Axial Axis Metastasis

Metástase do eixo axial

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Abstract

Axial axis metastasis remains a challenge for surgical as well as other treatment modalities, like chemotherapy, immunotherapy, and radiotherapy. It is unequivocal that surgery provides pain improvements and preservation of neurological status, but this condition remains when associated with radiotherapy and other treatment modalities. In this review, we emphasize the current forms of surgical treatment in the different regions of the spine and pelvis. The evident possibility of percutaneous treatments is related to early or late cases, and in cases in which there are greater risks and instability to conventional surgeries associated with radiotherapy and have been shown to be the appropriate option for local control of metastatic disease.

Keywords
- spine
- pelvis
- bone neoplasms
- spontaneous fracture

Resumo

As metástases no eixo axial permanecem um desafio para o tratamento cirúrgico bem como para outras modalidades, como quimioterapia, imunoterapia e radioterapia. É inequívoco que a cirurgia proporciona melhorias na dor e na preservação do status neurológico; porém, há permanência desta condição quando associada à radioterapia e a outras modalidades de tratamento. Nesta revisão damos ênfase às formas de tratamento cirúrgico atuais nas diferentes regiões da coluna vertebral e pelve. A evidente possibilidade de tratamentos percutâneos está relacionada a casos iniciais ou tardios, bem como a casos em que há maiores riscos e instabilidade às cirurgias convencionais associadas à radioterapia, e tem se mostrado a opção adequada para o controle local da doença metastática.

Palavras-chave
- coluna vertebral
- pelve
- neoplasias ósseas
- fraturas espontâneas

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Introduction

Bone metastasis may be related to risks of functional and neurological damage. The impediments caused by these damages are not essentially treated by surgeries. There are several forms of cancer treatment, such as chemotherapy, radiotherapy, immunotherapy, embolization, radiofrequency, and cryoablation, that can be used.

In the axial axis, the dynamics of the spine, upright in the coronal plane, with three inclinations in the sagittal plane supported in the sacrum that stabilizes in the pelvis, goes through the mechanical projection to the acetabulum, head, and femoral neck. Under normal conditions, this balance is complex and unique. Metastatic lesions, causing mechanical change, will primarily promote pain.[1,2]

In the vertebra, it is sought to indicate the reestablishment of balance, at the best moment. This means, lower morbidity, lower impact on stability, less impairment of the neurological condition, and still considering the extent and prognosis of oncologic disease. Surgery for spinal stabilization and decompression is a formal, but not absolute, indication in neurological deficit conditions.[1,2]

The mechanical risk factors to the pelvic girdle and the risk of inability to walk are a formal indication, not an absolute one, for a surgical approach.

Historically, vertebral metastasis has been treated with extensive spinal cord decompression surgery or block resection, and external radiotherapy alone or together. This treatment has high morbidity, and radiotherapy alone provides pain control close to 60%, with an average duration of 4 months.[3] However, doubts of a surgical treatment were better established, and there is no doubt that surgery associated with radiotherapy provides better local control than radiotherapy alone.[4]

The objectives of the treatment of bone metastasis are pain relief, prevention of pathological fractures, and preservation of function, to allow early weight discharge, and, if possible, enable the patient to return to activities and provide an intervention that will last throughout the patient's life.[3]

This is a systematic review of the treatment of metastasis that affect the axial axis, from the most common way to minimally invasive techniques.

Incidence

Cancer is the second leading cause of death per year in the world population, after cardiovascular diseases. In 2017, 9.7 million people have died from cancer. The highest cancer mortality rate was registered in patients $>$ 70 years of age.

Previous studies showed an incidence of 5 to 30% of secondary involvement of the spine, but in a postmortem study, they showed 70 to 90% of involvement. There is a prevalence in men, and it is most commonly observed in patients between 45 and 65 years old.[5,6]

The prevalence of primary lesions that eventually affect bone are breast, prostate, lung, kidney, and thyroid,[6,7] and about 10% of cancer patients are diagnosed through examination findings.[8,9]

Metastatic mechanism

The mechanism of evolution to metastasis is complex, and the most common route of dissemination is hematogenous.[8,9]

Clinical presentation

Four criteria are fundamental in the treatment decision: 1 - neurological condition; 2–biomechanical condition; 3 - cancer extension; and 4 - comorbidities.

Spine

Pain is the main symptom reported, and it precedes all others.[3,10,11]

In the biological mechanism, there is action of cytokines, which irritate the periosteum and stimulate the intraosseous nerves, in which there is increased intra-bone pressure or mass effect caused by the tumor. Improvement can be achieved with steroid use. At this stage, the treatment is systemic and with radiotherapy.

