Annals of Case Reports
Unterfrauner U, et al. Ann Case Rep: 7: 1087
www.doi.org/10.29011/2574-7754.101087
www.gavinpublishers.com

OPEN ACCESS
GAVIN PUBLISHERS

Research Article

Surgical Site Infections at Donor and Recipient Sites in Patients with Iliac Crest Harvesting For Autologous Bone Grafting - A Pilot Evaluation

Ines Unterfrauner[1], Maurits Olthof[1], Peter Jans[2], Regula Schüpbach[3], Michael Betz[1], İlker Uçkay[3,4*]

[1]Orthopedic Department, Balgrist University Hospital, Zurich, Switzerland

[2]Medical Informatics Service, Balgrist University Hospital, Zurich, Switzerland

[3]Unit of Clinical and Applied Research, Balgrist University Hospital, Zurich, Switzerland

[4]Infection Control, Balgrist University Hospital, Zurich, Switzerland

[*]**Corresponding author**: İlker Uçkay, Balgrist University Hospital, Forchstrasse 340, 8008 Zürich, Switzerland

Citation: Unterfrauner I, Olthof M, Jans P, Schüpbach R, Betz M, et al. (2022) Surgical Site Infections at Donor and Recipient Sites in Patients with Iliac Crest Harvesting For Autologous Bone Grafting - A Pilot Evaluation. Ann Case Report. 7: 1087. DOI: 10.29011/2574-7754.101087

Received Date: 09 December 2022; **Accepted Date**: 13 December 2022; **Published Date**: 15 December 2022

Abstract

Surgeons harvest the iliac crest for bone grafting. The epidemiology of surgical site infections (SSI) associated with this procedure at the donor, or recipient site, is unknown. We perform a retrospective pilot evaluation of adult patients undergoing first-time orthopedic surgery at the Balgrist University Hospital between 2014-2019. We excluded patients with infection at the index surgery, diabetic foot surgeries, superficial SSIs, and revision surgeries. We included 20,088 episodes of primary orthopedic surgery, of which 467 with iliac crest bone sampling (467/20,088; 2%). Only two iliac sites (2/467; 0.4%) become infected. In contrast, surgeries with iliac crest sampling yielded more SSIs at the recipient site than those without (1.9% vs. 0.8%; χ^2-test; p<0.01). These patients equally revealed more co-morbidities such as a longer duration of surgery (median 127 vs. 79 minutes), when compared to the general orthopedic population. In multivariate logistic regression analysis with the outcome "*SSI at the recipient site*", the iliac harvesting was independently associated with deep SSIs requiring surgical revision (odds ratio 2.1; 95% confidence interval 1.1-4.2). In our pilot evaluation with 20,088 primary orthopedic surgeries, the SSI risk of the iliac harvest site was low. In contrast, surgeries with supplementary iliac crest harvesting revealed a higher SSI risk than the general orthopedic population, potentially due to a mix of local independent risks of grafting together with a prolonged surgery time.

Keywords: Autologous bone grafting; Deep surgical site infections; Epidemiology; Iliac crest harvesting; Revision surgery

Introduction

Surgeons often restore osseous defects with autologous bone grafting, which is believed to be osteo-inductive, osteo-genetic and osteo-conductive [1]. The iliac crest represents the perfect donor site due to the ample quantity of retrievable bony graft and the possibility for tricortical grafts when structural support is needed [2]. However, iliac bone harvesting may be associated with substantial complications in up to 10-30% of cases [3]: persistent wound drainage, hematoma requiring revision, prolonged pain, persistent loss of sensibility and unfavorable scar formation with cosmetic deformity [3]. The epidemiology of deep surgical site infections (SSI) at the iliac site equally remains largely unknown. This procedure represents another clean intervention, but usually without preceding perioperative antibiotic prophylaxis. Hence, the ideal timing regarding the antibiotic effects administered might be suboptimal for the donor site. In the sparse literature on this topic, the SSI incidence at the iliac site oscillates between 0% [3] and 7% [4], with less than 100 surgeries.

Patients and Methods

We edified a composite database including all first-time (index) orthopedic surgeries at the Balgrist University Hospital between April 2014 and June 2019. We closed our database in May 2020; one year after the inclusion of the last surgery and excluded patients with local orthopedic infections prior to index surgery, pediatric cases, revision surgeries, diabetic foot surgeries or superficial SSIs not requiring revision in the operating theatre. The primary outcome was the deep SSI incidence at the iliac (donor) site. The secondary outcome was the SSI risk at the recipient site among those with iliac harvesting. We defined deep SSI according to internationally accepted norms [5]. In a second step, we compared clinical variables of surgeries with bone grafts to a general cohort of 19,621 primary orthopedic surgeries without iliac crest harvesting, using the Pearson-χ^2 or the Wilcoxon-ranksum-test, as appropriate (Table 1). Finally, we adjusted for the large case-mix by incorporation the iliac crest harvesting into a multivariate logistic regression model with the secondary outcome "SSI at the recipient site" (Table 2) and reviewed the available scientific literature (Table 3).

