Multiple Myeloma Involving the Thyroid Cartilage in a Patient with Prostate Cancer: a case report

BO-YING SU1  NAN-HAN LU1,2  LEE-REN YEH1,2  JHY-SHYAN GAU1

Department of Radiology1, E-DA Hospital / I-Shou University, Kaohsiung, Taiwan
Department of Medical Imaging and Radiological Sciences2, I-Shou University, Kaohsiung, Taiwan

ABSTRACT

Multiple myeloma (MM) involving the thyroid cartilage is an extremely rare disease. Only 11 cases have been reported in the English literatures. The diagnosis is difficult and challenging especially when patients present with an underlying malignancy. Herein, we report a case of MM with involvement of the spine and the thyroid cartilage in a patient with a medical history of prostate cancer. The patient clinically presented with acute lower back pain, a palpable neck mass, and hoarseness. Computerized Tomography (CT) images revealed osteolytic lesions in the spine, cortical thinning, expansion and destruction of the thyroid cartilage. Magnetic Resonance Imaging (MRI) of the neck mass exhibited T1 isointensity, T2 hyperintensity, water restriction on diffusion weighted images (DWI), and homogeneous enhancement on post-contrasted T1 weighted images (T1WI). This is the first report of thyroid cartilage MM presenting with DWI finding in the English literatures. The imaging findings and differential diagnosis are discussed in this report.

Keywords: multiple myeloma, thyroid, CT, MR

INTRODUCTION

Plasma cell neoplasms (PCNs) include multiple myeloma (MM), extramedullary plasmacytoma (EMP), and solitary plasmacytoma of the bone (SPB). They are characterized by monoclonal proliferation of plasma cells during their various stages of differentiation [1]. These three types of PCNs are considered as different manifestations of the same disease [2]. MM is the systemic form, the most common, and presents the worst prognosis. Extramedullous dissemination of MM is often observed and the usual sites are the liver, spleen, and lymph nodes [3]. We report an extremely rare case of MM involving the thyroid cartilage in a patient with a history of prostate cancer. The image findings and differential diagnosis are discussed.

CASE REPORT

An 80-year-old male with a medical history of prostate cancer was treated with radiotherapy and hormone therapy one year ago. He was referred to our urologic department due to severe lower back pain radiating to the left buttock. Additionally, increasing hoarseness and a palpable mass over the left anterior neck were noted for 6 months. The patient had a history of hypertension, which was efficiently controlled by medical therapy. He denied dyspnea or dysphagia and presented no risk factors for laryngeal cancer (smoking and heavy alcohol use).

Physical examination at the time of presentation revealed a 4 cm firm mass fixed to the left hemilarynx. There was no palpable cervical lymphadenopathy and the thyroid gland was unremarkable on palpation. Laryngeal fiberoptic examination performed in the ear, nose, and
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throat (ENT) department showed a supraglottic bulging and limited movement of the left vocal cord. The overlying mucosa of the larynx appeared normal.

Contrast enhanced Computed Tomography (CT) images demonstrated osteolytic lesions over the T12, L3, and S1 vertebrae (Fig. 1a) and an expansile mass with cortical thinning and destruction of the left thyroid cartilage (Fig. 2a). Magnetic Resonance Imaging (MRI) of the vertebral lesions exhibited T1 hypointensity, T2 hyperintensity, and heterogeneous enhancement after gadolinium-based contrast administration (Fig. 1b). Retropulsion of the T12 vertebra with ventral compression of the thecal sac was also observed. Head and neck MRI displayed an expansile mass originating within the left thyroid cartilage, extending to the left paralaryngeal space, and compression of the upper airway. The mass lesion exhibited intermediate signal on T1 weighted images (T1WI), hyperintensity on T2 weighted images (T2WI), marked water restriction on diffusion weighted images (DWI), and homogeneous enhancement on post contrast T1WI (Fig. 2b-2d). There was no evidence of cervical lymphadenopathy and the thyroid gland was normal. The radiologic diagnosis for the spinal lesions and the neck mass was metastasis based on the patient’s medical history and imaging findings.

Sonographic guided core needle biopsy of the neck mass and vertebroplasty of the vertebral lesions were performed. Histological examination of the specimens revealed diffuse infiltration of plasma cells. Tumor cells were predominantly mature in morphology and possessed a pinkish cytoplasm. Binucleation and younger forms were present. In immunochemical analysis, tumor cells were positive for leukocyte common antigen (LCA), CD20, CD138, and kappa light chain, while negative for CD30 and lambda light chain. Both serum and urine electrophoresis were performed, which revealed monoclonal IgG gammopathy and kappa light chain in the urine. In addition, beta-2 microglobulin levels were increased in the serum. Finally, MM was diagnosed on the basis of plasma cell infiltration in the vertebral lytic lesions, the neck mass and the presence of monoclonal immunoglobulin in the serum.

