

# Arthrodesis of the Lumbar Vertebrae after Radiosurgery for Residual Malignant Schwannoma

Domenico Murrone, Bruno Romanelli, Aldo Ierardi

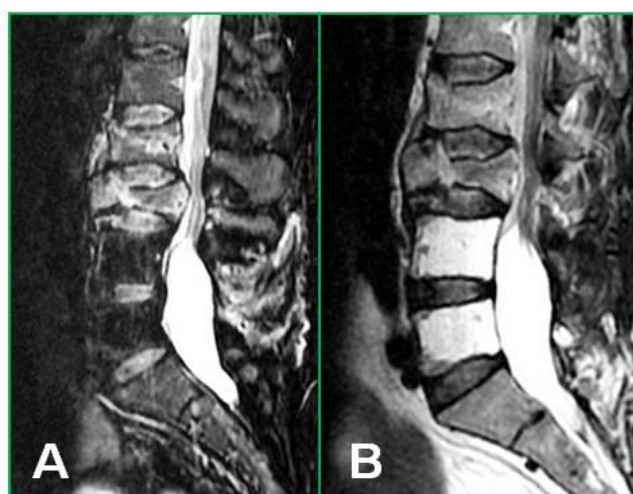
**Abstract**— In past years, instrumentation options for stabilization were very limited and spinal surgery was restricted to dorsal decompression alone. As technology evolved, surgeons began to approach the spine using lateral or ventral approaches, in addition to the standard dorsal approach using fusion and instrumentation and the effect of radiation on bones has been extensively described. **CASE REPORT:** 51 year old patient who had undergone in 2013 subtotal resection of malignant schwannoma (Ki67> 50%) at L4 level right through laminectomy and arrectomia partial at L4 and L5 with outcomes of mild erectile dysfunction. It was performed following adjuvant radiotherapy at L4-L5 level (46 Gy). In April 2015 reported lumbar accidental trauma with detection of burst fracture and diastasis intracanal of large fragment at L3 level. Neurologically the patient had no additional neurological deficits than in the past. After stabilization of hemodynamic parameters, the patient underwent arthrodesis L2-L4 bilateral transpedicular percutaneous. The postoperative course was normal with patient mobilization with lumbar bust in the third day. **DISCUSSION:** It is commonly known that radiation hinders the fusion process and reduces the strength of bones. The effect of radiotherapy on bony metabolism has been widely discussed but its role in influencing the failure of instrumented fusion has not yet been definitively analysed. Moreover, the most appropriate technique of instrumented fusion to be used after radiotherapy is not established. **CONCLUSIONS:** In the literature there are no significant studies about the spinal instrumentation after radiosurgery. From our point of view, the fusion is possible due to the extreme hardness of the vertebrae previously irradiated. The choice of the arthrodesis percutaneously depended on the need to avoid significant complications.

**Index Terms**— Arthrodesis after radiosurgery, percutaneous arthrodesis; radiosurgery effect; burst fracture.

## I. INTRODUCTION

In past years, instrumentation options for stabilization were very limited spinal and surgery was restricted to dorsal decompression alone. In this years several large series showed that Stand-alone XRT was the standard of care for patients with metastatic or residual spine tumors [1]-[3]. As technology evolved, surgeons began to approach the spine using lateral or ventral approaches, in addition to the standard dorsal approach. Patchell et al. [4] conducted a pivotal multicenter randomized trial comparing stand-alone XRT with surgery followed by XRT for patients with metastatic epidural spinal cord compression and he showed that a higher percentage of operated patients maintained or regained the ability to walk and required lower corticosteroid and analgesic doses compared with the

radiation monotherapy group, changing the treatment paradigm for epidural metastases, assuming instrumentation to restore stability and alignment. The benefit of adjuvant radiation treatment has never been fully investigated, but it is assumed to be beneficial because most malignant tumor resections do not achieve complete microscopic tumor cell eradication [5]-[8]. Surgical stabilization methods for malignant tumors vary widely.



**Figure 1:** Pre-operative fat-suppressed T2-weighted (A) and simple T2-weighted (B) sagittal magnetic resonance images of lumbar spine without contrast showing burst fracture of L3 and radiated L4 and L5.