In the mechanical apparatus, there is structural change of the vertebra. The presence of the lesion will destabilize the framework, and the axial load will determine the degree of impairment, which may be mechanical and/or neurological. Symptomatology may precede radiographic evidence. In this circumstance, steroids do not work, but improvement can be achieved with narcotics and orthotics, with surgery being the alternative to be considered before chemo or radiotherapy.[2,3,12]

Neurological signs

The involvement of the cervical or lumbar region may present with signs of root irritability, with involvement of the respective dermatomes.[12–15]

Impairments of thoracic levels may generate ipsilateral radiculopathy to the lesion but are less characteristic.[12–15]

Depending on the area, the spinothalamic tract may present symptoms corresponding to its compression. There may be root pain due to vertebral instability during mobility, and relief at rest.[12–15]

Considering that metastasis begins in the body from anterior to posterior, we can find myelopathy, starting the picture with hyperreflexia, sign of Babinski and Clonus. With the progression of the lesion, the patient may present weakness, sensory alteration, pressure, change in temperature and pain, and the proprioceptive process suffers varied damage, and fine sensitivity will be the last. When this occurs, pressure, pain, and propriception below the compression level are interpreted as autonomous dysfunction, and due to spinal cord or cauda equina compression, hyposensitivity and vesicofecal sphincter alteration may occur. When the lesion affects the medullary cone or sacrum, it leads to isolated sphincter alterations without sensory and motor signs.[12–15]

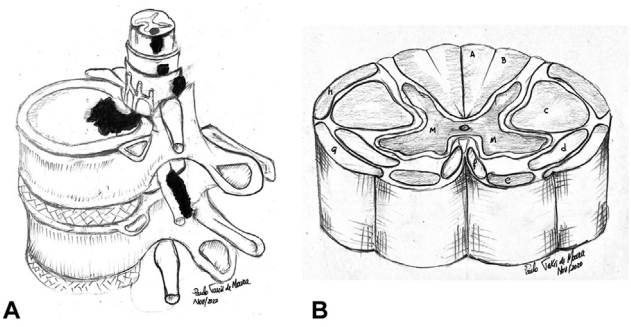

Fig. 1 (A) illustrates the cross section of the spinal cord and the possibilities of metastases in the spinal cord, intraespinal, intradural, extradural intracanal, as well as extraforaminal intraradicular and bone vertebral metastasis. (B) scheme of the distribution of sensory spinal tracts and the motor tract, a and b) gracile and cuneiform fasciculi: sensitivity of fine touch, vibration and position; c) lateral corticospinal tract (pyramidal), movement ability tract; d) lateral thalamic thorn tract, pain and temperature tract; e) anterior thalamic thorn tract, pressure sensitivity tract; f) anterior corticospinal tract (pyramidal), movement ability tract; g) spinocerebellar tract (Grower spine), proprioception; h) spinocerebellar tract (Flechsig fascicle), proprioception; m) central motor area, posterior and anterior horn. Compression usually occurs from anterior to posterior, and progressive sensory loss will go from pressure area to motor area to fine sensitivity.

In the lesion below the medullary cone, sphincter alteration occurs later with root changes and prominent mechanical pain.[12–15]

Focal weakness with decreased reflex is seen in cases of isolated root or brachial plexus, lumbar and/or lumbosacral v. ►**Fig. 1** shows anatomically the neurological evolution of spinal cord metastasis compression, and the understanding of the transsection of the spinal cord and the function of the spinal tracts.[12–15]

Pelvis

In the pelvis, the symptoms will clearly depend on the affected area. Areas in the iliac wings without involvement of the sacrum will have symptoms during trunk rotation or on direct palpation; when the sacroiliac joint is affected, there will be pain when walking, sitting, and even when lying down, in more joint-compromising cases. In the acetabulum, there are gait-related symptoms the greater the involvement, going from discomfort, in the case of minor injuries, to full inability to support. In the regions of the ischium and pubic branches, if metastasis compromises the pubic bone, near the symphysis, there will be pain during rotations and standing, and if there is involvement close to the acetabulum, pain in the inguinal region is frequent, but it does not impede walking; when the lesion is predominantly in the ischium, there is frequent discomfort to sit and pain in the gluteal region, with or without irradiation to the thigh, depending on the extent of the disease.[16]

Imaging

Imaging study is directed according to the clinical complaint. In vertebral lesions, it is recommended to perform an imaging study of the entire spine. In 20% of cases, lesions can be found at other vertebral levels and in the pelvis.[13,17]

Radiography

The presence of symptoms and of the "one-eyed owl" represent bone loss of 30 to 40%,[12] and evaluation of the vertebral axes indicates whether the lesion is lytic, blastic, or mixed.[18,19]

This method is used in the monitoring of mechanical evolution and in the evaluation of the pharmacological response of bisphosphonates.

