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Intradural Extramedullary Metastasis from Primary Carcinoma of Breast via Brachial Plexus Perineural Spread: A Case Report and Review of Literature

Anurag Chandrakant Dandekar[1] Mahesh P. Chaudhari[2]

[1] Department of Neurosurgery, Hospital & Medical Research Centre, Marine Lines, Mumbai, Maharashtra, India
[2] Department of Neurosurgery, Bombay Hospital & Medical Research Centre, Marine Lines, Mumbai, Maharashtra, India

Address for correspondence Anurag Chandrakant Dandekar, MBBS, MS, Department of Neurosurgery, Bombay Hospital & Medical Research Centre, Marine Lines, Mumbai, 400020, Maharashtra, India (e-mail: dr.anurag49@gmail.com).

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Abstract

Intradural extramedullary metastasis from breast carcinoma is a rare occurrence. Furthermore, patients with primary breast carcinoma presenting with neurological symptoms in the first place are even rarer, which was the case in our patient. A 60-year-old woman presented with left upper limb monoparesis for 2 years and rapidly progressive weakness in the left lower limb for 1 week. The patient was evaluated and investigated to find primary left breast carcinoma with metastasis to multiple sites including C5-T1 intradural extramedullary spread. The patient was treated surgically, and decompression and tissue diagnosis were achieved to form a base for starting adjuvant therapy and safeguarding further neurological deterioration due to cord compression. In advanced metastatic cancer, preservation of neurologic function is the goal of surgical treatment. Thorough evaluation of patients presenting with a neurological deficit is always mandatory. Patient education is equally important for palliative treatment as well as to help reduce the burden of metastatic diseases.

Keywords
- intradural metastasis
- breast carcinoma
- brachial plexus
- brachial plexopathy
- perineural spread

Introduction

Primary cancers that are most typically associated with spinal metastasis are, in descending order, prostate, breast, kidney, lung, and thyroid.[1] Breast cancer being one of the most common cancers worldwide also shows metastasis to the central nervous system, with intracranial involvement more common than extracranial sites. Here is a case report of a patient suffering from primary left breast carcinoma presenting with neurological deficits due to intradural extramedullary metastasis with spread along the brachial plexus.

Case Description

A 60-year-old woman, right-handed, known case of hypertension on regular medication, was diagnosed with left brachial plexitis 2 years ago when she started having pain in her left wrist and elbow joint associated with occasional numbness. She started developing gradually progressive weakness in the left upper limb starting distally with weakness in her grip, which later progressed to involve muscles of proximal joints such as the elbow and shoulder. For the last 1 year, her left upper limb was non-functional and she did

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not respond to any medications including steroids. She presented to us with weakness in her left lower limb and difficulty in walking for 7 days. She did not show any symptoms of cranial involvement. She also had a history of upper back pain for the last 1 year which was on and off and relieved on medication and more after lying down. There were no symptoms of bladder or bowel involvement. On neurological examination, we found left upper limb LMN weakness with power 1/5 and left lower limb power of 4/5. There was significant loss of pain, temperature sensation and joint position sense, vibration sensation in the left upper limb and lower limb. There was no local tenderness on the spine examination. On her physical examination, we found a scar of healed ulcer on the left breast in the lower inner quadrant with fixed overlying skin (►**Fig. 1**). (Incidentally, this history was not known to her husband, son, sister, and neither it was mentioned to us).

