Assessing donor site pain after Iliac Crest Bone Graft

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Abstract

Objective: To evaluate the frequency and intensity of donor site pain after autogenous iliac crest bone graft harvest for arthrodesis of joints and non-union of fractures.

Methods: This prospective cross-sectional study was conducted in Orthopaedics Department from July to August 2021. After obtaining written informed consent, 156 patients who underwent iliac crest bone graft harvest were included in the study. The frequency and intensity of donor site pain were assessed using the Visual Analogue Scale (VAS) after one month postoperatively. Ethical approval was obtained prior to the conduction of study. A pre-structured questionnaire was used for data collection. Patients' data, including demographic details and pain-associated characteristics, were recorded and statistically analyzed using Statistical Package for the Social Sciences (SPSS) version 16.0.

Results: Out of 156 patients, most of them were males (61.5%). The mean age and pain score observed in the enrolled patients was 34.7 ± 9.5 years and 2.24 ± 2.01, respectively. 23% of the patients reported no pain after autogenous iliac crest bone graft harvest, 50.6% had mild pain, 20.5% reported moderate pain, and 5.7% had severe pain. The pain intensity was assessed in relation to gender and age; there was no significant difference in the mean VAS scores between males and females (p=0.45), where females had relatively higher VAS pain scores than males. Furthermore, stratification with respect to age showed no significant variation in the pain scores among different age groups (p=0.99). However, patients aged 26-35 years had the highest mean VAS pain scores (2.27 ± 1.80), in comparison to any other age group.

Conclusion: The donor site pain remains significant morbidity associated with iliac crest bone graft; only 23% were pain-free after one month of the surgery. Furthermore, no significant effect of age and gender have been observed on the pain intensity.

Keywords: Arthrodesis, bone graft, donor site pain, visual analogue scale, iliac crest.

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Introduction

Bone grafting is a well-established procedure in the field of orthopaedic surgery[1];it is most commonly used in fusion surgeries and in the treatment of non-union fractures. Both autograft and allograft could beutilized for grafting[2]; the source of autogenous bone may be the iliac crest, rib, and proximal tibia. Autogenous bone harvested from the iliac crest is considered a gold standard source for the bone graft procedure[3].

It is defined as a very economical and reliable source, associated with enhanced bone growth, and includes no risk of disease transmission like allograft[4]. Furthermore, it is readily available in sufficient quantities with all the essential properties like osteoinduction, osteoconduction, and osteogenesis. It has no risk of disease transmission like allograft and is a very economical source compared to other alternatives. Despite the high success rate, autogenous iliac crest bone graft harvesting also hampers certain risks like donor site morbidit-

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y. The reported complication rate ranges from 2.8% to 39%[5-8]. In comparison, other alternative procedures are expensive, less favourable biologically, and usually followed by a list of complications such as bone morphogenic proteins, etc[9].

Iliac crest bone graft harvesting has numerous risks. Hip bone fracture, hernia, hematoma formation, and wound infection are commonly reported among them. Furthermore, as an additional procedure, it increases the surgical time. The complications associated with the harvesting procedures are classified as major or minor depending on the severity of pain and quality of life effects[10]. Minor complications require no or minimal treatment and do not cause permanent disability, while major complications are associated with a prolonged hospital stay, permanent disability, and require additional surgical procedures. Furthermore, it is also classified as acute (perioperative) or chronic (late). Superior gluteal artery or sciatic nerve injury, deep wound infection, and requirement of additional operation at the graft harvest site are among the major acute complications. While long-lasting disabling pain, meralgia paresthetica, herniation, and pelvic fractures are the major chronic complications. minor dysesthesia, superficial infection, drainage problems are acute minor, and dysesthesia lasting for six months or more is one of the chronic minor complications[10]. Donor site pain after iliac crest bone graft harvest surgery is considered the most common complication. This pain, at a time, may be very annoying for the patients and may compromise daily activity. In the majority of these patients, pain is temporary in nature and improves with time. But in some patients, the pain may persist beyond three months and become chronic. The reported incidence of donor site pain after iliac crest bone graft harvest is 11% at three months[11].

