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The Spine Journal 5 (2005) 109–114

THE SPINE JOURNAL

# Image-guided surgery in resection of benign cervicothoracic spinal tumors: a report of two cases

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Received 12 November 2003; accepted 24 June 2004

**Abstract**

**BACKGROUND CONTEXT:** Osseous spinal tumors are an uncommon cause of persistent axial pain and muscle spasm, but even benign lesions may grow to cause deformity or neurological signs. Traditional treatment approaches to resection can be debilitating even when the tumor is benign.
**PURPOSE:** Emerging technologies allow surgeons to diagnose and treat osseous neoplasms while minimizing the collateral damage caused by surgical exposure and tumor excision.
**STUDY DESIGN:** Technical considerations are presented through two cases of benign osseous neoplasm occurring in the cervicothoracic spine of competitive athletes, demonstrating the methods used to provide effective treatment while maintaining maximal functional capacity.
**METHODS:** Stereotactic imaging and intraoperative guidance was used as an adjunct to tumor care in these patients. Used in combination with minimally invasive, microsurgical techniques, stereotactic guidance localized and verified excision margins of benign vertebral lesions, minimizing soft tissue trauma and collateral damage.
**RESULTS:** Computer-assisted stereotactic localization allowed us to successfully ablate these lesions from their anatomically challenging locations, without disrupting the shoulder girdle or neck musculature, and without extensive bony resection.
**CONCLUSIONS:** Image guidance can accurately localize and guide excision of benign vertebral lesions while minimizing soft tissue trauma and collateral damage, allowing patients a rapid and complete return to high-demand function. 

*Keywords:* Spine; Tumor; Stereotactic guidance; Sports; Osteoblastoma; Osteoid osteoma

## Introduction

Although focal, persistent pain might be treated expectantly in a normally active teen or young adult, serious spinal pathology can occasionally be overlooked. Osseous spinal tumors are an uncommon cause of neck and back pain, but they do occur in young, healthy individuals [1]. When a spinal column tumor is identified, the primary goal is to determine its nature, benign or malignant, and the second is to provide effective treatment to control or cure the lesion. If the lesion is benign, treatment should be carried out without unnecessarily disrupting subsequent function. Traditional surgical approaches can be damaging to surrounding tissues, resulting in long-term impairment that would preclude return to high-demand activities. In athletes who throw, disruption of the shoulder girdle and cervicothoracic junction can be career ending.

When operative treatment is necessitated by persistent pain and/or neurological symptoms, traditional surgical approaches reliably control these tumors, but at a significant cost in muscular injury and functional impairment [2–4]. Benign, locally invasive lesions may require extensive dissection for definitive control.

Beyond reliably extirpating the lesion, the surgeon should consider the effect the surgical approach will have on function. While advances have been made in minimally invasive treatment of some tumors, percutaneous techniques cannot be safely applied immediately adjacent to the spinal cord [5,6]. Open techniques are still necessary in these circumstances.

FDA device/drug status: not applicable.

Nothing of value received from a commercial entity related to this research.

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1529-9430/05/$ – see front matter 
doi:10.1016/j.spinee.2004.06.020

Stereotactic image guidance (SG), combined with microsurgical techniques, allows surgeons to use a minimally invasive approach to accurately localize and excise these benign tumors, minimizing surgical morbidity and optimizing rapid return to unrestricted function. Application of these principles is illustrated by two cases of competitive athletes presenting with benign neoplasms of the cervicothoracic junction.

## Case reports

### *Case 1*

A 16-year-old soccer player presented with left-sided neck and shoulder pain of 5 month's duration, first noticed while playing soccer. The pain began insidiously but was sharply exacerbated when heading the ball. Initial X-rays showed no shoulder or neck abnormality, but bone scan revealed focal uptake at the C7 level.

Initially relieved with aspirin, the pain became less responsive over time. It was often present at night and on waking in the morning, without inciting events. The pain localized to the low cervical region just left of the midline, with radiation to the left shoulder, but it did not radiate distally into the arm. There were no right-sided symptoms.

Despite full range of motion, the patient experienced pain with extremes of flexion, extension and rotation, and while tilting his head to the right. He had no atrophy, but had mild weakness in his left-hand intrinsics. Deep tendon reflexes were equal bilaterally in the upper extremities, and his lower extremity examination was normal.

