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RESEARCH ARTICLE

TIBIA STRESS FRACTURES IN PATIENTS WITH SEVERE KNEE OSTEOARTHRITIS MANAGED WITH TOTAL KNEE ARTHROPLASTY WITH LONG STEM TIBIA COMPONENT: A CASE SERIES

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ABSTRACT

Introduction: Stress fractures in tibia is not a common finding in patients with knee osteoarthritis (OA). It is mostly seen in advanced disease with a significant varus deformity. The purpose of this case series is to bring forth the advantages of using stemmed knee replacement implants for treating this condition and to highlight the factors contributing to stress fractures in patients with severe knee arthritis.

Case Series: 4 patients with grade 4 Kallegren and Lawrence osteoarthritis, all obese, with >20 degree varus deformity, presented with sudden increase in pain around knee joint, with point tenderness in proximal tibia. Diagnosis was confirmed as proximal tibia stress fractures radiologically. All patients were managed by total knee replacement with stemmed tibial prosthesis. 2 patients had posterior stabilized system and 2 had constrained implants. Early mobilization was done in the post-operative period with gradual weight bearing over 2-3 weeks. No complications were noted and fracture united in all by 2 months. Rehabilitation of all the patients was satisfactory and at 6 months follow-up knee society score was comparable to standard knee replacement.

Discussion: Although such stress fractures show good union with conservative management, but knee immobilization may aggravate the symptoms of knee osteoarthritis .This case series show stemmed implants as an effective way of simultaneously treating the fracture and osteoarthritis of knee and provide early and quick rehabilitation. Severe osteoarthritis of knee with varus deformity pose a threat for stress fracture development and knee replacement should be considered as an option to prevent stress fractures in severely deformed osteoarthritic knees.

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INTRODUCTION

Stress fractures occur due to repetitive cumulative micro trauma on the bone over a period of time. They occur either due to abnormal stress placed on a normal bone (fatigue fracture) or normal stress placed on an abnormal bone (insufficiency fracture). The commonest site of affection is tibia in up to 50% cases (Milgrom *et al.,* 1986; Devas, 1975). Although they are of concern mostly in military cadets or athletes, they have also been studied in elderly people with rheumatoid arthritis, osteoporosis, Paget's disease, pyrophosphate arthropathy, hyperparathyroidism, after total knee arthroplasty, and in people who play sports incompatible with their age, and rarely with severe osteoarthritis of the knee (Marko Ćurković1 *et al.,* 2011).

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We present a case series of 4 patients, all with severe osteoarthritis knee and obesity with stress fractures in proximal tibia treated with total knee replacement with stemmed implants.

Case Presentations

4 patients presented with severe osteoarthritis of knee, grade 4 Kallegran and Lawrence. All patients had varus deformity and were obese.

Case 1: 67 year old female with BMI 32kg/m^{2,} varus deformity of 25 degrees and fixed flexion deformity of 15 degrees (Fig.1).

Case 2: 65 year old female with BMI 32 kg/m^2, varus deformity of 35 degrees and fixed flexion deformity of 20 degrees (Fig.3).

