Subdural Metastasis of Prostate Cancer

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Abstract

Dural metastasis from prostate cancer is rare and may mimic a subdural hematoma (SDH). Preoperatively diagnosis may be difficult and only reveal its presence during surgery. We present such a case and review the literature to identify common characteristics. A 65-year-old man presented with headache, confusion, and progressive right upper limb weakness. Past history included a prostate adenocarcinoma with bone metastasis 3 years earlier. Head computed tomography (CT) scan without contrast revealed a multinodular bilateral hyperdense extra-axial lesion interpreted as acute SDH. At surgery planned for SDH drainage no blood was found; instead there was an en plaque subdural yellowish tumor. Histopathologic examination was consistent with metastatic adenocarcinoma of the prostate. We found 11 cases reported as dural metastasis of prostate cancer mimicking SDH. Surgery was performed on nine cases with no suspicion of dural metastasis. On preoperative nonenhanced CT scan images, three types of image patterns can be described: a nodule in SDH, multinodular metastasis surrounded by SDH, and large en plaque subdural tumor. The latter group consists of those cases where no blood but rather an en plaque subdural tumor was found at surgery. Even though rare, dural metastasis should be considered among the differential diagnoses in a patient known for prostate cancer.

Keywords
► subdural hematoma
► metastasis
► prostate cancer
► dural
► surgical removal

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.1 Laigle-Donadey et al2 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 al3 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 $\mu$g/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 of the head without contrast 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.)
<table>
<thead>
<tr>
<th>Study</th>
<th>Age, y</th>
<th>History of trauma</th>
<th>Clinical signs</th>
<th>SDH description</th>
<th>CT scan</th>
<th>MRI</th>
<th>Other locations</th>
<th>Surgery</th>
<th>Surgery finding</th>
<th>Pathologic diagnosis</th>
<th>Type of image pattern</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meara et al9</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 Death 4 d postoperatively</td>
<td></td>
</tr>
<tr>
<td>George et al8</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 Death 7 d postoperatively</td>
<td></td>
</tr>
<tr>
<td>Yu et al11</td>
<td>62</td>
<td>No</td>
<td>Upper limbs weakness; convolution</td>
<td>Acute</td>
<td>Bilateral hyperdense to isodense extraaxial 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 NA</td>
<td></td>
</tr>
<tr>
<td>Dorsi et al7</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 NA</td>
<td></td>
</tr>
<tr>
<td>Dols et al6</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>C Death at day 3 of hospitalization</td>
<td></td>
</tr>
<tr>
<td>Patil et al10</td>
<td>71</td>
<td>Yes</td>
<td>Headaches; dizziness</td>
<td>Subacute on chronic</td>
<td>Isodense to hypodense collection</td>
<td>Postoperatively: homogeneous 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 25 mo</td>
<td></td>
</tr>
<tr>
<td>Cheng et al8</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 hematomat (no precision)</td>
<td>Diffuse thickening; yellowish tumor; no blood</td>
<td>On subdural tumor and dura matter</td>
<td>C 4 mo</td>
<td></td>
</tr>
<tr>
<td>Tomlin and Alleyne13</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 epidural and subdural tumor; no blood</td>
<td>On subdural tumor and dura matter</td>
<td>C 3 mo</td>
<td></td>
</tr>
<tr>
<td>Oka et al12</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 NA</td>
<td></td>
</tr>
</tbody>
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(Continued)
due to an impaired brain venous drainage secondary to the extensive dural metastasis. Histopathologic examination of the obtained tissue was consistent with metastatic adenocarcinoma of the prostate. Due to the extensive generalized bone metastasis that was nonresponsive to previous chemotherapy, no further treatment was undertaken. The patient died 5 months later.

**Review of Reported Cases**

In the literature we found 11 cases\(^4-11\) (\(\text{\textbullet\ Table 1\text{\textbullet}}\)) reported as dural metastasis of prostate cancer presenting as or mimicking an SDH. Between the first diagnosis of prostate cancer and the discovery of the dural metastasis, the time ranged from 3 months to 7 years (mean: 33 months); the mean age of these patients was 64.5 years. All patients (when data were known) presented in the advanced stage with metastasis. No correlation was found between an anterior history of head trauma and the finding of blood on surgery. Two cases were not operated on because of the obvious evidence of dural metastasis, seen on CT scan and MRI. In all the other cases surgery was performed with no suspicion of dural metastasis. In five cases no blood was found; there was an *en plaque* subdural tumor. In these cases the burr hole or craniotomy that had been preoperatively planned had to be converted into a larger craniotomy. When reviewing the preoperative nonenhanced CT scan images of all of the 11 patients, we can describe three types of image patterns (\(\text{\textbullet\ Fig. 2A\text{\textbullet}}\)): a nodule in SDH (two cases)\(^4,9\) multinodular metastasis surrounded by SDH (three cases)\(^4,7,8\) and large *en plaque* subdural tumor (six cases)\(^5,6,10-13\). This latter group consists of those cases where no blood was found at surgery.

**Discussion**

Brain metastasis secondary to prostate cancer is rare, as is dural metastasis. However, prostate cancer appears to be the most common origin of dural metastases.\(^7,14\) In their large series on dural metastases, Lairgle-Donadey et al\(^2\) observed that dural metastasis originated from the direct extension of skull metastasis in 57% of cases and from a hematogenous route in 43% of cases. Another potential mechanism for skull and subdural metastases of prostate cancer could be retrograde spread through the vertebral venous plexus. It is also known that dural metastasis can present as, or mimic, SDH.\(^4,5,7-10,12,13\) Including the present case, 12 cases have been reported.\(^4-10,12,13\) Of the 10\(^4,5,7-10,12,13\) operated cases, the preoperative diagnosis of subdural metastasis was missed. In five cases\(^5,10-13\) no blood was found during surgery; instead there was an *en plaque* subdural tumor. All 12 cases were known for prostate cancer with most of them in an advanced stage with bone or lymph node metastasis. In fact, as shown in \(\text{\textbullet\ Table 1\text{\textbullet}}\), prognosis was grim in all cases regardless of whether there was trauma or not, 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 discovery of the dural metastasis 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...
brain edema. The bone views often revealed diffuse sclerotic changes of the skull suggestive of bone metastasis. Including our case, only one other case\textsuperscript{11} 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 (\textsuperscript{12}Fig. 2) that could lead us to a more accurate diagnosis upon admission: (1) a nodule in an SDH\textsuperscript{4,9} (\textsuperscript{12}Fig. 2A), (2) multinodular metastasis surrounded by an SDH\textsuperscript{4,7,8} (\textsuperscript{12}Fig. 2B), and (3) an extensive en plaque subdural tumor\textsuperscript{5,6,10–13} (\textsuperscript{12}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.\textsuperscript{4,5,8–10} 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**