FDG PET CT and MRI with gadolinium contrast studies were done (►**Figs. 2–4**). PET CT revealed a primary hypermetabolic lesion in the left breast with metastasis in the left supraclavicular lymph nodes, right lung middle lobe with lytic destructive lesions of manubrium sterni and third rib of the left side, diffuse metastatic infiltration of C6, C7, and C8 nerve root with infiltration of the adjacent part of the superior trunk and posterior cord of brachial plexus, intraspinal extra-axial leptomeningeal thickening involving the anterior, left lateral and posterior surface of the spinal cord at C5, C6, C7 and D1 vertebral level with associated cord compression. MRI showed well-defined heterogeneously enhancing intradural extramedullary lesion extending from C5 to D1 with significant cord compression and edema mainly on the left side. There was thickening of brachial plexus nerve roots on MRI giving it an appearance of a clumped-up mass, which explained the left upper limb paresis. The pressure effect of mass on ipsilateral side of the cord was so significant that it resulted in progressive weakness in her left lower limb. Ultrasonography-guided trucut biopsy was taken from the left breast lesion and was evaluated for histopathology, ER, PR status, and HER2NEU status. For spinal lesion decompression was achieved by C5 to D1 laminectomy and subtotal excision of the intradural lesion was done. The lesion was densely adhering to the spinal cord and engulfing the nerve roots (►**Figs. 5–6**). While the posterior lesion was excised precisely, the left lateral and anterior parts of the lesion were very difficult to excise due to dense adhesions to the spinal cord and undistinguishable nerve roots. Adequate decompression was achieved. Postoperatively, the patient had improvement in her left lower limb power and back pain. Histopathology revealed primary invasive ductal carcinoma, grade 3 of the left breast with ER, PR positive, and HER2NEU equivocal status with Ki67 index of approximately 55% and metastatic carcinoma (C5 to T1) (►**Fig. 7A, B**). The patient was started on hormonal therapy and was advised for further adjuvant therapy.

Fig. 1 External appearance of breast lesion.

