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ORIGINAL ARTICLE

BEST OUT OF WASTE: USE OF EXCISED FEMORAL HEAD AS ALLOGRAFTS

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ABSTRACT: There is definite value of bone grafting in Orthopedics, especially allografts as and when required. There are bone banks in some metro cities and procuring the grafts is difficult and costly tasks. Such facilities are not available in peripheral and rural set up in developing countries like India. One has to depend and develop his own solutions to the problem being faced in day to day activities. Lytic lesions and bone loss in traumatic patients remain challenge when autogenous cancellous graft is scanty or difficult to retrieve such as those in younger child. We have developed our own technique of using cancellous, copious allograft from autoclaved femoral head which are available following arthroplasty. Tissue typing is not required as the graft is autoclaved. We have gratifying results and are waiting for long term follow-up.

KEYWORDS: Excised Femoral head, cancellous graft, bone defects.

INTRODUCTION: Bone grafting has been a proved as standard technique in some orthopedic procedures like filling of bone defects as in:

1. Bone loss in high velocity injuries including intra-articular fractures.
2. Cases of lytic bone lesions.

They play an important role in Osteogenesis Routine treatment of such bone defects include:

1. Use of bone substitutes
2. Bone cement
3. G bone
4. Allografts

In our general hospital, where maximum patients are from poor economic strata, the above said procedures are not affording and there is non-availability of bone bank.

Many patients present late after months of trauma with delayed and non-union. Also, additional surgery for donor site gives additional morbidity and delay to return to work as most of them are farmers.

Intracapsular fracture neck femur in elderly is treated with:

1. Girdlestone – excision arthroplasty
2. Hemiarthroplasty- Austin Moore prosthesis/ Bipolar
3. Total arthroplasty

Preserved femoral heads were used as Allografts.

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METHODOLOGY: Retrieved head of femur was:

- Washed with normal saline.
- Packed in polythene bag.
- Labelled and preserved in deep freezer.
- Used preferably within 8 days.

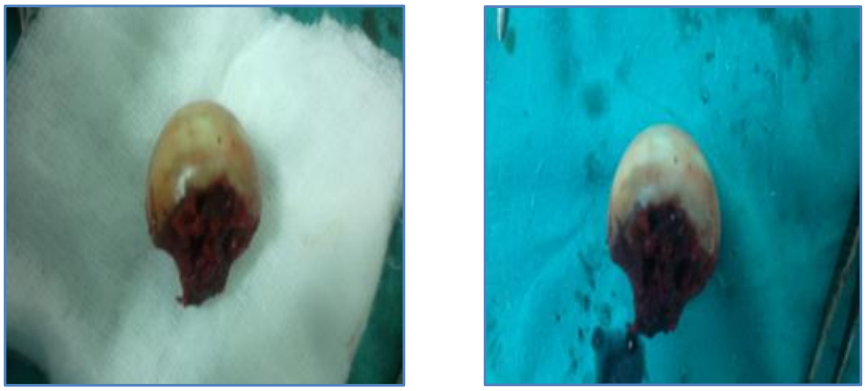

Fig. 1: Retrieved head of femur

Informed consent taken in vernacular language from both donor and recipient Head was stored for maximum duration of 3 weeks.

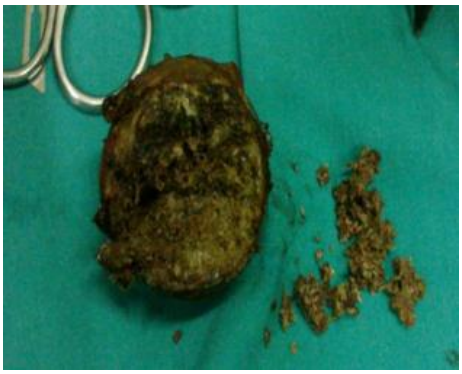

Fig. 2: Cancellous graft retrieved from the autoclaved head of femur

ADVANTAGES: Femoral head has osteo-conductive and heals with creeping substitution. Basic bone remodelling occurs at graft-host interface. Bone resorption is followed by bone reproduction.

Allograft:

1. Avoids additional scar
2. Decreases Morbidity
3. Reduces anaesthesia and surgical time
4. Bone loss at donor site is avoided
5. Complications following retrieval of bone grafts are avoided in children, Bone is not mature and there is risk of epiphyseal injury while retrieving bone grafts. Besides, it is free of cost and easily available.

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CONTRAINDICATIONS: It is not indicated for excision of head done for:

1. Malignancy (secondaries)
2. Infection
3. Severely Osteoporotic bone (allograft was retrieved from the head with good bone stock)

INDICATIONS: Following were the indications where we have used allografts:

1. Lytic benign lesions of bone especially in young age group presenting as bone cyst or non-Hodgkin's lymphoma where procuring adequate autograft is difficult because cavity is large & donor site is limited.
2. Comminuted condylar fractures of Tibia with wide gap
3. Non-union &Delayed union.(In these cases, allograft were mixed with autograft)
4. Also used for neglected and delayed presentation of trauma cases.

RESULTS: Following cases were done:

- 6 cases of bone cyst.
- 3 cases of non-union.
- 3 comminuted fractures of Tibial condyle.
- 4 cases of delayed union
- 1 case of non-Hodgkin's lymphoma
- 1 case of GCT

Fig. 3: Preopxray of comminuted intra-articular condylar fracture of tibia

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Fig. 4: Intra-operative photograph of same patient, defect being filled with autoclaved cancellousallograft retrieved from head of femur

Fig. 5: Postop xray showing internal fixation and graft

In some cases, autogenousc ancellous grafting was also done simultaneously to promote healing by osteo-inductive property.