Bone Scintigraphy

The most commonly used radioisotope is methylene technetium-99m diphosphonate (Tc99), which is more sensitive to detecting bone metastasis.[16] It presents sensitivity and specificity of 80% and 88%, respectively. Due to the low cost and good results of analysis, it remains a bone investigation test used for staging the lesions. Lesions with osteolytic component, such as thyroid and kidney metastases, may have low or negative uptake.[20,21]

Computed tomography (CT)

Computed tomography has been useful in clinical situations of surgically manipulated patients with implant material in the vertebra. It can be used with myelography to determine the level of compression.[19,22]

Magnetic resonance imaging (MRI)

Magnetic resonance imaging became the examination of choice for the analysis of metastatic lesions of the spine, with high sensitivity and specificity.[30] It allows visualization of the extent of bone as well as epidural and radicular injury, especially in T2-weighted imaging. Magnetic resonance imaging with contrast and diffusion as well as infusion study should be used.[23]

Positron emission tomography/computerized tomography (PET/CT)

The 2-[F-18]- fluoro-2-deoxy-D-glucose (FDG) positron emission tomography (PET) assists in the diagnosis of metastatic implant with improved specificity. However, the sensitivity maintains results similar to those of bone scintigraphy. The difficulty is found in lesions with osteoblastic areas.[19]

The difference between bone scintigraphy and PET-CT is the ability to evaluate metastatic lesions that do not compromise bone alone. The use of other radiopharmaceuticals, such as fluorine, associated with PET has increased the sensitivity of the results.[21]

Staging and Classification

The initial evaluation of the management considers response and sensitivity of the tumor to radiotherapy. In the radiosensitive tumor, we hope to have greater durability of the treatment effect, and the radioresponsive tumor is expected to have a faster response to treatment. With this information

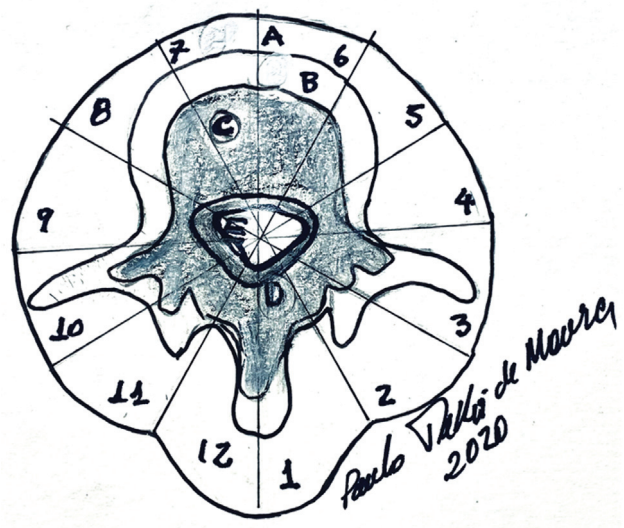

Fig. 2 Weinstein, Boriani, Biagini (WBB) classification (1997). The zones begin" from the spinous to the previous process, clockwise, the prefixes A–E are the radial levels of vertebral involvement: A: paravertebral soft tissues; B: superficial intraosseous; C: deep intraosseous; D: extra-dural extra-osseous; E: intradural extra-osseous. Allows planning of vertebral resection.

we can predict how quickly the tumor will regress with treatment, which makes it important for the decision of cases with epidural compression.

Examples of tumors with intermediate response in relation to radiosensitivity are breast, prostate, and squamous cell carcinomas. Examples of tumors with unfavorable responses are renal, thyroid, and melanoma carcinomas.

In surgical planning, we must consider tumor vascularization. Classically, kidney and thyroid metastases are hypervascularized, with risk of excessive intraoperative bleeding. Preoperative selective embolization is suggested.

There are several classifications available, which help to determine treatment. We highlight some of the most common use: the Spine Instability Neoplastic Score (SINS) instability score, specific for patients with vertebral cancer, ranges from 0 to 18. Based on six radiographic and/or clinical variants. It is considered: stable (0–6); potentially unstable (7–12), and unstable (13–18). The interobserver reliability was high (0.846 and 0.886), specificity of 80% and sensitivity of 95%.[24] If further judgments are required, the Tomita and Takurashi scores may assist in the decision.[25–27]

The understanding of the neurological state and the degree of compression and by which approach are feasible easy to understand by the surgeon. ►**Figs. 2** and **3** show examples of these guidelines.[28,29] However, the judgment of how effective and beneficial the surgery will be to the patient is controversial, and several classifications are being published in order to avoid poor indication. The same thinking is applied inrelation to the use of new drugs that have improved the survival of patients with lung, kidney, and

