are emerging for the post-operative pain management after THA. Among these the use of intraoperative periarticular injection (PAI) cocktail has already shown its rank in Total Knee Arthroplasty (TKA). The scope of PAI in THA has limited published articles. The post-operative epidural analgesia (EA) has been used in lower limb surgeries for decades. But its efficacy in management of post-operative pain and functional outcome in THA has to be quantified. Thus, our aim of the study was to compare the efficacy of intraoperative periarticular injection with post-operative epidural analgesia in Total Hip Arthroplasty.

Materials and Methods
A Randomised control study was done in 48 patients who underwent THA in a study period from June 2018 to June 2019. Patients with contraindication for spinal anaesthesia, regular opioid users, allergy or intolerance to the study drugs, renal and cardiac disease were excluded from the study. Patients were given random numbers from 1 to 48 based on a computer programme. Even numbers received Intraoperative periarticular injection categorised as PAI group and odd numbers received post-operative epidural infusion, categorised as EA group.
We followed same protocol for both groups with regarding to pre-operative preparations and prophylactic antibiotics. Both the groups received spinal anaesthesia. In EA group patients an in-dwelling epidural catheter was placed at L3-L4 level. After the surgery the catheter was connected to an infusion pump delivering continuous infusion of 200 ml of 0.2% Ropivacaine, 0.8 ml of Morphine Hydrochloride at the rate of 5ml/hr for 48 hours.
A Modified Hardinge approach was followed in all patients. In PAI group patients a cocktail of periarticular injection comprising of 40 ml 0.75% Ropivacaine, 2ml of Ketorolac, 0.8ml of Morphine, 0.3ml of Epinephrine (1:1000), 16.9 ml of saline together making into 60 ml. 20 ml of the cocktail were injected over the posterior capsule and psoas tendon and its insertion before reduction of hip, rest 40 ml were injected over the synovium, short external rotators, Gluteus medius and minimus and fascia latae. (figure 1-5)

