ORIGINAL ARTICLE

The use of locally harvested bone chips as a graft in spine fusion surgery

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Abstract

Objective: To evaluate the outcome of local corticocancellous bone chips used for fusion in various kinds of spine surgeries.

Methods: The observational prospective study was conducted at the Hayatabad Medical Complex, Peshawar, and Aman Hospital, Peshawar, from April 2011 to April 2013, and comprised cases in which locally harvested bone chips removed during decompression were used as bone graft for arthodesis. All cases were successfully followed up for at least one year. SPSS 16 was used for statistical analysis.

Results: Of the80 patients in the study, 44(55%) were female and 36(45%) were male. The overall mean age was 39.5±12.7 years (range: 13-75 years). Besides, 34(42.5%) were operated for spine surgery, 22(27.5%) for spondylolisthesis, 12(15.0%) for disc degeneration and 12 (15%) for spinal stenosis. In 54(67.5%) patients posterio-lateral fusion with decompression was done, while in 26(32.5%) transforaminal lumbar interbody fusion was done. Oswestry Disability Index scoreat last follow-up ranged from 4 to 56 with a mean of 17.7±10.7.

Conclusion: Locally harvested bone chips are reasonable alternative to iliac crest bone graft, having comparable results while avoiding donor site morbidity associated with iliac crest bone grafts.

Keywords: Bone graft, Iliaccrest, Locally harvested bone graft, Spine surgery. (JPMA 64: S-87 (Suppl. 2); 2014)

Introduction

Spinal fusion is the main goal of many spine surgeries in order to achieve long-term good results.[1] Spine fusion surgeries are constantly on the rise in the world and the evidence in its support is also increasing.[2] Different types of bone and bone substitutes are used in order to achieve fusion, including autogenous bone graft, allograft, bone morphogenic protein (BMP) and different kinds of bone substitutes.[3] Autogenousiliac crest bone graft (ICBG) has the most favourable biology, low cost, ready availability and are considered the gold standard.[4] But this comes with a price of morbidity, most commonly chronic pain at bone graft site, 2nd surgery, increase in the time of surgery and blood loss.[5,6]

In different spine surgeries when decompression is performed, the removed spinous process, lamina and often part of facet joint are a good alternative source of bone for fusion. It is autogenous and has almost the same biology like bone graft harvested from the iliac crest.[7] This bone can be used both for postero-lateral fusions (PLF) and inter body fusions like transforaminal lumbar interbody fusion (TLIF). Sometime it may not be of as good a quality as the iliac crest bone, the sclerotic bone may be predominant in older patients. The length of bone may be only sufficient for a single-level fusion rarely 2 levels.[8] There is now sufficient data considering it equally effective source of bone graft in selected patients.[7-9]

So whenever we treat spinal fractures or degenerative disorders in which decompression is required, the removed bone is carefully collected and used as a bone graft. In the current study, we mainly focused on functional outcome using Oswestry Disability Index (ODI). Plain radiographs were performed routinely on each follow-up but detailed radiology for non-union was only done in selected patients. Majority of the studies done on this aspect are international and these mainly focus on degenerative disorders. The current study was planned to clarify the outcome in the local context.

Patients and Methods

The observational prospective study was conducted at the Spine Unit of the Department of Orthopaedic and Spine Surgery, Hayatabad Medical Complex, Peshawar, and Aman Hospital, Peshawar, from April 2011 to April 2013.

It comprised patients in whom exclusively locally-harvested bone chips removed during decompression were used as a graft material for spinal fusion. Those having less than a year's follow-up were excluded.

Informed consent was taken from all patients for the

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primary surgery, mentioning clearly that bone graft may be taken from iliac crest if required. All the patients were thoroughly prepared preoperatively. Trauma patients were first stabilised according to Advanced Trauma Life Support (ATLS) protocol. In patients with disc degeneration disease, psychological components were kept in mind. Bone graft in these patients was obtained during decompression from lamina, spinous process and part of facets in TLIF. Soft tissue from the bone was removed and then cut into small chips. Bone was used for posterior-lateral or interbody fusion. At the end of the surgery, drain was used in most of the cases and intravenous (IV) antibiotics were used for 5 days. Initial mobilisation was done as early possible. All patients were followed up at 2 weeks, then monthly for 3 months, and then every 3 months for one year. At every follow-up, plain radiographs were obtained to assess the implant, and to see if there was any sign of failure or deformity progression. At 3 months and thereafter every three months functional assessment was done using ODI. Patients were not assessed routinely for union progression. If non-union was suspected, the modified Lee criteria9 was used. All data was analysed using SPSS 16.

Results

Of the 80 patients in the study, 44(55%) were female and 36 (45%) were male. The overall mean age was 39.5±12.7 years (range: 13-75 years) (Table-1).

Table-1: Statistics.

		Age in Years	VAS	ODI Scoring At Last Follow Up
N	Valid	80	80	68
	Missing	0	0	12
Mean		39.49	3.7000	17.6912
Median		40.00	4.0000	16.0000
Mode		45	4.00	8.00
Std. Deviation		12.767	1.06021	10.66065
Minimum		13	1.00	4.00
Maximum		75	7.00	56.00

VAS: Visual Analogue Score
ODI: Oswestry Disability Index.