The existing data presents a great variation in donor site pain incidence rate after the iliac crest bone graft harvest[6-9,11,12]. Several studies indicate a high frequency of long-term donor site pain experienced postoperatively after 2 years of the procedure. Among the major lacking in the literature are retrospective designs of the studies, inappropriate data collection, and patients' self-reported observations determining the pain frequency and intensity. One of the studies determined pain in the initial stages and concluded in favour of high-frequency pain, whereas it is known that the donor site pain usually improves over time. Therefore, such patients should be followed up for quite a time[7]. Furthermore, surgeons' and patients' pain perceptions greatly differ, as a study also identified greater pain intensity as per the surgeon's perception than the patient's[7]. But still, the pain has been determined by the chart review in most studies.

Several strategies have been discovered and applied to reduce the postoperative experience of donor site pain, such as local anaesthesia administered as separate injections or as an infusion with or without narcotics[13]. Studies suggest that the postoperative donor site pain in the acute phase could be handled via long-acting anaesthesia, while injection with added morphine appears to be more beneficial[14]. Whereas the chronic donor site pain hasn't been reduced using local anaesthesia. Furthermore, a continuous infusion of anaesthesia during the acute postoperative period using an indwelling catheter appeared ineffective in reducing the donor site pain. It may be associated with an increased risk of wound infection at the catheter site[15]. Other than these, several modifications are made to the iliac crest bone graft procedure to reduce morbidity[16]. No reduction in the donor site pain has been observed while keeping the outer and inner cortical tables intact[17]. The closed graft harvesting methods have been successful in retrieving small quantities of cancellous bone graft with cylindrical osteotomes and percutaneous needle techniques during craniofacial surgery. But it is ineffective in the case of retrieving sufficient quantities of graft and cannot be utilized for cortico-cancellous graft harvest[18].

Hence, the present study reports the prospective data on assessing donor site pain among the patients after autogenous iliac crest harvest for arthrodesis of joints and non-union of fractures. For the purpose of study, both intensity and frequency of donor site pain were assessed, and their association with the patient's age and gender were also determined.

Patients and Methods

This prospective cross-sectional study was conducted in the Orthopaedics Department from July to August 2021. A total of 156 patients of both genders, between 20 to 60 years of age and having bone grafts harvested from the iliac crest, were recruited via non-probability consecutive sampling techniques. The sample size was calculated using the Open Source Epidemiologic Statistics for Public Health (Open EPI) sample size calculator. The patients with a history of donor site infection, morbid obesity, uncontrolled diabetes with the sign of neuropathy, and with psychological disorders were excluded from the study.

An iliac crest bone graft was harvested from the anterior side in all patients. The incision was made in line with the skin crease. The iliac crest was exposed subperiosteally, and the required amount of cortico-cancellous bone was taken by using osteotomes of different sizes. The wound was closed in layers, and antibiotics were administered to avoid wound infections; a suction drain was used if there was significant oozing from the bone. In the end, Bupivacaine was injected subcutaneously.

The post-operative pain frequency and intensity were assessed using the Visual Analogue Scale (VAS); a score of 0 meant no pain, 1-3 indicated mild pain, 4-6 indicated moderate pain, and a score of 7-10 indicated severe pain. It was self-reported by the patient at a one-month postoperative follow-up.

The purpose of the study was explained to the patients, and written informed consent was obtained before inclusion. Ethical Committee approval was obtained from the Ethical Review Board of Bannu Medical College (Reference # 96/DiR&MJ/BMC/2020). Patients' data, including demographic details and pain-associated characteristics, were recorded using a pre-structured questionnaire. The statistical analysis was performed on Statistical Package for the Social Sciences (SPSS) version 16.0; categorical variables were presented as frequency and percentage, while mean and standard deviation were used for continuous variables. Independent sample T-test and one-way ANOVA - Analysis of variance, were used for comparing the mean pain scores with respect to age and gender; a p-value >0.05 was considered statistically significant.

