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Clinical study

Intracranial meningioma and breast cancer

Ann-Shung Lieu, Shih-Lin Hwang, Shen-Long Howng

Department of Neurosurgery, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan

Summary Breast carcinoma has a high predisposition to metastasize to the brain parenchyma. An association between carcinoma of the breast and intracranial meningioma has been reported. The available published articles regarding patients with intracranial meningioma and breast carcinoma have been reviewed. To the best of our knowledge, 86 cases including our 4 cases have so far been reported. All cases were female, and the mean age was 62.4 years when intracranial meningioma was diagnosed. The mean interval of the 2 tumours was 4.5 years. Twenty-five cases of breast tumour were infiltrating duct carcinomas. The location of intracranial meningioma and pathologic subtype showed no specific predominance. Hormone receptor study was performed in 28 cases. In meningioma, the positive rate of progesterone receptor (32.1%) is higher than oestrogen receptor (7.1%); while the positive rate of oestrogen receptor (53.6%) is higher than the progesterone receptor (42.9%) in breast cancer. A review of this study is presented with emphasis on the existence of intracranial meningioma and breast cancer in one patient at different periods. Lesions of the central nervous system in patients with breast cancer should not be immediately labeled as metastases. Intracranial meningioma should be excluded. Likewise, patients with meningioma should have periodic physical examinations and mammographies whereby disease may be diagnosed and treated at an early stage.

Keywords: intracranial meningioma, breast cancer

INTRODUCTION

Breast carcinoma is considered a common malignant neoplasm in women. Patients with a history of breast carcinoma develop neurological symptoms and signs. Frequently, they are considered to have brain metastases and submitted to radiotherapy, quite often without any further investigation. However, multiple primary tumours, benign or malignant, coexisting in the same patient occur with a frequency of 2.8% in patients with neoplasms.[1–3] Meningiomas represent 20% of all central nervous system tumours and are encountered twice as often in women as in men.[4]

The existence of breast carcinoma and meningioma was suggested by Schoenberg et al. in 1975.[5] An awareness of this existence, with modern techniques of investigation, may permit more cases to be diagnosed and treated earlier. Herein, we present 4 cases of intracranial meningioma and breast carcinoma, and a comprehensive review of the subject.

MATERIALS AND METHODS

During the period from January 1986 to May 1999, there were 4 cases of intracranial meningioma associated with breast carcinoma, out of a series of 246 intracranial meningiomas operated on at the Kaohsiung Medical University.

Case 1

A 40 year old woman underwent a left modified radical mastectomy in February 1996 for carcinoma of breast. Hormonal receptor studies were positive for estrogen and progesterone receptors. Following surgery, the patient received adjuvant chemotherapy and radiotherapy. In October 1998, she was readmitted for progressive dizziness and vomiting. Brain computed tomography (CT) without contrast medium enhancement showed one isodense mass with calcification in the cerebellopontine angle. Infusion of contrast medium, revealed homogenous enhancement. Brain magnetic resonance imaging was performed which raised suspicion of a meningioma. Craniectomy was performed with total removal of the tumour, which was subsequently reported as psammomatous type of meningioma by pathologic studies. Oestrogen and progesterone receptor study were negative.

Case 2

This 60 year old women was admitted to our hospital in May 1996, complaining of progressive weakness in her left limbs and unstable gait. Ten years prior, she underwent a left mastectomy for carcinoma of the breast. During hospitalization, brain CT scans demonstrated a well-defined mass in the right temporal region with moderate perifocal oedema. After contrast medium, it revealed homogenous enhancement. Craniotomy with total removal of tumour was performed. Histopathologic examination revealed it to be meningotheliomatous type. Oestrogen and progesterone receptor assay was done. The results showed a positive response of progesterone; and, negative of oestrogen.

Case 3

This 42 year old woman suffered from focal seizure of right lower limb. Brain CT scans showed a well-defined mass in the left parietal region with severe perifocal oedema and focal calcification. Homogenous enhancement was noted after infusion of contrast medium. A craniotomy was performed with total removal of a falx meningioma. The pathologic study demonstrated a meningiotheliomatous meningioma. Progesterone receptor test was positive, and the estrogen receptor was negative. Four years and 5 months later, she was found to have a hard mass in the left breast. Biopsy showed infiltrating duct carcinoma. A modified radical mastectomy was done and negative nodes were found. She is doing well 13 years after craniotomy.

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Correspondence to: Shen-Long Howng MD PhD, Department of Neurosurgery, Kaohsiung Medical University Hospital, No. 100, Shih-Chuan 1st Road, Kaohsiung City 807, Taiwan. Tel.: +886-7-3215049; Fax: +886-7-3215039.

