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## **POSTOPERATIVE PAIN AT DONOR SITE FOLLOWING BONE GRAFT PROCEDURES**

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### **Summary**

This is a prospective study of postoperative pain at iliac graft donor site in 40 selected cases undergoing bone graft procedures from the iliac bone. Comparison was made between 3 different surgical approaches (superior, medial and superior-lateral). Severity of pain after operation was assessed using 10cm. visual analogue scale (VAS). All patients were followed up as outpatient visits every 2 weeks for period of 3 months. All patients had significant donor site pain postoperatively; moreover, in 83.3% of patients the pain was more severe at donor site than the recipient site. The precise cause of donor site pain remained obscure. However, in 87.5% of cases pain which, was closely related to position as typically aggravated by walking could indicate a local muscular or periosteal origin. The superior-lateral approach was associated with the lowest level of measured pain at donor site which, was mostly due to minimal muscles stripping and also the use of outer table. The highest level of pain was associated with the use of the superior approach, which was probably due to excessive muscle stripping and reflection of both gluteal and abdominal muscles. Donor site pain was substantially higher in patients where both tables of ilium were involved. In 10 patients (superior-lateral approach), bupivacaine hydrochloride 0.5% (Marcaine) had been used to infiltrate their donor wound during operation and comparison was made with another 10 patients as control. Local infiltration with pubivacaine produced a significant reduction in postoperative donor site pain.

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### **Introduction**

**O**ne of the greatest services doctors can do to their patients is to acquire skill in the management of pain<sup>1</sup>.

It is an indictment of modern medicine that an apparently simple problem as the relief of postoperative pain relief should

be sought. Firstly, humanitarian, the doctor's role is to relieve suffering, pain in speedy recovery. Secondly, the pain free patient will be much more mobile and able to cough and breathe easily. This should play a part in reducing the incidence of postoperative chest problems and deep venous thrombosis.

Postoperative pain following bone graft procedures utilizing the iliac bone as donor site is common problem in our practice in orthopedics and traumato-

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logy; however, mechanism, causes and management are still unsolved yet.

The aim of this study is to investigate the possible causes and methods of analgesia for postoperative pain at iliac graft donor sites and recommend the most appropriate measures to relieve pain.

## Materials and Methods

This is a prospective study of 40 selected patients with bone graft operations from the iliac bone, operated on at Hammad Shihab Military Hospital between March 1993 and March 1995. Patients presented with one or more of the following criteria were excluded:

1. Age less than 20 years and greater than 60 years.
2. Concomitant systemic or neurologic disease that could possibly delay tissue healing e.g. Diabetes.
3. Previous surgery or injury to the ilium.
4. Drug therapy within past 3 months that could alter tissue healing e.g. systemic steroids, chemotherapy or immunosuppressants.
5. History of narcotic drug use within past 2 months.
6. Incooperative patient.

Accordingly, among 150 patients who had bone graft procedures done at our hospital, only 40 cases were included in this study.

All were males and the mean age of patients at time of study was 31.5 years with a range of 20-52 years.

Regarding the site where the bone graft was applied (recipient site) the tibia in 20 cases (50%), the humerus in 8 cases (20%), the femur in 6 cases (15%) and the last 6 cases the recipient site was the radius and ulna. The procedures for which the graft were used included nonunion in 20 patients (50%), arthrodesis in 6 patients (15%), filling

bone cavity in 10 patients (25%) and malunion in 4 patients (10%).

## Surgical approaches:

Three types of surgical approaches had been included in this study, the superior-lateral, the superior, and the medial approach.

In 20 patients (50%), the superior-lateral approach had been used, in 10 patients (25%), the medial approach had been used, while in the last 10 cases (25%), the superior approach had been used.

Half of the patients with the use of superior-lateral-approach i.e. 10 cases (25%) had local bupivacaine infiltration of the iliac graft donor sites comparison was done with another 10 patients with the same approach but without bupivacaine infiltration of the wound. In first group 20 ml of 0.5% bupivacaine hydrochloride with adrenaline (1:200.000), infiltrated through the periosteum, muscle and subcutaneous tissue just before the wound closure.

## Surgical technique

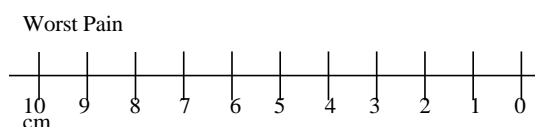
- 1- The superior lateral approach, in which the dissection is done on both superior and lateral aspect of the iliac crest, the crest is fractured free reflected medially and pedicled off its soft tissue attachments, the crest the sutured back into place after removal of subcrestal bone for grafting<sup>2</sup>.

