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Case Series

Comparision of Radiological Parameters Post Stentoplasty vs Balloon Kyphoplasty: A Case Series

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Abstract

Aim: To evaluate the efficacy of balloon kyphoplasty vs Stentoplasty in Dorso- Lumbar spinal fracture by analysing Kyphosis correction and height restoration.

Objective

- To evaluate Kyphosis correction in dorso lumbar spinal fracture treated with balloon kyphoplasty vs Stentoplasty by calculating local wedge angle of collapsed vertebrae pre and post operation.
- To evaluate height restoration in dorso lumbar spinal fracture treated with balloon kyphoplasty vs Stentoplasty by calculating anterior height of collapsed vertebrae pre and post operation.

Method

- In this Ambispective observational study, we included 10 patients With dorso-lumbar spinal fractures who needed cementing of the collapsed vertebrae as per the Indications.
- The patients were selected according to the inclusion and exclusion criteria.
- The patients were operated between 2023 and 2024 at Yashoda Super speciality Hospital, Nehru Nagar, Ghaziabad.
- We reviewed digital radiographs of 10 patients before and after balloon kyphoplasty and Stentoplasty.
- We measured the wedge angle of the fractured vertebral body, Wedge angle reduction and Restoration percentage of wedge angle, pre and post operation.
- We have also measured the anterior height of the collapsed vertebra, Anterior vertebral body height gain and Percentage of anterior height gain, pre and post operation.

Result

- Total 10 patients were assessed, out of which 5 patients underwent Stentoplasty and 5 patients underwent balloon kyphoplasty.
- In post Stentoplasty patients, Wedge angle reduction was 2.44 ± 1.07 and Restoration percentage of wedge angle was 19.32 ± 7.42, Anterior vertebral body height gain was 0.28 ± 0.13 and Percentage of anterior height gain was 16.16 ± 5.51.
- In post balloon kyphoplasty patients, Wedge angle reduction was 2.54 ± 1.78 and Restoration percentage of wedge angle was 19.64 ± 10.71, Anterior vertebral body height gain was 0.24 ± 0.11and Percentage of anterior height gain was 17.32 ± 8.17

Conclusion

- Balloon kyphoplasty and Stentoplasty both increases the height of the fractured vertebra and reduces the wedge angle of the collapsed vertebral fracture.
- Therefore, Balloon kyphoplasty and stentoplasty are equally effective and radiographic differences do not make significant influence on the clinical results.
- Still we need more high-quality RCTs with larger sample size, multi- centric, and longer follow-up are warranted to confirm the current findings.

Keywords: Radiological; Parameters; Post Stentoplasty; Balloon Kyphoplasty

Introduction

Percutaneous vertebroplasty is a therapeutic method in which the vertebral body is percutaneously filled with acrylic cement for pain relief. Galibert., *et al.* [1] performed the first percutaneous vertebroplasty procedure to treat an extensive hemangioma in the C2 vertebral body.

Vertebroplasty was initially used for the treatment of spinal tumors, such as angiomas, metastases, and multiple myelomas [2]; however, osteoporotic vertebral collapse has gradually been accepted as an indication for percutaneous vertebroplasty [3,4].

Kyphoplasty, or percutaneous balloon kyphoplasty, is a technique to create cavities within the fractured vertebral body and to elevate the endplates by inflating balloons inside the vertebral body, followed by fixation of the fracture with bone cement.

Some have assumed that kyphoplasty offers the additional advantage of realigning the spinal column and regaining height in the fractured vertebra; these benefits may help decrease the pulmonary and gastrointestinal complications and early morbidity related to compression fractures [5-7].

Procedural disadvantages of balloon kyphoplasty was incomplete fracture reduction or a significant loss of the restored height after balloon deflation prior to cement injection, respectively.

In order to avoid loss of height after balloon deflation, the concept of using an expandable scaffolding structure similar to vascular stents was developed [8], resulting in vertebral body stenting (VBS), utilizing a specially designed catheter-mounted stent which can be implanted extra- or transpedicularly and expanded with the use of an inflatable balloon inside the vertebral body.

The effect of balloon kyphoplasty and Stentoplasty in pain relief has been discussed extensively. Nevertheless, the kyphosis-correction and height-restoration effects of percutaneous balloon kyphoplasty and Stentoplasty have rarely been reported [9,10].

In this study, we determined these effects of percutaneous balloon kyphoplasty and Stentoplasty.

Method and Materials

Type of study: Ambispective observational study.

Place of study: Study was done at Yashoda hospital and Research center, Nehru Nagar Ghaziabad, Uttar Pradesh.

Period of study: From 2023 till 2024 INVESTIGATIONS - Xray Dorso lumbar spine - AP and Lateral MRI scan of the Dorso- Lumbar spine.