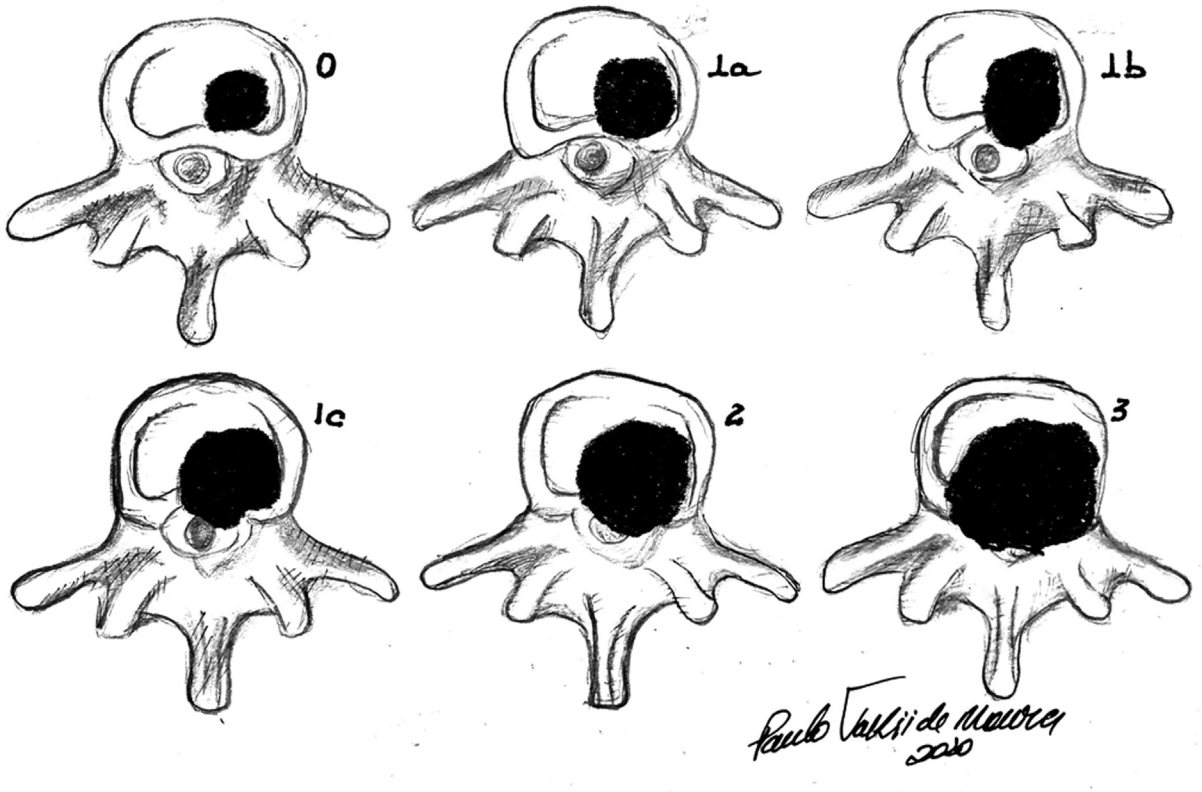

Fig. 3 Graduation of 6 medullary compression points (6 points ESCC- epidural spinal cord compresion)—0 - only bone disease; 1a - contact without deforming the thecal sac; 1b - deformation of the tecal sac without touching the medulla; 1c - deforms the tecal sac and touches the medulla; 2 - spinal compression but with visible liquor around the spinal cord; 3 - spinal cord compression without visibility of the liquor around the medulla—allows neurological understanding with morphological analysis of epidural compression.

melanoma cancer in order to modify the applicability of these "scores".[24–27,30–41]

Surgical techniques

We will approach the lesions located in the vertebral bone tissue, in addition to the intracanal extension, with or without spinal cord compression.

We will address pelvic and acetabula lesions.

We will not address intracanal, intra or extra dural, or root metastases.

Clinical scenarios

1- Single vertebral metastasis, painless and without neurological impairment

Systemic treatment is the most indicated. Control through imaging.[41]

2- Single vertebral metastasis, with pain and without neurological impairment

The risk of pathological fracture and the need to indicate surgical treatment or not should be evaluated. In the latter case, consider systemic treatment and radiotherapy.[4,41]

3- Single vertebral metastasis, with pain and neurological impairment

This clinical condition is the most complex. Resections of single metastasis are questionable as to their curative character.

If the metastasis is sarcomas, we can consider chemotherapy and subsequent reassessment. If there is no progression of the disease, and it is still possible to resect, we can consider surgical treatment. In the single metastasis of breast, prostate, or gastrointestinal tract adenocarcinoma, one can only achieve better local control.