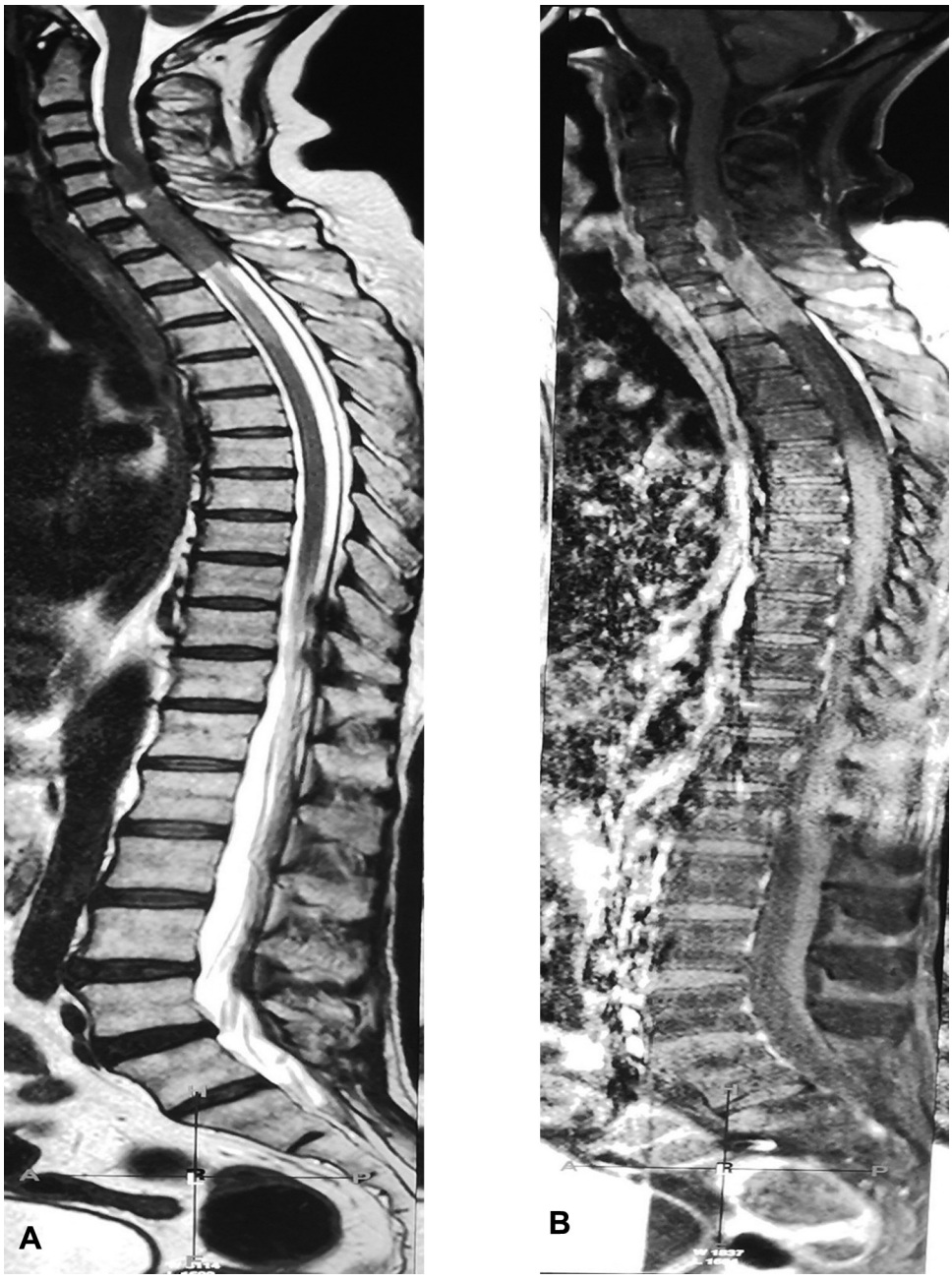

Fig. 2 (**A**, **B**) MRI with gadolinium contrast showing enhancing lesion from C5 to T1.

Discussion

Excluding lymph nodes, the skeleton is the third most frequent location for metastasis after the liver and the lungs,[1–4] with the spinal column being the most common site.[3] The spinal metastatic disease involves the vertebral bodies (80%) more often than the posterior elements (20%).[5,6] About 60% to 70% of metastases involve the thoracic, 20% to 30% the lumbosacral, and 10% the cervical region.[7–10] Breast and lung cancers usually metastasize preferentially to the thoracic spine, whereas prostate, colon, and pelvic cancers tend to arise in the lumbosacral spine.[7,8,10] Although spinal pathologic conditions are typically classified according to their anatomical location (epidural or extradural, intradural extramedullary, or intradural intramedullary), spinal metastases are regarded as arising from one of four compartments: spinal skeleton (85%), paravertebral region (10–15%), epidural space (< 5%), and intradural (extramedullary or intramedullary; remainder).[5]

There are four pathways for metastatic tumor spread to the spine: hematogenous dissemination (via an artery), through the paravertebral plexus of veins (Batson's plexus), direct invasion of the bone, and dissemination through cerebrospinal fluid.[11–14] Metastasis to the intradural space has five proposed routes of spread from outside the central nervous system including direct invasion, Baton's venous plexus, perineural lymphatics, CSF dissemination, and hematogenous spread through the arterial system.[15] Metastatic intracranial tumors

