The management of spinal metastases from renal cell carcinoma

JAMES LANGDON¹, ADAM WAY¹, SAMUEL HEATON¹, JASON BERNARD², SEAN MOLLOY¹

¹The Spinal Deformity Unit, The Royal National Orthopaedic Hospital, Stanmore, UK

²Department of Orthopaedics, St George's Hospital, London, UK

ABSTRACT

INTRODUCTION Osseous metastases occur in 50% of patients with renal cell carcinoma; of these, 15% occur in the spine. The treatment options for spinal metastases secondary to renal cell carcinoma are limited. This paper considers the current management options available for spinal metastases secondary to renal cell carcinoma.

PATIENTS AND METHODS A review of four patients with spinal metastases secondary to renal cell carcinoma.

RESULTS The presentation of four cases highlighting the current management options for spinal metastases secondary to renal cell carcinoma.

CONCLUSIONS Historically, spinal metastases from renal cell carcinoma have been poorly managed; however, as the treatment of the primary disease improves, better treatment of the secondary disease is needed. Cement augmentation, used alone for prophylactic stabilisation or in conjunction with a posterior decompression and fixation, provides a useful addition in the management of these patients optimising their chance to remain ambulant, continent, and pain-free.

KEYWORDS

Renal cell carcinoma – Vertebral body metastasis

CORRESPONDENCE TO

James Langdon, Specialist Registrar in Trauma and Orthopaedics, The Spinal Deformity Unit, The Royal National Orthopaedic Hospital, Brockley Hill, Stanmore HA7 4LP, UK

E: jmplangdon@googlemail.com

Renal cell carcinoma is the commonest malignant neoplasm of the kidney, accounting for 85% of all renal cancers, and 2% of all adult malignancies. Bony metastases from renal cell carcinoma are common, occurring in up to 50% of patients.^{1–3} For approximately 30% of patients with renal cell carcinoma, the primary presentation is with a pathological fracture.^{4,5} In the presence of metastasis, the prognosis is poor with an average life expectancy of 12–24 months. The prognosis is worse when metastases occur in the axial skeleton rather than in the extremities.^{4,5}

Osseous metastases from renal cell carcinoma are difficult to manage. They are relatively resistant to chemotherapy and radiotherapy; therefore, *en bloc* resection should be considered to minimise the risk of local disease progression.⁶ Despite complete resection, many patients still experience local recurrence.⁷ When planning resection and reconstruction, it should be borne in mind that osseous metastases from renal cell carcinoma are usually rapidly expansile and extremely vascular. The rich blood supply, in particular, can make complete resection hazardous.

Approximately 15% of osseous metastases from renal cell carcinoma are in the spine.⁴ Traditionally, spinal metastases

have not been well managed, with metastatic spinal compression occurring in 5–14% of patients.⁸ The gold standard treatment for a solitary spinal metastasis is a total *en bloc* vertebrectomy. However, not all patients are fit enough for total *en bloc* vertebrectomy, as this procedure requires an anterior approach to the spine or an extensive posterior procedure.^{9,10} A thoracotomy is contra-indicated in the presence of pulmonary metastases, and metastases at more than one level are not normally amenable to *en bloc* resection. Untreated, these metastatic deposits will continue to cause pain and may result in cord compression if they fracture or if the tumour progresses posteriorly into the spinal canal.

Historically, acute cord compression secondary to tumour was managed with a laminectomy. However, as most spinal metastases are located within the vertebral body, removing just the posterior elements of the spine not only fails to remove the tumour and decompress the cord, but potentially destabilises the spine.¹¹ The current standard treatment for patients who present with cord compression is posterior decompression and fixation. This gives those patients who are ambulatory at presentation the greatest chance of preserving their ability to walk.⁸

Figure 1 A sagittal CT of patient 1 showing an intra-compartmental L3 vertebral body metastasis, with vertebral body height maintained.

However, without anterior column reconstruction, the patient frequently remains in pain, and without anterior column support the posterior metalwork will fatigue and may eventually fail due to repetitive loading.

Cement augmentation is being increasingly used to reconstruct the anterior column of the spine in patients with osteoporotic vertebral compression fractures and in patients with pathological spinal fractures that do not require decompression.^{12,13} Percutaneous vertebroplasty is the technique of injecting polymethylmethacrylate (PMMA) bone cement directly into the fractured vertebral body. The injected cement acts to stabilise and stiffen the vertebral body, thereby relieving the patient of their pain and providing anterior column support, so preventing vertebral body collapse.^{14,15} Balloon kyphoplasty is a more recent technique developed in an attempt to treat the kyphotic deformity that occurs within the fractured vertebral body using an inflatable bone tamp. The bone tamp creates a void within the vertebral body which aims to reduce the fracture and restore normal anatomy. The void is then filled with PMMA

Figure 2 A sagittal MRI scan of patient 1 taken 6 months later showing L3 vertebral body collapse and extracompartmental disease.

bone cement. Percutaneous vertebroplasty and balloon kyphoplasty are both percutaneous techniques that take less than 30 min, and cause minimal blood loss. Both techniques can be used as an adjunct to posterior decompression and fixation, providing effective pain relief and lasting anterior column support. The cement injection is better controlled with balloon kyphoplasty making it a more favourable technique when dealing with spinal tumours. This paper considers the current management of spinal metastases from renal cell carcinoma.

