

Intradural Metastasis from Cutaneous Squamous Cell Carcinoma causing Cauda Equina Syndrome

François Mathieu¹ MD, Fan Jiang^{1,2} MD. FRCSC, Jamie Wilson¹ BM. BCh. FRCS, Phedias Diamandis³ MD, PhD, FRCPC, Michael Fehlings¹ MD. Ph.D. FRCSC. FACS

¹Division of Neurosurgery, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Canada

²Division of Orthopedic Surgery, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Canada

³Department of Pathology, Laboratory Medicine Program, University Health Network, University of Toronto

Author Emails:

François Mathieu MD: Francois.Mathieu@mail.utoronto.ca

Fan Jiang MD. FRCSC: fan.jiang@mail.mcgill.ca

Jamie Wilson BM. BCh. FRCS: Jamie.Wilson@mail.utoronto.ca

Phedias Diamandis MD, PhD, FRCPC: p.diamandis@mail.utoronto.ca

Michael Fehlings MD. Ph.D. FRCSC. FACS: Michael.Fehlings@uhn.ca

***Corresponding Author:**

Michael Fehlings MD. Ph.D. FRCSC. FACS

Division of Neurosurgery and Spinal Program

Department of Surgery

University of Toronto

Kremsil Neuroscience Center

Toronto Western Hospital

399 Bathurst St., Suite 4W-449

Toronto, Ontario, Canada M5T 2S8

T: (416) 603-5627

F: (416) 603-5298

E: michael.fehlings@uhn.ca

Michael.Fehlings@uhn.ca

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ABSTRACT

Background: Spinal leptomeningeal carcinomatosis from a cutaneous squamous cell carcinoma (SCC) origin is exceedingly rare. Herein, we describe the first report of cauda equina syndrome secondary to drop metastases from a skin SCC.

Case Description: A 69-year-old male with a history of recurrent SCC of the face with known cranial nerve involvement presented with acute onset sphincter and lower extremity symptoms. Neuroimaging revealed a compressive intradural mass at the lumbosacral junction. The patient underwent urgent surgical decompression followed by adjuvant fractionated radiotherapy. Substantial improvement in function and quality of life was reported on postoperative follow-up.

Conclusions: Cauda equina syndrome manifestations in a patient with a history of cutaneous SCC with perineural spread should raise suspicion for drop metastases. In this case, a relatively straight forward surgical procedure resulted in significant improvement in the quality of life. Therefore, operative intervention should be considered to prevent permanent neurological deficits depending on the patient's goals of care and overall clinical status.

INTRODUCTION

Cutaneous squamous cell carcinoma (SCC) is the second most common form of skin cancer in Caucasians. It arises from epidermal keratinocytes, typically in sun-exposed areas (1). Approximately 5% of patients develop metastases, most commonly to regional lymph nodes (2, 3). Previously identified prognostic factors for high-risk cutaneous SCC includes increased tumour diameter, increased depth of invasion, poor differentiation, a desmoplastic growth pattern, the location of the lesion at the site of a scar, perineural invasion and host immunosuppression (2-4). To our knowledge, the reported rate of spread of cutaneous SCC to the leptomeninges and intradural spinal compartment is exceedingly rare, including only three reported cases in the English literature of metastatic dissemination to the cauda equina (5, 6). Since no surgical indication was present, all three cases were treated with radiation and medical management. In this report, we, therefore, describe the first pathologically-confirmed case presentation and surgical management of a cauda equina syndrome secondary to a compressive drop metastasis. The literature on similar accounts previously published is also reviewed.

CLINICAL HISTORY

A 69-year-old Caucasian male was known for a two-year history of recurrent invasive SCC of the skin that had originated in his right temporal region. Patient's clinical course has been managed and closely followed by his oncologists, and previous screening imaging has ruled out other primary sites of SCC. The patient's past medical history was otherwise significant for remote

prostate adenocarcinoma treated surgically, type 2 diabetes mellitus, hypertension and a 30 pack-year history of smoking.