DISCUSSION

MM is the disseminated form of PCNs. It accounts for 1% of all malignancies [2] and accounts for 10% of hematologic malignancies [4]. Extraosseous disseminated lesions are common in patients with MM and they are usually clinically silent. Autopsy studies of patients with MM revealed that the usual sites of extraosseous deposits are the liver, spleen, and lymph nodes [5].

EMP is a localized PCN arising from soft tissues. It accounts for 3% of all PCNs and represents less than 1% of all head and neck tumors. Approximately 80% of EMPs

Figure 1

1a 1b

Figure 1. Post contrast CT image a. showed osteolytic lesions over the T12, L3, S1 vertebrae (arrows) with heterogeneous enhancement on post contrast T1 weighted fat saturation MR image b.
are found in the head and neck region and their common sites are the nasosinuses, nasopharynx, oropharynx, and larynx in decreasing order of frequency [6-8]. The laryngeal involvement of EMP is between 6% and 18% [9], but MM and EMP involving the thyroid cartilage are very uncommon diseases. To date, only 11 cases have been reported in the English literatures [3, 9-18].

There are two mechanisms to explain cartilaginous involvement in MM cases. First, the cartilage may be directly invaded by an adjacent plasmacytoma. Secondly, the cartilage may experience osseous metaplasia with formation of a marrow cavity where plasmacytoma can originate within the new formed marrow and the plasma cells may deposit and grow within the marrow space [3]. In view of the previously reported 11 cases of MM with involvement of the thyroid cartilage (Table 1), only 2 cases could be explained by the first mechanism [17, 18] and 9 by the second mechanism [3, 9-16]. In the present case, CT images revealed expansion, cortical thinning, and destruction of the thyroid cartilage lamina as well as the absence of a soft tissue mass adjacent to the thyroid cartilage, suggesting that the plasmacytoma originated from the thyroid cartilage rather than by invasion by an adjacent soft tissue plasmacytoma.

An autopsy study indicated that prostate cancer commonly metastasizes to the bone, and spine metastases are detected in 87% of patients presenting with bone metastasis [19]. Our patient had a medical history of prostate cancer. Thus, it was reasonably speculated that the spinal and thyroid cartilaginous lesions were prostate cancer metastases. However, head and neck metastases are uncommon for patients with prostate cancer. Only 6% of laryngeal metastases are of prostate cancer origin [20]. There are only 14 reports about laryngeal metastasis from prostate carcinoma [21]. The malignancies, which most often metastasize to the larynx, are malignant melanoma, renal cell carcinoma, breast, and lung carcinoma [20, 21].

PCNs involvement of the thyroid cartilage is very rare.

Figure 2

2a
2b
2c
2d

Figure 2. Pre-contrast CT image a., revealed expansion, cortical thinning, and destruction of the left thyroid cartilage (arrow). MRI of the neck mass displayed hyperintensity on T2 weighted image b., water restriction on diffusion weighted image c., and homogeneous enhancement on post contrast T1WI d.
The diagnosis is difficult and challenging, especially when the patient presents an underlying malignancy. In view of our patient, if the spine and the thyroid cartilage lesions are of the same disease entity, the differential diagnosis should include metastasis, multiple myeloma, and lymphoma. Primary laryngeal lymphoma is a rare entity, which accounts for less than 1% of laryngeal tumors, and fewer than 100 cases have been reported in the literatures [22, 23]. Both plasmacytoma and lymphoma are the most common hematologic neoplasms of the larynx [22]. On MRI, they typically demonstrated as intermediate T1 weighted, high T2 weighted signal intensity, and homogeneous gadolinium enhancement. Both will present water restriction and hyperintensity on DWI as observed in our case [22, 24].

Our report is the first case of thyroid cartilage myeloma presenting with DWI in the literatures (Table 1). However, to date, there is no report of primary lymphoma arising from the thyroid cartilage. This lessened the possibility of lymphoma for our patient. Moreover, MRI presentation of the spine of patients with MM are nonspecific and mimic the findings observed for patient with spinal marrow metastasis [25, 26]. Their similar imaging presentations make it difficult to distinguish them. Dynamic contrast-enhanced MRI (DCE-MRI) was performed to differentiate MM from metastatic cancers. The myeloma group showed a high peak signal enhancement percentage (SE%), a higher steepest wash-in SE% during the ascending phase, a higher K trans, and a higher K ep. These results may help discriminating whether a spinal lesion is of myelomatous origin [27, 28].

