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Comparative study of fascia iliaca compartment block and standard analgesia vs standard analgesia only in relieving pain in hip fractures

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Abstract
Background: Hip fractures usually occur following significant trauma in young population and trivial injury in elderly people. Presenting complaint in Emergency Department(ED) is pain which needs urgent management. There are various modalities suggested for relieving pain in patients with hip fractures which includes IV analgesia and more recently fascia iliaca compartment block (FICB).This prospective randomized trial was conducted to compare the outcome of pain management in patients with hip fractures (Neck of femur fracture, Intertrochanteric fracture, Sub trochanteric fracture) who received standard analgesia with or without FICB in ED.
Materials & Methods: After institutional review board approval, 62 consecutive cases that presented to ED of tertiary referral centre with hip fractures were randomized in two groups with 31 patients in group A (cases) receiving FICB and standard analgesia (1gm paracetamol TDS and 2mg butorphanol BD) and standard analgesia only in group B (control). The results were compared in terms of VAS (Visual Analogue Scale) score at presentation and at 10 minutes, 2 hours and 8 hours of starting pain management protocol.
Results: The mean age for case group was 66.90years (SD=14.132) and control group was 64.71years (SD=17.958) (p=0.595).40.3% were male and 59.6% were female (p=0.796). VAS for pain was significantly lower after standard analgesia plus FICB than standard analgesia alone at later stage (p value is 0.04 and 0.005 at 2 and 8 hours respectively).
Conclusions: FICB with standard analgesia was found to be more effective measure in relieving pain in patients with hip fractures who presented at ED in this cohort.

Keywords: analgesia, Fascia illiaca compartment block, Hip fractures, pain

Introduction

Background

Hip fractures usually occur following significant trauma in young population and trivial injury in elderly people with osteoporosis. The chief complain of patient when they present to emergency department is pain which needs urgent management. Hip fractures include intertrochanteric fracture, fracture neck of femur and sub trochanteric fracture. As with many orthopaedic injuries pain management is one of the most significant issues in those patients.

Pain is a distressing feeling often caused by intense or damaging stimuli. Since it is a complex and subjective phenomenon, defining pain has always been a challenge. The International Association for the Study of Pain's widely used definition states: "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [1].

It is well recognized that pain might be the cause of many undesirable effects on several physiological processes especially in elderly patients who usually have limited physiological reserves. There are conflicting reports in relation to pain threshold in elderly patients [2].

Mental and cognitive deterioration and delirium in elderly patients with hip fractures (because of the pain and may be some subclinical emboli) is a familiar picture during the preoperative visit to these patients. Presence of delirium is associated with increased morbidity, increased length of hospital stay, increased health care cost and poor functional outcomes [3].

There are various techniques for pain management. Oral analgesics, parenteral analgesics or regional analgesia techniques can be used for pain management. Similarly, various drugs can be used for pain management.

Fascia iliaca compartment block was first described as a single injection procedure for blocking the femoral, lateral cutaneous and obturator nerves. Fascia iliaca compartment block (FICB) is an approach to the lumbar plexus and was first described by Dalens in an Australian ER physician who was looking to help patient with hip fracture [4].

It has been demonstrated that FICB provides effective analgesia for a fractured femur shaft when administered either during pre-hospital management or in emergency departments in every age group patients, and that this type of block provides an effective method of managing post-operative pain [5].

Three major nerves (femoral, lateral cutaneous and obturator) of the lumbar plexus are blocked in FICB, first described by Dalens *et al*. The FICB has traditionally been undertaken by loss of resistance using palpable anatomical landmarks.

Ultrasound guided regional techniques offer a number of advantages including real time needle guidance and direct observation of local anaesthetic spread within tissue planes [6].

The mechanism behind the FICB is that the femoral and lateral femoral cutaneous nerves lie under the iliacus fascia. Therefore, a sufficient volume of local anaesthetic deposited beneath the fascia iliaca, even if placed some distance from the nerves, has the potential to spread underneath the fascia and reach these nerves.

The fascia iliaca is located anterior to the iliacus muscle within the pelvis. It is bounded superolaterally by the iliac crest and medially merges with the fascia overlying psoas muscle.

