Effects of local Infiltration of Bupivacaine in total hip and knee replacement for post - operative analgesia

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ABSTRACT

Background: Pain is one of the most postoperative complications of surgical wound especially within first 24 hrs. leading to delay hospital discharge, stress gastritis and increasing blood pressure. As wound infiltration with long acting local anesthetic (bupivacaine) has been proved to be effective after orthopedic surgeries especially total hip and knee replacements.

Objective: our study was designed to determine the effectiveness of local infiltration of 0.5% of bupivacaine before closure of surgical wounds in controlling postoperative pain and improve patient's outcome after total hip and knee replacement surgeries in first 24hrs postoperative period.

Methods: Twenty patients from class I (healthy patients) and class II (patients mild systemic diseases) of ASA (American society of anesthetists) undergoing elective orthopaedic surgeries were randomly assigned in two groups and (both of them have general anesthesia); Group A (10patients) received local infiltration of 0.5% bupivacaine before closure of surgical wounds and group B (10 patients) received local infiltration of 0.9% of normal saline. We use uniform technique of anesthesia in both at rest and on passive mobilization by nurses and residents groups. Visual analogue pain scale scores were assessed blinded to analgesic treatment and we check the needs for analgesic drugs post-operative in both groups.

Results: Group A showed a significant reduction in postoperative pain at rest and on mobilization after infiltration of 0.5% bupivacaine with short hospital stay and only 3 patients need for post-operative analgesia ,while all patients in group B require at least single dose of analgesia like pethidine or non-steroidal anti-inflammatory drugs.

Conclusion: The use of 0.5% Bupivacaine by wound infiltration is effective for post-operative pain relief, as it reduces the requirements for additional post-operative analgesia after total hip and knee replacements.

Keywords: local anesthesia, bupivacaine, postoperative analgesia and visual analogue pain scale.

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Postoperative pain after major orthopaedic surgery is most often reported by patients to be at its worst on the 1st and second postoperative days with risk of stress gastritis and increasing blood pressure and interferes with the patients' general activity and walking ability. Several studies have shown that non-steroidal anti inflammatory drugs (NSAIDs) are effective in reducing either early postoperative pain after orthopaedic surgery or the opioid requirement. However, these drugs are not always effective on early mobilization pain and have well documented potential side-effects.

In addition, some authors have reported that NSAIDs decrease the rate of fracture healing. Thus, alternative strategies for postoperative pain relief have been studied. In particular, the treatment of postoperative pain by topical administration of local anesthesia like bupivacaine 0.5%in the surgical area has recently proved effective in reducing postoperative pain after various surgical procedures specially after hip and knee arthroplasties.

Bupivacaine is a local anesthetic which blocks the g eneration and conduction of nerve impulses. It is commonly Bupivacaine has a longer duration of action than lidocaine, to which it is chemically related -approximately 6-8 hours as opposed to 1-2 hours for lidocaine. Duration of action is affected by the concentration of bupivacaine used and the volume injected. Concentration affects the time for local anesthesia to occur and the density of the block. Volume determines the area that is infiltrated and, therefore, anesthetized.

Total dose in mg/kg is important in local anesthetic toxicity. Signs of toxicity include central nervous system signs (seizures), and cardiac dysrhythmias progressing to a systole.

Bupivacaine is a prescription drug, but it is not a controlled substance. It is available in concentrations of 0.25%, 0.5% and 0.75%, either plain or combined with epinephrine. Epinephrine reduces cutaneous blood flow and therefore prolongs the local anesthetic effects. Maximum concentration of bupivacaine recommended for subcutaneous use is 0.25% to 0.5%. Higher concentrations are used mostly for caudal and epidural blocks in human medicine [3].

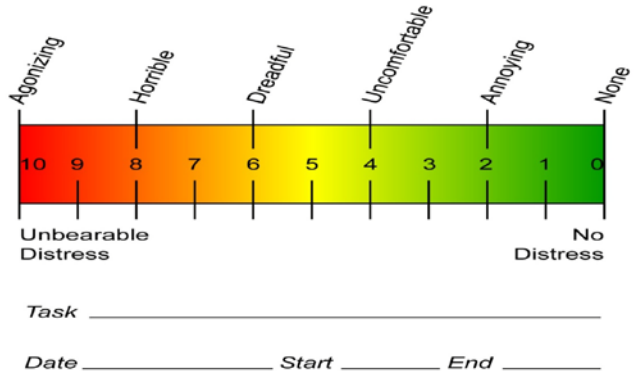
The present randomized study was designed to determine the effectiveness of local infiltration of 0.5% of bupivacaine before closure of surgical wounds in controlling postoperative pain and improve patients' outcome after total hip and knee replacement surgeries in first 24hrs postoperative period.

