

## Case Report

# Pleomorphic and Desmoplastic Malignant Mesotheliomas and a Malignant Mesothelioma with Osseous and Cartilaginous Differentiation: Case Reports

Hiroshi Hirano<sup>1\*</sup>, Manabu Ninaka<sup>2</sup>, Muneyoshi Kuroyama<sup>2</sup>, Akitoshi Satomi<sup>2</sup>, Soichiro Yokota<sup>2</sup>, Toshihiko Yamaguchi<sup>2</sup> and Masahide Mori<sup>2</sup>

<sup>1</sup>Department of Pathology, Toneyama National Hospital, Japan

<sup>2</sup>Department of Internal Medicine, Toneyama National Hospital, Japan

Special Issue on

Lung Cancer

\*Corresponding author

Hiroshi Hirano, Department of Pathology, Toneyama National Hospital, 1-1, Toneyama 5-chome, Toyonaka, Osaka, Japan, Tel: +81-6-6853-2001; Fax: +81-6-6853-3127; Email: hihirano@toneyama.go.jp

Submitted: 21 January 2014

Accepted: 27 February 2014

Published: 15 March 2014

Copyright

© 2014 Hirano et al.

OPEN ACCESS

Keywords

- Malignant mesothelioma
- Pleomorphic
- Desmoplastic
- Osseous
- Cartilaginous

## Abstract

We herein present three autopsy cases of unusual malignant mesotheliomas with peculiar histological features.

**Case 1:** The patient was a 69-year-old female. The tumor encased the entire left lung, and metastasized to multiple organs. Histologically, more than 80% of the tumor was occupied by large discohesive pleomorphic cells with single or multiple irregular nuclei, and the remaining part of the tumor showed a tubulopapillary and sarcomatoid pattern. The tumor of this case was pleomorphic mesothelioma.

**Case 2:** The patient was a 64-year-old male. A pleural biopsy disclosed malignant spindle cells, but a definitive diagnosis was not obtained until his death. The tumor encased the right lung invading the right chest wall, and had metastasized to multiple organs. Histologically, the tumor consisted of neoplastic spindle cells with foci of osseous and cartilaginous differentiations. The tumor of this case was a sarcomatoid mesothelioma with osseous and cartilaginous differentiations.

**Case 3:** The patient was a 75-year-old male, who had pleural effusion in the right thoracic cavity. A definitive diagnosis was not obtained by the cytological examination of the effusion or the tumor biopsy. During autopsy, it was found that the tumor encased the right lung, invading the diaphragm. Metastases were seen in the liver. The histological examination showed that the tumor was a desmoplastic mesothelioma.

## ABBREVIATIONS

CT: Computed Tomography; MRI: Magnetic Resonance Imaging; TTF-1: Thyroid Transcription Factor-1; CEA: Carcinoembryonic Antigen; TM: Thrombomodulin; CK: Pancytokeratin; DMM: Desmoplastic Malignant Mesothelioma

## INTRODUCTION

Malignant mesothelioma is a highly aggressive tumor that arises from the surface serosal cells of the pleura and, less frequently, the peritoneum and pericardium [1]. The incidence of the disease has been increasing and is expected to steadily rise and peak over the next two decades [1-3]. In the WHO classification, malignant mesothelioma is classified into four

groups; epithelioid mesothelioma, sarcomatoid mesothelioma, biphasic mesothelioma and desmoplastic mesothelioma [4]. However, each group of malignant mesotheliomas contains mesotheliomas with peculiar histology. We herein report three cases of malignant mesotheliomas with peculiar histological features.

## MATERIALS AND METHODS

Tumor tissues were obtained from three patients with pleural malignant mesothelioma. These patients were autopsied at Toneyama National Hospital (Toyonaka, Osaka, Japan). The permission for the arbitrary usage of tumor tissues for histological studies was obtained from the family of each patient.

The study was approved by the Toneyama National Hospital Ethics Committee.

Tumors tissues obtained at autopsy were fixed in 0.01M phosphate-buffered 10% formalin (pH 7.4), and several paraffin-embedded blocks were made from the tumor tissues of each patient. Then, sections (5  $\mu$ m thickness) were made from each tumor block. Some sections were used for hematoxylin-eosin staining and others for immunohistochemistry.

