

Kyphoplasty As A Day Care Procedure in Osteoporotic Vertebral Fractures

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ABSTRACT

Background: The vertebral compression fracture (VCF's) commonly present in old age. Conservative treatment is the mainstay for management, and it has its own merits and demerits. In old age, patients with comorbidities and open surgical management of VCF pose a risk to their lives.

Aim: To manage vertebral compression fractures due to Osteoporosis with Balloon kyphoplasty as a daycare procedure in patients with documented comorbidities under local anaesthesia and sedation for pain relief and the start of routine daily activities.

Methods: This prospective cohort was done using a non-probability consecutive sampling technique at the Department of Orthopedic and Spine Institute, "Doctors Hospital Medical Center", Lahore From January 2016 to February 2018. Seventy-six patients with osteoporotic vertebral fractures without neurological deficit with all documented comorbidities within six months of the injury were included in the study. They were aged between 45 to 70 year and above with a history of trivial injury, later confirmed on clinical examination, plain radiographs, dual-energy x-rays absorptiometry (DEXA) scan, and magnetic resonance image (MRI).

Results: All the patients relieved pain after the Balloons kyphoplasty, and they were able to walk 12-24 hours after the procedure. Amongst the total 76 patients (total 83 vertebrae), there were 34 (44.7%) male and 42 (55.3%) were female. The majority 46 (60.5%) had an acute injury, most 19 (25 %) had sub-acute, and 11 (14.5%) had a chronic injury.

Conclusion: Balloon kyphoplasty can be used as an effective treatment method in VCF to relieve pain and early return to the daily life

Keywords: Balloons kyphoplasty, Vertebral compression fracture, kyphotic angle, Osteoporosis

INTRODUCTION

Vertebral compression fractures (VCF) due to Osteoporosis in the elderly are common in the thoracolumbar Spine. Approximate 1.5million osteoporotic vertebral compression fractures (VCF) are reported annually¹..These fractures are associated with pain, disability and may result in secondary Osteoporosis. When they are not appropriately managed, they invariably result in multiple fractures and loss of vertebral height. They are common amongst female with 25% postmenopausal VCF in their lifetime².

Primary clinical manifestation of VCF's include localized pain and tenderness last between 4 to 6 weeks³ and it may result in backache, numbness, tingling sensation and loss of sphincter's control. The degree of kyphosis is associated with, patient well-being, physical activity⁴, spinal cord compression, restrictive changes in pulmonary function and contribute to cardiopulmonary morbidity⁵. Conservative treatment is the mainstay of symptomatic VCF's included bed rest, analgesic, brace and rehabilitation^{6,7}. Anti-inflammatory and certain analgesic also are difficult to tolerate in old age⁸. Medical management of these fractures is not sufficient to stop gibbus deformity, change of gravitational axis, and ultimately neurological compromise⁹. To maintain vertebral height and avoid this secondary complication with medication alone is a nightmare. Patients need a longer

time to recover, and the prevention of complications is not assured if treated conservatively.

Patients in older age have associated comorbidities, and surgery is an open procedure. It is indicated in patients with vertebral compression with compression of the nerve root and subluxation^{10,11}. It requires anaesthesia fitness which is difficult in older patients with comorbidities. Such fracture can be managed with "Balloon Kyphoplasty"¹². We treated osteoporotic VCF with Balloons kyphoplasty in elderly patients with reported comorbidities as a daycare procedure to pain relief and routine daily activities.

METHODOLOGY

This prospective cohort was done using a non-probability consecutive sampling technique at the Department of Orthopedic and Spine Institute, Doctors Hospital Medical Center, Lahore From January 2016 to February 2018. Seventy-six patients with osteoporotic vertebral fractures without neurological deficit with all documented comorbidities within six months of the injury were included in the study. They were aged between 45 to 70year and above with a history of trivial injury, later confirmed on clinical examination, plain radiographs, dual-energy x-rays absorptiometry (DEXA) scan, and magnetic resonance image (MRI). Exclusion criteria were all patients with a posterior longitudinal ligament injury and neurological

compromise diagnosed on clinical examination and magnetic resonance image.

Approval from the institutional review board was obtained. All patients included in the study signed written informed consent, and the study's purpose was explained to the patients. The duration of the injury was graded as acute (<2 weeks), sub-acute (2 weeks to 3 months) and chronic (>3months). In the recovery, the intravenous line of large bore 18Gauge was taken, and injection ceftriaxone1gm was given one hour before the surgery. Under sedation and local anaesthesia, we operated on all patients for "Balloon kyphoplasty". For local anaesthesia, injection xylocaine2%/20mg was given. Injection propofol20mg/70kg and midazolam2mg were given for sedation. The pain was assessed using a visual analogue scale. We measured local kyphotic angle, anterior vertebral height as a percentage of both pre-operative and post-operative. Bone-cementing (Poly-methylene-methacrylate) was injected into the compressed vertebral body through a needle under the image intensifier's guidance. Patients were mobilized 12-24hour after the procedure. All patients were followed in the out-patient department at a 4week interval for six months.