The initial treatment of SCC involved primary resection of the lesion and planned radiation therapy of 60 Grey (Gy) to the principal site. His post-resection care was complicated by identification of positive surgical margins as well as early discontinuation of radiotherapy at 52 Gy due to severe peri-orbital swelling and progressive ptosis of the upper eyelid. Although initial pathology showed no evidence of lymphovascular invasion at the time, a repeat MRI of the head to investigate the peri-orbital swelling showed evidence of thickening and enhancement of the right supraorbital nerve, as well as evidence of abnormal enhancement of the anterior aspect of the cavernous sinus in continuity with thickening and enhancement of the trigeminal nerve (V2) near the right foramen rotundum and V3 in the right foramen ovale consistent with perineural invasion. In light of the new finding, additional radiation comprising of 70Gy in 35Gy fractions was prescribed with the goal of controlling the spread of the disease. However, despite treatment, over the course of the following year, the patient developed right facial nerve involvement at the skull base and a rapidly progressive right pre-auricular mass for which he received a palliative radiation dose of 20Gy. He concurrently started Cetuximab therapy, a monoclonal antibody targeting epidermal growth factor receptor (EGFR).

The patient came under our care after a one-week history of difficulty with ambulation, worsening lower extremity neurogenic pain, urinary retention, saddle anesthesia, and fecal incontinence. Physical exam revealed significantly diminished power in the distal lower

extremities, the absence of sensation to light touch and pinprick in the saddle region, decreased rectal tone and an increased post-voiding residual volume. An urgent MRI of the spine revealed, in addition to leptomeningeal enhancement along the spinal cord, the presence of a 32 x 14 mm heterogeneously enhancing intradural mass at the L5-S1 level causing significant compression of the cauda equina (Figure 1).

Discussant: Prof Choi

The involvement of the central nervous system by squamous cell carcinoma is very rare and note-worthy in this case. The pattern of regional involvement in this case, and recurrence of squamous cell carcinoma around the skull base and cavernous sinus is also unusual. The involvement of cranial nerves is likely to be due to lymphatic or local venous spread, leading to nerve sheath and leptomeningeal involvement. SCC metastasis to the intradural space was presumably due to direct spread of tumour through the dura of the skull base. Periorbital swelling implies impaired drainage through the ophthalmic veins and cavernous sinus which was corroborated by the MRI findings.

The second rare finding was drop metastasis to the lumbar spine. It is well known that cauda equina syndrome is a neurosurgical emergency and requires immediate surgical decompression. This is more commonly due to acute lumbar disc prolapse, when the severity of sciatic pain is often the driver for the patient seeking medical attention. In subacute cases, presentation may be delayed, but nevertheless it is important to consider emergency decompression as soon as the diagnosis is made. Unfortunately, intradural involvement of the nerve roots by tumour has a

worse prognosis than the more usual extradural compression of the cauda equina by a disc prolapse.

Given the clinical and radiological findings of cauda equina syndrome, urgent surgical decompression and resection of the intradural mass was performed by the neurosurgical team in our center. Consent was obtained from the patient for laminectomy of L5 and S1, microsurgical resection of the intradural lesion and dural reconstruction. The primary goal of the operation, which included decompression of the neural elements and obtain tissue specimens for pathological analysis, as well as the associated risk involved with such endeavor was explained to the patient prior to the procedure.

Intra-operatively, the cerebrospinal fluid appeared xanthochromic, and the lesion was intimately associated with the cauda equina nerve roots. For this reason, gross total resection was not attempted. Great care was taken while debulking the tumor to spare the nerve roots, and a radical resection with good decompression of the cauda equina was achieved (Figure 2). A watertight dural repair was performed and tested under Valsalva maneuver before closure of the fascia and skin. Histopathological examination of the surgical specimen revealed collections of squamoid cells exhibiting mitotic activity, cellular atypia, prominent nucleoli and keratinization (Figure 3). While the site of origin of SCCs cannot be resolved by morphologic or immunohistochemical analysis, given the presenting clinical picture and the absence of other tumours from previous screening, this most likely represents a metastasis from the cutaneous origin.

Discussant: Prof Choi

Although spine surgery has an inherent risk, simple decompressive surgery without fusion or prosthetic implants is usually straightforward and beneficial for the patient. It is very important to maintain good clean technique, avoiding long surgical duration, and ensuring robust dural closure. Since this operation aims to improve quality of life (pain and sphincter control in particular) it is essential to minimise the risk of post-operative infection or CSF leakage which would negate the benefits of timely surgery.

Post-operatively, the patient reported a resolution of his radicular pain, and he was able to ambulate independently with a cane. He continued to experience intermittent urinary incontinence but no fecal incontinence. The case was discussed at our multidisciplinary tumor board, and adjuvant radiotherapy to the resection area was recommended with close radiological monitoring of the small leptomeningeal deposits located rostrally. At three months, the patient reported significant improvement in function and quality of life. He remained ambulatory and did not experience any recurrence of his radicular leg pain. Repeat imaging showed a stable residuum, with no evidence of enlargement compared to the immediate post-operative scans (Figure 4). However, due to the heavy underlying tumour burden and progressive clinical decline, the patient unfortunately died 8 months post-operatively.

