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Role of percutaneous vertebroplasty in osteoporotic compression fractures: A prospective study

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Abstract

Background: Osteoporotic vertebral compression fractures have gradually evolved into serious health care problem globally. Vertebroplasty is an outpatient procedure for OVCF.

Materials and methods: Our Prospective Study Consists of Twenty Patients of Which Fifteen Were Female and Five Were Male. Percutaneous Vertebroplasty Was Done In Single Level For 14 Patients Double Level For 4 Patients And Three Level For 2 patients.

Results: Results After 2 Year Follow up Was Excellent In 14 Patients Good In 3 Patients Fair In 1 Patient. 2 patients had cement leakage.

Conclusion: Percutaneous vertebroplasty is a technically feasible treatment in patients with osteoporotic compression fractures which doesn't respond to the best possible conservative treatment. Percutaneous vertebroplasty works as internal splint for the microfractures of vertebral body by methyl methacrylate cement which helps to relieve severe pain.

Keywords: Vertebroplasty, osteoporotic compression fractures, PMMA

Introduction

Vertebral Compression Fractures are commonest complications of osteoporosis. It causes progressive pain, deformity, disability and finally affecting the quality of life and morbidity. Standard conservative treatment consists of analgesics, bed rest and use of braces. Though it reduces pain dependence of drugs and narcotics progressively increases. Also prolonged recumbency further leads to bone loss, kyphotic deformity and limitation of activities of life. Percutaneous vertebroplasty is a recent development in the treatment of compression fractures using high viscosity PMMA. The goal of vertebroplasty is conferring strength and stability of vertebra. Percutaneous vertebroplasty is currently used in the treatment of osteoporotic as well as steroid induced compression fractures, spine metastasis, and vertebral haemangiomas.

Materials and Methods

Our study is prospective which analyses the functional and radiological outcome of percutaneous vertebroplasty in the treatment of vertebral osteoporotic compression fractures in patient who were treated in Tirunelveli government medical college and hospital with percutaneous vertebroplasty from July 2015 to September 2017 with total duration of 24 months

Inclusion Criteria

1. AGE above 60yrs
2. Pain due to compression fracture not subsided after 3 weeks of medical management

Exclusion Criteria

1. Active infection
2. Atypical fracture pattern
3. Unstable fracture involving posterior elements

Patient Evaluation

A physical examination is performed to document the exact site of the patient’s pain and tenderness, the patient’s baseline peripheral neurologic examination, and to detect any unrecognized weakness, neurologic impairment, or other factor which may require intervention, or which places the patient at increased risk if leakage of cement occurs.

Radiological Evaluation: X-RAY CT and MRI

Surgical techniques

The image intensifier is aligned so that the endplates of vertebra are sharp and spinous process is midline for the true AP projection. The lateral margin of pedicle is targeted by the needle in this projection at the 9 o’clock position for the left-sided approach and 3 o’clock position for right-sided approach. The needle is then embedded 2-3mm into bone using either the orthopedic mallet or the hand screwing motion. The image intensifier is turned to true lateral projection. The needle may now be advanced in lateral projection to a point approximately 1cm short of purpose of not advancing the needle to anterior cortex of the vertebral body on lateral projection is to avoid breaching anterior margin of vertebral body

Free flow of Normal saline injection on contralateral cannula indicate intravertebral cavity. Inject the cement in lateral projection with continuous fluoroscopic monitoring and cement consistency should be similar to the toothpaste. There should be no shine to cement’s appearance as this signify that it is thin. The greatest attention should be at posterior margin of vertebral body at epidural space. The operator should stop cement injection if cement reaches beyond 5mm anterior to posterior margin of vertebral body. The cement volume should be no more than the 1cc on each side for high thoracic (total<2cc), 2cc on each side for low thoracic (total <4cc), and no more than the 3cc on each side for a lumbar (total <6cc), with goal being top to the bottom filling on each side. sides.