Figure.1 . Pre operative x-ray AP and Lateral view of Case 1

Figure 2 . post operative x-ray of Case 1

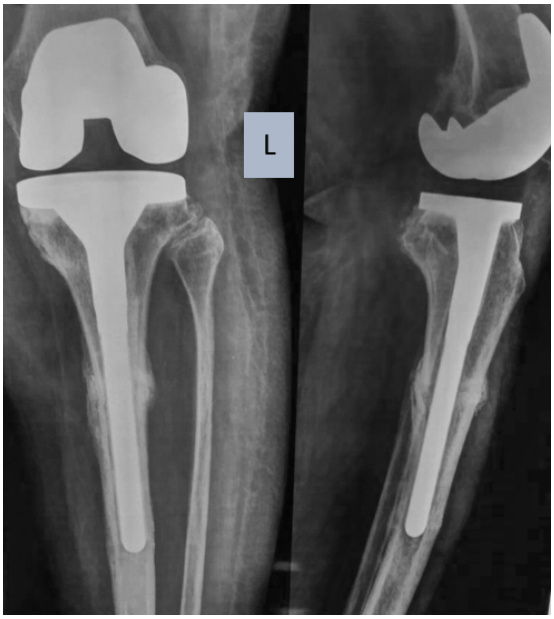

Figure 3. 2 month follow-up x-ray of Case 1

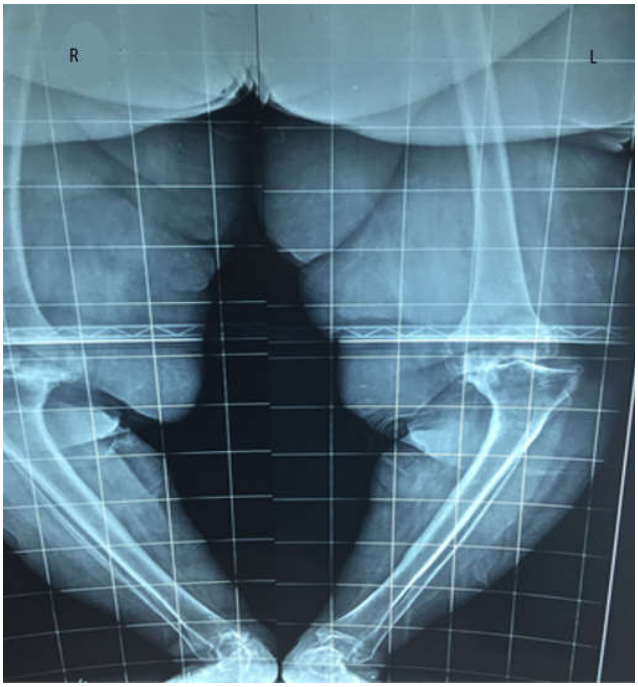

Figure 4. pre operative x-ray of Case 2

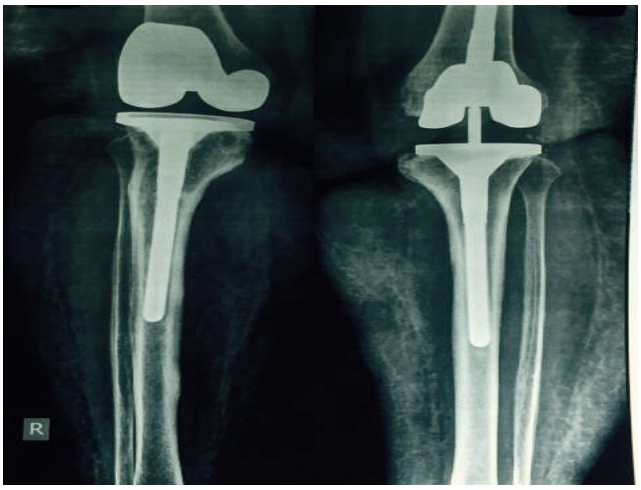

Figure 5. post operative x-ray AP view of Case 2

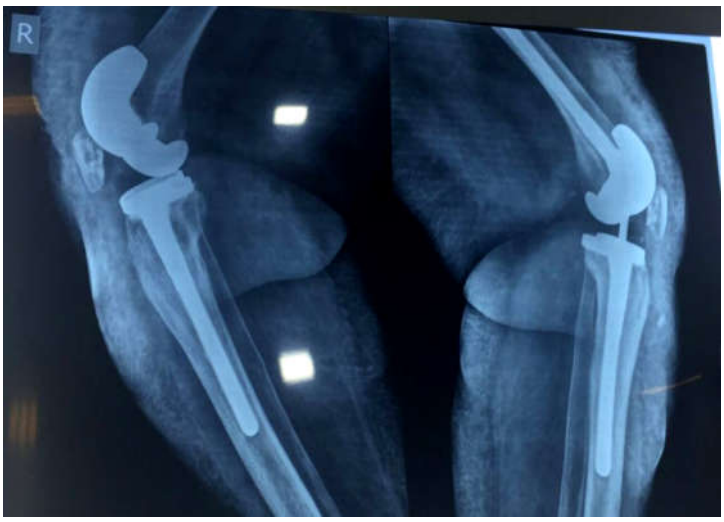

Figure 6. post operative x-ray Lateral view of Case 2

Case 3: 74 year old female with BMI of 30 kg/m^2, varus deformity of 25 degrees and fixed flexion deformity of 10 degrees.