### Immunohistochemistry

Immunohistochemical staining was carried out by an avidin-streptavidin immunoperoxidase method, as previously [5]. The antibodies used for immunohistochemistry are listed in Table 1. The antigen retrieval was performed by the incubating the deparaffinized sections in the cell condition 1 solution at a standard degree and subsequent immunohistochemical staining was carried out using an automated benchmark system (Ventana Medical System, Tucson, AZ, USA) according to the manufacturer's instructions. The immunostaining was defined as positive when at least 5% of the tumor cells were positively stained.

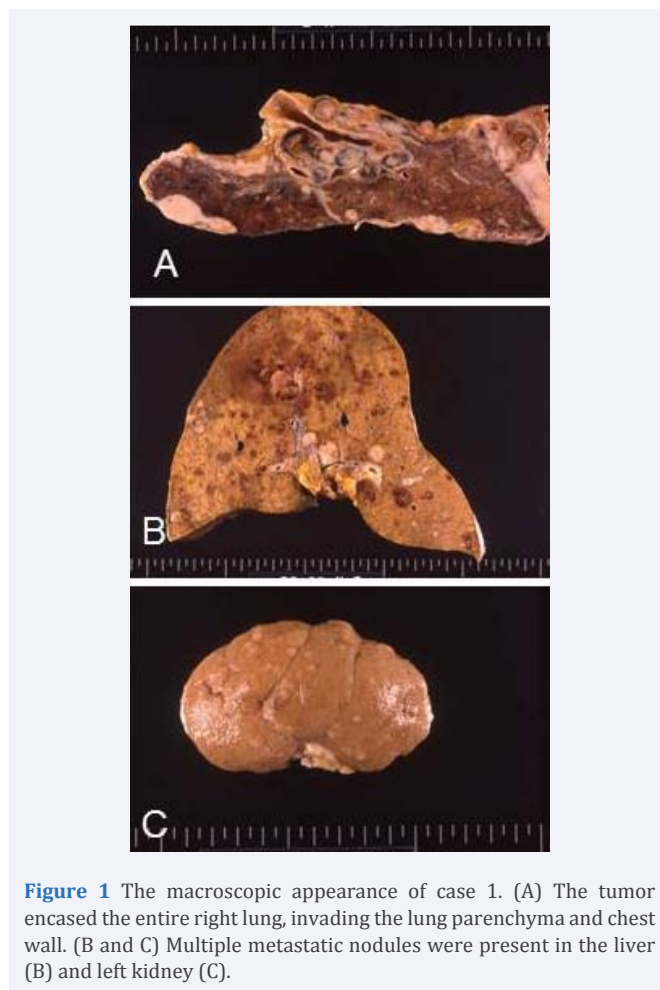
## RESULTS AND DISCUSSION

### Case 1

**Pleomorphic malignant mesothelioma.** A 69-female-old patient complained of dyspnea and a chest X-ray showed effusion in the left thoracic cavity. She had been a teacher and had no evidence of exposure of asbestos. She died of respiratory failure despite chemotherapy. The duration of time between the initial symptoms and the death was 17 months.

At autopsy, the tumor was noted to encase the entire left lung, invading into the lung parenchyma in places (Figure 1A). Macroscopically multiple metastatic nodules were observed in the liver (Figure 1B), left kidney (Figure 1C), adrenal gland, stomach, jejunum and vertebrae. In additions the tumor had metastasized to the mediastinal and paraaortic lymphnodes.

Histologically, necrosis was observed in the tumor at the left pleura and more than 80% of the intact tumor area at the left



**Figure 1** The macroscopic appearance of case 1. (A) The tumor encased the entire right lung, invading the lung parenchyma and chest wall. (B and C) Multiple metastatic nodules were present in the liver (B) and left kidney (C).

pleura was occupied by large discohesive tumor cells that varied in size and shape (pleomorphic tumor cells). They had abundant eosinophilic cytoplasm and single or multiple irregular nuclei with one or several nucleoli (Figure 2, A and B). The remaining tumor area was composed of tumor cells showing the tubulopapillary (Figure 2C) or sarcomatoid pattern (Figure 2D). The numbers of mitotic figures per 10 high power (400x magnification) fields in the tubulopapillary, pleomorphic and sarcomatoid components were 5, 8 and 0, respectively. All metastatic sites showed the sarcomatoid pattern (Figure 2E).