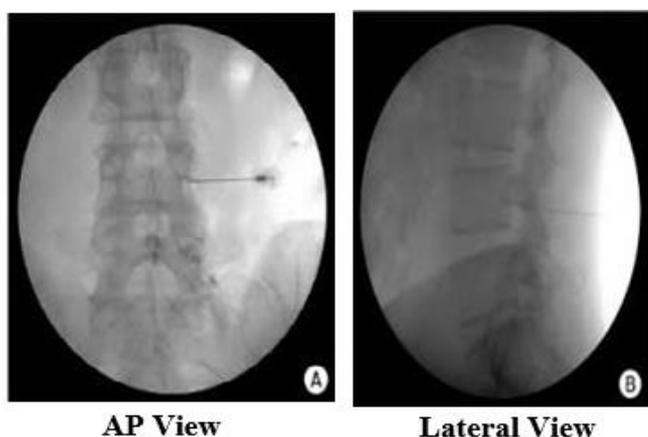


Fig 1: Anatomical Orientation

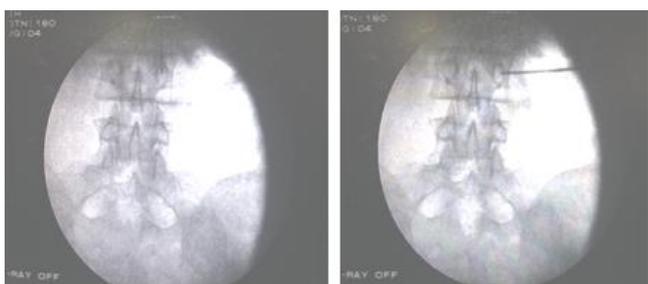


Fig 2: Marking the entry point

After completion of procedure patients were instructed to lie supine for 2 hr. Throughout the procedure and after that constant watch was kept on neurological status. Before discharging patient asses for improvement of pain immediately after the procedure and at 24 hrs then patients were observed for the presence of neurological deficit and any complication. All patients are evaluated after 8hr,3rd post op,1st month,3rd month after 1yr with Roland morris disability questionnaire & visual analog scale

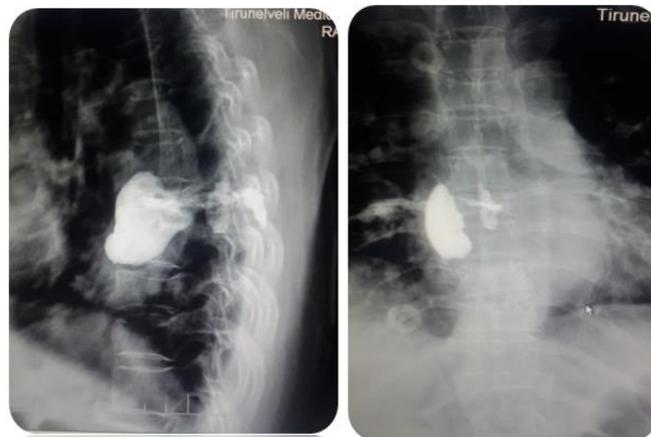


Fig 3: Complications

In our study two cases had Cement leakage into the disc and paravertebral region. Patients are treated with analgesics.

Results

Table 1: Immediate post-procedure result

| Clinical Status | No of patients | Percentage |
|-----------------|----------------|------------|
| Asymptomatic | 14 | 70 |
| Improved | 2 | 10 |
| Static | 2 | 10 |
| Detoriated | 2 | 10 |

At immediate post procedure period 14 patients were pain free and asymptomatic, 02 patients showed improvement. Two patients were static.