Discussant: Prof Choi

Although the patient ultimately had a poor prognosis, timely surgery in this case maintained his quality of life and mobility. In fact, there is little justification for delaying simple surgery for

cauda equina compression, even in patients with poor prognosis. The advantages and possible complications of surgery, together with the available alternative options, should be clearly discussed with the patient, as in this case. Occasionally patients may decline surgery, and their informed decision should be respected.

DISCUSSION

To our knowledge, this is the first reported presentation of acute cauda equina syndrome caused by a lumbosacral intradural metastasis of cutaneous SCC origin. We speculate based on the patient's history and corroborating radiographic images that this is a representation of perineural invasion by a primary tumor followed by leptomeningeal spread. Although perineural spread is observed in up to 5% of mucosal and glandular SCCs, invasion of the neuroaxis from a cutaneous source is uncommon (7, 8). Moreover, the leptomeningeal dissemination of cutaneous SCC to the spine is exceedingly rare, with only four cases reported in the literature, including three with cauda equina involvement (Table 1) (5, 6, 9).

In the earlier reports of intradural metastasis of cutaneous SCC, Begemann and colleagues described two cases of leptomeningeal spread of the disease to the cauda equina (6). They presented a 72-year-old man known for SCC involving the scalp with metastases to the right parotid gland and facial nerve presenting with a 6-month history of progressive lower extremity weakness and numbness. MRI of the lumbosacral spine confirmed nodules of enhancement along the thoracic spinal cord, conus medullaris and cauda equina with cerebrospinal fluid sampling establishing the presence of malignant cells. The patient was treated with fractionated radiation therapy and bi-weekly high-dose intravenous methotrexate

and succumbed to the disease six months after being diagnosed with the leptomeningeal spread.

The second case reported by Begemann was a 59-year-old man with recurrent invasive SCC originated from the temporal skin (6). The patient presented two years after diagnosis with worsening cranial nerve palsy, deviation of the tongue and was found to have the leptomeningeal disease of the cranio-cervical junction on MRI. Despite radiation therapy, the disease progressed to the entire spine including the cauda equina and patient passed away soon after.

In the case report by Zhu et al. 2003, the authors describe a 70-year-old man previously treated for multiple SCCs of the face and neck who developed right-sided cranial neuropathies over 5 years and subsequently presented with a few months history of left leg paresis (5). After a series of negative MRI of the head, an MRI of the brain and spine performed shortly after the patient presented with lower extremity symptoms revealed a right parasellar enhancing mass as well as enhancement of the cauda equina nerve roots. The patient underwent a pterional craniotomy for biopsy of the cavernous sinus lesion which was consistent with metastatic SCC on histopathological examination. Following the diagnosis, radiotherapy targeting the skull base and lumbosacral spine was delivered, and palliative hospice care ensued.

These clinical cases highlighted the importance of clinical vigilance towards spine involvement in patients with SCC. In all three cases, patients presented with a more indolent clinical course and radiographic evidence of root enhancement in the absence of a compressive lesion. Contrary to previous reports, our case is therefore unique in that patient presented with

a discrete intradural mass severely compressing the cauda equina and resulting in rapid-onset deficits requiring emergent surgical intervention.

Overall, spinal intradural metastases are relatively uncommon, representing approximately 5% of all spinal metastases with most of the lesions arising in this region being of primary neurological origin (10). Although accounts of cauda equina syndrome with cutaneous melanoma and squamous cell carcinoma of the lung, larynx, and anus exist in the literature (11-14), it has never been reported with skin SCC. The previously speculated mechanism of intradural infiltration of metastatic lesions includes a direct extension from involved spinal bony elements, hematogenous spread via spinal venous plexuses or perineural lymphatic spread (15). Although in our case, the SCC could have reached the intradural compartment through the hematogenous or venous route, his long-standing history of cranial nerve involvement suggests a pattern of invasion through the cerebrospinal fluid.

While controversies exist in the spine community as to the value of surgical intervention of metastatic epidural disease in patients with poor overall prognosis, this case illustrates that provided an acceptable risk profile, and excellent clinical outcome can be achieved. This conclusion is further substantiated by a recent AO Spine study (16), in which operative management of patients with at least 3 months of survival provided significant benefit in clinical recovery and quality of life improvements. Therefore, it is the authors' opinion that given the appropriate clinical context, surgical management is a feasible adjunct to radiation and chemotherapy.