Patients and Methods

This paper retrospectively reviews the management of four patients with renal cell carcinoma and spinal metastases.

Results

Patient 1

A 56-year-old woman with renal cell carcinoma, who was deemed not suitable for a total nephrectomy, presented with lower back pain. A solitary lytic metastasis at the level of L3 was identified on computed tomography (CT) scan. This

Figure 3 A lateral plain radiograph of patient 2 showing the cage and posterior metalwork *in situ* following T7 *en bloc* vertebrectomy.

was treated with radiotherapy. Ten months later, she presented with cauda equina syndrome. Imaging revealed a burst fracture at L3 and a significant soft tissue swelling. This woman became paralysed in both legs and incontinent of urine and faeces (Figs 1 and 2).

Patient 2

A 67-year-old man with renal cell carcinoma, who had had a previous total nephrectomy and subsequent proximal humeral replacement for a metastatic deposit, presented with progressive pain in his mid-thoracic spine. He was found to have a solitary spinal metastasis at the level of T7. This was treated with a total *en bloc* vertebrectomy, necessitating both anterior and posterior surgery, without complication. He remains ambulant, continent and pain-free after 13 months (Fig. 3).

Patient 3

A 53-year-old man, known to have renal cell carcinoma with pulmonary metastases, presented with severe and intractable back pain. A solitary metastasis was identified at the level of T10. This was treated with balloon kyphoplasty. He remains ambulant, continent and free of back pain after 14 months (Fig. 4).

Figure 4 A postoperative lateral plain radiograph of patient 3 showing the cement *in situ* with vertebral body height maintained.

Figure 5 A postoperative lateral plain radiograph of patient 4 showing the posterior fixation with cement providing anterior column support.

Patient 4

A 61-year-old man with renal cell carcinoma, who had had a previous total nephrectomy, presented with severe lower back and leg pain. He also had pulmonary metastases. Magnetic resonance imaging (MRI) revealed a large, extracompartmental lesion at the level of L1 causing nerve root compression with a pathological fracture of the vertebral body. This was treated with balloon kyphoplasty, posterior decompression and fixation without complication. The patient remains ambulant, continent and pain-free 19 months following surgery (Fig. 5).

Discussion

Renal cell carcinoma is a difficult disease to treat. As the treatment of the primary disease improves, patients are living longer; therefore, better treatment of the secondary disease is needed. A vertebral body containing a metastasis is structurally weakened and, if untreated, may fracture, potentially causing paralysis, incontinence and severe pain. The principles of managing a renal cell metastasis in the spine are no different to those in an extremity. The gold standard treatment for a solitary spinal metastasis is total *en bloc* resection. However, many patients present with multiple metastatic lesions making them not suitable for an *en bloc* vertebrectomy, and the presence of lung metastases precludes a thoracotomy or thoraco-abdominal approach. It is possible to perform an *en bloc* resection with posterior-only surgery, but it is technically difficult to attain anterior column stability using this technique and there is significant associated morbidity.

Patients who present with cord compression due to an extracompartmental spinal metastasis are managed by posterior decompression and fixation, as the extracompartmental disease precludes *en bloc* resection. However, in the absence of anterior column support, this frequently fails to address the pain and leaves the patient at risk of subsequent metalwork fatigue and failure. In these patients stabilising the vertebral body with cement provides both pain relief and anterior column support, reducing the extent to which the metalwork is fatigued, and minimising the need for complex revision surgery in the future.

If a metastatic lesion is not amenable to resection but is deemed to be at risk of fracture, prophylactic stabilisation should be considered, as fracturing through these lesions can cause spinal instability and acute cord compression.¹⁶ Cement augmentation can be used in these patients to stabilise the vertebral body prophylactically, thereby providing both pain relief and support to the anterior column of the spine.

If cement augmentation has been used to stabilize a vertebral body metastasis prophylactically and the patient subsequently develops cord compression as a result of disease progression at that level, they can still be managed with posterior decompression and fixation. However, as the cement continues to provide anterior column support, they will only require a limited posterior fixation, as the posterior metalwork does not have to compensate for a lack of anterior support.

Conclusions

Historically, spinal metastases from renal cell carcinoma have been poorly managed; as the treatment of the primary disease improves, better treatment of the secondary disease is needed. With prompt diagnosis and early referral there is no need for these patients to suffer painful vertebral body fractures, with the potential for cord compression. Total *en bloc* vertebrectomy maybe the gold standard treatment for solitary spinal metastases, but many of these patients are not suitable candidates. Cement augmentation can potentially revolutionise the treatment of spinal metastases from renal cell carcinoma. By stabilising the vertebral body the cement provides both pain relief and anterior column support, thereby ensuring spinal stability is maintained and that these patients are able to remain ambulant, continent and pain-free. Research is currently being carried out within our unit to define and clarify further the role of cement augmentation in the management of painful vertebral body metastases.

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