Case 4

A 46 year old woman with a mass in the left breast had a modified radical mastectomy after biopsy, showing infiltrating ductal carcinoma. All nodes were negative. Eight years later, she began exhibiting poor memory and bizarre behavior which was reported by her family. Brain CT scans showed a huge mass with perifocal oedema in the left frontal region. After infusion of contrast medium, it showed homogenous enhancement. Bone window showed left frontal hyperostosis. A craniotomy was performed with total excision of the tumour. Pathologic examination demonstrated a meningiotheliomatous meningioma. Oestrogen and progesterone receptor assay showed negative study. She had an uneventful postoperative recovery.

DISCUSSION

Between January 1986 and May 1999, 1853 patients with breast cancer underwent surgery in Kaohsiung Medical University. During this period, 246 patients underwent surgery for intracranial meningioma, giving a 1 to 7.5 ratio between intracranial meningioma and breast cancer, which is a considerably higher rate than that reported by Burns et al.[6] and Smith et al.[7] The interest in the existence of both breast cancer and meningioma is raised by the clinical relevance of an intracranial tumour discovered in a patient with history of breast cancer and the need to differentiate it from a metastasis.[8,9,10]

Published articles were reviewed and they revealed 82 case reports of patients with both breast cancer and meningioma, to which we have added 4 cases. The clinical details of these are

Table 1 Clinical data of patients with breast cancer and meningiomas: Literature Review

Authors	Age at diagnosis of meningioma (years)	Site meningioma	Breast cancer type	Meningioma type	Interval between tumours (years)
Markopoulos et al.[11]	45 (1)	Convexity	NC	NC	0.8
Salvati[12]	52.8*(9)	Convexity (3) Sphenoid ridge (6)	All IDC	Transitional (5) Psammomatous (2) Meningotheliomatous(2)	4.1*
Cervoni et al.[13]	65 (1)	Falx	ILC	Fibroblastic	<0.1
Di Bonito et al.[8]	74.9* (12)	Vault (6) Convexity (2) Parasellar (1) Middle fossa (1) Unknown (2)	IDC (9) ILC (2) NC (1)	Psammomatous (7) Transitional (4) Meningotheliomatous (1)	Unknown
Smith-Behn[14]	68.8* (4)	Olfactory (1) Unknown (3)	IDC (3) NC(1)	NC (4)	3.6*
Chow et al.[15]	50 (1)	Sphenoid ridge	NC	Meningotheliomatous	8
Knuckey et al.[16]	63.2* (5)	Convexity (2) Parasagittal (1) Posterior fossa (1) Middle fossa (1)	NC (5)	Fibroblastic (3) Psammomatous (1) Meningotheliomatous (1)	5.8*
Rubinstein et al.[9]	61.2* (9)	Convexity (5) Multiple (2) Suprasellar (1) Parasagittal (1)	NC (9)	NC (9)	4.1*
Zon et al.[17]	63 (1)	Convexity	ILC	NC	6
Doron[3]	64 (1)	Convexity	NC	Meningotheliomatous	3
Jacob et al.[18]	68.6* (12)	Sphenoid ridge (5) Unknown (7)	NC	NC	11.4*
Burns et al.[6]	56.4* (5)	Convexity (2) Suprasellar (1) Sphenoid ridge (1) Unknown (1)	IDC (2) NC (2) Other (1)	Meningiotheliomatous (2) Mixed (2) NC (1)	6.2*
Mehta et al.[10]	70* (3)	Olfactory (1) Posterior fossa (1) Falx (1)	NC (3)	NC (3)	2.2*
Barz[19]	56 (1)	Unknown	NC	Meningotheliomatous	2
Lodrini[20]	54 (1)	Olfactory	NC	Meningotheliomatous	1.2*
Chamber et al.[21]	66 (1)	Unknown	NC	Psammomatous	–
Savoiardo[22]	53 (1)	Olfactory	NC	Meningotheliomatous	1
Pöyhönen et al.[23]	79 (1)	Convexity	NC	Meningotheliomatous	2
Smith[7]	55* (2)	Parasagittal (1) Convexity (1)	IDC (2)	NC (2)	5.8*
Kepes[24]	52 (1)	Convexity	NC	Meningotheliomatous	2.5
Schoenberg et al.[5]	63.3* (7)	Unknown	NC (7)	NC (7)	7*
Haar[25]	Middle (1)	Convexity	NC	NC	2
Theologides [26]	74 (1)	Convexity	Scirrhous	Meningotheliomatous	0.2
Anlyan et al.[27]	42 (1)				
Raskind[28]	57 (1)	Sphenoid ridge	NC	NC	7.2
Kubo et al.[40]	57 (1)	Parasagittal	IDC	Transitional	4
Present	49.5* (4)	Convexity (2) Falx (1) Posterior fossa (1)	IDC (3) Carcinoma (1)	Meningotheliomatous (3) Psammomatous (1)	6.3*

* Mean.

IDC, infiltrating ductal carcinoma; ILC, infiltrating lobular carcinoma; NC, no classification; ( ), in authors' line, it represents reference number, the others represent case number.