Table 2: The pain score, activity level, analgesic intake

| | PR vertebroplasty | | Post vertebroplasty | | |
|------------------|-------------------|--------------------|---------------------|---------------------|---------|
| | Mean | Standard deviation | Mean | Slandered deviation | p-value |
| Pain | 6.26 | 1.75 | 1.59 | 1.99 | 0.0001 |
| Activity score | 1.38 | 1.41 | 0.53 | 1.23 | 0.0187 |
| Medication Score | 1.15 | 0.99 | 0.41 | 0.56 | 0.0003 |

Mean preoperative VAS score was 5.91 ± 2.07 (SD), and their mean postoperative VAS scores were 3.5 ± 2.22 (SD). Paired-samples t testing of preoperative versus postoperative VAS scores were significantly different ($P < 0.001$). The analgesic intake after the procedure was statistically significant ($p < 0.001$)

Table 3: Three months post-procedure result

| Clinical Status | No of patients | Percentage |
|-----------------|----------------|------------|
| Asymptomatic | 16 | 80 |
| Improved | 1 | 5 |
| Static | 1 | 5 |
| Detoriated | 2 | 10 |

At three months 16 patients were asymptomatic and 3 patients show clear improvement. One patient had static course.

Table 4: The pain score, activity level, analgesic intake

| | PR vertebroplasty | | Post vertebroplasty | | |
|------------------|-------------------|--------------------|---------------------|--------------------|---------|
| | Mean | Standard deviation | Mean | Standard deviation | p-value |
| Pain | 6.26 | 1.75 | 0.24 | 0.99 | 0.0001 |
| Activity score | 1.38 | 1.41 | 0.26 | 0.79 | 0.0002 |
| Medication Score | 1.15 | 0.99 | 0.06 | 0.24 | 0.0001 |

There is significant improvement of pain activity, physical activity and medication score at 3 month follow-up

Table 5: Follow up result at 12 months

| Clinical Status | No of patients | Percentage |
|-----------------|----------------|------------|
| Asymptomatic | 18 | 90 |
| Improved | 1 | 5 |
| Static | 1 | 5 |
| Detoriated | 0 | 0 |

At 12 months 18 patients were asymptomatic, 1 patient showed improvement, 1 patient had a static course. The patient who had static course underwent pain medication and osteoporosis management.

In our study among 20 patients, 18 patients shows good improvement in pain as well as in day today activities. 2 Patients had complication of cement leakage in disc & paravertebral Space, Who are all treated with analgesics shows improvement after one year of follow up.

Discussion

Osteoporosis usually remain silent and,just one third of the patients with osteoporotic Vertebral compression fractures are symptomatic. when a painfull VCF occurs, symptoms should be treated and predictable complications should be avoided. Both acute and chronic complications have been described. Postural changes associated with kyphosis may limit activity, including bending and reaching. Moreover, restrictive lung disease may arise when multiple thoracic fractures occur. Although the osteoporotic VCF have a multifactorial aetiology, bone mineral density (BMD)is the central component of any management plan. Osteoporosis is marked by bone deficiency status, defined with the BMD measurements>2.5 standard deviations below average peak bone mass. the term severe osteoporosis is defined as an osteoporosis status associated with the osteoporotic fragility fractures. Osteoporotic fragility fractures are defined as occurring at the site associated with low BMD; they have increased incidence after age of 50 yrs.

Age is another important factor that contributes to the risk independently of BMD. The risk of osteoporotic fracture increases significantly with the age for both men and the women. In addition, for each value of BMD, fracture risk is much higher in the elderly then in young people. In women, risk of osteoporotic VCF increases 6-fold from the menopause to age 85.A previous VCF is an important risk factor for the subsequent vertebral fracture.

