# Spinal metastases case series

A total of 128 patients who were suspected of having metastatic spinal cord compression and underwent surgery from 2008 to 2021 were enrolled in the study. All patients were categorized into either the 'debulking group' or the 'palliative group'.

The primary outcome was progression-free survival (PFS). The secondary outcomes were overall survival (OS), Frankel scale, and Karnofsky scores. All the outcomes were analyzed with a data cutoff of December 31, 2021. There was a significant difference between groups in progression-free survival (PFS) (p = 0.0094). However, there was no significant difference between groups in the overall survival (OS) (p = 0.0746). Age of onset, gender, duration of symptoms, location of spinal metastases, initial Frankel, initial Tomita scores, and initial Karnofsky performance scale showed no significant differences between groups.

Conclusion: In conclusion, debulking surgery was shown to provide better neurological recoveries and could be considered first in patients with metastatic spinal cord compression as the first malignancy manifestation [1)]

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136 patients who underwent surgery for spinal metastases. The most common primary cancers were prostate (24.3%, n = 33), breast (11.0%, n = 15), lung (10.3%, n = 14), and cancer of unknown primary (10.3%, n = 14). MESCC primarily affected the thoracic (77.2%, n = 105), followed by the lumbar (13.2%, n = 18) and cervical (9.6%, n = 13) spine. Pathologic fractures occurred in 63.2% (n = 86) of patients, mainly in osteolytic metastases. On the American Spinal Injury Association Impairment Scale , 63.2% (n = 86) of patients exhibited AIS grade D and 36.8% (n = 50) AIS grade C-A preoperatively. The presence of a pathologic fracture alone did not predict severe paralysis (AIS C-A, p = 0.583). However, the duration of sensorimotor impairments, patient age, spinal instability neoplastic score (SINS), and the epidural spinal cord compression (ESCC) grade together predicted severe paralysis (p = 0.006) as did the ESCC grade 3 alone (p = 0.028). This is in contrast to previous studies that stated no correlation between the degree of spinal cord compression and the severity of neurologic impairments. Furthermore, the high percentage of pathologic fractures found in this study is above previously reported incidences. The risk factors identified can help to predict the development of paralysis and assist in the improvement of follow-up algorithms and the timing of therapeutic interventions [2)].

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From January 2013 to January 2017 11 patients with 16 vertebral metastatic lesions (7 men and 5 women; mean age, 65 ± 11 years) with vertebral metastases underwent CT-guided microwave ablation and screw fixation followed by vertebroplasty (MASFVA). Technical success, complication rate, pain evaluation using a visual analogue scale (VAS), Oswestry Disability Index (ODI) and local tumor control were examined. (3) Results: Technical success rate was 100%. No procedure-related major complications occurred. VAS score decreased from 6.8 ± 0.7 to 0.6 ± 0.6. ODI score decreased from 3.1 ± 0.7 to 1.2 ± 0.4. All patients could walk independently without neurological complication after one week from the procedure. No new bone fractures or local disease recurrence occurred during a median follow-up of 12 months. (4) Conclusions: Our results suggest that MWA and percutaneous pedicle screw fixation followed by vertebroplasty for the treatment of painful vertebral metastases is a safe and effective procedure for painful vertebral metastases with vertebral pedicle

involvement, allowing pain relief and local tumor control [3].

# 2021

A retrospective chart review identified patients who had mechanical back pain from metastatic spinal disease and underwent spinal stabilization during 2017. Mobility metrics; the Activity Measure for Post-Acute Care (AM-PAC) inpatient mobility short form (IMSF) and the Johns Hopkins Highest Level of Mobility (JH-HLM), were reviewed.

Results: 26 patients were included in the analysis with median hospital stay of 8 days. Preoperative JH-HLM scores were available for 17 patients with a mean score of 5.4, increasing to mean score of 6.6 at last follow-up (p=0.036). Preoperative AM-PAC IMSF scores were available for 14 patients with a mean score of 19.4, decreasing slightly to a mean score of 18.7 at last follow-up (p=0.367). Last follow-up with mobility metrics occurred a median of 6.5 days postoperatively (range 3-66). Multivariable analysis showed that ASIA and KPS scores were significantly associated with both JH-HLM and AM-PAC mobility scores at last follow-up. A higher JH-HLM or AM-PAC score was significantly associated with direct home discharge while a higher AM-PAC score was associated with shorter hospital stay.

