Introduction

Carcinomatous infiltration of the dura from nonneurologic cancer is rare. It has been found at autopsy in 8 to 9% of cases of extraneural malignancy. Laigle-Donadey et al found in a series of 198 cases of dural metastasis that the tumor types metastasizing to the dura mater are cancers of the prostate (19.5%), breast (16.5%), lung (11%), and stomach (7.5%); thus prostate cancer is evidently more susceptible to spread to the dura. Tremont-Luktas et al reported that in 118 cases of brain metastasis of prostate cancer, 19 spread to the dura. In a few cases, the diagnosis of dural metastasis was made following subdural bleeding. However, in other cases no blood was found during surgery, thus revealing the mimicking appearance of the subdural metastasis. Recognition of this latter occurrence may help determine the best management for each individual case.

Material and Methods

We report a case of dural metastasis of prostate cancer mimicking subdural hematoma (SDH). We reviewed the English and French literature for cases presenting with...
suspected SDH to ascertain common clinical and imagery characteristics of metastasis mimicking SDH.

Results

Illustrative Case

A 65-year-old man was admitted to the emergency department presenting with headache, confusion, and progressive right upper limb weakness. He also reported a recent fall at home. Past history included a metastatic prostate adenocarcinoma 3 years earlier, for which he underwent hormonal therapy. His prostate-specific antigen (PSA) fell from 377 to 190 μg/L. Pelvic lymph nodes and bone metastasis were diagnosed 3 years ago. On initial examination he was mildly confused, with a drift of his left upper limb. Computed tomography (CT) scan revealed a multinodular bilateral hyperdense extra-axial lesion (Fig. 1A) with a midline shift of 4 mm to the right (Fig. 2B). This image was interpreted as acute SDH. The patient was initially observed. The next day he became more confused and progressively nonresponsive. A second CT scan showed progress of the midline shift to 7.8 mm. A left parietal burr hole was performed for SDH drainage. Upon opening the dura, no blood was found. Instead there was an obvious subdural tumor. A craniotomy was performed, revealing an en plaque frontoparietal temporal subdural yellowish tumor, with no cortical involvement. The bone had an abnormal appearance, suggesting bone metastasis. The tumor was excised as much as possible including the adjacent dura. The involved bone was not replaced. Postoperative magnetic resonance imaging (MRI) showed prominent irregular enhancing tissue along the dura consistent with bilateral dural metastasis (Fig. 1C). The patient progressively recovered and left the hospital at day 15 with little weakness of the arm. Retrospectively, we suspect that the clinical deterioration and the rapid increase of the midline shift might be

Fig. 1  (A) Axial nonenhanced computed tomography scan of the head without contrast showing a multinodular bilateral hyperdense extra-axial lesion with (B) a midline shift of 4 mm to the right. This image was interpreted as an acute subdural hematoma. (C) Postoperative magnetic resonance imaging showed prominent irregular enhancing tissue along the dura consistent with bilateral dural metastasis.