Inclusion criteria

- Male or female with at least 50 years of age.
- Radiographic evidence of one or two painful Vertebral collapse fractures between D6 and L4, aged <3 months, due to primary or secondary osteoporosis.
- Patient who failed conservative medical therapy.
- Patient mentally capable and willing to sign a study specific informed consent prior to any study procedures.
- Patient willing and able to comply with all study requirements including follow-up visits and radiographic assessments.

Exclusion criteria

- Target Vertebral Collapse Fracture (s) due to underlying or suspected tumor, high-energy aged trauma, osteonecrosis.
- Segmental kyphosis of target vertebra of >30°.
- Previous surgical treatment at the VCF index level (s).
- Spinal canal compromise causing clinical manifestations of cord, neural foramen, or nerve root compression at the level (s) to be treated.
- Any physical exam evidence of myelopathy or radiculopathy, pre-existing or clinically unstable neurologic deficit.

Exclusion criteria

- Pain based on clinical diagnosis of herniated nucleus pulposus or severe spinal stenosis (progressive weakness or paralysis).
- Any radiographic evidence of pedicle fracture visible on pre-op CT scan, spondylolisthesis >Grade 1 at target VB (s).
- Any underlying systemic bone disease other than osteoporosis.
- Not able to walk without assistance before fracture (s).
- Pain due to any other condition that required daily narcotic medication, disabling back pain due to causes other than acute fracture (s).
- Medical contraindication to spinal surgery and/or general anesthesia, such as coagulopathy and/or regular intake of anticoagulants.
- Body mass index >40.

Results

Stentoplasty

Case 1: Omwati

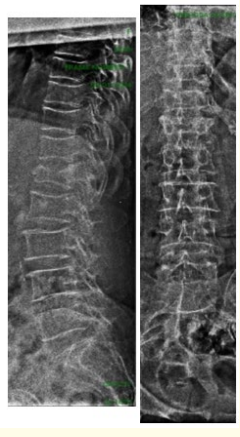


Figure 1: Pre op x- rays showing anterior wedge collapse fracture.

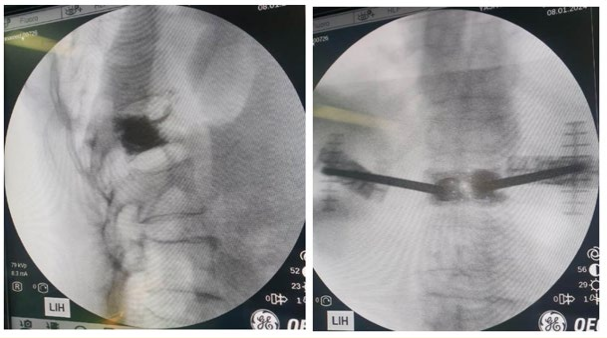


Figure 2: Intra op x-rays showing stentoplasty in collapsed vertebrae.

Figure 3: Post op x- rays showing stentoplasty in collapse vertebrae.

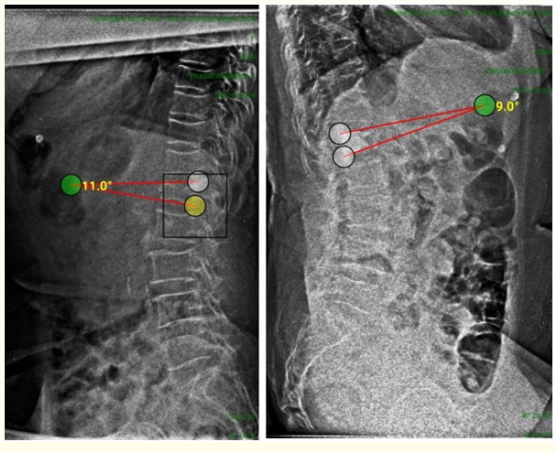


Figure 4: X-rays showing pre and post op change in anterior wedge collapse angle in case of Stentoplasty.

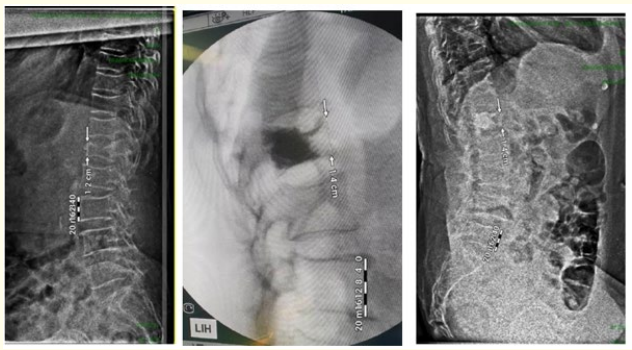


Figure 5: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Case 2: Bimla vati

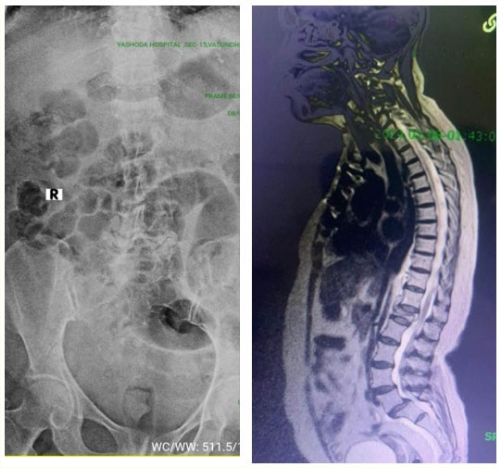


Figure 6: Pre op x- rays showing anterior wedge collapse fracture.