Results

We revealed 20,088 episodes of primary orthopedic surgery, of which 467 with iliac crest sampling (467/20,088; 2%). Only two iliac sites (2/467; 0.4%) become infected. With such few numbers, we were unable to perform group comparisons or multivariate analyses for iliac SSIs. The reason for our low proportion of harvested bone is the limitation to primary surgeries, as we had excluded revision surgeries that are more prone to bone grafting.

Regarding the secondary outcome, surgeries with iliac crest sampling yielded significantly more deep SSIs (9/467; 1.9%) at the primary (recipient) site than those without (149/19,621; 0.8%). Likewise, patients with iliac crest harvesting also revealed more classic risk factors for SSI, when compared to the general orthopedic population (Table 1). In multivariate logistic regression analysis, we confirmed iliac harvesting as an independent risk for deep SSI (odds ratio 2.1; 95% confidence interval 1.1-4.2) (Table 2). Unfortunately, the wound dressing modalities on the wards and the timing of perioperative antibiotic prophylaxis were too aleatory to be included into this multivariate model. Indeed, the iliac harvesting occurred at different timepoints during operations (at begin, middle or end; with only one prophylaxis administered at the start). Some operations started with iliac crest harvestings, others finished with it. Likewise, the duration of the harvesting equally varied; with an estimated additional time between 25 and 50 minutes. Similarly, there were no exact incision techniques, leading to a considerable variation of the wound length for harvesting. Available literature is sparse regarding deep SSIs at the donor sites (Table 3). Using the MeSH terms "*infection*" or "*surgical site infection*", together with "*iliac crest*" or "*graft*" or "*harvest*", we retrieved 181 hits in PubMed at the end of July 2020, by excluding single case reports. The majority of the articles concerned the use of bone grafts for non-unions. Only eight publications reported the SSI risk at the graft donor site, while none indicated the SSI incidence at the recipient sites (Table 3) [6-10]. In this literature, the deep SSI incidence at the iliac crest oscillates between 0-7%, while no article investigates the associated variables due to the paucity of cases.

	Iliac crest harvesting		**No bone graft harvesting**
n = 20,088	n = 467	p value*	n = 19,621
Female sex	218 (47%)	0.24	9,624 (49%)
Median age	50 years	**0.01**	53 years
Diabetes mellitus	29 (6%)	0.08	887 (5%)
Oncologic orthopaedic surgery	8 (2%)	0.14	564 (3%)
Median duration of surgery	127 minutes	**0.01**	79 minutes
ASA-Score ≥ 3 points	81 (18%)	0.17	2,813 (15%)
Median body mass index	25.4 kg/m^2	**0.01**	26.0 kg/m^2
Median length of hospital stay	4 days	**0.01**	3 days
Deep surgical site infection (recipient site)	9 (1.9%)	**0.01**	149 (0.8%)

ISSN: 2574-7754

ASA = American Society of Anaesthesiologists. *Pearson-χ2 or Wilcoxon-ranksum-tests, as appropriate.

Table 1: Patient populations with and without iliac crest harvesting for bone graft.

	Univariate results	Multivariate results
n = 20,088		
Age (*continuous variable*)	1.0, 1.0-1.0	1.0, 1.0-1.0
Body mass index (*continuous variable*)	***1.1, 1,1-1.1***	***1.1, 1.1-1.1***
ASA-Score 2 compared to Score 0-1	***1.9, 1.2-3.1***	1.6, 0.9-2.7
ASA-Score 3 compared to Score 0-1	***4.4, 2.7-7.3***	***2.8, 1.5-5.3***
ASA-Score 4 compared to Score 0-1	***6.0, 1.8-20.4***	***4.1, 11-15.0***
Diabetes mellitus	***3.8, 2.5-5.9***	***2.4, 1.5-3.8***
Oncologic orthopaedic surgery	***2.6, 1.4-4.8***	***2.9, 1.5-5.4***
Operation duration (*continuous variable*)	> 100	not done
1.5-2 hours compared to <1h	1.1, 0.7-1.7	0.9, 0.6-1.5
2 hours compared to <1h	***2.6, 1.8-3.8***	***1.9, 1.3-2.8***
Iliac crest bone graft harvesting	***2.6, 1.3-5.1***	***2.1, 1.1-4.2***
Statistically significant results are displayed in ***bold and italic.*** ASA = American Society of Anaesthesiologists' Score.		

Table 2: **Logistic regression with outcome *"infection at the recipient site"*.** *(Results expressed as odds ratios with corresponding 95% confidence intervals; goodness-of-fit test of the multivariate model; p=0.11*).

