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Fractures around the hip - post operative pain relief. comparison between spinal anesthesia with and without intraoperative periarticular local infiltration of drugs mixture

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Abstract

Background: The incidence of hip fracture is increasing worldwide. Better postoperative pain relief in patients with hip fracture can be achieved with multimodal anaesthesia. Using intraoperative local infiltration of surgical site can achieve this goal efficiently and also it can reduce need of rescue doses of systemic analgesia and adverse outcomes associated with opioids. We endeavor to compare the analgesia produced in patients operated for fractures around hip under spinal anesthesia with and without intraoperative periarticular local infiltration with drug mixture.

Material and Methods: A total of 60 patients were included in the study. 30 patients given spinal anaesthesia along with intraoperative local infiltration of mixture of drugs (Group A). 30 patients given plane spinal anaesthesia (Group B). 22 Gauge, 3.5 inches long needle used for local infiltration of mixture. Drug mixture used contained a combination of 300mg of ropivacaine, 30 mg of ketorolac and 0.5 mg epinephrine (approx. 160 ml). Intraoperative as well as postoperative measurements and recordings were done with respect to haemodynamic parameters as heart rate, systolic and diastolic blood pressure change trends were recorded. Pain measurement was done using 10 point Visual Analogue Scale (VAS) score, and need for additional analgesia in form of tramadol and /or diclofenac injection.

Result: The average scores on the VAS scores for both procedures were comparable except at 4 and 8 hours post-operatively, resulting in greater number of rescue analgesics in the Group B compared to Group A.

Conclusion: For surgeries done around hip spinal anaesthesia with intraoperative periarticular local infiltration of drug mixture is a good option to efficiently control postoperative pain. This reduces the need of rescue analgesia and thus helps avoid the adverse-effects that are due to use of opioids in immediate postoperative period.

Keywords: Hip fracture; postoperative analgesia; multimodal anaesthesia; rehabilitation

Introduction

The incidence of hip fracture is increasing world-wide. It has been estimated that by 2050 half of hip fractures will occur in Asia alone ^[1]. Increased age is always associated with a higher risk of fractures around hip. The mortality and morbidity associated with these fractures is higher and consumes considerable resources of the individuals ^[2]. Again in such patients the preoperative and postoperative pain is associated with various comorbidities and complications as sleep deprivation, depression, exaggeration of cardiac and pulmonary and endocrinological comorbidities ^[3]. Hence it is really important to achieve adequate pain relief in postoperative period, failing to which can lead to various postoperative complications, delayed and incomplete recovery. However an adequate postoperative pain relief can also potentially increase patient satisfaction and decreases the total duration of hospitalization, thus can be cost-effective. Opioids are most frequently used drugs in postoperative period to fight the pain ^[4, 5]. Using opioids lead to various systemic adverse-effects including constipation, central nervous system depression, vomiting and nausea and respiratory depression ^[6, 7]. The older age group is even more susceptible to these adverse effect. Using opioids in elderly is associated with prolonged hospital stay, readmission and increased cost of treatment.

Furthermore opioids are addictive and dependence for morphine may occur. An effective way to avoid the use of opioids and additional analgesic drugs in postoperative patients of hip fractures is use of multimodal anaesthesia, where a combination of various pharmacological as well as non-pharmacological techniques are used for treatment of pain in postoperative pain and hence reduced need for opioids^[8, 9, 10].

Periarticular regional anaesthesia techniques for surgery around hip was developed to analgesia without the complications associated with other techniques as opioid analgesia and nerve block.

Material and Methods

A total of 60 patients were included in the study. 30 patients given spinal anaesthesia along with intraoperative local infiltration of mixture of drugs classified as Group A and, 30 patients given plane spinal anaesthesia categorized as Group B.

Inclusion criteria: all consenting patients, age more than 18 years with any fracture around the hip planned for surgical management.

Exclusion criteria: Psychiatric illness, allergies to any drug components used in the studies, hepatic or kidney disease, cardiac or pulmonary compromised patient, non consenting patient.

