

Surgery of spinal metastasis

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Abstract:

Objective: this work aims to define the role of surgery in the management of spinal metastasis

Patients and methods:

This study of 25 patients having symptomatic vertebral metastasis who were operated on between 2017 and 2021 at the specialised neurosurgical hospital in Cherchell. We included all patients who presented with the score of Tokuhashi below 8.

Results:

Our study consists of 10 women and 15 men with the mean age of 45 years. Backpain was particularly present in all our cases (100%), while motor deficit or paraparesis was present in 18 patients (72% of cases). One case of conus medullaris syndrome was found in our Serie with 06 cases who were having an incomplete to complete cauda equina syndrome. Primitive spinal tumours were found to take origin from breast cancer in 10 cases, lung cancer in 08 cases, prostate in 06 cases and one case of renal cancer.

The thoracic location was the most common with 18 cases, followed by 07 cases located in the lumbar spine.

All our patients undertook first time surgical removal of somatic spinal metastasis with an antero-lateral approach followed by the use of autologous bone graft and osteosynthesis by pedicular screws.

Preoperative CT scan evaluation showed a sagittal deformation with an angle of 19.4° [0,33–51,56]. Post-operative assessment showed a significant correction ($p < 0,01$) with an angle of 8° [0,01–17,96].

By the end of the follow-up, the neurological status was unchanged in 08 cases, improved with one point in the ASIA score in 13 cases, and 02 points in 5 cases (overall 17 cases improved).

The complications rate was 16% (4 cases from 25). 03 cases presented minor post-operative morbidity (urinary infection in 02 cases, with one pleural effusion which was resolved without draining). One case of CSF leak which motivated surgical reintervention without osteosynthesis removal.

Conclusion:

The management of vertebral metastasis is complex and multidisciplinary that aims to improve the oncological and functional outcome after less aggressive surgical treatment.

Keywords: Vertebral metastasis, surgery, osteosynthesis, spinal instability, radiosurgery.

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I. Introduction:

The spinal column is the most frequent location of bony metastasis (1). Spinal metastasis is prone to get more frequent due to high life expectancy as well as the overall improvement of oncological management.

Metastatic lesions of spinal column represent an incidence of 70% from all the bony metastasis in terminally ill patients having cancer (1)

The survival rate of patients having cancer rose with 25% after 10 years in the seventies and 45% in 2007 (2).

The surgical management of patients having spinal metastasis depends on clinical, radiological and oncological features.

Therapeutic decision-making for patients having spinal metastasis might be difficult and depends particularly on the vital prognosis (3,4). However, surgery remains the most efficient therapeutic for those cases (3,4). Therefore, surgery has not only a palliative role, but it can also have a curative role for some specific patients while contributing to suppress the pain and the improvement of life quality.

The development of the minimally invasive techniques helped to suggest for the cancerous patients' efficient solutions with low morbidity rate.

Early diagnosis and the multidisciplinary management of those lesions are essentials to minimize functional sequelae and eventually improve the quality of life of those patients.

The prognosis depends mainly on the biological features of the primitive cancer. The survival rate after two years of patients having spinal metastasis varies from 09% for lung cancer to 44% for breast cancer and those of the prostate (4)

II. Patients And Methods:

25 patients having symptomatic vertebral metastasis were operated on between 2017 and 2021 at the neurosurgical specialised hospital in Chercell. All patients with Tokuhashi score below 8 were included in our Serie. We analysed the demographic, clinical and radiological data as well as the oncological features of each patient.

III. Results:

Our Serie consists of 10 women and 15 men with the mean age of 45 years. The vertebral metastasis causes constantly backpain followed by the onset of neurological symptoms.

Backpain was constant in all our cases (100%) followed by paraparesis present in 18 patients (72% of cases).

Other rare clinical symptoms were conus medullaris in one case, cauda equina syndrome in 6 patients.

All our patients undertook CT scan and MRI as well as plain radiography in frontal and sagittal views.

All our patients were referred from the oncological department for surgical treatment after radiological exploration.

Primitive tumours that were found in our serie originated from the breast in 10 cases, lung in 08 cases, prostate in 06 cases with one case of renal cancer.

the Thoracic location was the most frequent location of spinal metastasis that was found in 18 cases, followed by lumbar location is 07 cases.

The evaluation criteria were: the neurological status (score ASIA), the WHO score, the spinal sagittal deformation and the associated morbidity.

We adopted the algorithm of PATON et al (2005) in the management of our patients. This decision-making algorithm is based on 5 points:

- LMNOP was the first to incorporate SINS criteria that we have integrated to our algorithm (7). LMNOP incorporated the location and the level (L)
- Mechanical instability (M)
- Neurological status and the epidural extension (N)
- Oncological status (O)
- The overall clinical status of the prognosis and the future therapeutic management (P)

The score of mechanical instability (Spinal Instability Neoplastic Score)

SINS Criteria		Score
Location	Junctional (Occiput-C2, C7-T2, T11-L1, L5-S1)	03
	Mobile spine (C3-C6, L2-L4)	02
	Semi rigid (T3-T10)	01
	Rigid (S2-S5)	00
Pain	Yes	03
	Occasionnal pain (not mechanical)	01
	Indolor lésion	00
Lesion	Lytic bone	02
	Mixte (Lytic/blastic)	01
	Blastic	00
Vertébral alignment	Subluxation/translation	04
	De NOVO déformation (cyphosis/scoliosis)	02
	Normal alignment	00
Radiologie	Collapsed vertebrae > 50%	03
	Collapsed vertebrae >50%	02
	No compression but involvement of vertebral corpus >50%	01
	None of the criteria above	00
Involvement of postero-lateral vertebrae	Bilateral	03
	Unilateral	01
	None	00