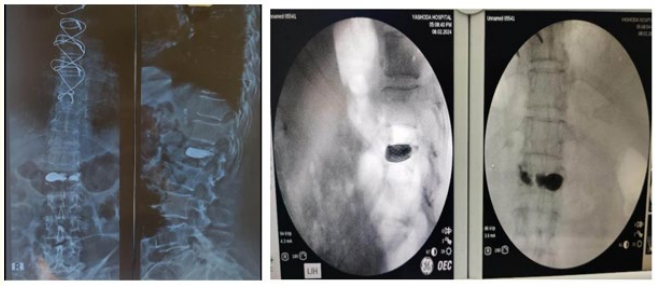


Figure 7: Intra op and post op x-rays showing stentoplasty in collapsed vertebrae.

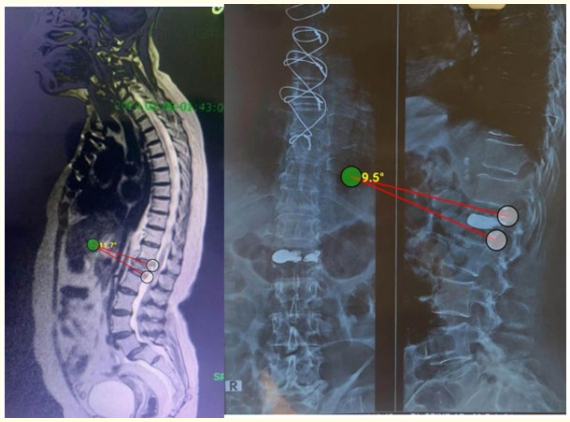


Figure 8: X-rays showing pre and post op change in anterior wedge collapse angle in case of Stentoplasty.

Figure 9: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Case 3: yogeshwar sharma

Figure 9: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Figure 10: Pre op x- rays showing anterior wedge collapse fracture.

Figure 11: Post op x-rays showing stentoplasty in collapsed vertebrae.

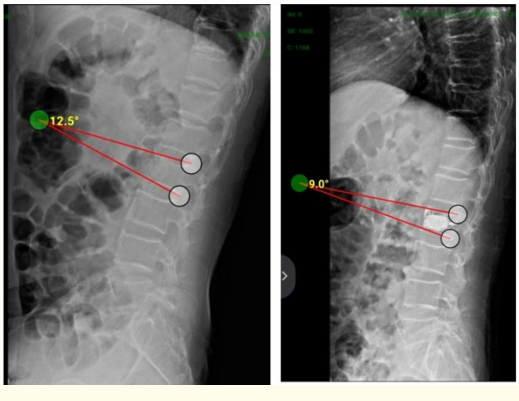


Figure 12: X-rays showing pre and post op change in anterior wedge collapse angle in case of Stentoplasty.

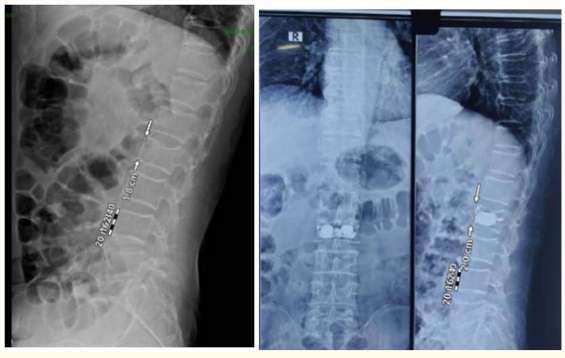


Figure 13: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Case 4: Rajesh kumari

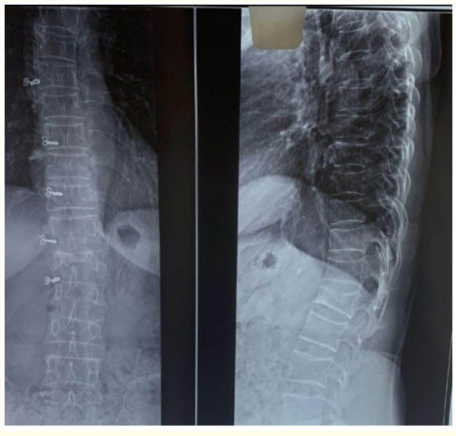


Figure 14: Pre op x- rays showing anterior wedge collapse fracture.