Material used: 22 Gauge, 3.5 inches long needle used for local infiltration of mixture, Drug mixture used contained a combination of 300mg of ropivacaine, 30 mg of ketorolac and 0.5 mg epinephrine (Approx. 160 ml).

Procedure: With patient in sitting position a midline lumbar puncture was done at L3-L4 interspace with 21 Gauge spinal needle. Once patient anaesthetized positioned supine for surgery and depending on type of surgery patient put on traction table or plane operating table. All the surgeries were done by same surgeon and all the patients having similar surgeries received implants from same manufacturer. Once implant was properly applied and fracture fixation was achieved, wound wash was done with normal saline. At this point of time the combination of drugs was infiltrated locally in the cases using 3.5 inches 22 Gauge needle. The infiltration was done using the extra-capsular procedure where a total volume of approximately 160 ml containing 300mg (150 ml 0.2%) of ropivacaine, 30 mg (1ml) of ketorolac and 0.5 mg epinephrine (5ml 0.01%) infiltrated. For inter trochanteric fracture and fracture neck of femur infiltration was focused more over medial side whereas in fractures of subtrochanteric region infiltration was focused around the fracture. Needle was inserted till the depth of bone prior to start infiltration and infiltration was done in approximately 1 cm in periphery of the incision line. Periarticular, muscles, subcutaneous tissues and skin was infiltrated followed by closure of the wound.

Intraoperative as well as postoperative measurements and recordings were done with respect to haemodynamic parameters as heart-rate, systolic and diastolic blood pressure change trends were recorded. Pain measurement was done using 10 point Visual Analogue Scale (VAS) score, and need for additional analgesia in form of tramadol and/or diclofenac injection.

Statistical analysis: Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean \pm Standard Deviation (SD) and median.

Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used. Quantitative variables were compared using Independent T Test/Mann whitney test (for non-parametric data). Qualitative variables were compared using Chi-Square test /Fisher's exact test. A p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

Distribution of age in both groups

The mean age was 45.83 ± 16.42 in group A and 45.53 ± 15.23 in group B which was comparable in both groups with a p-value = 0.826. Median age for both group A and group B is 45 years. Range of age for group A and group B is 18-76 and 20-78 respectively. (Table 1)

Gender distribution in both groups

In this study in group A and B number of males was 13(43.33%) and 8(26.67%) respectively. While number of females was 17(56.67%) and 22(73.33%) in group A and group B. Total number of cases are 30 in both group. Total male and female are 21 and 39 respectively.

P value = 0.176 (Table 2)

Body weight distribution in both groups

Mean weight was 61.53 ± 10.32 kilograms and 60.07 ± 8.02 kilograms in group A and group B respectively. Range of body weight was 45-90 kilograms and 45-75 kilograms in group A and group B. Median body weight was 60 kilograms in both groups (table 3)

Type of surgery in group A and group B

The two groups were comparable with respect to the type of surgery; p=0.593 (table 4)

Duration of surgery in group A and group B

The duration of surgery was similar in both the groups with a p value=0.085 (Table 5)

Intraoperative Haemodynamic Parameters

Changes in heart-rate in group A and group B

The mean baseline heart-rate was 91.27 ± 15.3 /minute in group A and 92.2 ± 17.36 /minute in group B which was comparable in both groups with a p-value = 0.826. There was statistically no significant difference between the two groups in mean heart rate at all time points in the intra-operative period (Table 6).

Intraoperative blood pressure observations

Changes in systolic blood pressure observed in group A and group B

The mean preoperative baseline systolic blood pressure was 136.7 ± 18.16 mmHg in group A and 130.9 ± 12.97 mmHg in the group B. The two groups were comparable with p-value=0.16 which is statistically insignificant. There was statistically no significant difference in mean systolic blood pressure at all times points in the intraoperative period (Table 7).