The immunohistochemical results, are presented in Table 2. The tubulopapillary component expressed pancytokeratin (CK) (Figure 3A), but the other components did not. All components except the sarcomatoid component expressed D2-40 (Figures 3, B and C). Vimentin was expressed in all components (Figure 3D). Mesothelioma markers, such as WT-1, Thrombomodulin (TM) and calretinin, and the lung adenocarcinoma markers such as Thyroid Transcription Factor-1 (TTF-1), Carcinoembryonic Antigen (CEA) and BerEp-4 were not expressed in any components. In addition, the expression of E-cadherin and  $\beta$ -catenin was not found in any of the components.

### Discussion

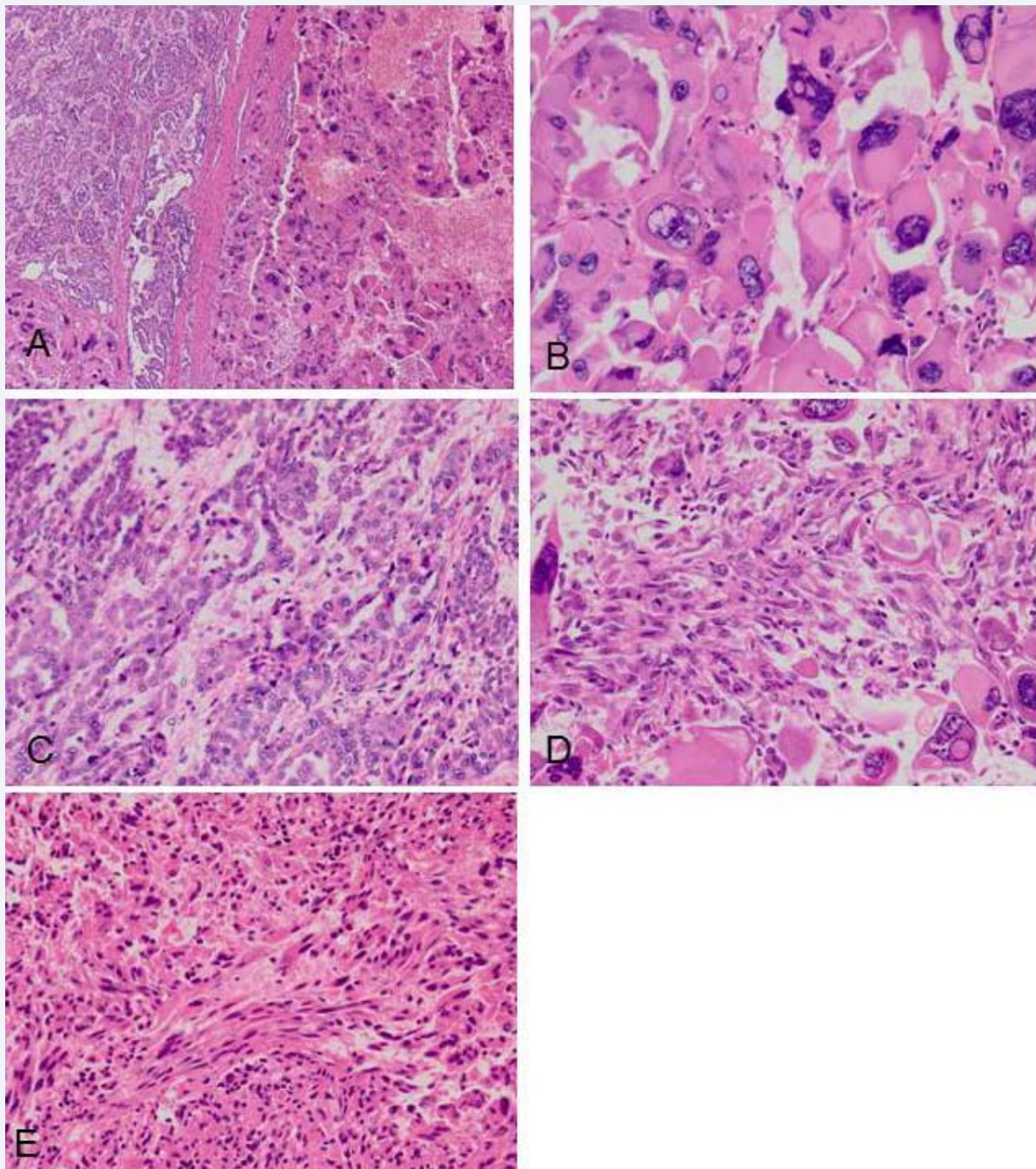
The most frequent histological patterns of the epithelioid malignant mesothelioma are the tubulopapillary, adenomatoid