- 2- The superior approach, in which dissection is done directly over the crest and continued down both lateral and medial cortices to obtain full thickness graft that include the crest<sup>2</sup>.

- 3- The medial approach, in which the soft tissue dissection is carried out on the medial aspect of the ilium and the bone graft is obtained by entry through the medial cortical plate<sup>2</sup>.

### Measurement and assessment of pain

Before premedication, all patients were instructed to the use of 10cm visual analogue scale (VAS) with zero and 10cm labeled respectively no pain and worst pain imaginable, the right hand end represented zero point, while the left hand end represent 10cm point<sup>3-6</sup>. Premedication induction and maintenance of anaesthesia were similar in all patients, no narcotic should be administered preoperatively. After recovery from anaesthesia, the patient is asked firstly whether there is pain or not and whether the pain is more in the donor site as compared to the recipient and then 8 hourly each day. VAS represents the continuum of the patient opinion of the degree of pain. The subject rates the degrees of pain by making a mark on the line scale values as follows.



The requirement for supplementary analgesics was recorded. The grades of pain are classified as follows<sup>7</sup>:

- 0 point VAS indicated no pain
- 1,2,3 (up to 3.9) points VAS indicated mild pain
- 4,5,6, (up to 6.9) points VAS indicated moderate pain
- 7,8,9, (up to 9.9) points VAS indicated severe pain
- 10 points VAS worst pain imaginable

### Postoperative care and follow up

The patient after operating is confined to bed for at least 12 hours, and then encouraged to walk (depending on the site). The drain is removed within 48 hours after operation. Sutures are routinely removed on the 12<sup>th</sup> –14<sup>th</sup> postoperative day. Treatment for donor site pain included oral non-narcotic

analgesia like paracetamol and non-steroidal anti-inflammatory drugs and narcotic analgesia like pethidine in the first 3 days after operation in cases with disabling pain.

All patients were followed up by regular outpatient visits for every 2 weeks following discharge for 3 months period.

### Results

All patients (100%) had a significant pain (grade 4 and above on VAS) at donor site postoperatively. The average hospital stay was 21.3 days with a range from 1-42 days and being higher in lower limb operation as recipient sites. The average post operative blood loss measured within 48 hours from the drain was 210 ml, a range of 33-150 ml.

30 cases (75%) had a localized pain at iliac graft donor site while 10 patients (25%) experienced diffuse pain at donor site.

2.6 patients (65%) described donor site pain as burning, in 10 patients (25%), the character of pain was pressing, 2 patients (5%) experienced aching type of pain and 2 patients (5%) described it as throbbing pain.

80% of patients (32) were unable to lie on the affected side because of iliac graft donor site pain, 35 patients (87.5%) found that the donor site pain was aggravated by walking, 13 patients (32%) the pain was aggravated by sitting while in 21 patients (52.5%) pain was aggravated by standing.

At the first 24 hours after iliac graft operation, the mean pain visual analogue scale (M.P.V.A.S) was 7.26 (severe pain according to grading mentioned earlier), while the MPVAS at the recipient site was 5.95 (moderate pain). There was more pain in the iliac graft donor site than the recipient site of the graft in 25 patients out of 30 patients (83.3%) (fig.1), those 30 patients in whom bupivacaine were not used locally.

While in the remaining 10 patients bupivacaine was infiltrated locally and there was more pain at recipient site than the donor site (Fig. 1).

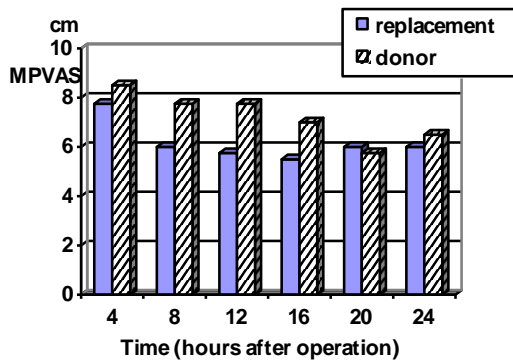


Figure 1. Histogram showing that those patients who had no pubivacaine infiltration at donor site had more pain than the recipient site.

In comparison between different types at of surgical approaches to harvest bone graft from the anterior ilium, the MPVAS at donor site in the first 24 hours after operation was 8.41 (severe pain), associated with the use of the superior-lateral approach. There was more pain at donor site associated with the use of the superior approach and the lowest level of measured pain was associated with the use of superior-lateral approach (Fig 2).