Resection of the single vertebral metastasis of renal carcinoma can lead to local control, with a decrease in local events, without fully ensuring the cure of the disease. In the single metastasis of variants of papillary thyroid carcinoma, in which radioactive iodine and radiotherapy may not adequately control the disease, resection may be considered.

However, decompression, radiotherapy and systemic treatment are indicated most often, and can control the disease.[4,41]

►**Fig. 4** shows an example of metastasis of osteosarcoma of the sacrum submitted to partial resection of the sacrum, preserving the roots of S2 and S1, with adequate local control.

3a- Should vertebral metastasis with complete paralysis be addressed?

The need for diagnostic confirmation, or whether there has been a histological change, should be considered.

There should be patient restaging, and confrontation of the clinical status with the surgery of wide margins determining local control, if it is single metastasis, which may result in a better survival. If the disease is advanced, in other organs and bones, it is considered the best treatment according to the primary tumor/histological type.[41,42]

3b- Is neurological damage recoverable?

It is known that the longer there has been neuronal damage, the lower the chances of recovery. And as long as there is full decompression, some neurological recovery is possible. Long-standing compressions can benefit from fixation and

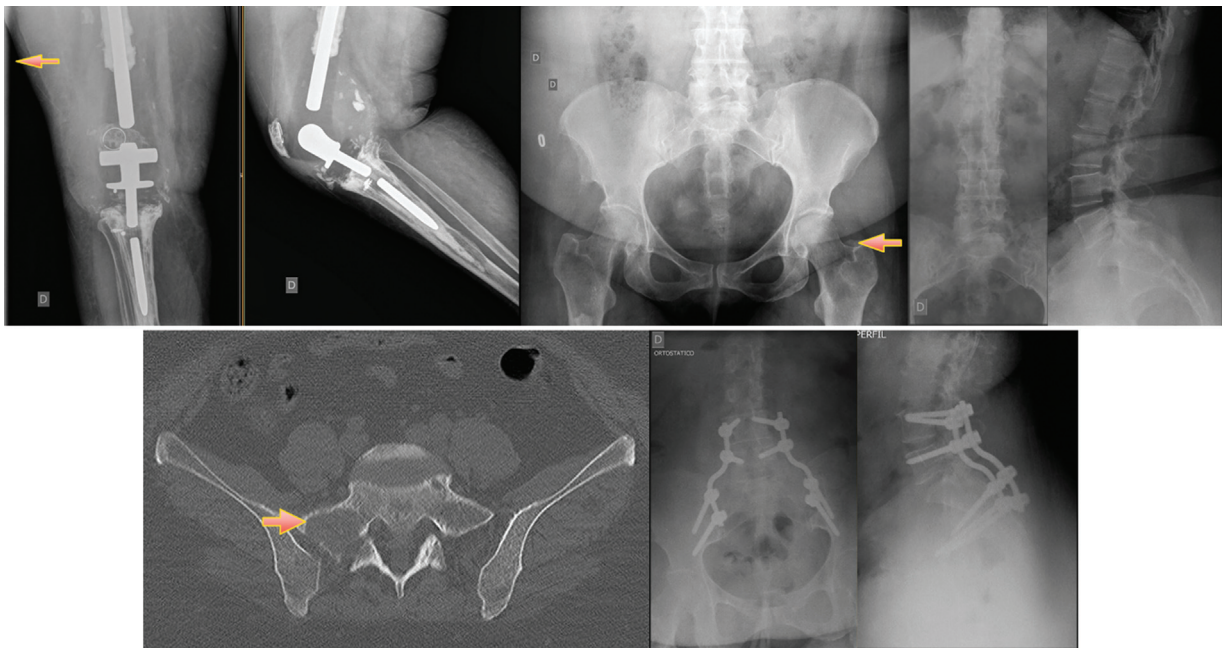

Fig. 4 Female patient, 47a chondroblastic osteosarcoma, 2008, presented with pathological fracture of the right distal femur and underwent neoadjuvant treatment with right knee stent. In 2017, she developed disseminated bone metastases and recurrence in the right popliteal fossa. She presented sacral lesion with severe pain when walking, and she was able to ambulate again after spinopelvic fixation. The patient died in 2020 from sepsis of the urinary tract.

stabilization surgery, if it allows the patient to be seated and mobilized, to prevent sours and other complications, in addition to improving pain and sensation, but sphincters are more unlikely to recover.[4,41,42]

Total spondylectomy of vertebra with metastasis causes a shortening of up to 1.0 cm, generating greater blood supply, and due to this increase in spinal cord blood flow, neurological recovery is more likely.[43]

4- Multiple vertebral metastases, pain-free and without neurological symptoms

In this clinical situation, it is possible to keep the patient under observation while waiting for oncological responses to systemic treatment. Protection with vest and periodic evaluations becomes an adequate conduct. The use of a vest is indicated because it provides safety, serves as a warning for care and risk of falls, but there are no clinical studies showing its efficacy.[4,41–43]

5- Multiple vertebral metastases, with pain and without neurological symptoms

Treatment should be discussed in a multidisciplinary manner, with confirmation of the painful vertebra and analysis of fracture risk.