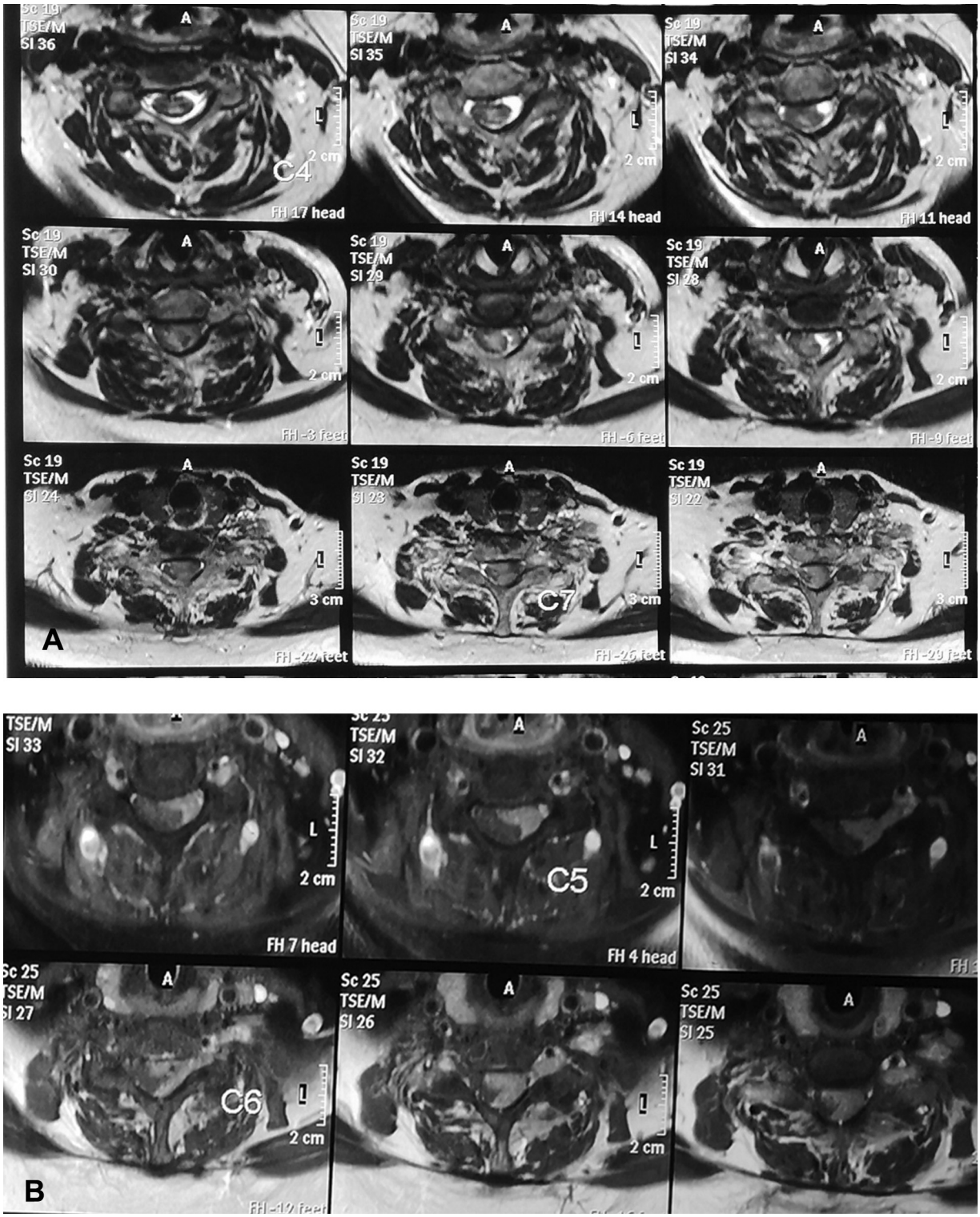

Fig. 3 (A, B) Axial sections showing significantly compressed cord mainly from left side with encasement of nerve roots.

are concomitantly detected in 90% of patients with metastatic intradural spinal cord tumors.[16]

Spinal metastatic disease can have a wide variety of clinical manifestations, including signs of systemic disease such as asthenia, anorexia, night sweats, and unintentional weight loss, axial pain is the earliest and most common symptom.[9,17–24] Patient can also present with radicular pain, sensory radiculopathy, myelopathy, and autonomic dysfunction. Any patient suspected to have the metastatic spinal disease should undergo a detailed and appropriately focused history and physical examination. Magnetic resonance imaging (MRI) is the "gold standard" imaging technique for assessing spinal metastasis. Intradural metastasis is the terminal stage of the disease and the average survival is between 6 and