FICB involves the fascia iliaca compartment to deliver a large volume of low concentrated local anaesthetic to reduce pain by affecting the femoral and lateral cutaneous nerve of the thigh.[4] FICB seems to be an efficient, safe and practical method for pain reduction in patients with a hip fracture [7].

Paracetamol (acetaminophen) is a centrally acting inhibitor of cyclooxygenases which has commonly been reported as a safe and effective analgesia in the ED. It is associated with fewer untoward effects than either opioids or NSAIDS and has few contraindications. Paracetamol also lacks significant drug interactions [8].

The efficacy, safety, and narcotic sparing effect of IV paracetamol, either alone or as an adjunctive treatment, have been established in different settings including postoperative pain, cancer pain and intravenous regional anesthesia [9, 10].

Bupivacaine is a medication used to decrease feeling in a specific area. It is used by injecting it into the area, around a nerve that supplies the area, or into the spinal canal's epidural space. It typically begins working within 15 minutes and lasts for 2 to 8 hours [11].

Bupivacaine is utilized for preoperative local anesthesia, postoperative analgesia and in the treatment of chronic pain [12].

This trial was conducted to compare the outcome of pain management in patients with hip fractures who received standard analgesia with or without fascia iliaca compartment block (FICB) in emergency department and to show that FICB is even effective in hand of non-anaesthetics if done properly.

Materials and Methods

The study is a prospective randomized clinical trial. All patients presenting to emergency department of tertiary referral centre, over a one year period, diagnosed with hip fracture radio graphically meeting the inclusion criteria were included in the study.

Inclusion criteria were age >18 years of either sex, patient giving informed consent and exclusion criteria were age <18 years of either sex, patients with head injury, patient not giving informed consent, documented hypersensitivity to any of the study medications, patients on anticoagulant or antiplatelet therapy or with bleeding diathesis, infection at the puncture site and haemodynamically unstable patients. The study approved by Institutional Review Committee.

By the end of the study period, a total of 62 patients were enrolled in the study out of which 31 were in case group (Group A) and 31 in control group (Group B). The sampling technique was done by a computer generated random number sequence and based on the computer generated random number table, patients were assigned to either group A or group B.

All recruited patients and their relatives were informed regarding the study, anaesthetic intervention, advantages and disadvantages of the medication being used and expected co-operation required. Informed and written consent was obtained for accepting participation in the study. Group A (case group) patients (n=31) received FICB with 0.5% bupivacaine (0.4ml/ kg ideal body weight diluted with 0.9% saline to make a total amount 40 ml) with standard analgesia (paracetamol 1gm IV TDS and butorphanol 2mg BD) and Group B (control group) (n=31) patients received standard analgesia only.

Ideal weight was calculated as:

Weight (In Kg) for male: Height (in cm)-100

Weight (In Kg) for female: Height (in cm)-105 [29].

After proper disinfection, the site to be punctured was marked 1 cm caudal to junction of lateral one-third with medial two-thirds of the inguinal ligament. The needle was inserted and advanced perpendicularly to the skin. The first loss of resistance was felt as the needle's tip crosses the fascia lata. The needle was then advanced further until the second loss of resistance was felt as the fascia iliaca is pierced. The angle to the skin then decreased to 30 degrees. The drug was injected after negative aspiration of blood to rule out intravascular needle placement, over one minute period and firm pressure was applied manually just distal to the puncture site. The intensity of pain was measured on a 10 cm Visual Analogue Scale (VAS) in which 0 represented no pain and 10 represented the worst possible pain. VAS was recorded just before the block then at 10 minutes then 2 hours and then 8 hours. The subjects were followed till 8 hours. Data was entered in Microsoft Excel 2007 and converted into Statistical package for social sciences (SPSS 11.5) for statistical analysis. For descriptive statistics: Percentage, mean, SD and/or minimum and maximum were calculated along with tubular and graphical presentation. For inferential statistics: Chi-square, independent t-test or Mann-Whitney U were applied to find the significant difference between standard analgesia group and standard analgesia and FICB group and other related variable at 95% CI where P value corresponds as <0.05.

Results

In this study a total number of 62 patients were enrolled with hip fractures were randomized and were divided into control to whom IV PCM and butorphanol was given and cases to whom FICB along with IV PCM and butorphanol was given and then VAS score was assessed.