Percutaneous techniques can be considered. Vertebroplasties with or without the balloon are possible, since the thermal and mechanical effect of bone cement is immediate.

Radiotherapy should be considered at this stage of the disease.[4,41–43]

6- Sacral metastasis and lumbosacral transition

This region undergoes a great mechanical force of traction and rotation.

The presence of pain should show the need for intervention. Complete resections require double route, and fixation of the lumbar spine with the iliac wings is a fairly valid tactic that diverts mechanical forces without compromising function, and it is better when the hip joint is intact.[44]

7- Pelvic metastasis - iliac wing and pubic region

These two regions are outside the axial and sagittal mechanical axes, but not of the rotational axes. Resection of these areas will not have major impacts on the possibility to stand and walk but can cause pain and disability in the rotational process.

Metastasis in the pubic region, especially in males, where incisional hernia may form associated with involvement of the scrotal stalk, with the presence of pain during sexual activity. These complications can be mitigated with the use of muscle screens and rotations.

The association of percutaneous techniques with the introduction of bone cement, or another method such as radiofrequency, can prevent resections.[45]

8- Metastasis in the acetabular region

In the acetabular region, the torque area is larger in the central area, and lesions with posterior predominance will present more marked pain when lifting and sitting, while in the anterior region, the pain will be in the trunk extensions. Percutaneous techniques with the introduction of bone cement applying the same technique used in vertebroplasty have been favorable.

When there is a fracture with joint involvement, resection and reconstruction with arthroplasty and acetabular reinforcement may be necessary. Risk and benefit assessment are necessary and should be discussed by a multidisciplinary team.[45]

Preoperative procedures

Arterial sacrifice

This technique is most often performed in cervical surgeries in which the involvement of the vertebra is associated with the vertebral artery. It may occur inadvertently or be performed in a planned manner. Occlusion of the vertebral artery is more related to cerebellar damage than to brain damage. Another way is super selective embolization to contain intraoperative bleeding, being an appropriate tactic to reduce complications.[25,46]

Surgical Procedures

Systematizing by Location

Technically, surgery of the vertebral half is the removal or curettage of multiple fragments, few services use the radical technique with a block removal of metastasis.

Craniocervical junction

Painful metastatic lesions and/or compressions are very critical, as they compromise the beginning of the medulla as well as the bulb area, and the olives are a risk site that can lead to death.

Two approaches to decompression are used, longitudinal and/or oblique paravertebral incision. In cases in which occipto-cervical fixation is required, the midline approach will be sufficient for this procedure. The fixation methods with pedicular or facet plates or screws are adequate, in addition to the decompression of the necessary segments that include part of the occipto-C1-C2.

Stabilization of the vertebrae below the decompressed segment is required, with a minimum of two vertebral bodies below the decompressed one.[46–48]

Transoral, translingual, and transmandibular

This approach is complex. It is recommended that a head and neck surgeon and/or otorhinolaryngologist are present during the surgery. The lesions in the anterior region of C1 and C2 are the most appropriate for this procedure. The type of access depends on the experience of the surgeon. Reconstructions after decompression are difficult to fix, and there are important risks of complications, including speech, swallowing, and respiratory risks. A multidisciplinary team should evaluate the risks and benefits of the procedure.[46–48]

Lateral approach to the vertebral and cervicothoracic skull junction

The approach is related to the decompression of high radiculopathies (C1 to C2).

A multidisciplinary team should evaluate the risks and benefits of the procedure, especially risks of the cranial pairs and jugular artery and vein, and the carotid artery.[46–48]

Pancoast Tumor

Neoplasia involving the pulmonary apex, with invasion of the T2/T3 vertebrae, and proximity to the brachial plexus and the subclavius vessels. Despite the starganglion, they produce symptoms according to the degree of impairment of the anatomical structures, going from symptoms of high back and scapular waist pain progressing to neurological symptoms related to the compromised roots, especially T1 and T2, as well as eyelid ptosis, with exophthalmia (Horner syndrome).

Vertebral resections are associated with lesion resectability, and are divided into three types:

Type A: when it invades the transverse region and part of the intervertebral system.
Type B: when its extension corresponds to less than 1/3 of the vertebral body.
Type C: when it involves 2/3 of the vertebral body.

Thus, the magnitude of the surgery increases according to this impairment.