The differential diagnosis of other neoplasm in the thyroid cartilage should include laryngeal squamous cell carcinoma (SCC), anaplastic thyroid carcinoma, giant cell tumor, and chondrosarcoma. SCC is the most common malignancy of the larynx and the direct invasion of the thyroid cartilage by laryngeal SCC is a common phenomenon [16, 29]. In view of fiberoptic laryngoscopy, CT, and MRI analyses of our patient, laryngeal SCC is less likely because of the smooth surface of the larynx and absence of cervical lymphadenopathy. Direct invasion of anaplastic thyroid carcinoma is also unlikely because the thyroid gland was normal on clinical examination and imaging studies. In the previous reported cases, two cases presented with coarse calcifications within the tumor masses. This may take place when patients present hypercalcemia, calcium depositions on amyloid, or fragmentations of the cartilage by tumor destruction [9, 11].

### Table 1. Summary of our case and previous reported multiple myeloma involving thyroid cartilage

<table>
<thead>
<tr>
<th>No. / Authors (year)</th>
<th>Age/ Sex</th>
<th>Involving thyroid cartilage</th>
<th>CT Findings of thyroid cartilage</th>
<th>MR Findings</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Van Dyke. et al. (1996)</td>
<td>62/M</td>
<td>Bilateral</td>
<td>An expansile mass originating within</td>
<td>NA</td>
<td>3</td>
</tr>
<tr>
<td>2. Saad R. et al. (2001)</td>
<td>79/M</td>
<td>Right</td>
<td>Mass with invasion and destruction of</td>
<td>NA</td>
<td>17</td>
</tr>
<tr>
<td>4. Aslan I. et al. (2002)</td>
<td>70/M</td>
<td>Right</td>
<td>An expansile and heterogeneous mass with destruction</td>
<td>NA</td>
<td>10</td>
</tr>
<tr>
<td>5. Gross M. et al. (2002)</td>
<td>70/M</td>
<td>Bilateral</td>
<td>An expansile mass with coarse calcifications</td>
<td>NA</td>
<td>11</td>
</tr>
<tr>
<td>7. Dispenza F. et al. (2007)</td>
<td>69/F</td>
<td>Right</td>
<td>Cortical expansion and thinning</td>
<td>NA</td>
<td>13</td>
</tr>
<tr>
<td>8. Kumar N. et al. (2011)</td>
<td>63/M</td>
<td>Left</td>
<td>Mass with invasion</td>
<td>NA</td>
<td>18</td>
</tr>
<tr>
<td>9. Kalina P. et al. (2012)</td>
<td>60/M</td>
<td>Right</td>
<td>Expanded and destructed with homogeneous enhanced mass</td>
<td>T1 hypointense, T2 hyperintense and homogeneous enhanced mass</td>
<td>14</td>
</tr>
<tr>
<td>10. Grobman A. B. et al. (2012)</td>
<td>58/M</td>
<td>Left</td>
<td></td>
<td>NA</td>
<td>15</td>
</tr>
<tr>
<td>11. Mitchell H. K. et al. (2013)</td>
<td>63/M</td>
<td>Left</td>
<td>Completely replaced by an enhancing mass with central necrosis</td>
<td>NA</td>
<td>16</td>
</tr>
<tr>
<td>12. The present case</td>
<td>80/M</td>
<td>Left</td>
<td>Cortical thinning, expansion, and destruction</td>
<td>T1 intermediate, T2 hyperintense, water restriction and homogeneous enhanced mass</td>
<td></td>
</tr>
</tbody>
</table>

F = female; M = male; NA = not available; No = number; Ref. = reference
imaging findings are similar to chondrosarcoma imaging results. Giant cell tumors of the larynx are very rare benign tumors. Their imaging features are expansile, solid lesions within the thyroid or cricoid cartilage, with destruction and displacement of the fragmentations of cartilaginous tissue peripherally. All imaging presentations are almost similar to those observed for our case and cannot be distinguished [30]. Therefore, chondrosarcoma and giant cell tumor must be included in the differential diagnosis.

The treatment of PCNs includes surgery, radiotherapy and chemotherapy. The option depends on the site, tumor size, and extension of the lesion. The preferred treatment modality for SPB and EMP is surgery or combined therapy (surgery and radiotherapy). If the lesion is local and well operable, surgical excision is suggested. When the complete removal of the tumor is not achieved, surgery followed by radiotherapy is recommended [8, 31]. On the other hand, MM is considered as a systemic disease, the treatment is based on chemotherapy and bone marrow transplantation. Radiotherapy for patients with MM aims at the local control of advanced disease and is performed to relieve bone pain or reduce the mass effect [7, 15].

CONCLUSION

In summary, MM with involvement of the thyroid cartilage is a very rare presentation. We report a case of MM involving the thyroid cartilage in a patient with prostate cancer that may pose a diagnostic challenge for both clinicians and radiologists. Despite its rarity, the differential diagnosis should include metastasis, laryngeal SCC, anaplastic thyroid carcinoma, lymphoma, giant cell tumor, and chondrosarcoma. The imaging findings include cortical thinning, expansion, destruction of the thyroid cartilage, and water restriction as well as homogeneous enhancement of the mass lesion on MRI. These may provide diagnostic clues before treatment.

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