Pain relief in vertebroplasty is by thermal & mechanical effect. The thermal effect postulated as a cause of pain reduction due to neurolysis of vertebral and periosteal neural transmission. The mechanical effect is a cause of pain relief minimising micromotion of vertebral fracture which would

stimulate pain nociceptors

Bone scan and MRI is helpful to determine the age of a compression fracture, especially when history is negative for trauma or fall. however bone scan may not show a fracture for upto 10 days after an acute injury. MRI usually shows decreased the signal on T1 sequences and marrow edema on T2 fat saturation sequences at fracture site

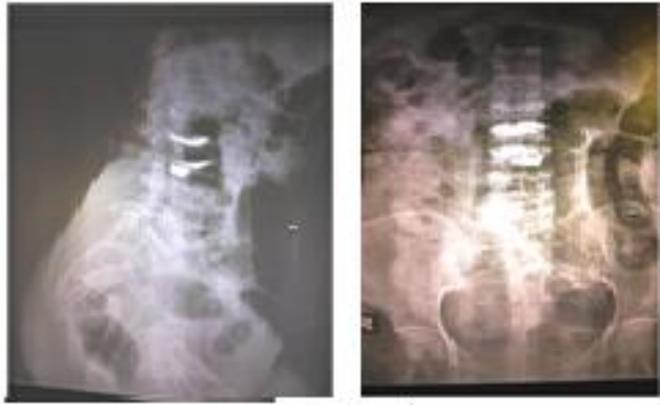
When VCF has been diagnosed, it is important to distinguish between osteoporotic and tumour associated fractures. To rule out the malignant nature of fracture, MRI can be the helpful because presence of a soft tissue mass or the pedicle involvement is suggestive of tumour.

Case 1

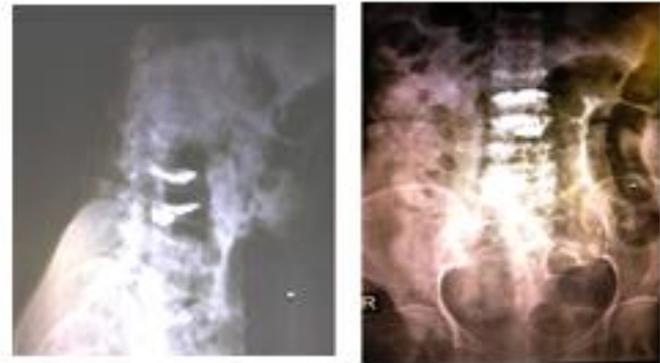
Preop L2, L3 osteoporotic compression fracture