Data were entered and analyzed with the help of SPSS version 20.0. We presented data for age, pre-and post-pain scores, pre and post-operative vertebral height as Mean + standard deviation. We calculated gender frequency and percentages, t-test was applied to compare the difference in treatment outcome by injecting poly methylene methacrylate cement before and after the surgery. P-value ≤0.05 was considered significant.

RESULTS

All the patients relieved pain after the Balloons kyphoplasty, and they were able to walk 12-24 hours after the procedure. Amongst the total 76 patients (total 83 vertebrae), there were 34(44.7%) male and 42(55.3%) were female. The mean age of the patients was 53.84±9.78 (range 45-71 year). The duration of the injury was asked, 46(60.5%) had duration acute injury, 19(25%) patients had sub-acute, and 11(14.5%) had more chronic injury. There

were 26(31.3%) dorsal-12 (D12) vertebrae, 48(57.8%) lumbar-1 (L1) vertebrae, 07 (8.4%) had lumbar1-2 (L1-2) vertebrae and 2(2.4%) had lumbar2-3 (L2-3) vertebrae involvement (Table 1). The mean pre-operative local kyphotic angle was 13.1447±1.622 and the mean postoperative local kyphotic angle was improved to 5.591±1.767, and it was statistically significant p-value <0.001. The pain was assessed using the visual analogue score and pre-operative, it was 6.684±1.378, and post-operative VAS was 1.31±0.867. This difference was statistically significant p-value <0.001. We measured the anterior vertebral height pre and post-operatively. The pre-operative anterior vertebral height was 43.447±11.94, and it was 85.27±6.016 post-operatively (p-value <0.001) (Table 2).

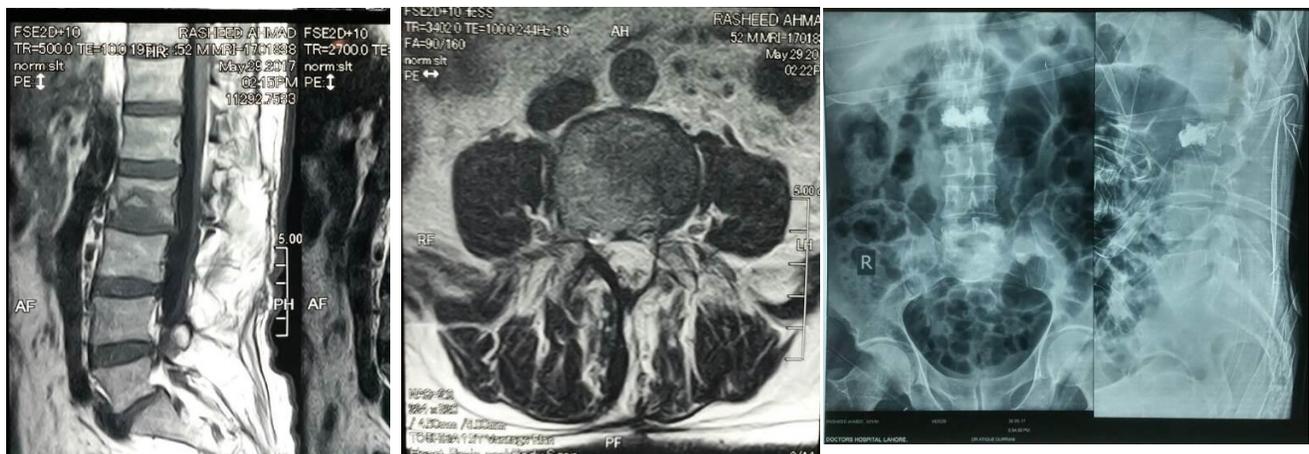
Table 1: Demographic data, age, side, union, AKSS and primary bone graft (n=76)

| Variables | Frequency | %age |
|-------------------------------|------------|-------|
| Gender | | |
| Male | 34 | 44.7% |
| Female | 42 | 55.3% |
| Age in years (Mean±SD) | | |
| | 53.84±9.78 | |
| Time Since Injury | | |
| Acute | 46 | 60.5% |
| Sun-acute | 19 | 25 % |
| Chronic | 11 | 14.5% |
| Level of Involvement | | |
| D-12 Vertebrae | 26 | 31.3% |
| L-1 Vertebrae | 48 | 57.8% |
| L 1-2 Vertebrae | 07 | 8.4% |
| L 2-3 Vertebrae | 02 | 2.4% |