Figure 15: Post op x-rays showing stentoplasty in collapsed vertebrae.

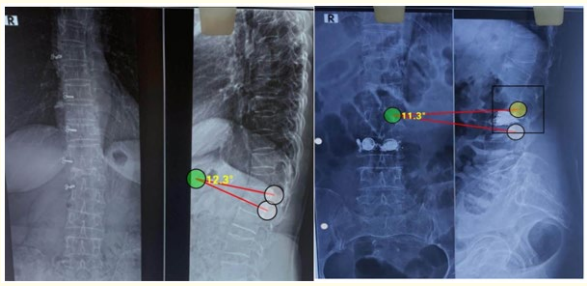


Figure 16: X-rays showing pre and post op change in anterior wedge collapse angle in case of Stentoplasty.

Figure 17: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Case 5: Jagwati devi

Figure 18: Pre op x- rays showing anterior wedge collapse fracture.

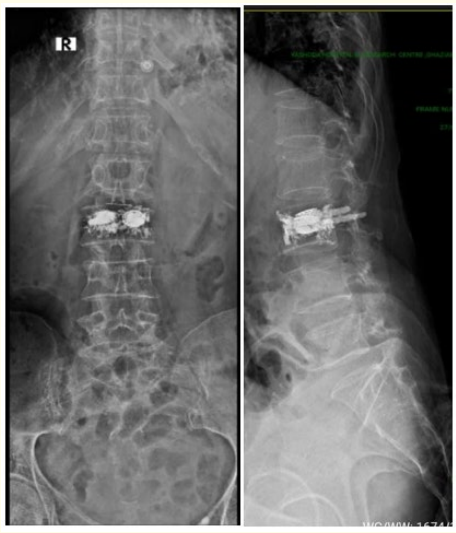


Figure 19: Post op x- rays showing stentoplasty in collapsed vertebrae.

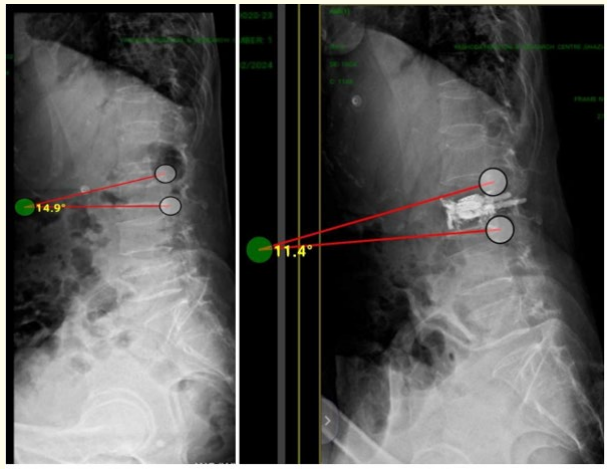


Figure 20: X-rays showing pre and post op change in anterior wedge collapse angle in case of Stentoplasty.

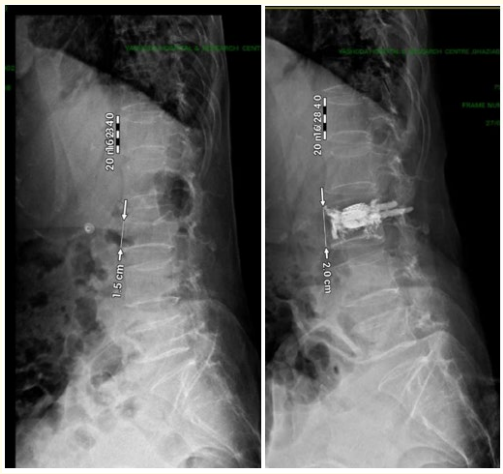


Figure 21: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Stentoplasty.

Figure 23: Post op x-rays showing balloon kyphoplasty in collapsed vertebrae.

Balloon kyphoplasty

Case 1: kanta devi

Figure 22: Pre op x- rays showing anterior wedge collapse fracture.

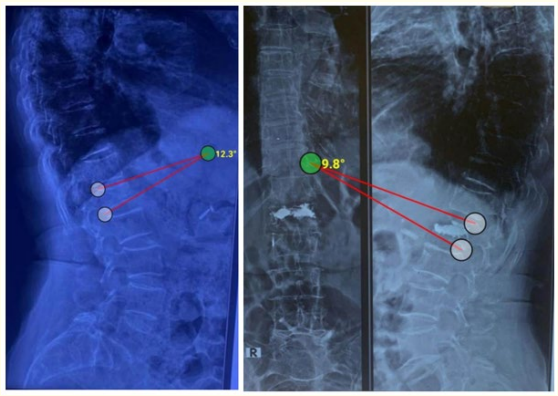


Figure 24: X-rays showing pre and post op change in anterior wedge collapse angle in case of Balloon kyphoplasty.