CONCLUSION

Although an extremely rare presentation, lower extremity and sphincter dysfunction in patients with invasive skin SCCs should raise the possibility of drop metastases, especially in those with concomitant cranial neuropathies or established perineural spread. In this case, emergent surgical decompression followed by local radiation therapy was associated with significant recovery of function and adequate local spinal tumor control at three months postoperatively.

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Figures and Tables:

Table 1. Characteristics of patients with leptomeningeal carcinomatosis from cutaneous SCC.

Reference	Age (years), sex (M/F)	Tumour origin	Spinal symptoms	Radiographic findings	Management of leptomeningeal metastases	Outcome
Begemann et al. 2003	72, M	Scalp SCC with spread to the neck and the parotid on the right side	Progressive bilateral lower extremity weakness and numbness	Nodular enhancement of the thoracic cord, conus medullaris as well as the cauda equina	Local fractionated RTx	Death at 6 months
Begemann et al. 2003	59, M	SCC of left temporal skin	Confusion, tongue deviation, and worsening 7th cranial nerve palsy	Leptomeningeal enhancement at the craniocervical junction progressed to involve the entire spine including the cauda equina despite RTx	Local fractionated RTx	Death at approximately 4 months

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Zhu et al. 2004	70, M	Multiple facial SCC with right V1 and V2 involvement	Right cavernous sinus syndrome followed by left leg paresis	Enhancement of the cauda equina nerve roots	Local fractionated RTx	N/A
Wostrack et al. 2012	68, M	Skin SCC	N/A	IDEM enhancing lesion at T10	GTR + adjuvant RTx	N/A
Mathieu et al. 2019	69, M	SCC right supraorbital skin with V2 and V3 involvement	Acute CES	enhancing compressive intradural mass at L5-S1	STR + adjuvant RTx	Partial functional recovery, ambulatory at 3 months follow up

SCC: squamous cell carcinoma; RTx: radiotherapy; N/A: Not available; IDEM: intradural extramedullary; GTR: gross total resection; CES: Cauda equina syndrome; STR: subtotal resection