Results

The baseline characteristics of the enrolled patients are given in table 1. The mean age of the patients was 34.7 ± 9.5 years; the majority of them were males (61.5%), while 38.5% were females. The mean Visual Analogue Scale (VAS) pain score was 2.24 ± 2.01.

It was observed that 23% of patients reported no pain at one month postoperatively after autogenous iliac crest bone graft harvest; 50.6% of the patients had mild pain, 20.5% had moderate pain, and 5.7% had severe pain, as shown in figure. 1.

Table 2 shows that there was no significant difference in the mean pain score with respect to age and gender (p>0.05). The mean VAS pain score was comparatively higher among females (2.23 ± 0.10) than males (2.23 ± 0.09). Moreover, the mean pain score was highest among patients aged 26-35 years (2.27 ± 1.80).

Table 1. Baseline characteristics of the study population

Variables		n (%)
Gender	Male	96 (61.5)
	Female	60 (38.5)
Age; years (Mean ± SD)		34.7±9.5
VAS pain score (Mean ± SD)		2.24±2.01

Table 2. Mean VAS pain scores with respect to age and gender

Variables		Mean VAS pain score	p-value
Gender	Male	2.23±0.09	0.45
	Female	2.26±0.10	
Age group	18-25 years	2.22±2.11	
	26-35 years	2.27±1.80	0.99
	36-45 years	2.24±2.14	
	> 45 years	2.20±2.06	

*p<0.05 is considered significant

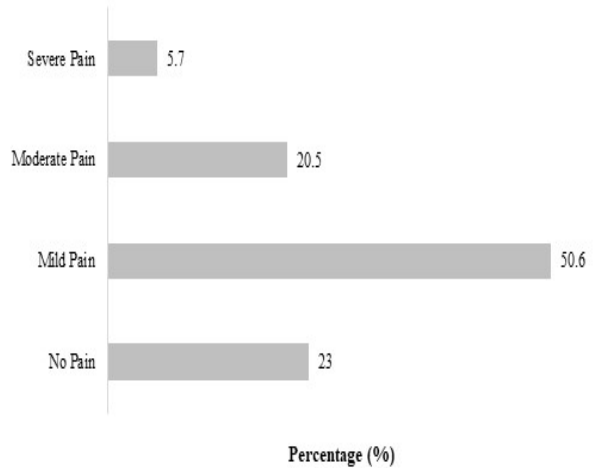

Fig 1. Intensity of donor site pain at one-month follow-up

Discussion

Autogenous iliac crest bone graft harvest has been considered a gold-standard graft procedure for spinal fusion. Despite the high success rate of various patients and treatments, associated factors must be considered to avoid pseudarthrosis following the procedures as it plays an important role in improving the patient outcomes[19]. Literature confirms that the fusion rates are highly affected by osteoporosis, diabetes, smoking, number of levels treated, instruments or interbody grafts used, and surgical methods applied[20,21].

Post-operative donor site pain has long been identified as the most frequently reported morbidity associated with autogenous iliac crest bone graft[6-8]. However, a recent study from Florida implied that the post-operative pain among patients who underwent iliac crest bone graft is usually over-reported. The researchers identified no significant difference in the pain score, post-operatively at the iliac and contralateral iliac crest sides[22]. Hence, the true picture of morbidity remains controversial, as the incidence rate varies greatly across the studies[5-9,22]. The present study aimed to assess the frequency and intensity of donor site pain after iliac crest harvest. More than 50% of enrolled cases reported mild pain at onemonth postoperative follow-up. In contrast, a similar study with comparatively long-term follow-up (2-years) identified persistent donor site pain in 31% of the patients after iliac crest graft harvest[23], which is low compared to that reported in the present study and also supported by existing literature[6-8].