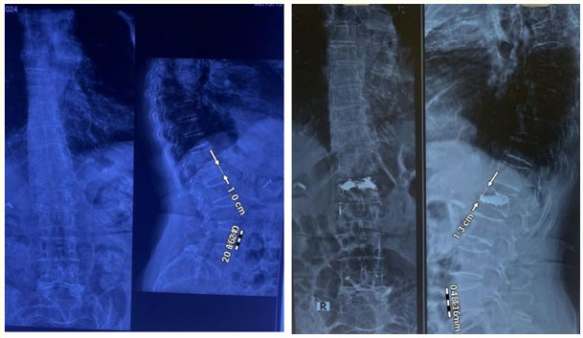


Figure 25: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Balloon kyphoplasty.

Case 2: Veer pal singh

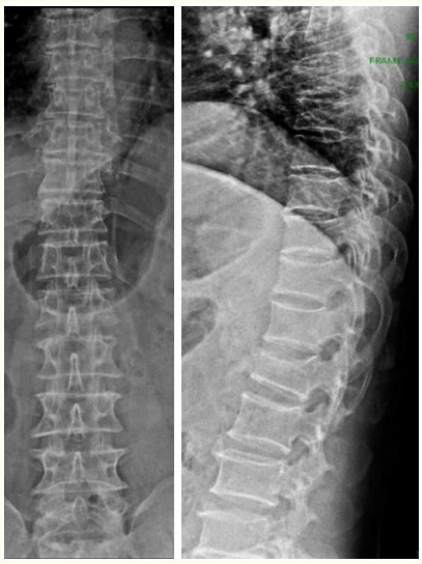


Figure 26: Pre op x- rays showing anterior wedge collapse fracture.

Figure 27: Post op x- rays showing balloon kyphoplasty in collapsed vertebrae.

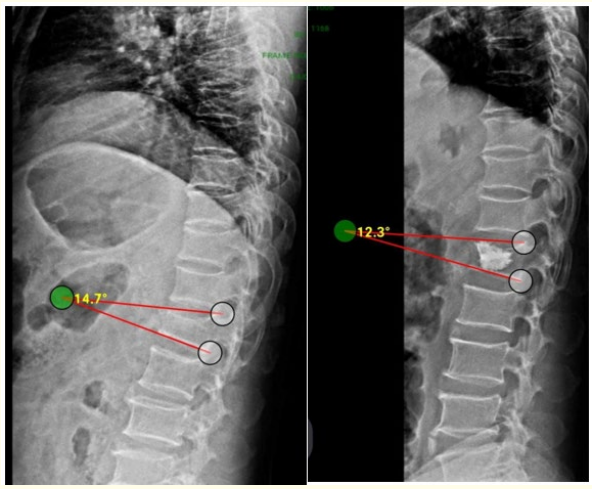


Figure 28: X-rays showing pre and post op change in anterior wedge collapse angle in case of Balloon kyphoplasty.

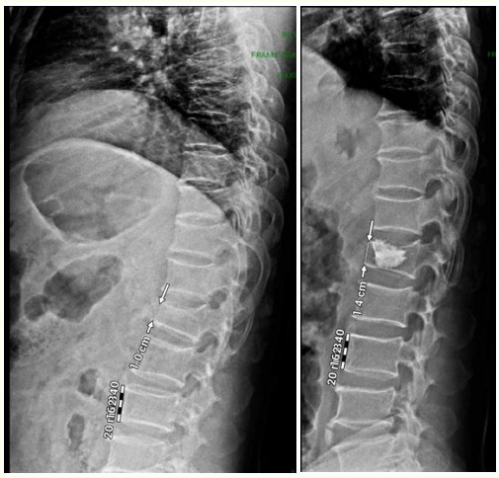


Figure 29: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Balloon kyphoplasty.

Case 3: Vijay pal singh

Figure 30: Pre op x- rays showing anterior wedge collapse fracture.

Figure 31: Post op x- rays showing balloon kyphoplasty in collapsed vertebrae.

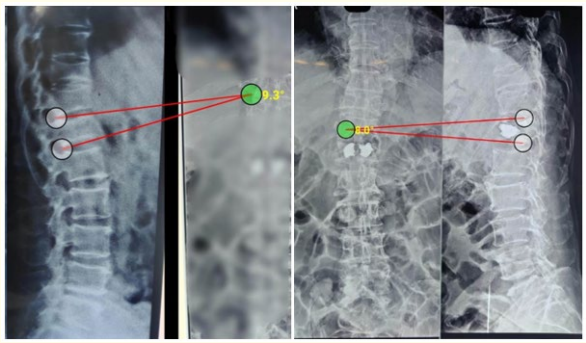


Figure 32: X-rays showing pre and post op change in anterior wedge collapse angle in case of Balloon kyphoplasty.