Methods. This study was carried out on 20 patients, and was held according to the classification of American Society of Anesthetists (ASA) class I (healthy patients) or class II (patients with mild systemic diseases). Table 1 shows some

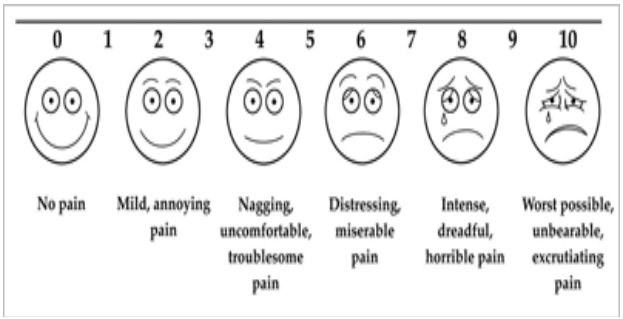
features of the patients enrolled in the current study. These patients underwent hip and knee arthroplasty surgeries under general or spinal anesthesia, at Al-Yarmook teaching hospital.

Informed consent was obtained from all patients, and the study was approved by the local ethics committee. Patients were evaluated every 4 hours for 24 hours after the operation using a visual analogue pain scale (VAS), figure1 and 2.

A pain scale measures a patient's pain intensity or other features, Pain scales are based on self-report, observational (behavioral), or physiological data, self-report is considered primary and should be obtained if possible. Pain scales are available for neonates, infants, children, adolescents, adults, and persons whose communication is impaired. Pain assessments are often regarded as "the 5th Vital Sign." [4] where a 10 cm bar was constructed and the patients were asked to mark a point to indicate pain, having been instructed that one end represents no pain and the other worst pain imaginable, and to request analgesia as needed.



Figurer 1: Visual analogue scale (VAS).



Figurer 2: Visual analogue scale (VAS).

The policy was to give pethidine (1mg/kg) injection I.M as needed or to give diclofenac injection75-100 mg injection I.M next morning after the operation [5]. Table1 shows patients characteristics which randomly divided into two groups A and B:

1-Group A: General anesthesia + Bupivacaine Infiltration (N=10): This group was selected randomly with ten patients undergoing total hip and knee replacements and at the end of the surgery, 20 ml of 0.5% Bupivacaine was infiltrated into the wound and the skin closed.

Infiltration procedure for Total hip and knee replacements: We used a 15-20 ml vial of 0.5% bupivacaine diluted with 30-40 mL of distal water. After finishing the bone cut and the knee is ready for joint component placement, 20 mL of the anesthetic injected, using 21-gauge needle inserted all the way, from deep to superficial into the medial and lateral sides of the posterior capsule. We then inject the collaterals, into the periosteum around the cut surface of the femur and tibia, into the synovium and suprapatellar pouch, and finally into the cruciate ligament area for knee arthroplasty as shown in figure 3 and the same procedure for hip arthroplasty shown in figure 4 [6].

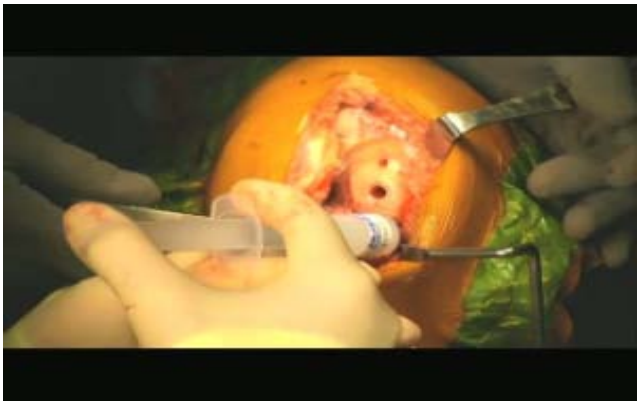


Figure 3: Local infiltration of knee.

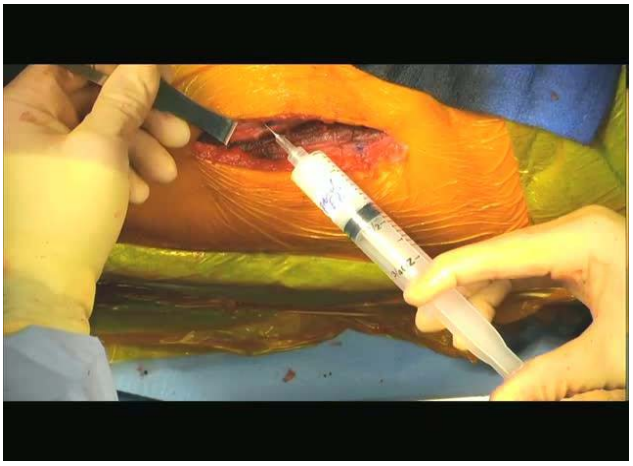


Figure 4: Local infiltration of hip.

2- Group B: General anesthesia with infiltration 0.9% of normal saline (N=10): All patients received only general anaesthesia (as mentioned previously in group A), without supplementation (infiltration) with Bupivacaine at the end of the surgery, but we infiltrate only 0.9% of normal saline [7].

