Kypho-Intraoperative Radiation Therapy (Kypho-IORT) for Loacalized Spinal Metastasis

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INTRODUCTION

- Open surgery or kyphplasty followed by external irradiation is the standard of care for patients with unstable spine metastasis.
- Radiation induced vertebral compression fractures range from 11-39%.
- Radiation is typically palliative due to the systemic tumor burden.
- Pain control and improvement of quality of life is a paramount goal of treatment.
- Kypho-IORT is a minimally invasive procedure to radiate metastasis and prevent compression fractures while providing immediate pain relief in potentially unstable spines.
- Due to rapid fall off, higher doses of radiation can be administered to the tumor bed while limiting spinal cord toxicity, when compared to stereotactic body radiation therapy (SBRT).

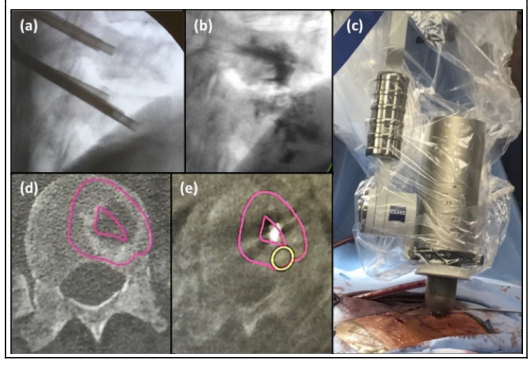
METHODS

- **Phase I/II single institution, prospective trial**
- Enrolled patients met the following criteria: known primary histology, potentially unstable spine (SINS score 7-12), and low Bilksy grade (0)
- Pre and postoperative pain and functional status scores were assessed.

Kypho-IORT Procedure

- The involved vertebral body is accessed percutaneously via its pedicles (a).
- A metallic sleeve is placed and intraoperative CT was utilized to confirm proper placement within the tumor via the pedicle (d).
- An introducer is placed within the sleeve and *INTRABEAM radiation system (Carl Zeiss Surgical, Oberkochen, Germany)* is guided down the sleeve into the tumor bed (c).
- **10Gy to tumor margins is delivered** (e). Due to rapid radiation drop off >200% of the 10Gy dose is delieverd at tumor center. (*Schneider et al. 2010*)
- The **spinal cord dose is limited to 12Gy**.
- Kyphoplasty of the vertebral body is then completed, with the ability to restore vertebral body height when appropriate (b).

Kypho-Intraoperative Radiation Therapy Procedure



RESULTS

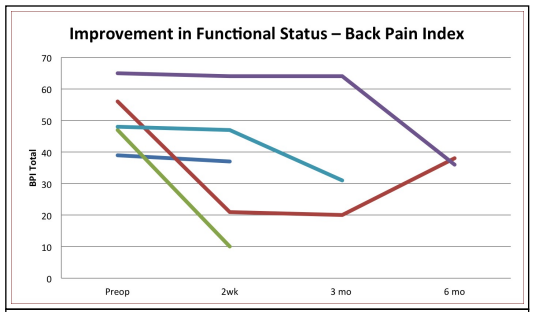
- 9 vertebral levels were treated
- All patients were discharged home within 12 hours of Kypho-IORT.
- All patients remained neurologically stable postoperatively.
- 1 recurrence (colon adenocarcinoma)
- Mean SINS score of 8.6±1.9

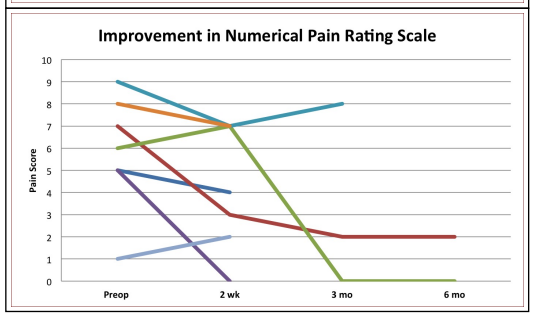
Patient Demographics and Tumor Histologies

Demographics	Number
Male	5
Female	3
Histology	
Breast	3
Lung	1
Myeloma	2
Prostate	1
Colon	1

Improvement in Pain and Functional Status

	Preop	Postop	P value
Numerical Pain Rating Scale	6.57 ± 2.82	4.00 ± 2.16	0.035
Back Pain Index – Functional Status	52.67 ± 11.94	36.0 ± 17.26	0.021





CONCLUSIONS

- **Kypho-IORT is a safe option for metastases in a potentially unstable spine**.
- Patient reported **pain scores significantly improve** within two weeks.
- Patient reported **quality of life scores significantly improves** within two weeks.
- Palliative treatment that allows same day return to home.
- Long-term follow up is necessary to further evaluate local control, fracture rates, pain and functional scores.
- Dose escalation studies need to be conducted to determine maximal safe dose.