Changes in diastolic blood pressure observed in group A and group B

Mean baseline diastolic blood pressure in group A was 82.03 ± 10.81 mmHg and in group B was 81.13 ± 10.35 mmHg with a p-value of 0.743 which is statistically insignificant. The mean

diastolic pressure was comparable in both groups throughout intraoperative period (Table 8).

Postoperative observations in heart-rate in group A and group B

The mean baseline heart rate was 91.27 ± 15.3 /min in group A and 92.2 ± 17.36 /min in group B which was comparable in both groups with a p- value =0.826. There was statistically no significant difference between the two groups in mean heart rate at all time points in the post-operative period (Table 9).

Changes in postoperative blood pressure

Changes in systolic blood pressure observed in group A and group B

The mean preoperative baseline systolic blood pressure was 136.7 ± 18.16 mmHg in group A and 130.9 ± 12.97 mmHg in the group B. The two groups were comparable with p-value=0.16 which is statistically insignificant. There was statistically no significant difference in mean systolic blood pressure at all times points in the post-operative period. One patient in group A had significant hypotension in post-operative period which was managed by intravenous fluids administration (Table 10).

Changes observed in diastolic blood pressure in group A and group B

Mean baseline diastolic blood pressure in group A was 82.03 ± 10.81 mmHg and in group B was 81.13 ± 10.35 mmHg with a p- value of 0.743 which is statistically insignificant. The mean diastolic pressure was comparable in both groups throughout post-operative period (Table 11).

Pain

Pain was assessed using the 10-grade visual analog score system (VAS, ranging from 0= no pain to 10=absolutely intolerable pain). Patients in group A were observed to have significantly

lower pain visual analogue score (VAS) between time points T4 to T8 ($p < 0.05$) (Table 12).

Duration of analgesia

Patients in the group A did not receive any rescue analgesia for 551.11 minutes while patients in the group B needed analgesia after 427.25 minutes. This difference is statistically insignificant with p value=0.115.

Number of rescue analgesic doses in first 24 hours

Rescue analgesia was required in 9 of 30 patients in group A and in 20 of 30 patients in group B with a p-value of 0.041 which is statistically significant. The rescue analgesia was given in form of Injection Diclofenac 75 mg intra muscular (i/m) and/or injection tramadol 1.5 mg/kg i/v or i/m. (Table 13).

Table 1: Distribution of Age in Both Groups

Age (years)	Group A	Group B
Mean age	45.83 ± 16.42	45.53 ± 15.23
Median age	45	45
Range	18-76	20-78

Table 2: Gender Distribution in Both Groups

Gender	Group A	Group B	Total	p value
Female	17(56.67%)	22(73.33%)	39(65.00%)	0.176
Male	13(43.33%)	8(26.67%)	21(35.00%)	
	30(100.00%)	30(100.00%)	60(100.00%)	

Table 3: Body Weight Distribution in Both Groups

Weight (kg)	Group A	Group B	p-value
Mean	61.53 ± 10.32	60.07 ± 8.02	0.910
Median	60	60	
Range	45-90	45-75	

Table 4: Type of surgery in group A and group B

Surgery	Group		Total	p value
	A	B		
Bipolar Hemihip Arthroplasty	12 (40.00%)	8 (26.67%)	20 (33.33%)	0.593
Total hip replacement	7 (23.33%)	7 (23.33%)	14 (23.33%)	
Proximal Femoral Nailing	5 (16.67%)	6 (20.00%)	11 (18.33%)	
Dynamic Hip Screw	4 (13.33%)	3 (10.00%)	7 (11.67%)	
Cortical Cancellous Screw	0 (0.00%)	2 (6.67%)	2 (3.33%)	
Others	2 (6.67%)	4 (13.33%)	6 (10.00%)	
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)	

Table 5: Duration of surgery in group A and group B

Duration of Surgery	Group A			Group B			p value
	Mean ± Stdev	Median	Min-Max	Mean ± Stdev	Median	Min-Max	
Duration of surgery(min)	154.83±52.02	145	65-270	133.33 ± 47.66	120	60-240	0.085