Journal, year	First Author	Study population	SSI donor site	SSI recipient site	Remarks
J Neurosurg Spine, 2014	Pirris SM, et al.	Spine patients, n=25	4%	not reported	Clinical article
Injury, 2014	Calori GM, et al.	Orthopaedic trauma, n=70	7%	not reported	Introduces a new reaming method
Int Orthop, 2014	Hernigou P, et al.	Orthopaedics, n=435	0%	not reported	Only two superficial scar infections
Injury, 2011	Dimitriou R, et al.	Orthopaedic surgery	1.90%	not reported	Systematic review article; no own cases
Spine J, 2009	Kim DH, et al.	Spine patients, n=110	not reported	not reported	Literature review on pain
West Indian Med J, 2008	Palmer W, et al.	Orthopaedic surgery, n=30	0%	not reported	Pain assessment
J Oral Maxillofasc Surg, 2006	Swan MC, et al.	Oral surgery, n=73	3%	not reported	Literature review on pain
Spine, 2003	Silber JS, et al.	Cervical spine, n=187	1.50%	not reported	Pain assessment by questionnaires

Present report	*Unterfrauner et.al*	*Primary orthopaedics*	*0.40%*	*1.90%*	*University orthopaedic centre; n=20,088*

Table 3: Literature review of deep surgical site infections (SSI) at the donor (iliac crest) and recipient sites (exclusion of case reports).

Discussion

Our single-center pilot evaluation with 20,088 primary orthopedic surgeries found a very low SSI risk (0.4%) in the iliac harvest (donor) site. In contrast, first-time surgeries with supplementary bone grafting yielded higher SSI risks (1.9%) at the recipient sites, when compared to the general orthopedic population (0.8%). The reasons might be multiple. First, we identified the bone grafting as a separate association for SSI in our multivariate analysis. Additionally, patients with bone grafting revealed more classic risk factors for SSI, such as a long operation time. Furthermore, we speculate that the order of the two interventions needs to be fixed. Probably, the perioperative antibiotic prophylaxis (with correct timing) should target the primary site, leaving the harvesting at the end. Alternatively, the repetition of the antibiotic prophylaxis during harvesting might be considered, in as much as the bone harvesting may last up to 50 minutes. These are future investigations.

Conclusion

In our pilot evaluation with 20,088 primary orthopedic surgeries, the SSI risk of the iliac harvest site was low. In contrast, surgeries with supplementary iliac crest harvesting revealed a higher SSI risk than the general orthopedic population, potentially due to a mix of local independent risks of grafting together with a prolonged surgery time.

Acknowledgements

We are indebted to all professional teams of the Balgrist University Hospital for support.

Disclosure statement

The authors declare that they have no competing interests.

Funding

The Balgrist University Hospital supported our project with an internal funding of 1,000 Swiss Francs (equaling 1,000 US$).

Availability of data and material

We may share anonymized key data upon reasonable request to the corresponding author.

Author's contribution

IU 1: concept, investigation, writing. MGLO: concept, investigation, correction. PJ: data mining. RS: regulatory aspects, organization. MB: concept, investigation, review. IU 2: idea; concept, investigation, analyses, writing.

Ethics approval

This study is a side study (side analysis) of a larger retrospective study, which was approved by the local Ethical Committee in Zurich (BASEC 2019-00849). The study was carried out in accordance with the declaration of Helsinki.

All authors declare no financial support, grants, financial interests or consultancy that could lead to conflicts of interest. Parts of the manuscript will be presented online at the 80th Swiss National Congress of Orthopedic Surgery on 27 August 2020 in Basel, Switzerland.

References

1. Bauer TW, Muschler GF (2000) Bone graft materials: an overview of the basic science. Clin Orthop Relat Res 371:10-27.
2. Dimitriou R, Mataliotakis GI, Angoules AG, Kanakaris NK, Giannoudis PV (2011) Complications following autologous bone graft harvesting from the iliac crest and using the RIA: A systematic review. Injury 42: 3-15.
3. Kim DH, Rhim R, Li L, Martha M, Swaim BH, et al (2009) Prospective study of iliac crest bone graft harvest site pain and morbidity. Spine J 9: 886-892.
4. Calori GM, Colombo M, Mazza EL, Mazzola S, Malagoli E, et al (2014) Incidence of donor site morbidity following harvesting from iliac crest or RIA graft. Injury 45: 116-120.
5. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR (1999) Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. Am J Infect Control 27: 97-132.
6. Pirris SM, Nottmeier EW, Kimes S, O'Brien M, Rahmathulla G (2014) A retrospective study of iliac crest bone grafting techniques with allograft reconstruction: do patients even know which iliac crest was harvested? Clinical article. J Neurosurg Spine 21: 595-600.
7. Hernigou P, Desroches A, Queinnec S, Lachaniette CHF, Poignard A (2014) Morbidity of graft harvesting versus bone marrow aspiration in cell regenerative therapy. Int Orthop 38: 1855-1860.
8. Swan MC, Goodacre TE (2006) Morbidity at the iliac crest donor site following bone grafting of the cleft alveolus. Br J Oral Maxillofac Surg 44: 129-133.
9. Palmer W, Crawford-Sykes A, Rose REC (2008) Donor site morbidity following iliac crest bone graft. West Indian Med J 57: 490-492.
10. Silber JS, Anderson DG, Daffner SD, Brislin BT, Leland JM (2003) Donor site morbidity after anterior iliac crest bone harvest for single-level anterior cervical discectomy and fusion. Spine (Phila Pa 1976) 28: 134-139.