**Table 1:** Antibodies used for immunohistochemistry.

Antigen	Clone	Source	Dilution
TTF-1	8G7g3/1	Dako	1:1000
Ber-Ep4	Ber-Ep4	Dako	1:100
CEA	II-7	Dako	1: 50
Cytokeartin	AE1/AE3	Dako	1:200
Thrombomodulin	1009	Novocastra	1:500
Calretinin	polyclonal	Nichirei	Diluted
D2-40	D2-40	Dako	1:200
WT-1	6F-HZ	Dako	1: 50
E-cadherin	36B5	Novocastra	1: 50
$\beta$ -Catenin	$\beta$ -Catenin-1	Dako	1: 80
Vimintin	Vim3B4	Dako	1:200

Dako, Tokyo, Japan; Novocastra, Newcastle tyne; UK; Nichirei, Tokyo, Japan.



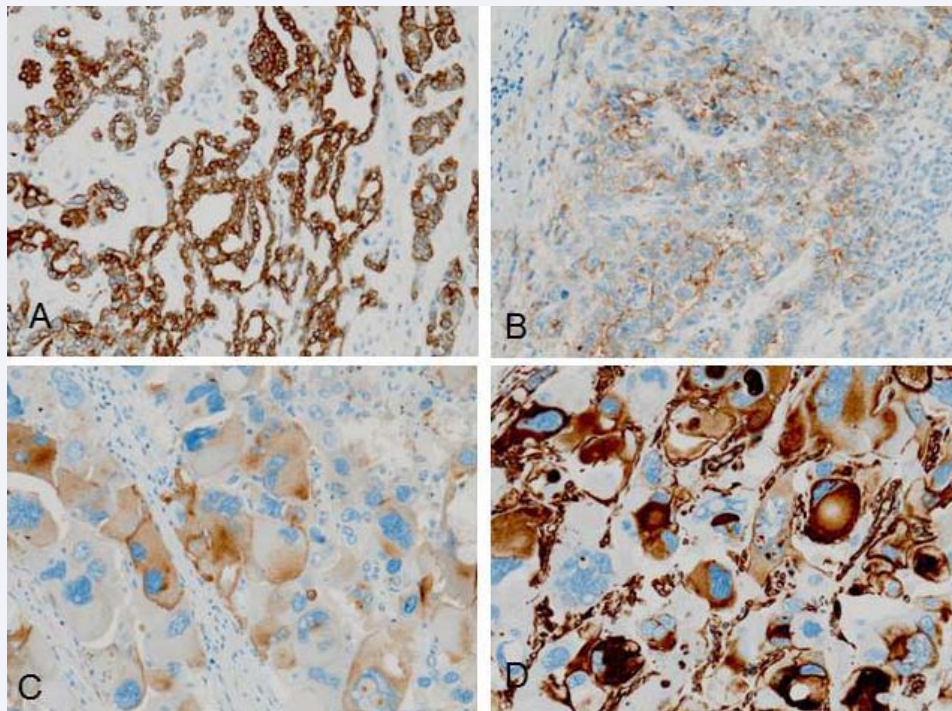


**Figure 2** The histological findings of case 2. (A) Co-existence of the tubulopapillary and pleomorphic patterns. (B, C and D) High power views of the pleomorphic (B), sarcomatoid (C) and tubulopapillary patterns (D) of the primary tumor. (E) A metastatic tumor of the liver showing the sarcomatoid pattern.