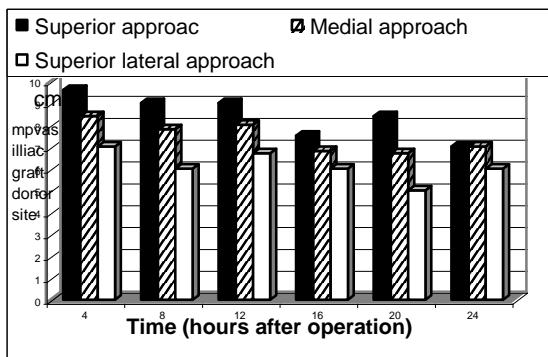


Fig 2. Histogram showing that the MPVAS at donor site was more in the superior approach.

At 32-72 hours after operation, the MPVAS at donor site associated with the superior approach was 7.63 (severe

pain). The MPVAS to the medial approach was 6.85 (moderate pain). The MPVAS to the superior-lateral approach was 6.3 (moderate pain). There was high level of pain scoring associated with superior approach (severe pain), (Fig 3).

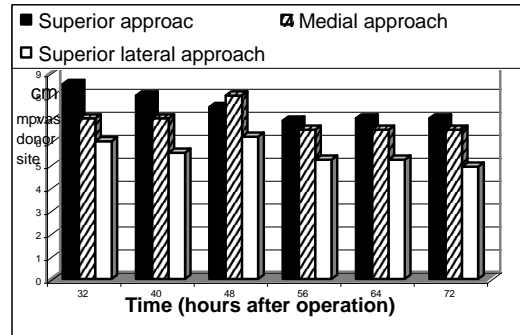
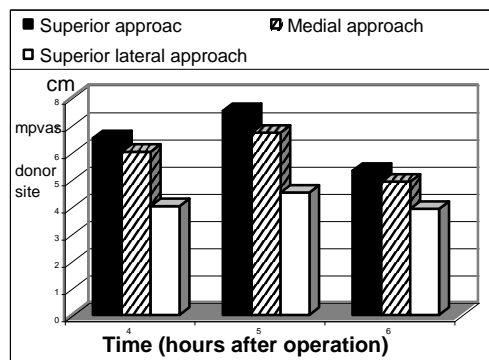


Fig 3. Histogram showing that the MPVAS at donor site was more in the superior approach.

At 4-6 days after operation, the MPVAS at donor site measured for these 3 days was 6.3 (moderate pain) associated with use of superior approach, 5.6 (moderate pain) with use of medial approach and 3.9 (mild pain) associated with use of superior-lateral



approach (fig.4)

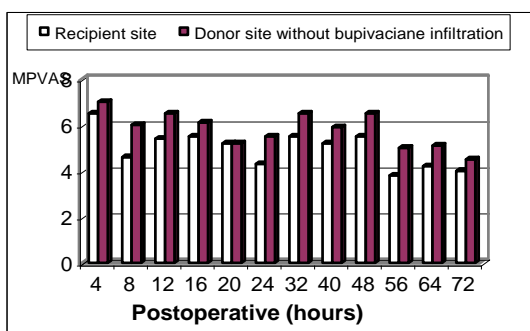
Fig 4. Histogram showing that the superior-lateral approach had the lowest level of MPVAS at 4-6 days after operation.

From these results, the superior-lateral approach had the lowest level of the measured pain scoring at the donor site and the superior approach associated

with the highest level of donor site pain from the ilium.

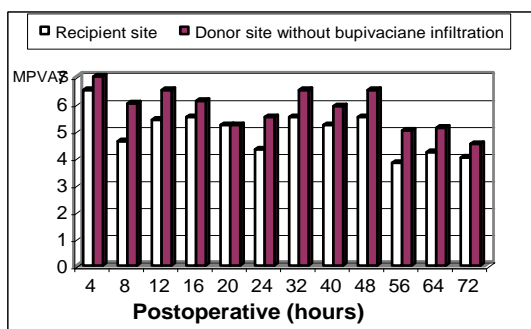
**Results of bupivacaine infiltration at the iliac graft donor site:**

At the first 72 hours after operation, the MPVAS at the recipient site was 5.4, the MPVAS at the donor site without bupivacaine infiltration was 5.9. Thus more pain in the donor site in all 10 patients with the superior-lateral approach, those who had no bupivacaine infiltration, than the recipient site, (fig.5).