Fig 1: Injecting cocktail on anterior capsule and synovium

Fig 2: Cocktail injecting on fascia latae

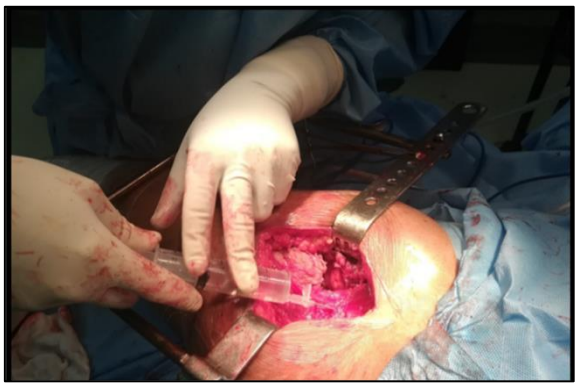

Fig 3: cocktail injecting on gluteus medius

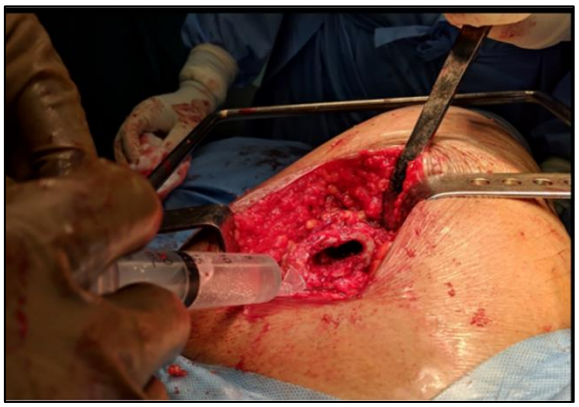

Fig 4: cocktail injecting on psoas tendon and its insertion

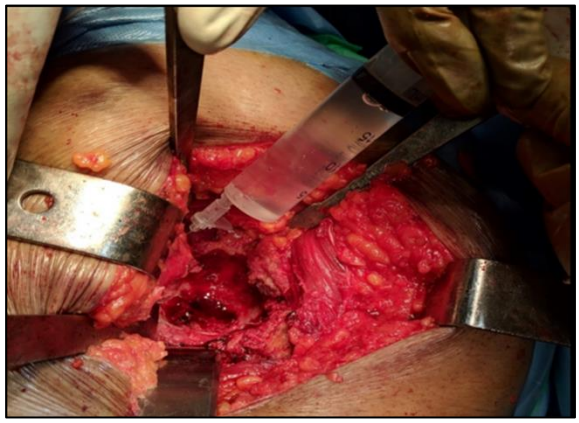

Fig 5: Cocktail given on posterior capsule

Outcome measures

The outcome of the study was analysed by Visual Analogue Score (VAS) for pain at rest and activity 4th hourly in the first 24 hours and 8th hourly up to 72 hours. The highest VAS calculated at 0-24 hours, 24-48 hours, 48-72 hours were taken and compared. The 'zeroth' hour was taken as the time when the effect of spinal anaesthesia had weaned off. The VAS on activity was measured by asking the patient to cough voluntarily in the first 24 hours and then measured at the time of mobilisation. The patient was mobilised on post-operative day one (POD 1) with the aid of a four poled walker. The functional outcome was measured by the distance patient walked in POD 1 and POD 2 in meters. Number of days taken by the patient to walk 100 meters at stretch was also taken for analysis. Four most common side effects for opioids ie Vomiting, nausea, constipation, drowsiness were taken for comparative analysis in both the groups. Post operatively patient was given paracetamol suppository as analgesics only on demand. The need for this rescue analgesia was compared in two groups.

Results

Patient demographics

Mean age of the patient in PAI was 57.16 +/- 8.11 and EA was 56.91 +/- 8.08. Male to female ratio was 1:1 in PAI and 1:1.33 in EA. 50% of patients in both groups underwent THA on the right side (Table 1). In PAI group 79.2% underwent THA for fracture neck of femur in contrast to 66.7% in EA group (table 2). Other indications were osteoarthritis, avascular necrosis and rheumatoid arthritis.

Table 1: Demographic parameters

Distribution of age		
Age	PAI	EA
30-49	4	6
51-70	20	18
Distribution of sex		
Sex	PAI	EA
Male	12	9
Female	12	15
Distribution of side		
Side	PAI	EA
Left	12	12
Right	12	12

Table 2: Indications for THA in both groups

Diagnosis	PAI	EA	Total
Fracture Neck of Femur	19 (79.2%)	16 (66.7%)	35 (72.9%)
Osteoarthritis	2 (8.3%)	6 (25.0%)	8 (16.7%)
Avascular Necrosis	2 (8.3%)	2 (8.3%)	4 (8.3%)
Rheumatoid Arthritis	1 (4.2%)	0 (0.0%)	1 (2.1%)

Pain score comparison

The mean VAS for pain at rest in PAI was 3.042 +/- 0.806 in 0-24 hours, 2.125 +/- 0.612 in 24-48 hours and 0.375 +/- 0.495 in 48-72 hours. For EA group it was 3.792+/-0.833, 2.542+/- 0.833, 1. 542+/- 0.612 respectively. In 24-48 hours the p value was above significance level (p=0.076) (Table 3). The mean VAS on activity in PAI group was 3.750+/- 0.847, 2.667+/-0.702, 1.208+/-0,977 during 0-24 hrs, 24-48hours, 48-72 hours respectively. For EA group VAS on activity was 4.735 +/- 0.875, 3.292 +/- 0.806 and 1.792 +/- 0.833 respectively. The difference between the VAS on activity in PAI and EA groups was statistically significant with a p value < 0.05 (Table 4)

Table 3: VAS at rest in both groups

Group	Mean	SD	p - value
Pain at Rest (0hrs – 24hrs)			
PAI	3.042	0.806	0.004
EA	3.792	0.833	
Pain at Rest (24hrs – 48hrs)			
PAI	2.125	0.612	0.076
EA	2.542	0.833	
Pain at Rest (48hrs – 72hrs)			
PAI	0.375	0.495	0.000
EA	1.542	0.977	

Table 4: VAS on activity in both groups

Group	Mean	SD	p - value
Pain on Activity (0 - 24)			
PAI	3.750	0.847	0.014
EA	4.375	0.875	
Pain on Activity (24 - 48)			
PAI	2.667	0.702	0.008
EA	3.292	0.806	
Pain on Activity (48 - 72)			
PAI	1.208	0.977	0.030
EA	1.792	0.833	

Functional outcome

The mean distance walked by the patient during the first post-operative day (in meters) in PAI was 24.79 and with EA was 18.33. P value was 0.000 and statistically significant (table 5). Mean distance walked in the second post-operative day was more in PAI than EA. It was also statistically significant (table 6). Number of days patient taken to walk 100 meters at a stretch was 3.792 in PAI group and 4.750 in EA group was also statistically significant (table 7).