Pain after the anterior ilium bone graft harvesting has various causes, and it can be due to wound infection, stress fracture, hematoma, damage to cutaneous nerves, and the surgery itself. A study reported that the donor site pain lasts for an average of 3.75 weeks regardless of its pathology. Symptoms of discomfort resolve in 90% of patients within one month, but 3% of the patients can have persistent pain lasting for more than 3 months[24]. Some studies have also shown patients complaining of protracted pain for more than a year after iliac crest bone harvesting (29%)[24].

The ilio-inguinal and ilio-femoral nerves injury is quite a common complication of anterior iliac graft harvesting and is the source of intractable pain. When the lateral femoral cutaneous nerve is injured during surgery, Meralgia Paresthetica can occur[24]. Its symptoms may include numbness, paresthesia, and pain over the anterolateral thigh instantly after surgery, and these symptoms are aggravated with ambulation[25].

Although the success rate of the iliac crest bone graft is recommendable, the associated donor site pain has been the prime concern. Most of the cited literature comprises level III and IV data. Banwart and colleagues, in a retrospective mail su-

rvey, reported a 10% complication rate, and 3 of them experienced affected function secondary to pain[26]. Fernyhough et al. concluded that the pre-operative diagnosis is a far more significant factor affecting the frequency of donor site pain than the surgical graft harvest approach [27]. They found that the frequency of chronic pain was 2 times higher among patients with donor sites harvested for reconstructive spinal procedures than those harvested for spinal trauma, i.e., 39% Vs. 18%, respectively. But as the study lacked the data on pre-operative posterior iliac crest pain, the results cannot be generalized, as it must be essentially taken into account.

Studies with multiple follow-ups showed that the mean VAS scores gradually increase from baseline until 2 days post-operation and then again start decreasing. Sasso et al. reported no pain in 17% of the patients after 6 weeks and in 43% of the patients after 3 months of the surgery[23]. While Clarke et al. described no pain at the donor site among 89% of patients by 3 months after the surgery[28]. The present study only described the pain frequency and intensity once, i.e., one month after the procedure, which is the major shortcoming. The observed mean VAS score was 2.24 ± 2.01. Although the frequency of pain-free patients in the present study was relatively low i.e., 23%, when compared with the results of Sasso et al., at 6 weeks of follow-up[23], . Literature confirms that the intensity of donor site pain is limited by the size and quality of the harvest. Parallel to our findings, Skeppholm et al. reported an average VAS score of 2.7 at 4 weeks of follow-up[28].

A more detailed investigation was carried out to identify the potential individual factors influencing the pain occurrence. The association of pain intensity with age and gender was observed, and it was found that there was no significant association among the studied factors ($p>0.05$). Similarly, Clarke et al. also intended to study the factors affecting the pain occurrence; they studied the effect of age, gender, body mass index (BMI), comorbidities, wound length, complications, etc[29]. None of these factors significantly affected the donor site pain after the graft was harvested, except the procedure (indication)[29]. We observed no major complications, which were resolved later, and no further surgical interventions were required; these findings are consistent with prior studies[30-32].

The prospective nature of the present study was its major strength, while among the shortcomings were the inability to assess the amount of bone harvested, pain intensity over long-term follow-up, length of the iliac crest wound, and comorbid conditions (if any). All these could be significant modifiers of the pain frequency or intensity in the local population. Furthermore, we only focused on the pain intensity as per the patient's perception, which tends to differ from that reported by physicians usually as per the existing literature. Hence, it is recommended that large-scale studies with multiple follow-ups should be conducted focusing on the donor site pain intensity over a long period of time and the cofactors associated with it.

Conclusion

Though the iliac crest bone graft remains the gold standard harvesting procedure, based on the present study outcomes, it is not definitive to conclude that it is associated with no pain and complication rate in the local population enrolled as we observed mild donor site pain in half of the patients after iliac crest bone graft harvest surgery. But with this short follow-up duration, these inferences could not be generalized. Hence, it is recommended that large-scale studies with multiple follow-ups should be conducted focusing on the donor site pain intensity over a long period of time and the cofactors associated with it.

Conflict of Interests

The authors have no conflict of interests and received no grant/funding from any organization.

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