Fig. 2  The three types of image patterns on computed tomography scan. (A) Nodule with subdural hematoma (SDH). (B) Multinodular metastasis with SDH. (C) Large en plaque subdural tumor.
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<th>Other locations</th>
<th>Surgery</th>
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<tr>
<td>Meara et al</td>
<td>62</td>
<td>No</td>
<td>Epistaxis; cognitive impairment</td>
<td>Acute on chronic</td>
<td>Nodular hyperdense and hypodense extra-axial collection</td>
<td>No</td>
<td>NA</td>
<td>Burr hole; collection evacuation</td>
<td>Hematoma and thickening of dura</td>
<td>On dura matter</td>
<td>A</td>
<td>Death 4 d postoperatively</td>
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<tr>
<td>George et al</td>
<td>72</td>
<td>No</td>
<td>Confusion</td>
<td>Chronic</td>
<td>Hypodense lentiform extra-axial collection</td>
<td>Dural enhancement; nodular lesion</td>
<td>NA</td>
<td>Burr hole; collection evacuation</td>
<td>Hematoma</td>
<td>On hematoma membrane</td>
<td>B</td>
<td>Death 7 d postoperatively</td>
</tr>
<tr>
<td>Yu et al</td>
<td>62</td>
<td>No</td>
<td>Upper limbs weakness; convulsion</td>
<td>Acute</td>
<td>Bilateral hyperdense to isodense extra-axial collection</td>
<td>Diffuse enhanced meningeal thickening; nodular areas; enhancing bilateral dural soft tissues</td>
<td>Bone, lung, liver</td>
<td>No surgery</td>
<td>–</td>
<td>–</td>
<td>C</td>
<td>NA</td>
</tr>
<tr>
<td>Dors et al</td>
<td>71</td>
<td>Yes</td>
<td>Headaches; word-finding; instability; apraxia</td>
<td>Chronic</td>
<td>Hypodense lentiform extra-axial collection</td>
<td>Extensive dural enhancement; nodular lesions</td>
<td>NA</td>
<td>Craniotomy; tumor resection; collection evacuation</td>
<td>Yellow fluid under high pressure; thickening of dura with nodularity</td>
<td>On dura matter</td>
<td>B</td>
<td>NA</td>
</tr>
<tr>
<td>Dols et al</td>
<td>54</td>
<td>No</td>
<td>Headaches; nausea; Facial palsy</td>
<td>Acute on chronic</td>
<td>Isodense extraaxial collection and edema</td>
<td>Extensive dural enhancement</td>
<td>Bone</td>
<td>No surgery</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>C</td>
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<tr>
<td>Patil et al</td>
<td>71</td>
<td>Yes</td>
<td>Headaches; dizziness</td>
<td>Subacute on chronic</td>
<td>Isodense to hypodense collection</td>
<td>Postoperatively: homogenous enhanced subdural lesion</td>
<td>NA</td>
<td>Burr hole transformed in craniotomy; tumor biopsy</td>
<td>En plaque diffuse subdural tumor; no blood</td>
<td>On subdural tumor</td>
<td>C</td>
<td>25 mo</td>
</tr>
<tr>
<td>Cheng et al</td>
<td>72</td>
<td>No</td>
<td>Headaches; hemiparesis</td>
<td>Chronic</td>
<td>Hypodense extraaxial collection and edema</td>
<td>Postoperatively: enhancing lesion along the dura matter, extending bilaterally from the skull base</td>
<td>Bone</td>
<td>Surgery for hematoma (no precision)</td>
<td>Diffuse thickening; yellowish tumor; no blood</td>
<td>On subdural tumor and dura matter</td>
<td>C</td>
<td>4 mo</td>
</tr>
<tr>
<td>Tomlin and Alleyne</td>
<td>61</td>
<td>Yes</td>
<td>Headaches; cognitive impairment</td>
<td>Subacute</td>
<td>Isodense extraaxial collection</td>
<td>Postoperatively: enhancing lesion along the dura matter</td>
<td>Bone, lymph node</td>
<td>Burr hole transformed in craniotomy; tumor biopsy</td>
<td>Diffuse thickening of dural; confluent epi-dural and subdural tumor; no blood</td>
<td>On subdural tumor and dura matter</td>
<td>C</td>
<td>3 mo</td>
</tr>
<tr>
<td>Oka et al</td>
<td>60</td>
<td>No</td>
<td>Headaches; cognitive impairment; hemiparesis</td>
<td>Acute</td>
<td>Hypodense multilobular crescent</td>
<td>No</td>
<td>Bone</td>
<td>Craniotomy for acute hematoma</td>
<td>Subdural yellowish tumor; no blood</td>
<td>On subdural tumor</td>
<td>C</td>
<td>NA</td>
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</tbody>
</table>

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Table 1 (Continued)