Conclusions: Surgical stabilization for patients with mechanical back pain secondary to metastatic spinal disease might lead to an objective improvement in JH-HLM score. JH-HLM and AM-PAC scores may be correlated with length of hospital stay and discharge disposition. Future studies are encouraged to further characterize the role of these mobility metrics in the management plan of these patients [4].

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Patients eligible for this study were those with metastases at the cervicothoracic junction (C7-T2) who had been consecutively treated in 2005-2019 at 7 academic institutions across Europe.The Spinal Instability Neoplastic Score, neurological function, clinical status, medical history, and surgical data for each patient were retrospectively assessed. Patients were divided into four surgical groups: 1) posterior decompression only, 2) posterior decompression and fusion, 3) anterior corpectomy and fusion, and 4) anterior corpectomy and 360° fusion. Endpoints were complications, surgical revision rate, and survival.

Among the 238 patients eligible for inclusion this study, 37 were included in group 1 (15%), 127 in group 2 (53%), 18 in group 3 (8%), and 56 in group 4 (24%). Mechanical pain was the predominant symptom (79%, 189 patients). Surgical complications occurred in 16% (group 1), 20% (group 2), 11% (group 3), and 18% (group 4). Of these, hardware failure (HwF) occurred in 18% and led to surgical revision in 7 of 8 cases. The overall complication rate was 34%. In-hospital mortality was 5%.

Posterior fusion and decompression was the most frequently used technique. Care should be taken to choose instrumentation techniques that offer the highest possible biomechanical load-bearing capacity to avoid hardware failure (HwF). Since the overall complication rate is high, the prevention of in-hospital complications seems crucial to reduce in-hospital mortality [5].

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Survival of cancer patients continues to improve with systemic treatment advancements, leading to

an increase in cancer-related complications such as pathological spinal fractures. In a study,

Meleis et al. from the MD Anderson Cancer Center Houston and Baylor College of Medicine aimed to evaluate the outcome of percutaneous stabilization with cement augmentation of the pedicle screws in the management of patients with metastatic cancer to the spine.

They reviewed a retrospective case series of 74 patients with symptomatic pathological spine fractures treated with cement-augmented pedicle screws implanted with a percutaneous technique. The mean imaging follow-up was 11.3 months. Data on demographics, clinical outcomes, and complications were collected. Cement extravasation, spinal hardware integrity, and fusion rates were assessed on CT scans.

Among 50 patients with follow-up imaging, 23 patients (46%) showed facet joint fusion. The length of segmental stabilization was not a significant predictor of the occurrence of fusion. Pre- or postoperative radiation therapy, postoperative chemotherapy, and the location of spinal lesions did not have a statistically significant effect on the occurrence of fusion. Patients older than 60 years of age were more likely to have fusion across facet joints compared with younger patients. There was a significant difference in the mean visual analog scale pain score, with 6.28 preoperatively and 3.41 postoperatively, regardless of fusion status ($p < 0.001$). Cement extravasation was seen in 51% of the cohort, but in all instances, patients remained asymptomatic. Most importantly, the incidence of hardware failure was low (4%).

Percutaneous fixation with cement-augmented pedicle screws in patients with pathological spine fractures provides an improvement in mechanical back pain, with a low incidence of failure, and in some patients, spontaneous facet fusion was observed. Further research is necessary with regard to both short-term benefits and long-term outcomes [6].

## 2020

A retrospective analysis of data from the DWG registry on patients who have undergone decompression with and without instrumentation undergoing tumor debulking, the release of the neural structures, spinal stabilization or tumor extirpation in spinal metastases in 124 departments from January 2017 to January 2020, as well as vertebroplasty and percutaneous instrumentation (MIS). The outcomes evaluated were major complications defined by Finkelstein et al. as death; cerebral (new postoperative coma or stroke), cardiac, pulmonary or renal complication; symptomatic venous thromboembolism (VTE); surgical site infection (SSI).