Table 6: Intraoperative HR trends in group A and group B

	Group A			Group B			p value
	Mean ± Stdev	Median	Min-Max	Mean ± Stdev	Median	Min-Max	
HR baseline	91.27±15.3	90	65-132	92.2 ± 17.36	88.5	60-130	0.82600
HR 30 min	79.23 ± 14.13	77.5	56-115	81.57 ± 19.51	80	53-133	0.59800
HR 1 hr	74.1 ± 11.79	73	50-104	79.87 ± 20.22	75	52-145	0.18600
HR 1 hr 30 min	73.97 ± 13.88	72	47-118	82.77 ± 17.71	80	52-140	0.03600
HR 2 hr	77.04 ± 15.46	72	48-131	82.36 ± 16.97	78	52-133	0.22500
HR 2 hr 30 min	78.68 ± 15.02	80	49-120	85.57 ± 19.02	82	52-141	0.17700
HR 3 hr	84.94 ± 16.07	88	64-130	88.62 ± 17.81	88.5	60-122	0.53100
HR 3 hr 30 min	86.42 ± 13.31	84	68-117	101.5 ± 20.91	101	78-138	0.07900
HR 4 hr	91 ± 9.27	90	72-103	93.6 ± 12.6	102	77-103	0.67500

Table 7: Intraoperative Systolic BP trends in group A and group B

Intra op Systolic BP	Group A			Group B			p value
	Mean \pm Stdev	Median	Min-Max	Mean \pm Stdev	Median	Min-Max	
Intra op Systolic BP 0	136.7 \pm 18.16	135	104-186	130.9 \pm 12.97	132.5	100-163	0.16000
Intra op Systolic BP 30min	114.73 \pm 15.38	113.5	90-143	112.57 \pm 17.43	112	83-146	0.61200
Intra op Systolic BP 1 hr	112.93 \pm 13.64	110	92-141	109 \pm 15.48	107	78-144	0.30100
Intra op Systolic BP 1 hr 30 min	112.2 \pm 12.34	111	92-134	109.6 \pm 13.08	108.5	92-142	0.43200
Intra op Systolic BP 2 hr	110.64 \pm 12.27	107.5	90-133	110.46 \pm 14.23	108.5	88-146	0.96000
Intra op Systolic BP 2 hr 30 min	109.8 \pm 10.36	110	93-134	112.14 \pm 12.47	110	94-136	0.49000
Intra op Systolic BP 3 hr	108.89 \pm 11.08	107	94-138	113.25 \pm 11.29	111	95-129	0.26500
Intra op Systolic BP 3 hr 30 min	108.92 \pm 10.56	109	91-126	119 \pm 8.29	119	106-130	0.05600
Intra op Systolic BP 4 hr	116.38 \pm 11.4	116	98-132	116.4 \pm 9.34	119	102-126	0.99700

Table 8: Intraoperative Diastolic trend in group A and group B

Intra op Diastolic BP	Group A			Group B			p value
	Mean \pm Stdev	Median	Min-Max	Mean \pm Stdev	Median	Min-Max	
Intra op Diastolic BP 0	82.03 \pm 10.81	82	64-104	81.13 \pm 10.35	80	62-107	0.74300
Intra op Diastolic BP 30min	66.6 \pm 11.06	65	45-90	66.8 \pm 10.34	66.5	48-90	0.94300
Intra op Diastolic BP 1 hr	65.73 \pm 10.56	63	43-87	64.87 \pm 11.01	62.5	46-95	0.75700
Intra op Diastolic BP 1 hr 30 min	67.3 \pm 8.81	67	54-88	64.63 \pm 9.91	61.5	50-88	0.27500
Intra op Diastolic BP 2 hr	65.25 \pm 9.26	63	45-83	67.32 \pm 8.77	66	52-95	0.39400
Intra op Diastolic BP 2 hr 30 min	64.12 \pm 8.91	62	48-81	69.19 \pm 8.32	68	57-85	0.05400
Intra op Diastolic BP 3 hr	63.37 \pm 9.88	62	51-81	70.61 \pm 11.83	68	50-95	0.05100
Intra op Diastolic BP 3 hr 30 min	63.33 \pm 7.74	64	48-75	73.5 \pm 15.07	73	57-95	0.16900
Intra op Diastolic BP 4 hr	65.5 \pm 8.26	62.5	56-79	75.8 \pm 11.61	79	61-91	0.08700