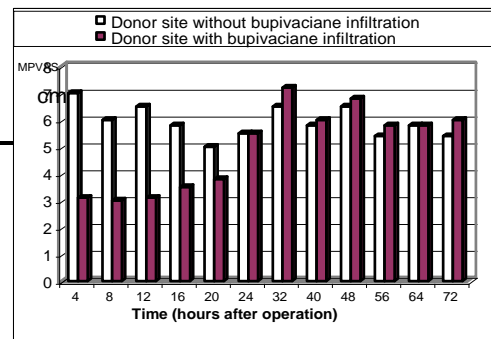


**Fig 5. Histogram showing that those patients without bupivacaine infiltration at iliac donor site had more pain than the recipient site**

The MPVAS at donor site with bupivacaine infiltration locally was 3.86 (mild pain) at the first 24 hours after operation. while the MPVAS at the recipient site was 5.4 (moderate pain), thus there was more pain in the recipient site than the donor site (fig.6).



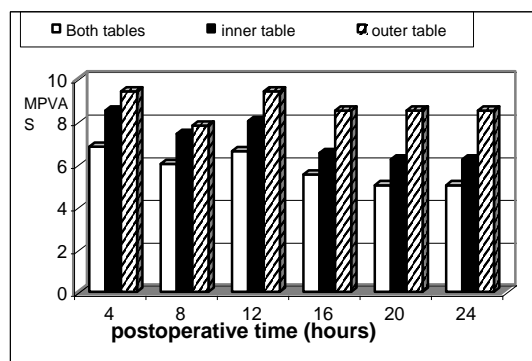
**Fig 6. Histogram showing that patients with bupivacaine infiltration had less pain at donor site than at recipient site in the first 20 hours after operation.**



At the first 24 hours after the operation, the MPVAS at iliac graft donor site without bupivacaine infiltration was 5.9, while the MPVAS at donor site with 20 ml of bupivacaine hydrochloride (Marcaine) infiltration was 3.86; thus the level of pain scoring measured at iliac graft donor site who had infiltration into their wounds was greatly reduced than the iliac donor site without bupivacaine especially during the first 20 hours after operation, but after 24 hours from time of operation, the level of measured pain was the same at both donor sites (fig.7).

**Fig 7. Histogram showing reduced pain at donor site for the first 24 hours in those who had bupivacaine infiltration.**

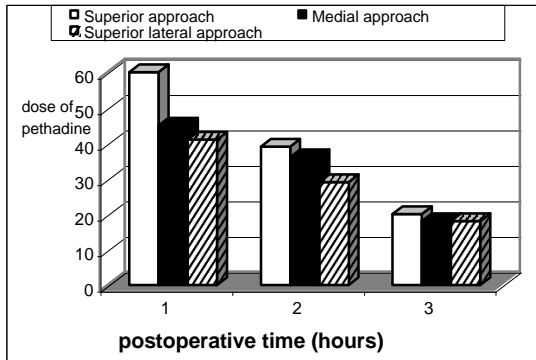
The MPVAS measured at donor site in the first 24 hours after operation was 5.9 (moderate pain) when the outer table was involved in bone graft procedure. The MPVAS at donor site was 7.5 (severe pain) when the inner table was involved. The MPVAS at donor site was 8.8 (severe pain) when both tables were involved, (fig.8).



**Fig 8. Histogram showing level of pain with different tables involved in bone graft procedure.**

The mean dose of pethidine required was 120 mg in the superior approach,

100 mg in the medial approach and 90 mg in the superior-lateral approach. This requirement was in the first 3 days after operation, (fig.9).



**Fig 9. Histogram of pethadine requirement**

A significant chronic donor site pain for more than 6 weeks, grade 4 and above on VAS was presented in 7 patients (17.5 %). 4 patients out of 7 (57.1%) associated with the use of the superior approach, 2 patients out of 7 (14.2 %) associated with the use of the superior-lateral approach.

#### **Complications of bone graft procedures:**

1. Deep venous thrombosis was noted in 1 patient (2.5 %) that required systemic anticoagulant therapy.
2. After 6 weeks, 11 patients (7.5 %) complained of difficult walking, however, it is difficult to isolate gait abnormalities related to donor site pain from the sequelae of lower limb operations.
3. 2 cases (5%) had hematoma that required drainage while 3 cases (7.5 %) had wound infection at donor site, antibiotics were given and results of these 5 cases were excluded from the study.
4. Meralgia paraesthetica was noted in 2 patients (5 %).

5. Some sensory changes at donor site was observed in 6 cases (15 %).

#### **Discussion**

Progress in the relief of postoperative pain has been slow and unimpressive in comparison with the advances made in other areas of surgery. For many years, the mainstay of therapy has been morphine or similar narcotic analgesics. In our hospital, the pain felt at the iliac graft donor site was greater postoperative problem to the patient than the surgery itself.