## II. CASE REPORT

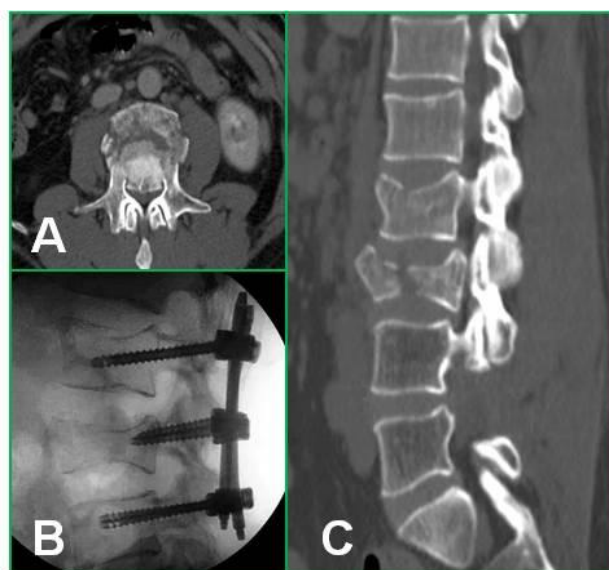
The main 51 year old patient who had undergone in 2013 subtotal resection of malignant schwannoma (Ki67> 50%) at L4 level right through laminectomy and arrectomia partial at L4 and L5 with outcomes of mild erectile dysfunction. It was performed following adjuvant radiotherapy at L4-L5 level (46 Gy). In April 2015 reported lumbar accidental trauma with detection of burst fracture and diastasis intracanal of large fragment at L3 level, compound fracture of the ischio-pubic brancha right edematoma the psoas muscles. Neurologically the patient had no additional neurological deficits than in the past. After stabilization of hemodynamic parameters, resolution of the fracture and hematoma on the paraspinal mentioned, the patient underwent arthrodesis L2-L4 bilateral transpedicular percutaneous. In intra-operative level was observed considerable difficulty in entering in L4 screws (because the previous irradiation which gave consistency ivory). The postoperative course was normal with patient mobilization with lumbar bust in the third day. The postoperative

radiographs showed good screw placement with reduction of diastasis of the root canal fragment.

### III. DISCUSSION

The effect of radiation on bones has been extensively described [9],[10]. Long bone fractures in laboratory animals are associated with a high pseudarthrosis rate, delayed union, decreased strength and decreased periosteal osteoblastic proliferation, decreased formation of cartilage and osteoid, and decreased vascularity after irradiation. Emery et al. [11],[12] reported a 16% pseudarthrosis rate in patients undergoing vertebrectomies and reconstruction with autologous bone graft, with or without dorsal instrumentation. All patients were irradiated either before or after surgery. Vrionis and Small [13] presented a series of 96 patients who underwent surgery for spinal metastases, of which 3.1% had hardware failure. The authors reported that two thirds of the patients were treated with radiation, but it is unclear whether the failures were irradiated or not. Publications on fusion of an irradiated site are scarce, and the true failure rate is yet to be determined. Ibrahim et al. [14] reported on 223 patients operated for spinal metastases and followed prospectively. They reported a 2.2% instrumentation failure rate, but not all patients were instrumented, some received presurgical or postsurgical radiation, and some were not irradiated. Bouchard et al. [15] examined the effects of radiation therapy on a dorsal spinal fusion model in rabbits. Rabbits that were irradiated immediately before or after surgery were found to have less stiff fusions and had less fusion mass, when evaluated histologically, than the untreated control group. Fusion and instrumentation outcomes of patients treated with SRS after surgical tumor debulking and stabilization have not been published. Rock et al. [16] reported 18 patients treated with spine surgery followed by SRS and concluded that radiosurgery for residual disease is an effective treatment for pain control and neurologic stabilization or improvement. In this cohort, only a subset of patients were instrumented, and the follow-up period was short, not allowing the authors to comment on the effects of radiosurgery on instrumentation and fusion. Adjuvant radiation to the spine is now common practice for malignant or residual tumors, although surgery and radiation have never been compared with surgery alone in a large-scale trial. The rationale for radiation therapy is to achieve local control of the residual tumor in the resection cavity, which is a common practice in other oncologic fields [17] – [19]. Radiation causes changes in normal tissue surrounding the tumor, however, including weakening of the bones and interference in normal healing and fusion processes [20]. It is commonly known that radiation hinders the fusion process and reduces the strength of bones. Treatment paradigms using evidence-based approaches that address immediate and long-term outcomes, with careful monitoring of the patients' quality of life through the course of their disease, must be developed. Delayed instrumentation failure and the need for further surgical intervention negatively affect patients' quality of life. The effect of radiotherapy on bony metabolism has been widely discussed but its role in influencing the failure of instrumented fusion has not yet been definitively analysed.

Moreover, the most appropriate technique of instrumented fusion to be used after radiotherapy is not established.



**Figure 2:** Pre-operative axial (A) and sagittal (C) computed tomography scans of lumbar spine revealing burst fracture of L3. Post-operative (B) lumbar radiography showing good screw placement with reduction of diastasis of the root canal fragment.

### IV. CONCLUSIONS

In the literature there are no significant studies about the instrumentation after radiosurgery. From our point of view, the fusion is possible due to the extreme hardness of the vertebrae previously irradiated. In this case the choice of the arthrodesis percutaneously depended on the need to avoid significant surgical incisions typical of open surgery that could adversely affect the scarring in a previously irradiated area, and in the case of quoted, limiting further bleeding of the psoas muscles. The particularly hard consistency to the intraoperative control of radiated vertebra has contraindicated any pre-vertebroplasty arthrodesis, as originally scheduled.

#### Consent

Written informed consent was obtained from the patients for publication of this case report and any accompanying images.

**Abbreviations:** XRT: Conventional Fractionated Radiation, SRS: Stereotactic Spine Radiosurgery.

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