Table 9: Post operative HR trends in group A and group B

	Group A			Group B			p value
	Mean \pm Stdev	Median	Min-Max	Mean \pm Stdev	Median	Min-Max	
HR baseline	91.27 \pm 15.3	90	65-132	92.2 \pm 17.36	88.5	60-130	0.826
HR 2hr	84.1 \pm 14.53	81.5	65-126	85.27 \pm 14.28	83.5	64-114	0.755
HR 4hr	85.63 \pm 14.66	84.5	68-130	85.57 \pm 13.62	84	65-116	0.986
HR 8hr	85.73 \pm 13.6	82	70-124	87.87 \pm 15.57	86	70-130	0.574
HR 12hr	84.27 \pm 13.48	80	70-120	84.03 \pm 13.4	83	62-120	0.947
HR 18hr	82.07 \pm 12.83	80	68-126	83.67 \pm 14.33	83	60-124	0.65
HR 24hr	84.9 \pm 14.48	83	62-134	84.27 \pm 13.74	82	58-118	0.863

Table 10: Post operative systolic BP trend in group A and group B

	Group A			Group B			P value
	Mean \pm Stdev	Median	Min-Max	Mean \pm Stdev	Median	Min-Max	
Systolic BP 0 min	136.7 \pm 18.16	135	104-186	130.9 \pm 12.97	132.5	100-163	0.16
Systolic BP 2hr	116.57 \pm 13.68	115.5	86-141	118.73 \pm 12.22	114.5	100-144	0.52
Systolic BP 4hr	117.4 \pm 13.16	120	84-140	155.33 \pm 180.78	125	100-1110	0.256
Systolic BP 8hr	119.5 \pm 13.3	120	82-148	120.13 \pm 24.04	124	10-150	0.9
Systolic BP 12hr	117.2 \pm 15.21	118	80-152	122.93 \pm 12.37	122	104-154	0.115
Systolic BP 18hr	117.3 \pm 13.92	118	78-148	120 \pm 12.48	118	100-150	0.432
Systolic BP 24hr	119.87 \pm 14.94	120	84-150	123.07 \pm 13.04	121	100-150	0.38

Table 11: Post operative Diastolic BP trends in group A and group B

	Group A			Group B			P value
	Mean \pm Stdev	Median	Min-Max	Mean \pm Stdev	Median	Min-Max	
Diastolic BP 0 min	82.03 \pm 10.81	82	64-104	81.13 \pm 10.35	80	62-107	0.743
Diastolic BP 2hr	68.27 \pm 9.4	66	47-86	72.93 \pm 9.22	73	58-90	0.057
Diastolic BP 4hr	69.97 \pm 10.78	70	40-90	74.77 \pm 8.15	73	60-92	0.057
Diastolic BP 8hr	72.53 \pm 10.53	70	54-98	75.73 \pm 9.61	74	60-96	0.224
Diastolic BP 12hr	71.47 \pm 11.05	70	52-96	75.17 \pm 8.82	75	60-92	0.157
Diastolic BP 18hr	70.87 \pm 10.79	70	50-96	74.73 \pm 9.25	74	58-94	0.142
Diastolic BP 24hr	71.4 \pm 11.5	70	56-98	75.33 \pm 9.16	74	60-98	0.148

Table 12: VAS Score

Time (hrs)	Group A	Group B	p value
T2	0.47 ± 1.28	0.83 ± 1.46	0.066
T4	0.73 ± 1.51	2.5 ± 2.97	0.004
T8	0.93 ± 1.41	2.53 ± 2.29	0.002
T12	0.9 ± 1.56	2.03 ± 2.54	0.051
T18	0.73 ± 1.64	1.6 ± 2.18	0.055
T24	0.2 ± 0.81	0.33 ± 0.71	0.161