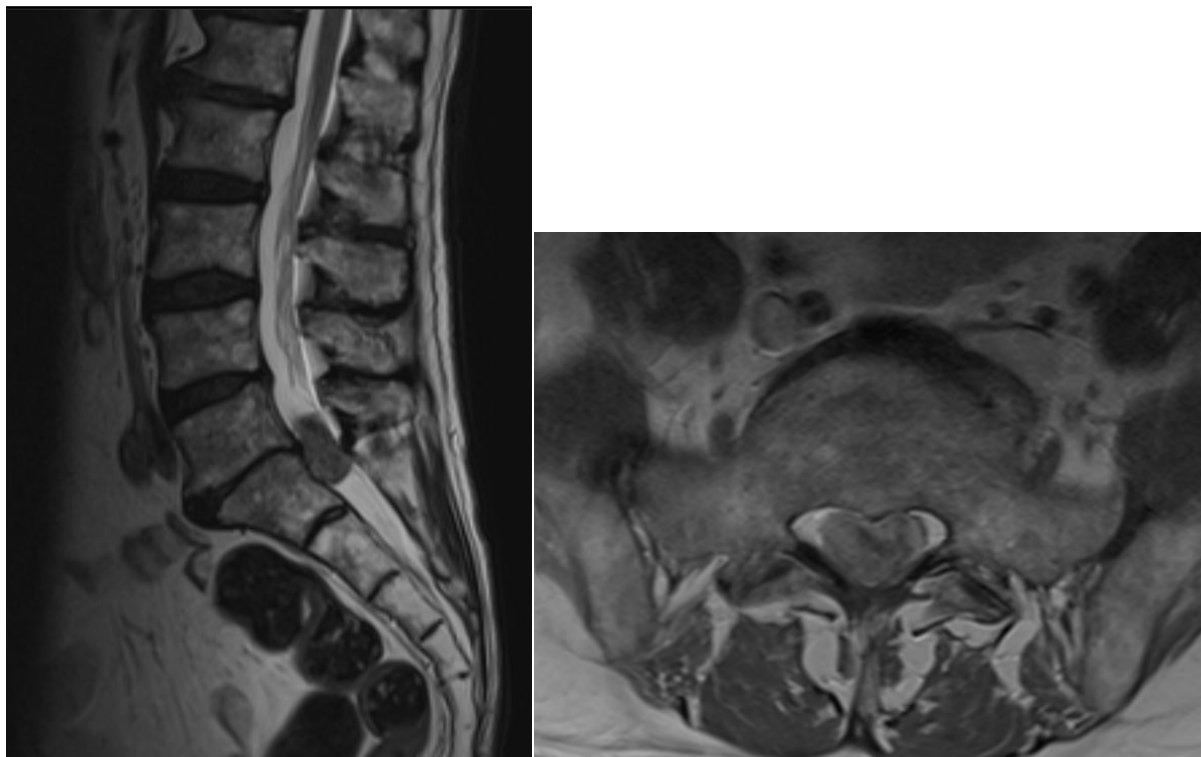


Figure 1. Coronal and Axial MRI scans of the lumbosacral spine. **A.** T2-weighted MRI sagittal view showing heterogeneously enhancing intradural mass at the level of L5-S1 measuring 32 x

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14 mm. **B**, Axial, post contrast, T1-weighted MRI view at the level of L5-S1 showing intradural lesion causing significant mass effect and compression of the nerve roots in the cauda equina.

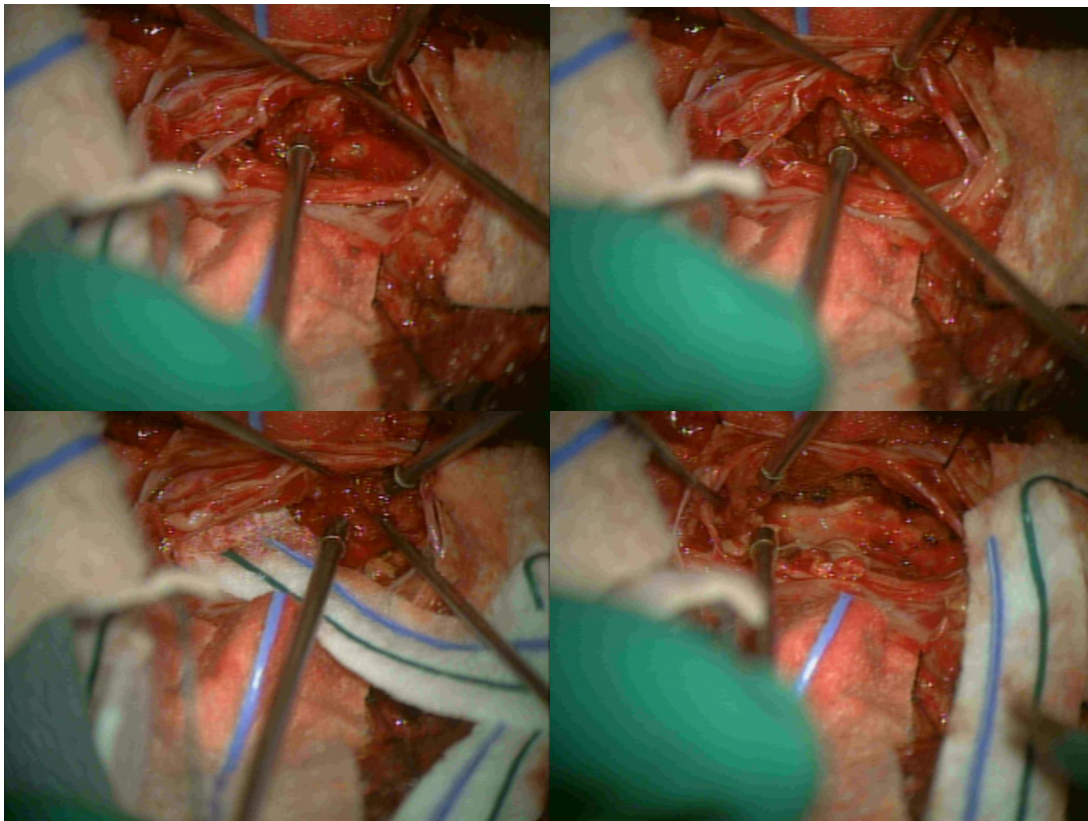


Figure 2. Intraoperative images of surgical resection of the L5-S1 intradural tumour. **A**, after durotomy was performed at the level of L5-S1, tumour was visualized and found to intimately associated with the nerve roots in the cauda equina. **B**, careful dissection, identifying the nerve roots of the cauda equina and separating them from the tumour mass. **C**, radical resection of the tumour took place while great care was taken to protect and spare the nerve roots. **D**, completion of the resection and good decompression of the cauda equina was achieved.