It is notorious that complications come from this surgery, going from respiratory problems to neurological damage, especially to the root of T1.[49]

Transthoracic surgical access

Open surgical access allows ample exposure, but with risks associated with bleeding and atelectasis. In this technique, there is the possibility of resecting close to 75% of the vertebral body; however, the pedicle area and the wall contralateral to the surgical access cannot be adequately reached.

Surgical access in lateral decubitus allows access to the region of the scapular angle.

For higher access, the medial lip is used, and the 4th rib is resected. For the T5 to T12 vertebrae, the resection takes place between the 7th and 8th ribs.

Usually, the patient is positioned in right lateral decubitus, but in oncology it depends on where the largest tumor is. The venous structures and the thoracic sympathetic plexus are definitely connected to perform the procedure.[50]

Thoracoscopy resection and reconstruction

Thoracoscopy is a technique indicated for resecting the vertebral body of the anterior region in fragments, working very well for single lesions, and it should be associated with the titanic cage and anterior plate. It has the limitation of making it impossible to resect the wall and the contralateral pedicle.

Vertebral sagittal osteotomy, longitudinal hemivertebrectomy - thoracic and lumbar region

The posterior approach through the midline, with the resection of the posterior elements (uni or bilateral). Resection of the right half of the vertebra has increased security. The left half has a risk of aortic injury.

This technique may not offer adequate oncological margin.

Combined lateral and posterior approach

This is a technique employed for large extravertebral masses that partially involve the vertebral body. Osteotomy is performed from posterior to anterior, and it can only be from the posterior arch or the vertebral body.

This is a more difficult technique due to the need to sacrifice vessels and nerve roots that cross the lesion.[5]

Total vertebrectomy of cervical vertebrae

This is a complex approach, and one that may involve the sacrifice of the vertebral artery or dissection and isolation thereof. The approach is by double track, and the indication is reserved for selected cases. The procedure is always started posteriorly and followed by the anterior route.

Arterial ligation may be endovascular or intraoperative.[46–48]

Total vertebrectomy of the thoracic and lumbar spine

This procedure is less complex than in the cervical region.

Doable in single metastasis. No indication in disseminated metastasis.[25,50]

Hemicorporectomy and inter-ilium-abdominal disarticulation for vertebro-sacrum-pelvic junction lesions

These extreme resections are little used in metastases. They are more frequent in primary neoplasms with low potential for metastases, with curative objective.[51]

Reconstruction of the sacrum-iliac joint

This procedure is reserved for cases of metastases in the sacrum, especially those involving sacroiliac joint, without the indication of resecting the sacrum, in which there is compression or fracture component. Thus, fixation of the spine, usually L4 to L5, and iliac promotes comfort, and reduces pain, and decompression determines improvement, especially of cauda equina syndrome.[45,53–55]

Sacral resection

Reserved mainly for lesions below the third sacral vertebra that generate little functional impairment in the sphincters. In some cases, total resection may be considered, but with sphincter sequelae. In this technique, advances of the maximum gluteus muscles should be made to avoid incisional hernia of the sigmoid neck and anal canal, which can be painful, especially in the act of evacuating and sitting.[53–56]

Pelvic injury

It is quite difficult to understand that there is no fracture risk rating for these metastatic injuries. In addition, the mechanical situations in the three regions are different. Thus, the location of metastasis determines the forms of treatment.[45,57–59]

Iliac wing

The metastatic lesion on the iliac wings does not compromise the ability to walk or biped-station. However, it compromises rotational movements with flank pain, and irradiation to the gluteus and pelvic region. Simple resection without reconstruction may be indicated. The nonplacement of screens or reinsertion of the musculature can determine the appearance of incisional hernias. External radiotherapy is favorable but has a delay in ossifying the lesion.[16,45,57,60]

Ischiopubic Branch

This region is more symptomatic than the iliac wings due to the support area, and because it has the center of rotation next to the pubic synphysis, associated with the impact of gait on the acetabulum. Surgery in this region differs according to the symptoms and sex of the patient.

Bladder hernia is frequent and can be painful in both.

In women, there may be a greater number of urinary infections, and even herniations of the intestinal loop.

In males' scrotal hernia, hydrocele can occur and, according to resection, there may be impairment of penile insertion, resulting in physiological changes.

Painful coitus is also reported after this procedure.

Radiotherapy in this region has more complications according to the technique and the symptoms, due to the affected organs, going from voiding urgency to urethral stenosis, among others.[16,45,57,60]

Acetabulum

The region is more complex due to circumferential involvement.

We divide the involvement into anterior, medium, and posterior.

There may be involvement of one or more areas, with or without fracture of the joint.[45,57–59]

Complications

Among the most frequent clinical and surgical complications are deep vein thrombosis and surgical infections.