The results were entered in MS-Excel worksheet and analyzed using Statistical Package for Social Science (SPSS 11.0). Results were compared using t-test and chi-square test depending on the variable. A p-value of less than 0.05 was considered statistically significant.

The demographic parameters between the patients of both the groups were similar.

The mean age in years for case group was 66.90 and control group was 64.71.The mean age in both group is similar and there is no significant difference in the mean age of samples in the two group (p value is greater than 0.05). (Table I)

The mean weight in kg in Group A (61.68) and Group B (62.35) is similar and there is no significant difference in the mean age of samples in the two group (p value is greater than 0.05). (Table II)

The sex wise distribution in two groups were similar and not significantly different

(P value is greater than 0.05). In both groups there are more

females than males. Out of the total number of cases there were less male (n=25) as compared to female (n=37). As the study was randomized and double blinded this incidence, could neither be predicted nor manipulated. However, the distribution of both genders was comparable in the two groups. There was no statistical significance between the distribution of patients in two groups with regard to sex (p=0.796). (Table III)

At presentation, the maximum and minimum VAS score for cases and control was found to be 10 and 6 respectively with a median of 8 and interquartile range for cases is 8-9 and control is 7-9 and there was no statistical significance found between two groups with p-value 0.530.

At 10 minutes, the maximum and minimum VAS score for cases and control was found to be 9 and 6 respectively with a median of 8 for case and 7 for control with inter-quartile range of 7-8 for both groups and there was no statistical significance found between two groups with p-value 0.278. At 2 hours, the maximum and minimum VAS score for cases and control was found to be 4 and 1 respectively with a median of 2 for case and 3 for control with inter-quartile range of 2-3 for both groups. At this time statistical significance was found between two groups with p-value 0.043 and at 8 hours, the maximum and minimum VAS score for cases was 4 and 1 and for control 4 and 2 with a median of 2 for case and 3 for control with quartile range of 2-3 in both groups. At this time statistical significance was found between two groups with p-value 0.005.

Using Mann-Whitney Test we can compare statistical significance in the difference in the means in the two groups at various timing pre and post intervention. The p-values from the test shows that there is no significance difference between the two groups at presentation and also immediately after giving respective analgesia. However, there are significance difference between the two groups in the VAS at later stage (p value is 0.04 and 0.005 at 2 and 8 hours respectively) indicating better analgesia in case group. (Table IV)

Table 1: Age distribution in case and control group

Group	Mean (years)	Std. Deviation	P value
Case (A)	66.90	14.138	0.595
Control (B)	64.71	17.958	

Table 2: Weight distribution for case and control group

Group	Mean (kg)	Std. Deviation	P value*
Case (A)	61.68	9.506	0.790
Control (B)	62.35	10.372	

* Independent t test

Table 3: Distribution of sex in case and control groups

Sex	Case group (A)	Control group (B)		P value*
Male	13 (41.9%)	12 (38.7%)	25 (40.3%)	0.796
Female	18 (58.1%)	19 (61.3%)	37 (59.7%)	
Total	31(100.0%)	31(100.0%)	62(100.0%)	

* Chi-square test

Table 4: Difference in VAS in two groups at various time.

VAS	Group	Max	Min	Q1	Median	Q3	P value
At presentation	A	10	6	8	8	9	0.530
	B	10	6	7	8	9	
At 10min	A	9	6	7	8	8	0.278
	B	9	6	7	7	8	
At 2hrs	A	4	1	2	2	3	0.043
	B	4	1	2	3	3	
At 8hrs	A	4	1	2	2	3	0.005
	B	4	2	2	3	3	

Discussion

Hip fractures are intensely painful and commonly occur in young patients with significant trauma and with trivial trauma in elderly patient with osteoporosis. Pain is a stress response of the body to damage, and is not only a physiological response but also a psychological reaction. Different people have varying susceptibilities to pain. Provision of effective analgesia is important not only for humanitarian reasons but also because pain may have negative impact on recovery. Severe pain can cause patients to experience psychological burden, stress, and restless mood.

Pain is from periosteum, muscles and capsular stretching. Advanced age, cardiac and respiratory co-morbidities and in the elderly patient may add complexity in pain management of these patients. Pain treatments in these patients with intravenous administration of NSAIDS are frequently associated with exaggerated side effects.