<table>
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<tr>
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<th>Type of image pattern</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Bucci and Farhat4</td>
<td>62</td>
<td>No</td>
<td>Headaches; confusion</td>
<td>Subacute</td>
<td>Isodense fluid collection</td>
<td>No</td>
<td>NA</td>
<td>Craniotomy for subacute hematoma</td>
<td>Thin membrane-covered hematoma</td>
<td>On hematoma membrane</td>
<td>B</td>
<td>Dead at 4 d postoperatively</td>
</tr>
<tr>
<td>63</td>
<td>No</td>
<td>Confusion; lower limbs weakness</td>
<td>Chronic</td>
<td>Hypodense subdural collection</td>
<td>No</td>
<td>Bone</td>
<td>Craniotomy for chronic hematoma</td>
<td>Hematoma with membrane</td>
<td>On hematoma membrane</td>
<td>A</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Our case</td>
<td>65</td>
<td>Yes</td>
<td>Confusion; upper limb weakness</td>
<td>Subacute</td>
<td>Bilateral multinodular hyperdense extra-axial collection</td>
<td>Postoperatively: prominent enhancing lesion along the dura matter</td>
<td>Bone</td>
<td>Burr hole craniotomy</td>
<td>Diffuse thickening: yellowish tumor; no blood</td>
<td>On subdural tumor, dura matter, and bone</td>
<td>C</td>
<td>5 mo</td>
</tr>
</tbody>
</table>

Abbreviations: CT, computed tomography; NA, not available; NMR, nuclear magnetic resonance; SDH, subdural hematoma.

*A, single nodular; B, multinodular; C, en plaque.

Brain metastasis secondary to prostate cancer appears to be as the most common origin of distal metastases. Pathologic analysis of the dura yielded metastatic adenocarcinoma in all cases. The type of image pattern (CT scan images of all of the 11 patients) was nodular, en plaque, or multinodular, associated at times with large extracranial tumor (six cases), en plaque subdural tumor (six cases), and large extracranial tumor (six cases), with survival ranging from a few days to 5 months, except for one patient who survived for 25 months.

The time between the first diagnosis of prostate cancer and the development of dural metastases was highly variable, ranging from 3 months to 7 years. The preoperative appearance on the CT scan of the subdural collection was nodular or multinodular, associated at times with the discovery of the dural metastasis was highly variable, ranging from 3 months to 7 years.

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brain edema. The bone views often revealed diffuse sclerotic changes of the skull suggestive of bone metastasis. Including our case, only one other case was bilateral. Also, on postoperative MRI, there were diffuse pachymeningeal thickening with enhancement and areas of nodular enhancing soft tissues.

Reexamining the CT scans provided in the literature of these 12 cases, we identified three patterns (Fig. 2) that could lead us to a more accurate diagnosis upon admission: (1) a nodule in an SDH (Fig. 2A), (2) multinodular metastasis surrounded by an SDH (Fig. 2B), and (3) an extensive en plaque subdural tumor (Fig. 2C) as in our case. Types 1 and 2 may be particularly misleading because a burr hole to drain the blood may miss the tumor. In type 3 cases, where unexpectedly no blood is found, a larger craniotomy reveals an extensive tumor not amenable to surgical treatment.

Knowing these imagery features in advance helps us to be more vigilant and thus make a more accurate diagnosis to choose the right course of treatment and possibly avoid unnecessary surgery. Indeed, of the 10 patients who underwent surgery, 6 died within 4 days to 3 months. This suggests that dural metastasis secondary to prostate cancer occurs at an end stage of advanced disease.

**Conclusion**

Although rare, dural metastasis should be considered among the differential diagnoses in a patient known for prostate cancer, particularly with bone metastasis. The nodular features of the subdural collection on a nonenhanced CT scan should alert us to the possibility of subdural metastasis and prompt us to investigate further. This can lead to better management and possibly avoid unnecessary surgery. Simply being aware of the possibility that dural metastasis may mimic hematoma in cases of metastatic prostate cancer may help evaluate the indication for surgery, especially in this group of patients often harboring a poor prognosis.

**References**