Figure 33: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Balloon kyphoplasty.

Case 4: Rajnesh garg

Figure 34: Pre op x- rays showing anterior wedge collapse fracture.

Figure 35: Post op x- rays showing balloon kyphoplasty in collapsed vertebrae.

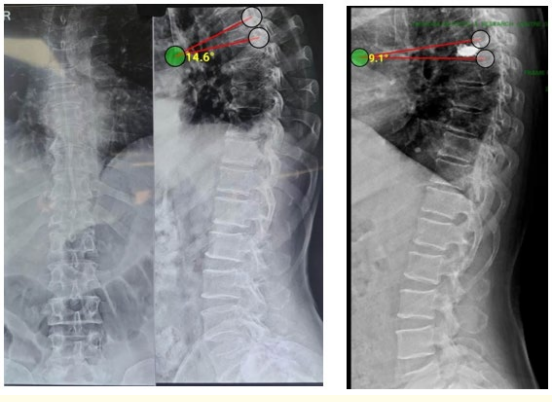


Figure 36: X-rays showing pre and post op change in anterior wedge collapse angle in case of Balloon kyphoplasty.

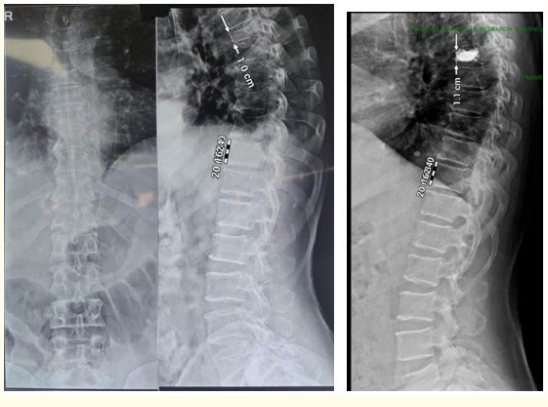


Figure 37: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Balloon kyphoplasty.

Case 5: Vishal singh

Figure 38: Pre op x- rays showing anterior wedge collapse fracture.

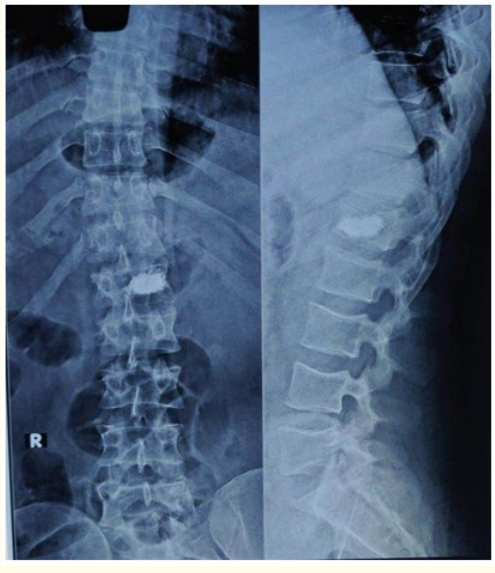


Figure 39: Post op x- rays showing balloon kyphoplasty in collapsed vertebrae.

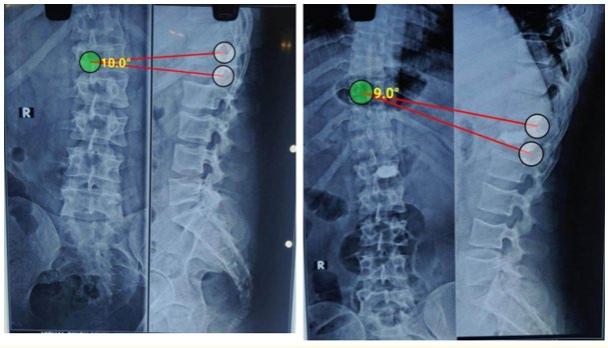


Figure 40: X-rays showing pre and post op change in anterior wedge collapse angle in case of Balloon kyphoplasty.