In total, 1617 decompressions with and without instrumentation undergoing tumour debulking, release of the neural structures, spinal stabilisation or tumour extirpation in metastatic disease in the spine were identified in the registry; n=266 developed a major complication (group 2), while n= 1351 had no complication (group 1). The mean age in group 1 was 65 years (58.5%), in group 2 69 years (63.5%). In group 2, most of the patients had preoperatively an ASA score of 3 and 4 (patients with severe general disease): 202/266 (75.9%) being significant. The overall prevalence of a major postoperative complication was 16.5% and for an intraoperative complication remained 8%. The likelihood ratio (OR) for major complications by blood loss greater than 500 ml were as follows: cardiovascular event with a likelihood of 4.22 pulmonary insufficiency 4.18 and cerebral 5.47.

This analysis provides predictive models for surgeons to identify patients who may benefit from transitional care programs. Preoperative status, invasiveness, blood loss> 500 ml, and blood transfusions are independent predictors associated with a higher risk of complication [7].

Mueller Müller et al. performed a retrospective analysis of electronic patient data from 19 patients, which were treated on symptomatic spine metastases through hemilaminectomy between 2009 and 2017. They evaluated the pre- and postoperative neurological function using the American Spinal Injury Association Impairment Scale. A comparative literature analysis was carried out to assess the Spinal Neoplastic Instability Score, Tokuhashi score and Tomita score.

Nine participants suffered from prostate cancer, four from mammary carcinoma, three from bronchial carcinoma and three from other cancers. The preoperative American Spinal Injury Association Impairment Scale median was C and postoperatively significantly improved to D (sign test p=0.002). None of the patients needed stabilization within the follow-up period of up to 56 months.

In this patient population, minimal intervention could significantly improve neurological disorders. This outcome was seen over the whole study period. Even though different scoring systems suggest stabilization, these results show that sole spinal decompression might be indicated as well [8].

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740 consecutive patients were treated for spine metastases (SpM) between January 2014 and 2017. A categorisation of the anatomical distribution of spine lesions was conducted.

One hundred and seventy patients (22.9% of series) presented cervical SpM, 440 (60%) lumbar SpM, and a majority 530 (71.6%) at the thoracic vertebral level. Metastases were more often present in the vertebral body (645 patients, 87.2%) than in a posterior location (278 patients, 37.6%, $p < 0.0001$). 212/740 patients (28.6%) presented circumferential spine involvement (body and posterior elements). An associated epiduritis was presented in 404 patients (54.6%). Primitive neck tumors spread towards the cervical spine: ENT (34.8%, $p = 0.049$), thyroid (33.3%, $p = 0.043$) whereas pelvic tumors targeted the lumbar spine: prostate (72%, $p = 0.011$), bladder (75%, $p = 0.047$). All tumors presented a tropism for thoracic vertebrae. Significant tumor/vertebrae associations were identified: lung ($p = 0.004$) and thyroid ($p = 0.028$) for L1, bladder for L5 ($p = 0.0025$), breast for C6 ($p = 0.006$), Prostate for L1-L4 ($p = 0.002$-$0.04$), multiple myelomas for C7, $p = 0.03$, T3-T7 ($p < 0.0001$-$0.025$) and L1-L4 ($p = 0.004$-$0.027$). Spine was the latest organ affected by metastases with a median-free survival of 4.2 months (SD 1.8, $p = 0.001$).

Although Amelot et al. determined that some tumors have a significant propensity to localize at certain vertebral levels, it remains premature to conclude on a spinal metastases profile. To date, it is too early to provide recommendations in imaging follow-up or in preventive therapeutic based on this mapping of spine metastases [9].

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Saadeh et al., described a mini-open (MO) technique and retrospective analysis of 20 open surgery (OS) patients who were matched to 20 MO patients by histology, spinal region, and levels instrumented. Mini-open surgery combined a traditional midline exposure for tumor resection with transfascial pedicle screw fixation. Outcome measures included estimated blood loss (EBL), operative time (OT), length of stay (LOS), transfusion rate, complication rate, American Spinal Injury Association Impairment Scale (AMS), and pain scores. Statistical analysis used unpaired t-tests and Fisher's exact test.

Average age was 58.3 years. Forty-eight percent of patients were female. Average number of levels

treated was 5.9. Both groups had similar LOS (P=0.98), OT (P=0.30), perioperative complication rates (P=0.51), transfusion rates (P=0.33), and AMS (P=0.17). EBL was found to be significantly lower in the MO group compared to the open group (805±138 mL versus 1732±359 mL, respectively, P=0.019). The MO group had a significant reduction in postoperative pain (-1.71±0.5 versus 0.33±0.7, P=0.018).