Table-2: Diagnosis.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Spondylolisthesis	22	27.5	27.5	27.5
	Spine Fractures	34	42.5	42.5	70.0
	Spinal Stenosis	12	15.0	15.0	85.0
	Disc Degeneration Disease	12	15.0	15.0	100.0
	Total	80	100.0	100.0	

Table-3: Disability severity.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Minimal	44	55.0	55.0	55.0
	Moderate	22	27.5	27.5	82.5
	NA	12	15.0	15.0	97.5
	Severe	2	2.5	2.5	100.0
	Total	80	100.0	100.0	

Table-4: Diagnosis-disability severity cross-tabulation.

		Minimal	Moderate	NA*	Sever	Total
Diagnosis	Spondylolisthesis	10	11	0	1	22
	Spine fractures	21	1	12	0	34
	Spinal stenosis	6	5	0	1	12
	Disc degeneration disease	7	5	0	0	12
Total		44	22	12	2	80

*NA 12 is missing ODI was not calculated.

The most common surgery was for spine factures in 34(42.5%) patients, followed by 22(27.5%) for spondylolisthesis, 12(15.0%) for disc degeneration and 12(15%) for spinal stenosis (Table-2). In 54(67.5%) patients PLF with decompression was done, while in 26(32.5%) patients TLIF was done.

ODI scoring at last follow-up ranged from 4 to 56 with a mean of 17.7±10.7.Of the total, 44(55%) had minimal disability, 22(27.5) had moderate, 2(2.5%) had severe disability, while in 12(15%) patients ODI scoring was not possible due to their neurological condition (Table-3). In these patients, back pain intensity was measured by visual analogue score (VAS) and radiological features were considered for outcome measurements. In 6(7.5%) patients, VAS was 4, in 4(5%) It was 3 and in 2(2.5%) it was 5.

Out of 34(42.5%) trauma patients, there was only 1(2.9%) with moderate disability and 21(61.7%) had minimal disability. In 12(35.3%) patients with trauma, ODI scoring could not be done. Among those with degenerative disk disease (DDD), 7(58.3%) of the 12 patients had minimal disability, while 5(41.7%) had moderate. Out of 22(27.5%) patients of spondylolisthesis, 10(45.4%) had minimal disability, 11(50%)had moderate and 1(4.6%)had severe disability. Of the 12(5%) patients treated for spinal stenosis 6(50%) had minimal, 5(41.3%) had moderate and 1(8.7%) had severe disability (Table-4).

Overall, there were complications in 6(7.5%) cases. Among them, 3(50%) developed infection diagnosed on the bases of pain, fever and discharge. They were in early postoperative period. Wound exploration was

performed immediately with specimen sent for culture, wound was washed and closed. All the three responded well and were kept for 2 weeks on IV antibiotics and then on oral antibiotics. Two (33.3%) patients in whom short segment fixation was done for trauma came with implant failure with no signs of deformity progression and pain. Only the implants were removed and both did well. One (16.6%) patient in whom TLIF was performed 2 years back came with severe pain, disability (56 ODI) for a month due to implant failure. Chronic infection was excluded by erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). Also, 3D computed tomography (CT) was done and it showed no fusion. He was re-operated. Readjustment of pedicle screws and rod construct was done and bone graft taken from the iliac crest was put in. He had dramatic relief soon after the surgery.

Discussion

It is a well-established fact that iliac crest is the most common source of bone harvest in spine surgery. It has overall good results in terms of fusion rates and functional outcomes.[10] In our part of the world it is almost exclusively the sole source of bone graft as here financial issues come into play and majority of our patients cannot afford allografts, bone substitutes and bone morphogenic proteins.

A study of 224 patients reported the results of single-level instrumented PLF with ICBG. It reported 7.6% graft-related complication and achieved union in about 90% patients at 2 years. The mean ODI score was 25.3.[11] In one of our previously published series of 139 patients, 45(32.4%) had some pain at the bone graft site; 8(5.8%) had early deep infection, 6(4.3%) had early superficial infection, and 9(6.4%) patients had superior gluteal nerve injury evident by parasthesia in the zone of distribution.[12] As is evident from our data, laminectomy bone chips used as a bone graft are free of these complications. The overall results are comparable. In our study the mean ODI was 17.7 and majority had minimal disability. Our score may look good compared to the above study, but it may be due to the fact that our sample was comparatively diverse. If we only compare our patients with degenerative disorders, then majority of the patients had moderate disability like them.

One study compared the results of ICBG and laminectomy bone chips. It reported 65% fusion rate for locally harvested bone graft, while 75% for ICBG. But in single-level fusion rate, locally harvested bone chips achieved 80% fusion. There was slightly better Improvement in ODI score compared to ICBG group, but it was not statistically significant. Clinical outcome was not related to fusion.[13] This is why we focused in our study on functional aspects rather than on radiology.

A study on the use of laminectomy bone chips in the treatment of lumbar spondylolisthesis reported 94% union.[14] Similarly, another study reported 90% union rate for laminectomy bone chips although it had mixed it with bone morphogenetic proteins (BMP).[15] Though our study focused on functional outcomes and not all the patients were followed up for 2 years, our results are comparable to these studies.

If locally harvested bone graft produces comparable results and avoidsmorbidity of ICBG, it is a good alternative and should be used wherever the conditions permit.

Conclusion

Locally harvested bone chips are reasonable alternatives to ICBG, which produces comparable results in selected patients and avoid the morbidity associated with ICBG harvest.

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