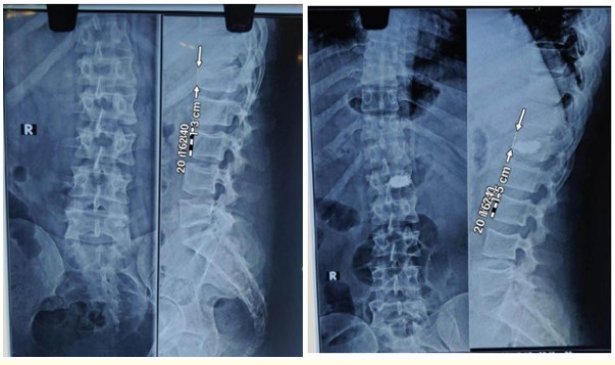


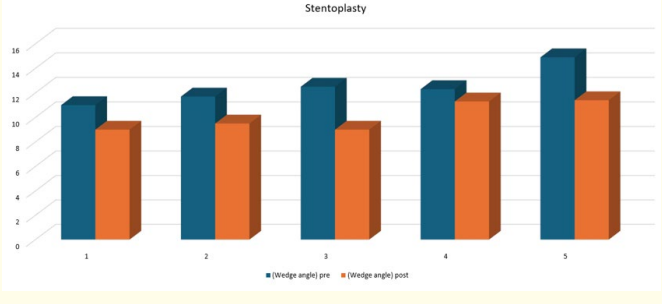
Figure 41: X-rays showing pre and post op change in height of anterior wedge collapse vertebrae in case of Balloon kyphoplasty.

Parameters	Loss from fracture	Gain from stentoplasty
Wedge angle of the vertebrae	(Wedge angle) pre	(Wedge angle) pre - (Wedge angle)post
Height of the vertebrae	(Height) pre	(Height) post - (Height) pre

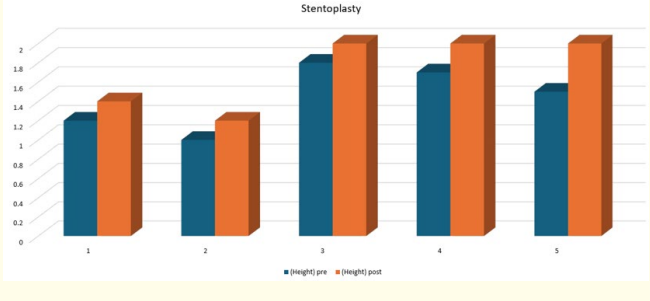
Table 1: Comparison of parameters in case of Stentoplasty.

Case no.	(Wedge angle) pre	(Wedge angle) post	Reduction of wedgeangle after stentoplasty	Restoration percentage of the wedge angle poststentoplasty
1.	11	9	2	18.2
2.	11.7	9.5	2.2	18.8
3.	12.5	9	3.5	28
4.	12.3	11.3	1	8.1
5.	14.9	11.4	3.5	23.5
	12.48± 1.47	10.04± 1.21	2.44± 1.07	19.32 ± 7.42

Table 2: Wedge angle of the collapsed vertebrae (in degrees).



Graph 1: Change in Wedge angle of collapsed vertebrae pre and post stentoplasty.



Graph 2: Gain in anterior height of collapsed vertebral body post stentoplasty.

Case no.	(Height) pre	(Height) post	Gain in vertebral body anterior height post stentoplasty	Percentage of height gain poststentoplasty
1.	1.2	1.4	0.2	14.2
2.	1	1.2	0.2	16.6
3.	1.8	2	0.2	10
4.	1.7	2	0.3	15
5.	1.5	2	0.5	25
	1.44 ± 0.33	1.72 ± 0.39	0.28 ± 0.13	16.16 ± 5.51

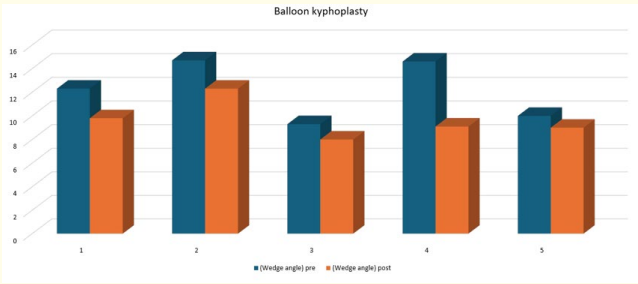
Table 3: Anterior height of the collapsedvertebrae (in mm).

Parameters	Loss from fracture	Gain from balloon kyphoplasty
Wedge angle of the vertebrae	(Wedge angle) pre	(Wedge angle) pre - (Wedge angle)post
Height of the vertebrae	(Height) pre	(Height) post - (Height) pre

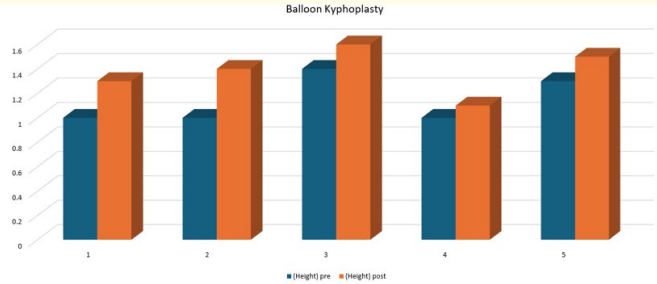
Table 4: Comparision of parameters in case of Balloon kyphoplasty.