The fascia iliaca compartment block is a simple, inexpensive, and effective method of analgesia for femoral fracture [13].

The FICB technique is associated with minimal risk as the analgesic is injected at a safe distance from the femoral artery and the femoral nerve [14]. It is considered safe if it is administered with repeated aspiration to ensure that local anaesthetic is not injected into blood vessels. In addition to high safety profile of the FICB, it has also been shown to be an effective analgesia [13].

FICB is one of the different options that have been shown to be useful before, during and after surgical management of femoral fractures. Anaesthetic drug injected immediately below the fascia iliaca favors the spread of drug at the inner surface of this fascia to make contact with the nerves emerging from the lumbar plexus that supply the lower limb relieving pain in the area supplied [15].

FICB uses the fascia iliaca compartment to deposit a sufficient volume of local anaesthetic to spread to the femoral and lateral femoral cutaneous nerve [4]. It is superior to the 3-in-1 block, intramuscular morphine, and standard analgesia regimens [16, 17] in terms of pain relief for femoral neck fracture. Its efficacy has been reported to be 69.5% to 90% [17].

Bupivacaine has been used to investigate the analgesic effect of FICB [15, 16, 18, 19]. It has a rapid onset (2–5 minutes) [20] with the maximum plasma level occurs after 15 to 30 minutes [21]. It has fewer toxic reactions relative to lidocaine [22] with a half-life of 157 minutes [23] and its local anaesthetic effect lasts for up to 8 hours [12].

The technique for FICB is easy and safe to perform and ensures a safe distance away from the femoral nerve and artery and reduces the incidence of complications [6].

FICB can be performed quickly and effectively by emergency doctors [16], and effectively reduces the incidence of delirium in patients with femoral neck fracture [24]. FICB should be introduced earlier in the analgesia pathway in patients with hip fractures [6, 18, 25, 26].

We randomly selected the case and control and then standard analgesics only or in combination with FICB were given accordingly. The aim of this study was to investigate the feasibility and efficacy of FICB performed by orthopaedic resident medical personnel at ED as a supplement or alternative to conventional analgesia for patients with hip fractures.

Dolan *et al*. [6] noted a significant improvement in the success rate of the block when performed under ultrasound guidance (up to 95%); however, we achieved a significant result by ensuring that we performed the loss of resistance technique correctly. This increases practicality in the ED as it abolishes the need for equipment such as nerve locators or ultrasound scanners. We also showed the accessibility of the technique to the non-anaesthetist. This is similar to what Monzon *et al*. who concluded that parenteral NSAIDs are very effective as analgesics after hip fracture patients, fascia-iliaca regional blocks are nearly as effective for up to about 8 h after administration, and regional fascia-iliaca blocks effectively the hip fracture pain and also minimizes deleterious side effects of other pain relieving drugs like NSAIDS.

In the ED, by significantly reducing pain, fascia-iliaca regional blocks can permit more rapid assessment and diagnostic procedures [27] and Høgh *et al*. who concluded that the fascia iliaca block is easy to perform and requires minimal introduction. There is no need for expensive equipment and is carried out with a low risk approach. This study has shown that the FIB performed by junior registrars is a feasible and efficient supplement to conventional pain treatment for patients with hip fractures before surgery [17].

In our study, there was no difference in the demographic characteristics between the two groups reflecting proper randomization. Our study has shown prolonged analgesia in patients receiving FICB with standard analgesia.

Our study showed significant pain relief using FICB which was similar to result found in study of Williams et.al which is the VAS for pain was significantly lower after standard analgesia plus FICB than standard analgesia alone. In patients with standard analgesia alone, the VAS for pain reduced from 15 minutes to 8 hours but not significantly. In patients with standard analgesia plus FICB, the VAS for pain reduced from 15 minutes and the effects lasted for the entire 8 hours [28] and Jagdish Durega et.al who also concluded both the groups were statistically comparable regarding age, height, weight and sex distribution. ($P > 0.05$) [29] Which was similar to our study.

The main limitation of our study is that we did not study the cost of the procedure.

Other limitations of this study included the small sample size, could it have more larger sample size, result could be more valid. Traction application and its application time were not recorded.

Conclusion

In conclusion FICB with standard analgesia was found to be effective measure in relieving pain in patient with hip fractures presented to the emergency department.

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