Although further studies are needed, the MO approach appears to result in decreased blood loss and postoperative pain, without compromising neural element decompression or spinal stability. These findings are consistent with the use of muscle sparing, minimally invasive pedicle screw fixation [10)].

## 2018

Metastatic epidural spinal cord compression (MESCC) is radiologically defined as an epidural metastatic lesion causing the displacement of the spinal cord from its normal position in the vertebral canal.

A retrospective observational case-control study performed on patients with MESCC from solid tumors surgically treated from January 2010 to December 2016. Patients included were divided in two groups depending on surgery that was performed within or after 24 h the admission to the hospital. Neurological status was assessed with American Spine Injury Association (ASIA) Impairment Scale.

No statistically significant difference was observed in the variation of ASIA if surgery is performed within or after 24 h from the admission to the hospital. A statistically significant difference was observed after surgery in each group in the improvement of neurological status. A statistically significant difference was reported in the early post-operative complications in patients surgically treated within 24 h.

MESCC management is challenge for spine surgeons and may represent an oncologic emergency and if not promptly diagnosed can lead to a permanent neurological damage. According to this study, there is no difference in the chance of neurological recovery if surgery is performed within or after 24 h the admission to hospital, but there is a greater rate of early post-operative complications when surgery is performed within 24 h from the admission to the hospital [11)].

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Between 2007 and 2017, 55 patients with oncologic disease of the spine underwent 60 spine surgeries and concomitant muscle flap reconstruction. Charts were retrospectively reviewed for diagnosis and indications for surgery, as well as risk factors for poor wound healing including diabetes, steroid use, body mass index (BMI), history of pre-operative chemo and or radiation therapy, preoperative albumin and hemoglobin levels. Outcomes were postoperative wound related complications including surgical site infection, wound dehiscence and/or need for reoperation.

60 reconstructions were included in 55 patients. Median follow up was 253 days. Paraspinous muscle flaps were used in all cases. There were 2 major complications (3.3%) related to wound infections which required reoperation and 10 minor wound complications (16.7%), of which 9 were subcutaneous seromas aspirated in the office, that did not require return to the operating room. Median postoperative stay in the hospital was 10 days. Closed suction drains placed at the end of the reconstruction were removed at a median of 17.5 days. Regression analysis found patient BMI to be a significant risk predictor for wound related post-operative complications.

Post-operative wound specific complications that required return to the operating room were uncommon despite the high-risk profile of this subset of patients. These data indicate that muscle flap closure should be routinely practiced in this high-risk cohort of patients [12].

**2017**

25 patients included 17 men (68%) and 8 women (32%), with a mean age of 55 years (range, 14-81 years). Eleven patients (44%) presented with varying degrees of motor deficits ranging from flaccid paralysis to paraplegia. Motor deficits were completely reversed in 4 patients postoperatively. The tumors were localized to the upper thoracic spine (T1-4) in 2 patients, in the midthoracic spine (T5-8) in 2 patients, in the lower thoracic spine (T9-12) in 8 patients, in the cervical 7 in 1 patient, and in the lumbar spine in 12 patients. In 10 patients, the tumor affected multiple spinal regions. Nonosseous tumors were not present in 10 patients. Ten patients had an extradural tumor. Costal involvement was detected in 2 patients. The tumors were pathologically identified as lung cancer (n = 3), lymphoma (n = 5), breast cancer (n = 3), gastric cancer (n = 2), liver cancer (n = 2), prostate cancer (n = 2), renal cell carcinoma (n = 2), malignant melanoma (n = 1), plasmacytoma (n = 1), bladder cancer (n = 1), paraganglioma (n = 1), Ewing sarcoma (n = 1), and yolk sac carcinoma (n = 1). Posterior instrumentation was performed in patients with instability. In addition, decompression was performed in patients with neurologic deficit.

Considering that 10% of patients with cancer are diagnosed by vertebral metastases, presence of malignancy should be suspected and a detailed examination should be performed in patients presenting with vertebral fractures caused by no or minor trauma. Moreover, in patients presenting with neurologic deficit, soft tissue metastases leading to spinal cord compression should be kept in mind and further examinations should be promptly administered [13].