Case 4: 70 year old female with BMI of 31kg/m^2, varus deformity of 20 degrees and fixed flexion deformity of 10 degrees. All 4 pts developed stress fractures in the proximal tibia. All patients were known cases of severe osteoarthritis of knee, with complaints of pain while walking, climbing stairs and sitting crossed legged with restricted activities of daily living. There was a sudden increase in intensity of pain in past few days without any preceding history of trauma. As per the patients, pain was excruciating which was restricting their ability to bear weight over the affected limb. On examination, there was point tenderness in the proximal tibia with associated findings of severe osteoarthritis knee. X-ray of knee joint was done with full tibia and distal femur. In 3 patients, x-rays showed stress fracture in proximal tibia, all were un displaced. In the 4th patient, x-ray did not show any fracture, so MRI was done which revealed proximal tibia fracture. All patients after proper pre-operative work up, underwent cemented total knee replacement with a long tibia stem. In 2 patients (Case 2 and Case 3) femoral stem was also fixed. Posterior stabilized system was used in 2 patients (Case 1 and 4) and constrained prosthesis was used in another two (Case 2 and 3). For Case 2, total knee replacement of the opposite knee was also done with stemmed tibia implant in the same sitting. There were no in tra-operative complications in any of the patients. Routine post op mobilization was done but weight bearing was delayed. Toe touch weight bearing was started by post op day 2 and gradually increased in a period of 2 weeks. CPM was not used. All fractures healed by 2 months. Patients were followed up for 6 months and showed similar outcomes as regular total knee replacement surgeries. Knee society scores were 85, 81, 79 and 83 for case 1, 2, 3 and 4, respectively. Scores were graded as excellent for case 1, 2 and 4, and good for case 3. All patients were able to walk unaided, and had good range of flexion >100 degrees without any flexion deformity, pain or tenderness. Extensor lag of <10 degrees was present in 2 patients (case 2 and 3).

DISCUSSION

Stress fracture of the lower extremity present as localized pain that worsens during exercise or weight bearing. Any history of trauma is typically lacking. In elderly people, it has been reported in association with rheumatoid arthritis but rarely with severe osteoarthritis of the knee (3). A review submitted by Sourlas etal in 2009, found only 31 patients of tibial stress fractures in elderly associated with knee osteoarthritis from 1972 with 29 out of the 31 patients having malaligned knees, varus deformity in 24 and valgus deformity in 5 patients (Sourlas *et al.,* 2009). When stress fracture is associated with severe knee osteoarthritis, commonly knees are malaligned in varus and patients are obese (Sourlas *et al.,* 2009; Reynolds, 1972; Mar tin *et al.,* 1998; Nabors *et al.,* 1995; Satku *et al.,* 1987). The paper published by Reynolds in 1972 was a milestone in proving relationship of stress fractures of tibia to knee osteoarthritis. He stressed that varus or valgus knee deformity caused by degenerative arthritis increases tibial load and results in stress fracture (Reynold, 1972). The paper published by Tomlinson (1995) and Martin (1995) outlines the importance of joint stiffness and axis of deformity as contributing factors to stress fractures in osteoarthritis patients.