MINIMALLY INVASIVE SURGICAL TREATMENTS

Injection of percutaneous bone cement (vertebronplasty, chiphonoplasty)

Indicated for painful vertebral lesions, without full instability, or that do not have spinal cord compression, provided that the posterior wall of the vertebra is intact. This is the necessary condition for cement not to leak into the medullary canal and cause neurological damage.

The pathway may be transpedicular and/or paravertebral, guided by radioscopy or CT.

Painful single lesion with diagnosis, and without neurological, is a great indication. The problem lies when there are multiple painful lesions to properly assess which lesions are symptomatic, and whether there is cortical rupture or fractures.

The lesions produce destruction, and the cement penetrates effortlessly in the vast majority of cases. The penetration of cement at increased speed and pressure provides risks, including venous embolism that spreads through the azygos system can compromise lung tissue, with varied consequences until death.

The reaction to the quantity is not very basic, and it is difficult to establish how many vertebrae can be addressed in the same procedure. Complications with embolism and cardiac arrest can occur, and it is important not to exceed more than three bodies per procedure.[58,59]

Radio frequency

This palliative treatment is recommended for painful vertebrae, mixed, and blastic lesions, in which no mechanical

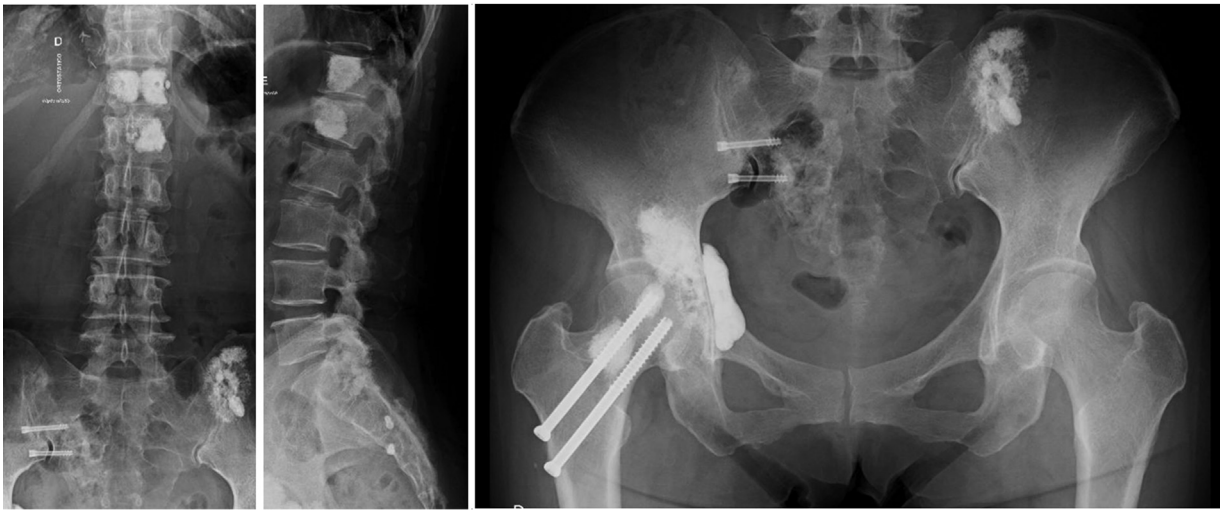

Fig. 5 Patient, 67a Yellow F. History of Papillary Thyroid Carcinoma, submitted to several percutaneous procedures, radiofrequency associated with "vertebroplasty", and cementation of lesions around the sacroiliac joint of the acetabulum (acetabuloplasty) and percutaneous fixation of the proximal femur, keeping it in functional stability without interrupting systemic treatment.

reinforcement is required. The technique introduces the needle after a path has been created with a drill or trephine, so it is understood that penetration into dense tissue is limited. It follows the same indications for vertebroplasty, but the time and temperature must respect the proximity to neural structures. If properly positioned up to 100°C for 6 minutes, it may provide relief of painful symptoms for up to 3 months.[58,59] ►**Fig. 5** shows a case of multiple metastases of thyroid papillary cancer submitted to various percutaneous procedures with adequate pain and functional control.

Combination of percutaneous techniques

It is possible to combine techniques such as radiofrequency with vertebroplasty or other techniques to avoid failure of a single method.[58,59]

Final Considerations

Extensive knowledge of metastatic disease and of the advancement of various forms of treatment and improvements in surgical techniques are necessary to support patients in this more aggressive phase of the disease. However, the best management strategy is frequent oncological evaluation to prevent adverse advents.

Source of Funding
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Conflict of Interests
The authors declare that there is no conflict of interests.

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