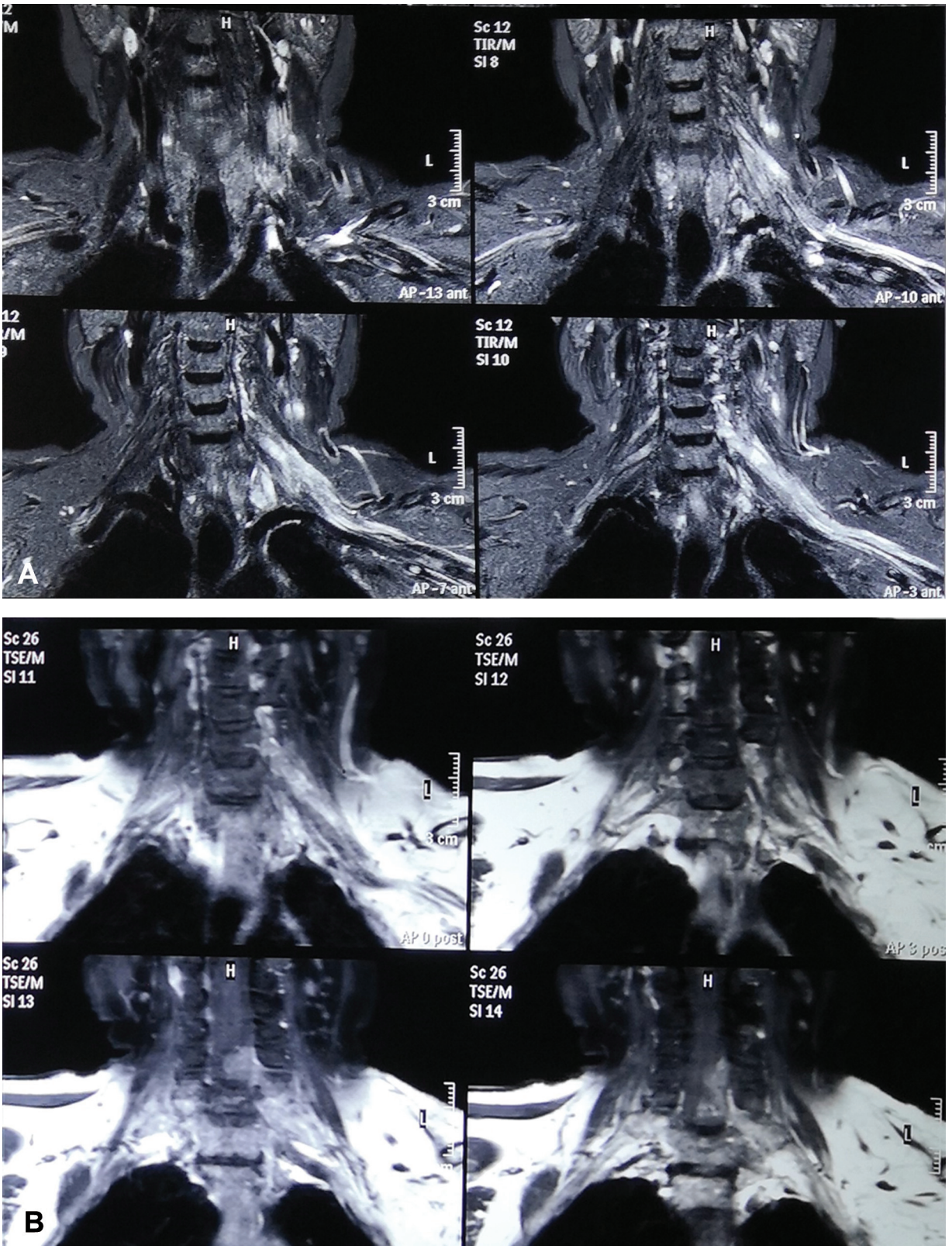

Fig. 4 (**A, B**) Coronal MRI images showing thickened brachial plexus roots and lesion extending intradurally.

9.5 months.[25] Our patient was having progressive monoparesis starting 2 years ago and was being treated as brachial plexitis. Her signs and symptoms did not improve with medications. Her symptoms started with brachial plexus involvement and the patient came to us with rapidly progressive weakness of the left lower limb and impending quadriparesis/plegia. Metastatic breast and lung cancers are the most common non-traumatic causes of brachial