Case no.	(Wedge angle) pre	(Wedge angle) post	Reduction of wedgeangle after balloon kyphoplasty	Restoration percentage of the wedge angle post balloon kyphoplasty
1.	12.3	9.8	2.5	20.3
2.	14.7	12.3	2.4	16.3
3.	9.3	8	1.3	14
4.	14.6	9.1	5.5	37.6
5.	10	9	1	10
	12.18± 2.51	9.64 ± 1.62	2.54 ± 1.78	19.64 ± 10.71

Table 5: Wedge angle of the collapsedverterbrae (in degrees).



Graph 3: Change in Wedge angle of collapsed vertebrae pre and post balloon kyphoplasty.



Graph 4: Gain in anterior height of collapsed vertebral body post balloon kyphoplasty.

Case no.	(Height) pre	(Height) post	Gain in vertebral body anterior height post stentoplasty	Percentage of height gain post stentoplasty
1.	1	1.3	0.3	23.1
2.	1	1.4	0.4	28.6
3.	1.4	1.6	0.2	12.5
4.	1	1.1	0.1	9.1
5.	1.3	1.5	0.2	13.3
	1.14 ± 0.195	1.38 ± 0.192	0.24 ± 0.11	17.32 ± 8.17

Table 6: Anterior height of the collapsed verterbrae (in mm).

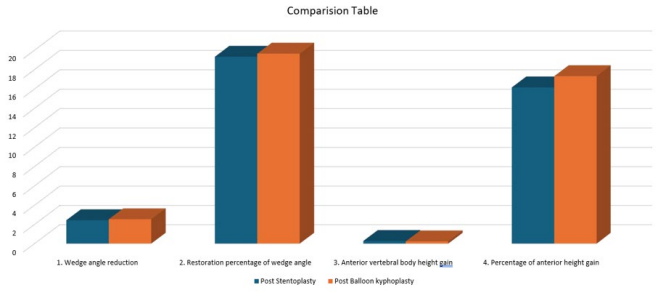
Parameters	Post Stentoplasty	Post Balloon kyphoplasty
Wedge angle reduction	2.44 ± 1.07	2.54 ± 1.78
Restoration percentage of wedge angle	19.32 ± 7.42	19.64 ± 10.71
Anterior vertebral body height gain	0.28 ± 0.13	0.24 ± 0.11
Percentage of anterior height gain	16.16 ± 5.51	17.32 ± 8.17

Table 7: Overall comparision of both the parameters in Post stentoplasty and post balloon kyphoplasty patients.

Patient name	Age / Sex	Collapse vertebral level	Type of surgery performed	(Wedge angle) pre	(Wedge angle) post	Reduction of wedge angle after surgery	Restoration percentage of the wedge angle post surgery	(Height) pre	(Height) post	Gain in vertebral body anterior height post surgery	Percentage of height gain post surgery
1. Mrs. Omwati	62/F	L1	Stentoplasty	11	9	2	18.2	1.2	1.4	0.2	14.2
2. Mrs. Bimla vati	73/F	L1	Stentoplasty	11.7	9.5	2.2	18.8	1	1.2	0.2	16.6
3.Mr. Yogeshwar sharma	59/M	L2	Stentoplasty	12.5	9	3.5	28	1.8	2	0.2	10
4. Mrs. Rajesh kumari	65/F	L3	Stentoplasty	12.3	11.3	1	8.1	1.7	2	0.3	15
5. Mrs. Jagwati devi	69/F	L3	Stentoplasty	14.9	11.4	3.5	23.5	1.5	2	0.5	25

6. Mrs. Kanta devi	78/F	L1	Balloon kypho-plasty	12.3	9.8	2.5	20.3	1	1.3	0.3	23.1
7. Mr. Veerpal singh	60/M	L1	Balloon kypho-plasty	14.7	12.3	2.4	16.3	1	1.4	0.4	28.6
8. Mr. Vijaypal singh	75/M	D12	Balloon kypho-plasty	9.3	8	1.3	14	1.4	1.6	0.2	12.5
9. Mr. Rajnesh kumar garg	66/M	D6	Balloon kypho-plasty	14.6	9.1	5.5	37.6	1	1.1	0.1	9.1
10. Vishal singh	51/M	L1	Balloon kypho-plasty	10	9	1	10	1.3	1.5	0.2	13.3

Table 8: Overall comparision of all the parameters in respective patients of Stentoplasty and balloon kyphoplasty.



Graph 5: Comparison of results between Stentoplasty vs Balloon Kyphoplasty wrt following parameters.

Conclusion

- Balloon kyphoplasty and Stentoplasty both increases the height of the fractured vertebra and reduces the wedge angle of the collapsed vertebral fracture.
- Therefore, Balloon kyphoplasty and stentoplasty are equally effective and radiographic differences do not make significant influence on the clinical results.
- Still we need more high-quality RCTs with larger sample size, multi- centric, and longer follow-up are warranted to confirm the current findings.

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