Table 2 Differential diagnosis of intracranial meningioma from metastatic breast carcinoma

	Intracranial meningioma	**Metastasis**
Skull X-ray	Hyperostosis	Destruction
CT		
Non-enhanced	Isodense or slightly hyperdense	Variable
Enhanced	Well-defined mass with homogenous enhancement	Well-defined mass with heterogenous enhancement and extensive perifocal oedema
MRI		
Non-enhanced	T1-weighted: isointense or mildly hypointense T2-weighted: isointense or mildly hyperintensive	T1-weighted: hypointense T2-weighted: hyperintense
Enhanced	Homogenous enhancement with meningeal tail	Heterogenous enhancement

summarised in Table 1. The mean age of presentation for patients with intracranial meningioma was 62.4 years, and mean age for patients with breast cancer was 56.2 years. This age is typical of patients with either intracranial meningioma or breast cancer. Breast cancer was diagnosed first in 80.2% of cases and the mean duration before the diagnosis of the second tumour, be it breast cancer or intracranial meningioma, was 4.5 years. The longest interval between tumour diagnoses was 29 years.[18] The trend of breast cancer presentation first, which is also reflected in 3 of our 4 patients, may simply reflect the slow growth of intracranial meningioma. The location of intracranial meningioma was as follows: convexity (23 cases), sphenoid ridge (15), parasagittal/falx (7), olfactory (4), others (18) and unknown (21). The subtype of meningioma was as follows: meningotheliomatous (17), psammomatous (12), transitional (10), fibroblastic (5), mixed (2) and no classification (40). The location and subtype of intracranial meningioma revealed no specific predominance.

Breast cancer and meningioma share several features that might account for their existence in 1 patient. From epidemiologic survey, both tumours occur commonly in the same adult female population, usually in the fifth and sixth decade; which is similar to those in our review.[4,29] From the viewpoint of clinical course, intracranial meningioma express symptoms rapidly, with an increase in size during pregnancy and a complete clinical subsidence postpartum.[30,31] It has yet to be clarified as to whether the increase in size is due to an expedition of the rate of growth, influenced by hormonal changes during pregnancy, or to an increased fluid content, based on the generally increased water retention during pregnancy.[5,11,30,31]

Breast cancer cells often express oestrogen and progesterone receptors.[32] In meningioma, oestrogen receptors had been detected initially, but progesterone receptors were later documented in higher tissue concentration.[33–35] In fact, quantitative assessment of these hormone receptors usually yielded twice as many progesterone receptors as oestrogen receptors in meningiomas.[34,36] In breast cancer, the cytoplasmic progesterone receptors are usually elevated when cytoplasmic oestrogen receptors are present in high levels.[17] Therefore, the hormone receptor status of meningioma appears to be different from that of breast cancer. This discrepancy suggests a possible derangement of the normal cellular hormonal control mechanism in meningioma.[17] In our 4 meningioma cases, progesterone receptor tests were positive in 2 patients, and oestrogen receptor tests were all negative. Among the 86 reviewed cases, including our 4 cases, hormone receptor tests were performed in 28 cases. Regarding intracranial meningioma, the progesterone receptor tests were positive in 9 cases (32.1%), and oestrogen receptor tests were positive in only 2 cases (7.1%). This incidence is similar to the report of Cahill et al.,[34] but is lower than other authors' reports.[35–38] In breast cancer, oestrogen receptor positive rate (53.6%) is higher than the progesterone receptor rate (42.9%), but is of no significant difference.

Jacobs et al.[18] and Salvati et al.[12] suggested sphenoidal ridge meningiomas were more likely to be associated with breast cancer. However, in our study the association was not apparent.

Onset and types of neurologic symptoms and signs can not be used to distinguish between metastatic breast cancer and intracranial meningioma, since they are similar. Brain CT scans and magnetic resonance imaging (MRI) may be useful (Table 2). On brain CT scans and MRI, metastasis of the breast cancer shows as outward expansion of the gray/white matter junction (intra-axial lesion) rather than inward buckling by the intracranial meningioma (extra-axial lesion). Extensive perifocal oedema is present with metastasis, whereas this is not common in intracranial meningioma. Bone destruction is found in metastasis, but in intracranial meningioma, hyperostosis may be seen. On enhanced MRI, intracranial meningiomas undergo homogenous enhancement with linear enhancement along the dura adjacent to the tumour (meningeal "tail").[39]

In summary, intracranial meningioma and breast cancer usually occur in the same age groups; therefore, the physician should be aware of the possibility of the existence of both breast cancer and intracranial meningioma. The findings of cerebral mass in a patient with breast cancer should not definitively indicate metastasis. Resectable intracranial meningioma should be diagnosed differentially. Likewise, patients with intracranial meningioma should have periodic physical examinations and mammographies, by which disease may be diagnosed and treated at an early stage.

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