From our study, all patients had significant iliac graft donor site pain and as compared with results obtained from study of Keathley et al, 1984 that 71% of patients experienced moderate to severe postoperative pain<sup>8</sup>. Also as compared with the study of summers, 1989 where 50% of the patients had donor site pain<sup>9</sup>. These differences refer to the different approaches which were used in our study while the lateral approach had been used alone by the above mentioned studies.

The pattern of donor site pain was characteristics most of our cases (65%) described as burning, 87.5% of patients found the pain was aggravated by walking. Postoperatively, majority of patients (83.3 %) who did not have bupivacaine infiltration have more pain at donor sites than the pain at site of recipient, similar results were obtained from study of summers, 1989 and the study of Nicholson, 1974<sup>9,10</sup>.

Chronic donor site pain was presented in 17.5% of our patients while Laurie et al. 1984 reported such pain in 10% of patients after iliac crest grafting for maxillofacial procedures<sup>11</sup>. Cocking, 1971 found only 6% with such pain<sup>12</sup>.

In our study, 6 patients (15%) experienced sensory nerve deficit, this may be due to the injury of the lateral cutaneous branches of the subcostal

nerve<sup>12</sup> and iliohypogastric (L1). Both branches provide sensory innervation of the skin overlying the gluteus medius and minimus muscles. In the study of Marx, 1988, 38% experienced a sensory nerve deficit<sup>13</sup>. This difference is due to the use of anterior and posterior ilium to harvest bone graft materials in that study.

Meralgia paraesthetica can theoretically occur if the skin incision reaches the anterior superior iliac spine. In our study, it was found in 2 cases (5%). This was noted in 4.87% of patients in the study of Forrest et al, 1992 despite preservation of the nerve during surgery<sup>14</sup>.

The precise cause of donor site pain remains obscure. We can postulate that it is either muscular or periosteal secondary to the excessive stripping of the muscles from the ilium or neurologic secondary to sensory nerve injury.

However, pain which is closely related to position at donor sites as typically aggravated by walking (87.5%) may indicate a local muscular or periosteal origin. The muscular attachments to the ilium play a significant role in donor site pain. The most important muscular attachment involved in the anterior ilium is the tensor fascia lata muscle. It 1- together with tensor lata proper makes up the iliotibial band which functions in walking to lift and flex the leg and to stabilize the upper thigh. Inflammation of this muscle from reflection and retraction lead to pain. Incomplete reattachment and inflammation of 2- gluteus medius and minimus is less significant factor than such involvement of the tensor fascia lata muscle. Both muscles i.e. gluteus medius and minimus have a shorter length than the tensor lata and the reattachment can be expected to 3- be more complete (no dense fascial band to hamper reapproximation and closure).

The lower pain scores were associated with use of the superior-lateral approach 4- is mostly due to little muscular stripping

at the outer table, that is necessary for walking and also due to use of the outer table.

In the superior approach, there is extensive muscular stripping (the gluteal and abdominal muscles), in the medial approach even the iliacus is smoothly adherent to inner table together with stripping of peristeum.

One of the most silent features of donor site pain was its resistance to treatment. None of the conventional treatment we used was successful and spontaneous resolution was very rare. Thus we used local infiltration of bupivacaine at iliac graft donor site to relieve pain. Bupivacaine hydrochloride (Marcaine) is long acting local anaesthetic related to lignocaine. Its duration of action is said to be 16 hours<sup>1</sup>. In our study, the effect of infiltration lasted for 20 hours after operation. The same results were obtained by Todd, 1991<sup>15</sup>, we believe that 20 ml of 0.5% bupivacaine is safe and effective and adrenaline prolongs its effect and reduces speed of systemic absorption<sup>16</sup>.

## Conclusions

The superior-lateral approach is associated with the lowest level of the measured pain at iliac graft donor site and this is mostly due to little muscles stripping in this approach and also due to the use of the outer table.

The superior approach is associated with the highest level of the measured pain at donor site, which is probably due to excessive muscles stripping and reflection of both gluteal and abdominal muscles.

Donor site pain is substantially higher in patients when both tables are involved in bone graft procedures.

Good reapproximation of the muscles and fascia lata attachment to

the ilium by minimizing muscles dissection and by rigid closure of the defect results in minimum post-operative pain.

- 5- Local infiltration of the donor site wound with bupivacaine produces a significant reduction in postoperative donor site pain and facilitates early mobilization of the patient. The infiltration provides

effective pain relief, the technique is simple and requires no special equipment.

### Acknowledgment

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