Table 5: distance walked by the patient in pod 1

Group	Mean	SD	P-Value
PAI	24.79	6.672	0.00
EA	18.33	5.036	

Table 6: Distance walked by the patient in pod 2

Group	Mean	SD	P-Value
PAI	56.25	7.837	0.00
EA	35.83	9.402	

Table 7: number of days taken by the patient to walk 100 m

Group	Mean	SD	P-Value
PAI	3.792	0.779	0.00
EA	4.750	1.260	

Need for rescue analgesia

The number of doses of rescue analgesia needed was less in PAI group when compared to the EA group and was also statistically significant (p value 0.021). 9 patients in PAI group did not require any post-operative analgesia (table 8)

Table 8: Need for Rescue Analgesia

Rescue Analgesia	PAI	EA	Total	P-Value
No Analgesia	9 (37.5%)	3 (12.5%)	12 (25%)	0.021
1 Dose	12 (50.0%)	8 (33.3%)	20 (41.7%)	
2 Doses	3 (12.5%)	9 (37.5%)	12 (25%)	
3 Doses	0	2 (8.3%)	2 (4.2%)	
4 Doses	0	2 (8.3%)	2 (4.2%)	
Average	0.75 +/-0.08	1.67+/-1.09	1.21+/-1.01	

Side effects

Constipation and drowsiness were more noted among EA group but was not statistically significant. Fatigue was more in PAI group, but its statistical significance was questionable (Table 9).

Table 9: comparison of side effects

Side Effects	PAI	EA	Total Patients	P-Value
Constipation	4	10	14	0.111
Nausea	0	6	6	0.022
Vomiting	0	1	1	---
Drowsiness	5	0	5	0.050

Discussion

Early mobilisation is the key for success in Total Hip Arthroplasty [3]. Post-operative pain control is linked to early mobilisation, reduced hospital stay and increased range of motion in THA [4]. The rationale for using analgesic cocktail was to facilitate the smooth muscle contraction that lines the arterioles to minimize the intraarticular bleeding and prolong the time agents would act locally. Ketorolac has analgesic and anti-inflammatory action, which act synergistically with other NSAIDS. Significant pain relief has been reported when ketorolac had been mixed with ropivacaine and epinephrine when compared to other studies.

In our study we compared the efficacy of intraoperative periarticular injection cocktail with post-operative epidural analgesia infusion. Statistically significant reduction in pain was noted in PAI group both at rest and activity at 0-24hrs, 24-48 hrs, 48-72 hours (p value < 0.005). This is similar to the study done by Ageliki Pandazi *et al.* in 2013 which showed VAS scores at rest, at 6, 12 and 24 hours and during activity at 6 and 12 hours postoperatively were lower in infiltration group compared to PCA (patient controlled analgesia) group [5]. Similar results were noted by Busch *et al.* in 2010 [1]. George Mathew srampickal *et al.* did a randomised control study to determine the effectiveness of periarticular drug infiltration in providing pain relief and early functional outcome following total hip arthroplasty and published in May 2019 and concluded that PIC provides significantly better pain control and functional recovery in the early preoperative period with less side effects when compared to the epidural analgesia group [6].

In our study we compared the functional outcome in both PAI and EA group. The distance walked by the patient on the first and second post-operative day was significantly more in PAI group when compared to EA group (p value <0.05). The number of days patient took to walk 100 meters a stretch was significantly lower in PAI group (PAI-3.792, EA- 4.750, p value 0.006). Karen Anderson *et al.* in a similar study compared the length of hospital stay in both groups and concluded that the length of hospital stay was significantly less in periarticular injection group [7].

We also compared the need for rescue analgesia in both the groups. The number of doses of rescue analgesia needed in PAI group was significantly less when compared to the EA group. 37.5% patients in PAI group did not require any analgesia. Jun-Bin Yin etal in 2014 done a meta-analysis of local infiltration in controlling pain after Total hip arthroplasty. They concluded that the need for rescue analgesia was lesser in the first 24 hours after surgery [8].

On comparing the side effects in both the groups no statistical difference were obtained. Contrary to our study Hari K parvataneni obtained a significantly lower side effects with PAI [9].

Limitations of study

VAS is subjective and depends on the pain tolerance of each patient, age and sex of patient. Regarding the site for injecting the cocktail, the efficacy of analgesia depends on the amount of nociceptor concentration in hip [10]. The studies regarding the concentration of nociceptors in hip joint is limited when compared to knee joint. With these limitation from previous studies we included 8 areas which includes the anterior capsule, iliopsoas tendon, its insertion, fascia lata, gluteus maximus and its insertion, posterior capsule, short external rotators and synovium.

Conclusions

Periarticular injection is superior to epidural analgesia in addressing post-operative pain at rest and during activity, thus aiding in early mobilisation of the patient. Need for post-operative adjuvant analgesia is lesser in periarticular injection group and thus reducing the side effects of the same.

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