Total score (ST)

0 - 6	stable spine
7 - 12	spine potentially instable
13 - 18	instable spine

Recommendation of surgical intervention if $ST \geq 7$

Pain is improved with decubitus and exaggerated after mobilisation of the spine in the

Fracture of one or many articulations, fractures of one pedicle or costo-vertebral articulation, tumoral

All patients underwent surgical removal of corporeal spinal metastasis with a postero-lateral approach and the use of an autologous graft, osteosynthesis with pedicular screws in one surgical time.

Preoperative CT scan assessment showed an angle of sagittal deformation of 19.4% [0,33–51,56], whereas the post-operative evaluation showed a significant correction ($p < 0,01$) with an angle of 8.0% [0,01–17,96].

By the end of the follow-up, the neurological status was unchanged in 8 cases and has improved in 17 cases. 13 patients gained 1 point in ASIA score and 5 patient gained 2points.

The complication rate was 16% (4/25 patients) while 3 cases showed minor post-operative morbidity (urinary infection and one pleural effusion that was resolved without drainage). One patient presented with CSF leak before reintervention without osteosynthesis removal.



Figure 1: MRI in sagittal and axial views showing spinal metastasis of T11 with epidural and antero-lateral extension



Figure 2: CT scan showing sagittal view of corpectomy and spinal stabilisation of the spine with trans pedicular screws

IV. Discussion :

The management of spinal metastasis has evolved in the last decades due to the advanced surgical techniques and the progress in osteosynthesis (4-5-6-7). The surgical treatment allows: 1) the immediate reduction of the local mass effect, 2) the mechanical direct stabilisation of the spine, 3) cytoreduction of the tumoral tissue which improves the efficiency of the adjuvant treatment as well as the patient's prognosis with best local tumoral control.

The surgical benefit is the pain control with the spinal stabilisation in addition to the recovery of neurological function.

The surgical benefit needs to surpass the complication rate that increases with the extent of the complexity of the surgical procedure. The complication rate of this surgery can reach 30% according to the literature (3). The decision making to operate on a spinal metastasis is a complex process in which the life expectancy, the overall health status of the patient, the histological type of the primitive tumour, the preoperative neurological status of the patient, the radiological findings of the spinal pathology are taken into account. Therefore, many classification systems have been used like: Takahashi, Tomita, Neurologic oncologic mechanical instability and systemic disease (NOMS), Weinstein-Boriani-Biagini systems (WBB) and more (4-5-8).

The evolution of the surgical management of spinal metastasis started in 1980 when laminectomy was performed by a posterior approach and represented the main surgical treatment of that pathology (1-9). After that, few studies concluded that laminectomy followed by radiotherapy was not superior than radiotherapy alone. Moreover, Laminectomy weakened the posterior elements of the vertebrae and allows instability (Cyphosis, direct compression, collapsed vertebrae and worsening of pain). Accordingly, the surgical treatment was replaced by external radiotherapy and became secondary in the management of spinal metastasis during many past decades. Many retrospective studies confirmed the benefit of radiotherapy alone versus radiotherapy after laminectomy (10-11).

The choice of the surgical approach that offers a sufficient nervous decompression and spinal stabilisation depends on the location of the metastasis and its epidural extension (anterior approach versus posterior approach).

In 2005, Patchell and al proved the superiority of the circumferential surgical decompression of the spinal cord and followed by radiotherapy versus radiotherapy only (8). This study showed that more patients were able to walk or have walked for longer in the group of the operated patients when compared with the non-operated patients (84% versus 57%, 122 days versus 13 days respectively). 90% of operated patients showed a very significant improvement of their pain which can be associated with the use of steroids and pain killers (8).

The mini invasive techniques (decompression via trans muscular retractor and per cutaneous trans pedicular osteosynthesis) allows -in particular cases- to achieve a satisfactory stabilisation and decompression with low surgical morbidity in vulnerable patients (10-11-12-13).

Techniques of spinal expansion (vertebroplasty, kyphoplasty) can be used to manage pathological or painful fractures in the absence of mechanical instability and neurological compression.

The stereotactic radiosurgery is used to deliver radiation in an extremely precise fashion to patients with minimal epidural extension while avoiding spinal cord and radio sensitive structures. This technique allows a

durable tumoral control which is not related to the sensitivity or the resistance of the primitive tumour to external radiotherapy (19-20-21).

Finely, stereotactic radiotherapy is associated to surgery according to a technique called “separation surgery” that refers to the procedure in which tumoral resection is limited to the decompression of the spinal cord to allow a distance between the tumour and the spinal cord, therefore this technique helps to apply a high radiation dose. Laufer and al documented a durable tumoral control with the minimum of morbidity (16-18). Radio resistant tumours like spinal metastasis of kidney cancer can also be treated by stereotactic radiation. (18-19).

V. Conclusion:

The management of vertebral metastasis is complex and multidisciplinary aiming to offer the best oncological and functional result possible with the less aggressive treatment modality. The spinal instability needs to be addressed by stabilisation surgery.

The minimally invasive surgical advancements and the stereotactic radiosurgery helped to improve the quality of life of patients

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