A computed tomography (CT) scan revealed a lesion in the left pedicle of C7, suggestive of osteoid osteoma (Fig. 1, top). Based on his progressive symptoms and the failure of conservative measures to maintain adequate function, surgical excision was indicated. A fine-cut CT was obtained and downloaded into the stereotactic workstation.

Through a 2.5-cm dorsal incision, a microsurgical approach was made to the C7 lamina. The SG system was registered to the C7 vertebra, using the spinous process and the adjacent facet margins for triangulation. The SG wand was then used to select the proper entry point, through the laminar surface, based on the position and depth of the intraosseous lesion (Fig. 1, middle). A 1.2-cm window was made through

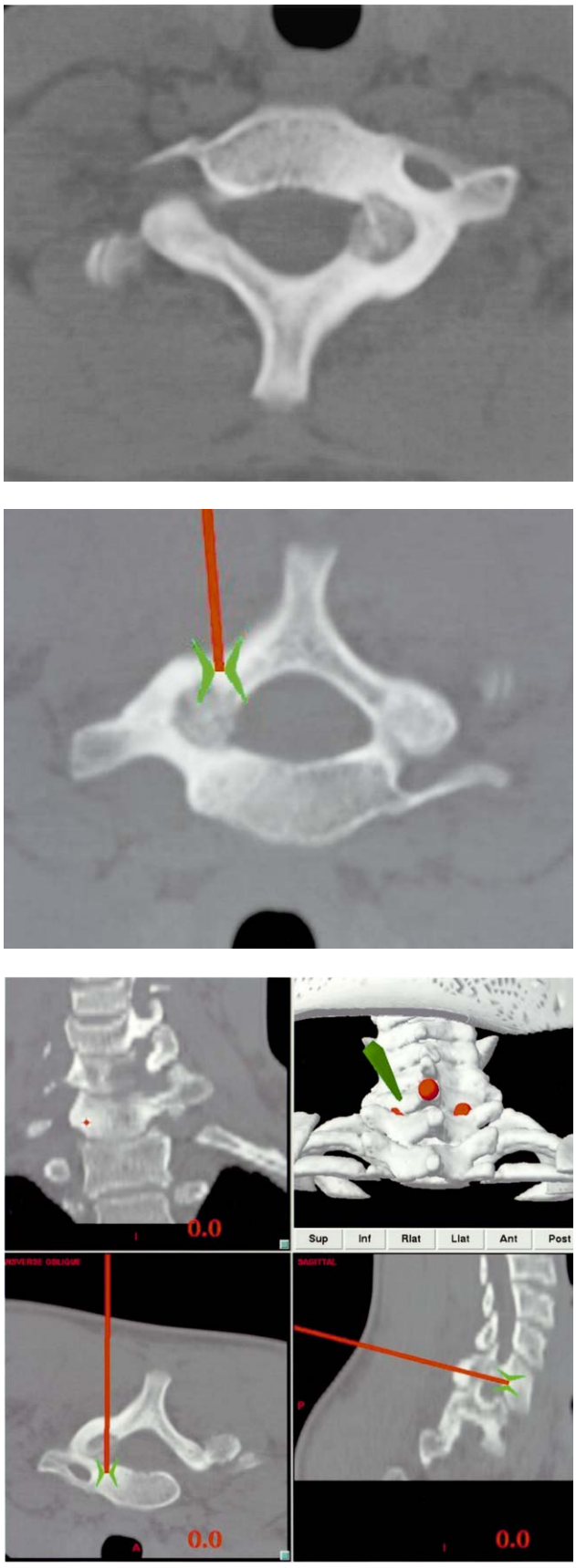


Fig. 1. (Top) Axial computed tomography image demonstrating well-circumscribed lytic lesion in cervical pedicle, with erosion of medial cortex into the neural canal. (Middle) Intraoperative stereotactic image after registration, showing probe tip over cortical entry point providing optimal access to osteoid osteoma. (Bottom) Intraoperative stereotactic image demonstrating probe tip at base of void created during excision of tumor nidus. Stereotactic image guidance permitted complete ablation of tumor without risk of entry into the canal.