In our case series too all patients had severe osteoarthritis with varus deformity more than 20 degrees, all the patients were obese with BMI more than 30 kg/m^2. The diagnosis of stress fractures may often be delayed or missed. Plain radiographs may be negative, concealed by severe osteoarthritic changes or sometimes, may not be taken including the entire tibia. Also, the symptoms may be attributed to osteoarthritis, damaged menisci, loose bodies or condylar osteonecrosis. Stress fracture should be considered in a patient with osteoarthritis presenting with sudden deterioration, severe localized tenderness to palpation and localized swelling or periosteal thickening at the pain site, and local temperature elevation. Thorough clinical evaluation followed by imaging modalities is necessary to clinch the occult diagnosis (Bojanic *et al.,* 2001). Triple phase nuclear bone scans are more sensitive in the early clinical course. Magnetic resonance imaging or computed tomography scans are much more sensitive than plain radiographic films for initial diagnosis and characterize the fracture better than bone scans (Sanderlin and Raspa, 2003).

Treatment of these stress fractures maybe conservative or surgical. Knee immobilization generally leads to fracture union but may aggravate the symptoms of knee osteoarthritis (Martin *et al.,* 1988; Moskal and Mann, 2001). Surgical options include autologous bone grafting and cast immobilization, internal fixation with plate or intramedullary nail, osteotomy for correction of axis deformity and plate fixation, total knee arthroplasty and non–weight bearing until fracture healing or long-stem total knee arthroplasty for fracture bridging (Tomlinson *et al.,* 1995; Martin *et al.,* 1988; Moskal and Mann, 2001; Gacon *et al.,* 1990; Templeton *et al.,* 1995; Sawan *et al.,* 1999; Raviraj Adala *et al.,* 2013). Bilal De Mir, et al (2009) presented a series of 3 cases of proximal tibia stress fractures with severe knee oateoarthritis which were all planned for stemmed total knee replacement but only 1 patient accepted this line of treatment, one was treated with an interlocking nail and the other was managed non surgically. Satku, et. al. presented 3 cases of knee osteoarthritis which were managed conservatively (Satku *et al.,* 1987). Sawant, et.al. presented 4 cases with valgus deformity in the knee and stress fractures in tibia which were all treated by modular TKR with long tibial stem (Sawant *et al.,* 1999). Haspi et al described two cases of severely angulated tibial non-unions after proximal tibia stress fractures associated with ipsilateral osteoarthritis treated with modular knee endoprosthesis with a long tibial stem to stabilize non-union fragments (Haspi *et al.,* 2003). Similarly, in our cases, total knee replacement with long stemmed tibial prosthesis in all patients was done along with long stemmed femoral prosthesis in 2 patients. Intra-operatively, some difficulty was encountered during reaming of the tibial canal due to callus formed at the fracture site. So, care has to be taken during reaming of canal so as not to cause communition or extension of the fracture or inadvertently ream the cortex and cause an iatrogenic fracture. Post-operatively, patients were mobilized early, started with partial weight bearing and gradually increased to full weight bearing in a period of 2 weeks as per patient comfort. At follow-up of 6 months, clinical and functional results were similar to standard knee replacement cases with minimal limitations. But how well constrained implants fare in long term can be known by long term followup. There have been a few studies which indicate that survivorship of knee replacement decreases with increased constrains in prosthesis (Rand and Ilstrup, 1991; Rand *et al.,* 2003).

ll stress fractures were associated with severe varus deformity but our case series is too small to determine how much varus deformity is significant to cause stress fracture. A detailed bio-mechanical study incorporating various factors like BMI, quality of bone, exertional level of patient may lead to some answers in this regard.

Conclusion

Severe osteoarthritis with varus deformity pose a serious threat for stress fractures in tibia and knee replacement should be considered as a management option to treat and/or prevent stress fractures in such patients. Total knee replacement should not be delayed in patients with severe osteoarthritis because they may develop a stress fractures. Early diagnosis of stress fractures is important, aided with clinical and radiological means. Management should be aimed to restore alignment and prevent abnormal stresses on bone. In such cases, use of stemmed implant is a good option but cost of the implant is more than regular implants and surgery is technically more complex than a standard knee replacement. Also, long term survivorship of constrained implants is inferior to unconstrained prosthesis.

Clinical message: Stress fracture of tibia in patients with osteoarthritis is a known problem with wide range of causes and stemmed implants have shown good healing without impairing functional outcome and physiotherapy protocol.

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