**2016**

There were 152 patients identified for inclusion. Overall surgical site infection SSI rate was 11.2 per 100 patients (9.7 per 100 procedures). An increase in the risk of SSI was observed when surgery involved a greater number of vertebral levels (odds ratio 1.26, p=0.019) when controlling for primary spinal region. Controlling for the number of spinal levels, the odds of SSI increased by a factor of 5.6 (p=0.103) when the primary surgical region was thoracic, as opposed to cervical or lumbar.

In conclusion, surgery associated with multiple vertebral levels for treatment of spinal metastases, particularly of the thoracic spine, is associated with increased risk of SSI [14].

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A study included 202 patients with 206 lesions treated in January 1997 to December 2006 and continuously followed-up for more than 6 months or dead within this period. A total of 124 patients with 124 lesions were operated before 2002 were allocated to the control group and 78 patients with 82 lesions prospectively treated after 2002 were allocated to the prospective study group. The primary managements were nonsurgical treatment, palliative surgery, debulking, and en bloc resection. Neurologic evolvement, postoperative survival time, and local recurrence/development rates were statistically compared as the indexes of treatment outcome.

Although there was no significant difference of neurologic evolvement immediately after operation (P

= 0.24), the prospective study group achieved significantly better neurologic function than the control group long time after operation (P = 0.03). No significant difference (P = 0.26) was shown in local recurrence/development rate comparison. The mean postoperative survival time comparison showed significant difference (P < 0.01).

The efficacy of the algorithm has been validated preliminarily by the significantly longer survival time and better long-time neurologic function evolvement in the prospectively study group. But the algorithm should continuously be in development and be updated with the latest improvement in metastatic treatment [15].

1)
Ho UC, Lai DM, Xiao FR, Yang SH, Chen CM, Tsuang FY. Metastatic spinal cord compression as the first manifestation of malignancy: A retrospective study of surgical outcome from single institution. Asian J Surg. 2023 Sep 7:S1015-9584(23)01334-9. doi: 10.1016/j.asjsur.2023.08.159. Epub ahead of print. PMID: 37689519.
2)
Klein L, Herget GW, Ihorst G, Lang G, Schmal H, Hubbe U. Does the Pathologic Fracture Predict Severe Paralysis in Patients with Metastatic Epidural Spinal Cord Compression (MESCC)?-A Retrospective, Single-Center Cohort Analysis. J Clin Med. 2023 Feb 1;12(3):1167. doi: 10.3390/jcm12031167. PMID: 36769814; PMCID: PMC9918209.
3)
Pusceddu C, Marsico S, Derudas D, Ballicu N, Melis L, de Felice C, Calabrese A, Santucci D, Faiella E. Percutaneous CT-Guided Microwave Ablation Combined with Pedicle Screw Fixation Followed by Vertebroplasty (MASFVA): Initial Experience of a Minimally Invasive Treatment of Vertebral Metastases with Extension to the Vertebral Pedicle. Curr Oncol. 2023 Jan 30;30(2):1663-1672. doi: 10.3390/curroncol30020127. PMID: 36826088; PMCID: PMC9955473.
4)
Planchard RF, Lubelski D, Ehersman J, Alomari S, Bydon A, Lo SF, Theodore N, Sciubba DM. Surgical Stabilization for Patients with Mechanical Back Pain Secondary to Metastatic Spinal Disease is Associated with Improved Objective Mobility Metrics: Preliminary Analysis in a Cohort of 26 Patients. World Neurosurg. 2021 Jun 14:S1878-8750(21)00865-2. doi: 10.1016/j.wneu.2021.06.034. Epub ahead of print. PMID: 34139354.
5)
Hubertus V, Gempt J, Mariño M, Sommer B, Eicker SO, Stangenberg M, Dreimann M, Janssen I, Wipplinger C, Wagner A, Lange N, Jörger AK, Czabanka M, Rohde V, Schaller K, Thomé C, Vajkoczy P, Onken JS, Meyer B. Surgical management of spinal metastases involving the cervicothoracic junction: results of a multicenter, European observational study. Neurosurg Focus. 2021 May;50(5):E7. doi: 10.3171/2021.2.FOCUS201067. PMID: 33932937.
6)
Meleis A, Larkin MB, Bastos DCA, Muir MT, Rao G, Rhines LD, Cowles CE, Tatsui CE. Single-center outcomes for percutaneous pedicle screw fixation in metastatic spinal lesions: can spontaneous facet fusion occur? Neurosurg Focus. 2021 May;50(5):E9. doi: 10.3171/2021.1.FOCUS20671. PMID: 33932939.
7)
Vinas-Rios JM, Rauschmann M, Sellei R, Arabmotlagh M, Sobotke R, Meyer F; DWG-Register study group. Intra-and postoperative complications in the treatment of spinal metastases. A multicentre surveillance study from the German Spinal Registry (DWG-Register). J Neurosurg Sci. 2020 Oct 12. doi: 10.23736/S0390-5616.20.05029-8. Epub ahead of print. PMID: 33047579.
8)
Mueller Müller M, Abusabha Y, Steiger HJ, Petridis A, Bostelmann R. The Role of Stabilization-free Microsurgical Decompression in the Surgical Treatment of Spinal Metastases. World Neurosurg. 2019 Sep 25. pii: S1878-8750(19)32513-6. doi: 10.1016/j.wneu.2019.09.083. [Epub ahead of print] PubMed PMID: 31562975.