Table 2: Clinical Parameter before and after the surgery after paired t-test

| Variables | Pre-op (Mean±SD) | Post-op (Mean±SD) | p-value |
|----------------------------------|------------------|-------------------|---------|
| Local kyphotic angle | 13.1447±1.622 | 5.591±1.767 | <0.001 |
| Anterior Height (% of vertebrae) | 43.447±11.94 | 85.27±6.016 | <0.001 |
| Visual analogue score | 6.684±1.378 | 1.31±0.867 | <0.001 |

Figure 1 Pre-operative X-rays involving Lumbar-2 vertebrae, later confirmed on MRI before Treatment. X-rays are showing both AP and Lat view after the treatment



DISCUSSIONS

Osteoporosis is a systematic disease of progressive loss of bone mineral density. It affects the bone architecture leaving the vertebral column vulnerable to compression fracture. VCF is associated with pain and limitation in the physical activity of daily life. If VCF is not appropriately managed, it can result in progressive spinal deformity in the sagittal plane. The deformity contributes to the alteration of biomechanics and increases the fivefold risk of vertebral fractures¹³.

The treatment with Balloon kyphoplasty gives strength to the treated vertebrae. It fortifies the compressed vertebrae. The vertebral height is maintained with an injection of polymethyl methacrylate. It has additional analgesic effects, maintaining vertebral height, immediate fixing of affected vertebral fracture, and playing a role in reverse the osteoclastic action in the vertebrae. It also has added effect of controlling the neurogenic pain due to sensitive vanilloid receptor and ions channels^[14]. The 70-degree heat-up temperature and polymerization effect of polymethyl methacrylate affect the bone nerve^[15]. It augments the height and pain of the compressed vertebrae secondary to Osteoporosis¹⁶.

VCF can be managed conservatively with calcium, vitamin-D supplements and with braces. It has a long treatment duration¹⁷⁻¹⁹ and prolongs the return to daily life activities. It is associated with pain at the fracture site that limits routine activities. In contrast to this fact, Balloon kyphoplasty can be advocated as a daycare procedure. The restoration of the vertebrae's height with this procedure helps maintain the spinal's standard curve and prevents nerve compression and prevents the progression of the kyphotic deformity.

The mean pre-operative local kyphotic angle was 13.1447 ± 1.622 and the mean postoperative local kyphotic angle was improved to 5.591 ± 1.767 (p-value < 0.001). Wang et al.^[20] reported a similar result of improvement with statistical significance. Y et al²² reported that VCF's might lead to the collapse of the posterior wall collapse of the vertebral body in the later stage, resulting in neurological compromise. Conservative treatment is long, and the mainstay of the management^{6,7} is that analgesia intolerance with comorbidities in old age can be a significant treatment problem. The restoration of the gravitational axis and prevention of neurological compromise is essential in managing VCF's. We managed patients in old age, keeping all the problem that may present, and our result showed successful results in our population.

Osteoporosis can be prevented by managing modifiable factors^{22,23} and non-modifiable factors²⁴. When we prevent modifiable factors, it included activity, behaviour, and calcium and vitamin D deficiency^{22,23}. Continuous pain and restricted daily routine activities with VCF may result in secondary Osteoporosis²³. In our study population, all patients could walk from 12-24 hours after the surgery. It will help patients restore their daily life activities and may also help in the prevention of secondary Osteoporosis.

In our study, there was a significant improvement of the pre-operative and post-operative anterior vertebral height of the involved vertebrae from pre-op percentage 43.447 ± 11.94 to post-op 85.27 ± 6.016 (p-value < 0.001). Yu et al²⁵ reported that change in pre-operative vertebral height as $52\% \pm 6.9$ to post-operative improvement in height as $74.5\% \pm 7.9$ in their population. When we compared the result, the improvement in anterior vertebral height was significantly improved in our study. The pre-operative visual analogue score was 6.684 ± 1.378 , and post-operative VAS was 1.31 ± 0.867 (p-value < 0.001). Chen et al²⁶ have done pool analysis from 11 studies and showed decreased pain on VAS after the procedure.

Furthermore, in our study, there were 34(44.7%) male and 42(55.3%) were female. The duration of the injury was asked, 46(60.5%) had a duration of fewer than two weeks duration of injury, 19(25%) had a duration of between 2 weeks to 3-months duration, and 11(14.5%) had more than three months duration of the injury. There were 26(31.3%) Dorsal 12 vertebrae, 48(57.8%) Lumbar1 vertebrae, 7(8.4%) had Lumbar1-2 vertebrae and 2(2.4%) had lumbar 2-3 vertebrae involvement.

Our study has limitations with smaller sample size and absence of a control group in the study population for generating an adequate level of evidence for better treatment methods in patients managed for prevention of complications and daily activity.

CONCLUSION

As a daycare procedure in relieving pain and early return to daily life activities, Balloon kyphoplasty is an effective procedure in vertebral compression fractures. We recommend the randomized controlled trial with a larger population to further extend the effectiveness of our study results.

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