Table 1: Some patient characteristics.

	Group A (n=10)	*Group B (n=10)*
Weight (Kg)	75± (6)	80± (7)
Type of Surgery (hip/knee)	5/5	4/6
Duration of Surgery (hrs)	2- 2.5 hrs	2- 2.5 hrs
Length of Incision (cm)	≈ 23.4	≈ 22.4

Results. Age distribution of current cases showed that the mean age of group A was about (60.5) years old, which is near to that of group B (58.5 years old). Table 2 shows the age distribution of current study cases.

Sex distribution of current study patients is shown in figure 5. Females showed slightly more predominance of cases in the current study.

The results obtained suggest that, after orthopedic surgeries, infiltration of the edges of the surgical wound with Bupivacaine before skin closure provides a good adjuvant analgesia with general anesthesia as shown in table 3.

Table 2: Age distribution among current study cases.

Age Groups	Group A (n=10)	Mean class interval	Group B (n=10)	Mean class interval
40- 49 years	2		-	
50- 59 years	2		7	
60- 69 years	4	60.5 yrs	2	58.5 yrs
70- 79 years	2		1	
Total	10		10	

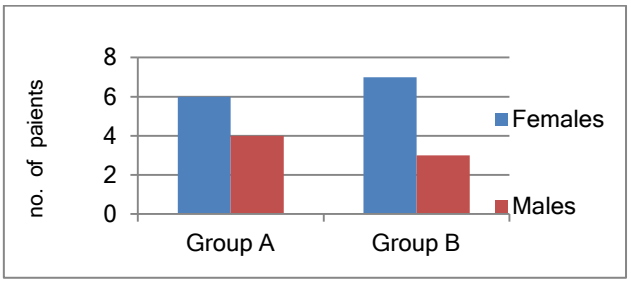


Figure 5: Sex distribution of current study cases in both groups.

It is worth mentioning that some of the patients could not explain if it was a true pain (at the surgical wound incision) or the pain threshold differ from one patient to another [8]. In these patients, infiltration of the wound with long acting local anesthetics would give encouraging results.

Table 3: Results of study on group A and group.

	Group A (n=10)	Group B (n=10)
Time to next analgesia (hrs)	6-8 hrs	Directly after surgery
Duration after Opera8-10tion	Pain degree according to the VAS (cm)	
0hrs	0.0	9.0
4hrs	1.6	7.5
8hrs	3.9	6.0
12hrs	2.6	5.2
16hrs	2.2	4.5
20hrs	2.9	3.6
24hrs	2	3.2
Mean ± SD	2.17 ± 1.2	5.57 ± 2.1
Standard Error	0.916	
T- test	3.7124 (df* = 12)	
P- value	0.003 (Highly Significant)	

* df = degree of freedom

Discussion. From this study, it was found that group A did not require any dose of pethidine or NSAIDs in the first 6 hours post-operatively, while all patients from group B required at least one dose during this period. Time taken to the first request for analgesia -starting from the end of surgery- was 6-8 hours for group A, and no time at all for group B (immediately after the operation).

Three patients from group A receive one dose of pethidine or diclofenac in the first 24 hours post operatively, while the rest from group A did not received any dose of analgesia.

Infiltration of the surgical wound with 0.5% Bupivacaine in current study at the end of the surgery after general anesthesia provided a significant degree of analgesia as shown by the smaller pain scores and pethidine consumption, this is in keeping with the prolonged duration of action of Bupivacaine. The pain scores showed a significant statistical difference ($p<0.05$) between patients in group A and group B.

Other trials of wound infiltration with 0.5% Bupivacaine for post operative analgesia after orthopedic surgeries proved to reduce significantly the pain scores and the analgesic requirements in the post operative period ($p<0.05$) [9,10].

In comparison with other studies done by ; 1; Fatin Affas et al , they compared local infiltration analgesia and femoral block with regard to analgesia and morphine demand during the first 24 h after total knee arthroplasty. They found local infiltration is much superior than femoral block because it's much easier and superior[11]. 2; Denise McCarthy et al , they found local infiltration analgesia has been shown to be an effective analgesic method. It has been proven to be superior to no infiltration, placebo saline infiltration and, in one study, epidural analgesia[12]. 3; Lombardi et al, they found soft tissue infiltration with 0.25% of bupivacaine ,epinephrine and morphine reduce postoperative pain and blood loss in immediate postoperative period and less needing for narcotic analgesia[13]. 4; A review of literature done by Tushar Gupta et al , show a significant reduction in postoperative pain and length of hospital stay when used local infiltration analgesia which agree with our study[14].

In conclusion, the use of 0.5% Bupivacaine by wound infiltration is effective for post operative pain relief, as it reduce the requirements for additional post operative analgesia in orthopaedic surgery with less early post operative complications.

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