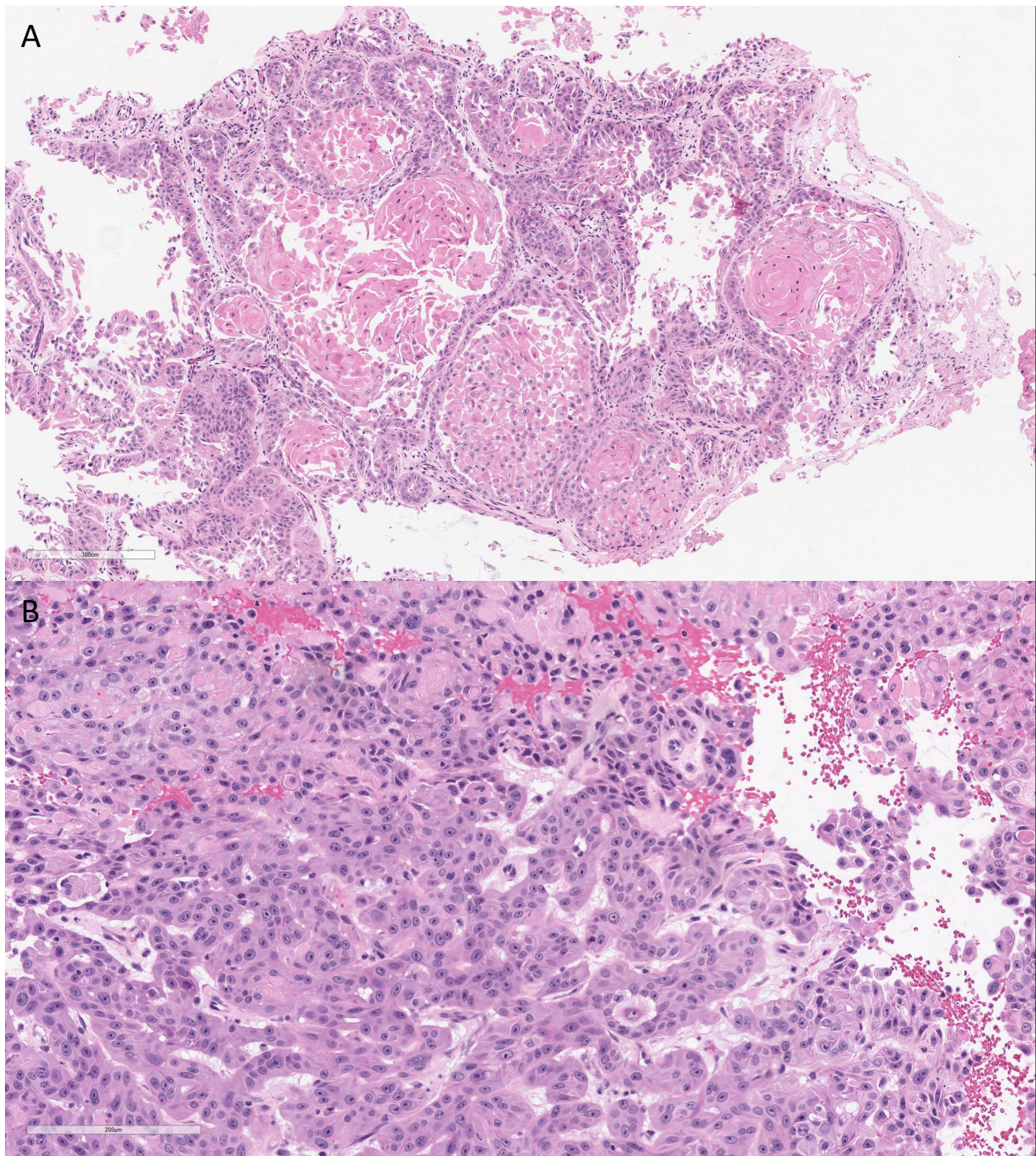


Figure 3. Histopathological examinations showing low power (A) and high power (B) views of an epithelial neoplasm supportive of a metastatic squamous cell carcinoma with atypia, prominent nucleoli, and mitotic activity. The cohesive tumor cells form round islands with a central area of keratinization and a surrounding desmoplastic stromal reaction.



Figure 4. Postoperative MRI was performed. **A**, T2-weighted mid-sagittal view of the lumbar spine. **B and C**, T2-weighted axial views of L5 and S1 showing some residual tumour but good decompression of the cauda equina.