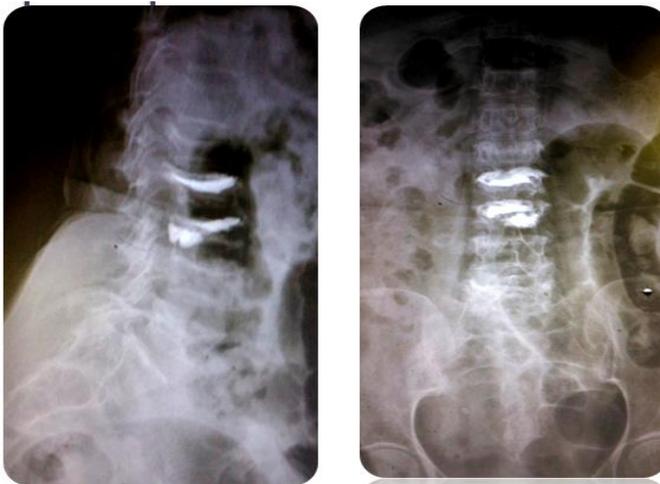
Immediate Post op



Follow up third month

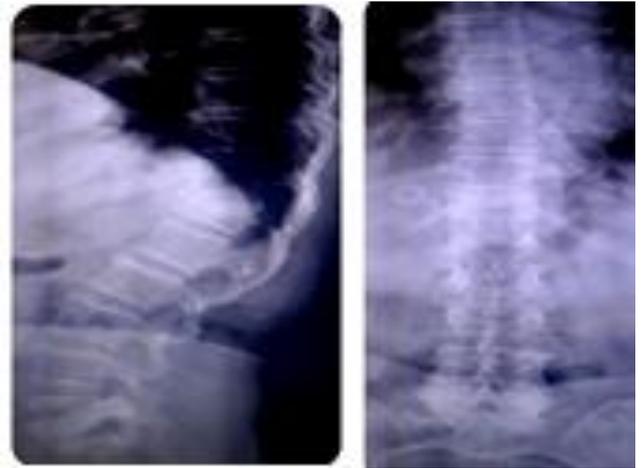


Follow up one year

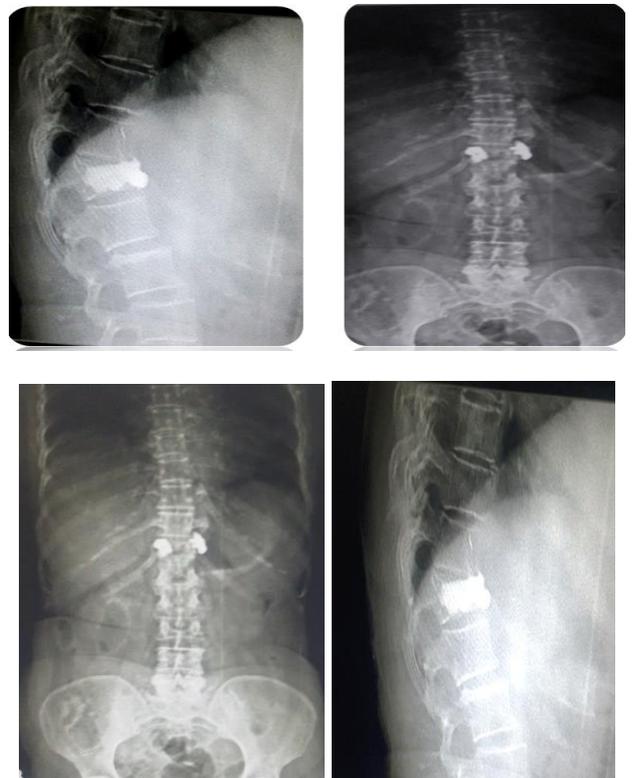


Case 2

Preop D12osteoporotic compression fracture

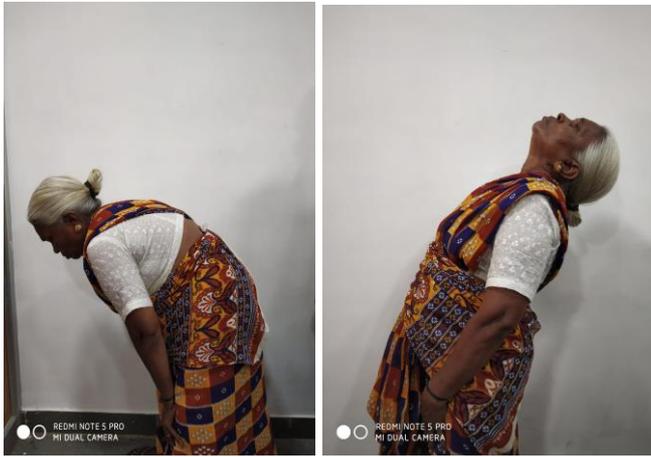


Postop D12osteoporotic compression fracture



One Year Follow up





Conclusion

Percutaneous vertebroplasty is a technically feasible treatment in patients with osteoporotic compression fractures which doesn't respond to the best possible conservative treatment. Percutaneous vertebroplasty works as internal splint for the microfractures of vertebral body by methyl methacrylate cement which helps to relief severe pain. The pain relief and the improvement of deformity, mobility, function and stature after percutaneous vertebroplasty is immediate. Successful treatment depends largely on appropriate patients selection, preoperative assessments, proper planning, meticulously performed procedure.

In our opinion, the percutaneous vertebroplasty is an extremely useful procedure in the management of complications of vertebral compression fractures including severe pain and vertebral deformity. Modification in conventional technique of vertebroplasty significantly decreases the incidence of cement leakage during the procedure.

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