Fig. 6: Aneursymal bone cyst of tibia filled with allograft

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Patients were followed up for 3 to 18 months; assessed clinically and radio logically. Weight bearing was advised accordingly. There was no any evidence of:

1. Infection,
2. Allergic reaction
3. Graft rejection or any other complication Average time of remodelling was 5- 8 months.

DISCUSSION: The technique was introduced into the UK by Ling at Exeter in 1987. Slooff and colleagues[1, 2] published their results of impaction grafting with 79% stable graft at 15 years and Ornstein et al.[3] produced 71% stable graft with 2-year follow-up the mechanical strength of well-graded morselised bone was greater than that of a more uniform size.[4,5] The aim of impaction grafting is to restore living bone around the implant without affecting its stability. The technique of impaction bone grafting was first introduced by Slooff and co-workers in Nijmegen, in the late 1970s[6, 7]

Immediately after impaction bone grafting, the mechanical properties of the impacted bone are used to provide the initial implant stability. Later, we believe that bone grafts can be remodeled and gradually transformed into normal living bone (biological property).[8]

The osteoarthritic head harvested during primary total hip replacement is the commonest source of fresh frozen femoral heads for impaction bone grafting. It contains three types of tissue: cancellous bone in its bulk, cortical bone (mainly from the neck) and remnants of articular cartilage.[9] Slooff et al.[7] reported the use of cancellous graft alone. Brewster et al.[10] and Gie et al.[6]used most of the femoral head including cortical portion but without articular cartilage. No team has yet reported using the whole femoral head including the articular cartilage.[9]

In our study, we have not removed the articular cartilage from the femoral head allograft but we have removed the synovial lining and other soft tissue attachments. Our technique has advantages such as reduced operating time and reduced bone loss due to femoral head allograft preparation. It has been shown that the minimum loss of graft material is 40% of initial graft mass when obtaining pure cancellous graft from a femoral head allograft, 25% of graft mass is lost in obtaining cortico - cancellous graft after removing cartilage, and less than 10% loss of initial graft mass when using the whole femoral head without removing the articular cartilage.[9]

The early function of the impaction graft is to provide mechanical stability to the prosthesis. Some groups argue that implant stability is affected by the graft size, [11, 12] the ideal size is larger, and research suggests that 8–10-mm diameter chips provide the best initial stability. Brewster et al.[10] claim that the absolute particle size is less important than the grading. The initial mechanical stability of a prosthetic component implanted into a contained defect that has been augmented with morselised bone graft will be greatest when the graft has a well-graded particle size profile and has been effectively compacted.

The mechanical strength of well-graded morselised bone was greater than that of a more uniform size.[4,5] The mechanical performance of morselised bone derived from frozen whole femoral heads and impacted into a contained cavity is improved by the provision of a profile of particle size. Shear strength is improved by adding measured quantities of small and very small fragments.[10] A study comparing bone in-growth into non-compacted and compacted bone showed that increasing compaction reduces bony in-growth.[13] The presence of cartilage will minimally increase the compaction.[9]

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A comparison of bony in-growths into compacted material with a non-ideal grade particle-size distribution with that ideal grade particle mix showed increased in-growth into the non-ideal grade graft.[14] We believe that we are able to achieve comparable results with other published studies because milling the osteoarthritic head, which contains patchy areas of cartilage, produces different sizes of particles.

This non-uniform graft mass improves resistance against shear stresses. It is our assumption that we are able to get non-uniform graft by retaining the cartilage of osteoarthritic femoral head allograft. Further research will be needed to corroborate this. Furthermore, we feel that, by retaining the articular cartilage, the compactness of the graft is reduced slightly but it promotes bone in-growth into the graft material.

The dynamics of the relationship between initial stability and ultimate re-incorporation of the graft into the host bone are poorly understood.[10] Allograft is degraded in the biological process of bone remodelling and this may affect the implant stability. It is also unclear how important incorporation of the graft is, provided that the construct remains stable over a long period and does not itself increase the formation of particulate debris to stimulate macrophage activity and further skeletal resorption.[12]

In our study, only two sockets showed full demarcation at the end of most recent follow-up (2 years and 9 months) but they were clinically asymptomatic with good bone stock and remain under close review. Interestingly, all the radiologically loose sockets (2 sockets, 5%) showed poor allograft trabecular remodelling (100%). Our results suggest that allograft remodelling is an important determinant of long-term success of impaction grafting and implant stability.

We have used osteoarthritic femoral head allograft harvested during the primary hip replacement. It is difficult to quantify the amount of cartilage left with femoral head allograft. Further follow-up is needed to assess the long-term outcome.

CONCLUSION: Large defects are difficult to fill up especially in younger with Autografts because of-

1. Immature bone
2. Risk of epiphyseal injury during retrieval
3. Adequacy of graft- ?

Hence this problem was sorted by Allograft from excised head of femur.

Excised head of femur is discarded as a waste. We have utilized this nature's gift as the best boon for filling the bone defects.

Allograft used in properly indicated cases gives good result.

We couldn't find relevant references of such technique. Long term follow-up is awaited and will welcome communications from Surgeons who might have used this technique with their experience and suggestions if any.

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