9)
Amelot A, Terrier LM, Cristini J, LeNail LR, Buffenoir K, Pascal-Moussellard H, Bonaccorsi R, Mathon B. Approaching spinal metastases spread profile. Surg Oncol. 2019 Sep 5;31:61-66. doi: 10.1016/j.suronc.2019.08.007. [Epub ahead of print] PubMed PMID: 31539643.
10)
Saadeh YS, Elswick CM, Fateh JA, Smith BW, Joseph JR, Spratt DE, Oppenlander ME, Park P, Szerlip NJ. Analysis of Outcomes Between Traditional Open Versus Mini-Open Approach in Surgical Treatment of Spinal metastases. World Neurosurg. 2019 Jun 24. pii: S1878-8750(19)31673-0. doi: 10.1016/j.wneu.2019.06.121. [Epub ahead of print] PubMed PMID: 31247354.
11)
Pipola V, Terzi S, Tedesco G, Bandiera S, Bròdano GB, Ghermandi R, Evangelisti G, Girolami M, Gasbarrini A. Metastatic epidural spinal cord compression: does timing of surgery influence the chance of neurological recovery? An observational case-control study. Support Care Cancer. 2018 Sep;26(9):3181-3186. doi: 10.1007/s00520-018-4176-3. Epub 2018 Mar 30. PubMed PMID: 29600414.
12)
Franck P, Bernstein JL, Cohen LE, Härtl R, Baaj AA, Spector JA. Local muscle flaps minimize post-operative wound morbidity in patients with neoplastic disease of the spine. Clin Neurol Neurosurg. 2018 May 29;171:100-105. doi: 10.1016/j.clineuro.2018.05.022. [Epub ahead of print] PubMed PMID: 29890458.
13)
Aycan A, Celik S, Kuyumcu F, Akyol ME, Arslan M, Dogan E, Arslan H. Spinal metastases of Unknown Primary Accompanied by Neurologic Deficit or Vertebral Instability. World Neurosurg. 2017 Sep 23. pii: S1878-8750(17)31606-6. doi: 10.1016/j.wneu.2017.09.099. [Epub ahead of print] PubMed PMID: 28951274.
14)
Atkinson RA, Stephenson J, Jones A, Ousey KJ. An assessment of key risk factors for surgical site infection in patients undergoing surgery for spinal metastases. J Wound Care. 2016 Sep;25 Suppl 9:S30-4. doi: 10.12968/jowc.2016.25.Sup9.S30. PubMed PMID: 27608739.
15)
Gasbarrini A, Li H, Cappuccio M, Mirabile L, Paderni S, Terzi S, Boriani S. Efficacy evaluation of a new treatment algorithm for spinal metastases. Spine (Phila Pa 1976). 2010 Jul 1;35(15):1466-70. doi: 10.1097/BRS.0b013e3181c680b9. Erratum in: Spine (Phila Pa 1976). 2011 Jan 15;36(2):179. PubMed PMID: 20195197.