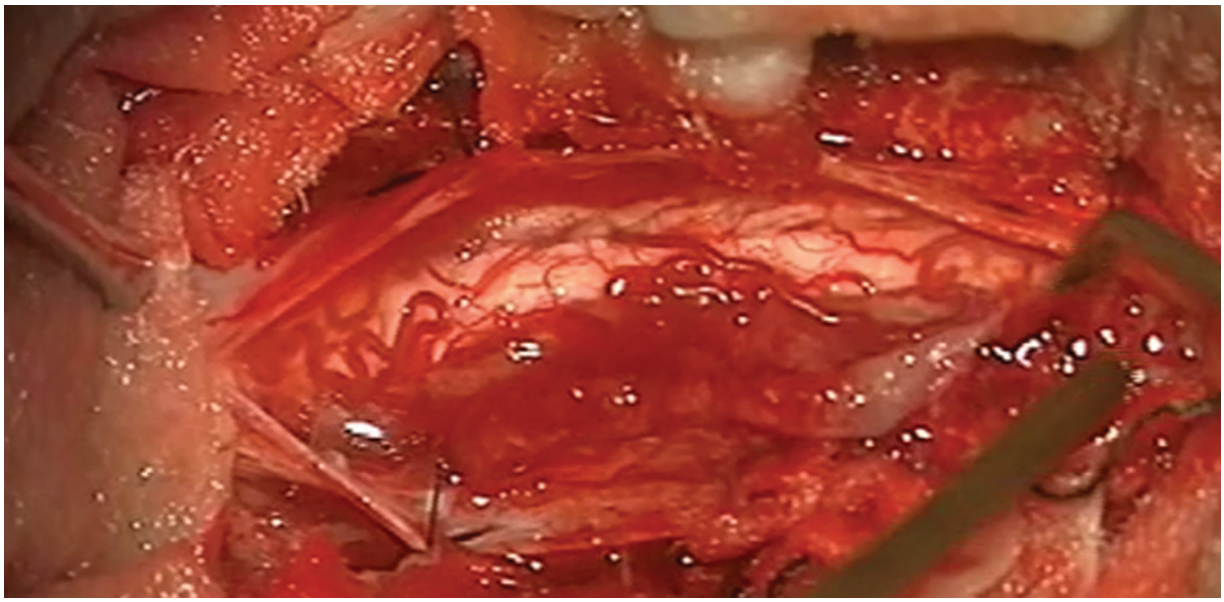

Fig. 5 Intraoperative image of lesion.