Table 13: No. of injection diclofenac and tramadol required in 1st 24 hrs

No. of Inj. Diclofenac	Group		Total	P value
	A	B		
0	23 (76.67%)	11 (36.67%)	34 (56.67%)	0.011
1	4 (13.33%)	8 (26.67%)	12 (20.00%)	
2	1 (3.33%)	8 (26.67%)	9 (15.00%)	
3	2 (6.67%)	3 (10.00%)	5 (8.33%)	
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)	

No. of inj. Tramadol	Group		Total	P value
	A	B		
0	28 (93.33%)	23 (76.67%)	51 (85.00%)	0.033
1	2 (6.67%)	1 (3.33%)	3 (5.00%)	
2	0 (0.00%)	6 (20.00%)	6 (10.00%)	
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)	

Discussion

In this randomized prospective study, we compared the effect of compare the analgesia produced in patients operated for fractures around hip under spinal anesthesia with and without intraoperative periarticular local infiltration with drug mixture on post-operative haemodynamic parameters, post-operative pain scale, time for postoperative analgesia. The results obtained during our study is reproducible and comparable with the same studies found in literature [11, 12, 13].

Haemodynamic parameters – On comparing the post-operative haemodynamic parameters in between the two groups there was statistically no significant difference in heart rate, systolic blood pressure, diastolic blood pressure. As far as pain scores are considered there was difference in two groups regarding mean pain scores at 4 and 8 hour postoperatively resulting in greater number of rescue analgesic requirement in the group that did not got local infiltration intraoperatively, than in the group with intraoperative local infiltration of anaesthetic drug mixture. Duration for postoperative analgesia- The mean time duration for postoperative analgesia in with intraoperative local infiltration of anaesthetic drug mixture group was 551.11 minutes while patients in the group B needed analgesia after 427.25 minutes. This difference is not statistically significant. Spinal anaesthesia with local infiltration intraoperatively was more effective than the spinal anaesthesia alone in providing analgesia after hip surgery as observed in our study. The average scores on the visual analogue pain scale for both procedures were comparable except at 4 and 8 hours post-operatively, resulting in greater number of rescue analgesics in the group with intraoperative local infiltration of anaesthetic drug mixture. The findings of our study are consistent with previous studies demonstrating that the addition of local infiltration in patients having spinal anaesthesia significantly improves postoperative pain relief [14]. It may be concluded that the combination of spinal anaesthesia and local infiltration can prevent sensitization

of central nervous system via an additive of effect. Wound infiltration tends to maintain a persistent suppression of the noxious stimuli of pain.

One of the main aim of any fracture surgery around hip or any other joint is earliest possible mobilization of patient. The early mobility achieved by patients in Group A i.e. spinal anaesthesia with local infiltration lead to shorter hospital stay and earlier rehabilitation, both these factors provided better patient satisfaction with a better quality of life and reduced the treatment cost. The higher degree of patient satisfaction compared with systemic analgesia is further evidence in favour of the use of this technique for postoperative pain management. One of the major concern related to this study may be the potential chances of compromised healing of wound and possibility of introducing infections in the surgical site. But the current study showed no signs of infection. Postoperatively all the wounds healed timely without any complications. Furthermore, many studies have stated the local bacteriostatic role of anaesthetic drugs [15]. One drawback of this study was smaller sample size, similar study with more standardization and a larger sample size can further validate our results.

Conclusion

Both spinal and spinal anesthesia with intraoperative local infiltration of anaesthetic drug mixture are safe and effective techniques for postoperative pain relief following hip surgery. Using the multimodal analgesia with intraoperative local infiltration of drug mixture can curtail opioid needs in patients in postoperative period, thus avoiding the adverse reactions related to opioids in operated patients. It also reduces the overall hospital stay and cost burden of the treatment in such patients.

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