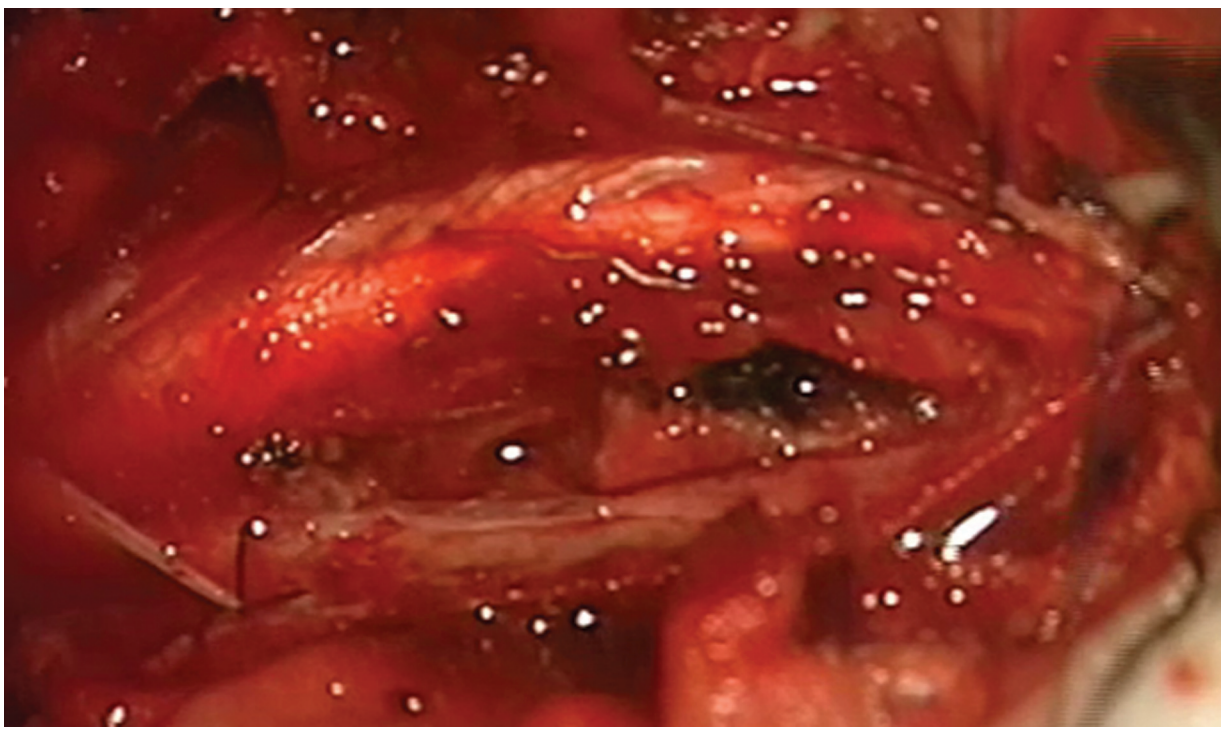

Fig. 6 Intraoperative image after decompression and subtotal excision of lesion.

plexopathy, after radiation-induced fibrosis.[26] The incidence of brachial plexopathy due to breast carcinoma is approximately 0.5%.[26] Because one of the major lymphatic drainages of the breast is through the apex of the axilla, it is not uncommon for metastatic breast cancer to invade the brachial plexus.[27] The most likely pathway is via the intercostobrachial nerve, which may communicate with the brachial plexus via the medial cord, the medial and posterior antebrachial cutaneous nerves, or the T2 ventral ramus.[28] Other less likely possible routes include the lateral and medial pectoral nerves, which originate from the lateral and medial cord, and the supraclavicular nerves, which may communicate with the brachial plexus at the level of the suprascapular nerve and C5 root.[28] The patient had multiple sites of metastatic spread, which were through the hematogenous spread, but the intradural spread must have been perineural because the patient first started having signs and symptoms of brachial plexus involvement, which then progressed to show signs and symptoms of the nerve root and cord compression. MRI also showed thickening of the brachial plexus giving it a mass-like appearance that was contiguous with the intradural extension (►**Fig. 4**). The absence of any other lesion in the CNS deters the CSF

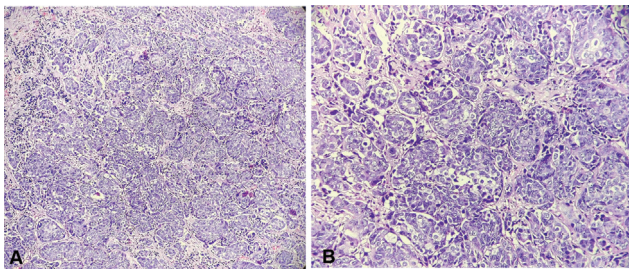

Fig. 7 (**A**, **B**) Histopathology images of metastatic lesion at 100 um and 200 um respectively.

spread and the absence of any local tissue destruction or active metabolic site on FDG-PET deters the direct spread. By the review of current literature, until now, the perineural spread of breast carcinoma to intradural extramedullary space has not been reported. There has been one case of renal cell carcinoma spreading along the autonomic nerves to the aorticorenal, celiac, and mesenteric ganglia and then along the thoracic and lumbar splanchnic nerves to the corresponding spinal nerves to the intradural, extramedullary space.[29] Further research is necessary to identify factors that predispose neoplasms to metastasize via specific routes to the intradural space. Intraoperatively also, the nerve roots were completely encased by the mass. The main aim of surgical treatment-laminectomy with decompression and subtotal resection was to help stop the further neurological impairment and alleviate the pain. The surgery was strictly palliative and to increase or maintain the quality of life for the remainder of the life. Considering the terminal stage of the disease treatment options, prognosis, need for adjuvant therapy, and risks and complications of surgery are of utmost importance while counseling the patient and the family members. The presence of a pre-surgical neurological deficit is an independent overall negative predictor of survival with one study reporting a hazard ratio of 10.2.[30]

Conclusion

In advanced metastatic cancer, preservation of neurologic function is the goal of surgical treatment. The surgical treatment is strictly palliative and to increase or maintain the quality of life for the remainder of the life. Thorough evaluation of patients presenting with a neurological deficit is always mandatory. Patient education is equally important for palliative treatment as well as to help reduce the burden of metastatic diseases. Further research is necessary to identify factors that predispose neoplasms to metastasize via specific routes to the intradural space.

Conflict of Interest
None declared.

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