**Table 2:** Immunohistochemical findings of the present cases.

Case	Histology	TTF-1	BerEp4	CEA	EMA	CK	WT-1	D2-40	TM	Calretinin	vimentin
1	tubulopapillary	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(+)
	pleomorphic	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)
	sarcomatoid	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)
2	sarcomatoid	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(+)
3	desmoplastic	(-)	(-)	(-)	(-)	(+)	(-)	(+)	Focal	(-)	(+)

**Abbreviations:** CEA: Carcinoembrionic Antigen; EMA: Epithelial Membrane Antigen; CK: Pancytokeratin; TM: Thrombomodulin.



**Figure 3** The immunohistochemistry of case 1. (A) Pancytokeratin was noted in the area with a tubulopapillary pattern. (B and C) There was D2-40 expression in the areas with the tubulopapillary (B) and pleomorphic patterns (C). (D) Vimentin staining in the pleomorphic cells.



**Figure 4** The macroscopic appearance of case 2. (A) The tumor encased the left lung, invading the lung parenchyma and mediastinal tissue. (B) The metastasis to the jejunum, (C) Multiple metastases in the vertebrae.



(micropapillary) and solid patterns. Less common histological patterns of the epithelioid malignant mesothelioma include the decudoid, clear cell, small cell, signet ring cell and pleomorphic cell patterns [4]. Pleomorphic malignant epithelioid mesothelioma is rare, and is composed of pleomorphic large cells that vary in size and shape, with having abundant eosinophilic cytoplasm and single or multiple irregular nuclei [1,6-8].

The pleomorphic component of the present case did not express CK. However, a study by Ordóñez [6] that analyzed 10 pleomorphic malignant mesotheliomas showed that all 10 pleomorphic components expressed CK and keratin-7. Therefore, the present case is an exceptional case with regard to the expression of CK. Furthermore, the pleomorphic cells of the present case expressed D2-40, as the only mesothelioma marker. Ordóñez [6] has reported that the expression of the mesothelioma markers, including calretinin and WT-1, was variable.

Vimentin was expressed in all components (the tubulopapillary, pleomorphic and sarcomatoid components) of the present case. Furthermore, E-cadherin and  $\beta$ -catenin were not expressed in any of the components. These results suggest that the Epithelial Mesenchymal Transition (EMT) may have occurred easily in the malignant mesothelioma of the present case. In agreement with this possibility, all lymphatic and distant metastatic sites showed the sarcomatoid pattern.

Pleomorphic mesothelioma cells are often discohesive [6]. In the present case, the pleomorphic cells did not express adhesion molecules, that is, E-cadherin and  $\beta$ -catenin. The loss of these molecules may be partly ascribed to the dis-cohesion of the pleomorphic mesothelioma cells. This possibility has to be investigated in further cases to confirm our findings.

The patient died 17 months after the initial symptoms. However, Galateau-Salle et al. [9] reported that the median survival period of 44 patients with epithelioid mesothelioma with pleomorphic features was seven months, whereas that of the patients more conventional epithelioid mesothelioma was 13 months. In general, several studies have shown that the prognosis of patients with pleomorphic mesothelioma is worse than that of the patients with conventional epithelioid mesothelioma [6,8,9].

## Case 2

Sarcomatoid mesothelioma with osseous and cartilaginous differentiation.

The second case was a 64-year-old male patient, who had been followed up for pneumoconiosis for 10 years, who complained of exertional dyspnea and left lateral chest pain. The patient had a history of occupational exposure to asbestos (between the ages of 28 and 61 years) and a long smoking history (43 years) of 20 cigarettes per day. A biopsy under Computed Tomography (CT) showed malignant spindle cells. Despite chemotherapy, he died 10 months after the initial symptoms developed.

At autopsy, the tumor was found to unite the right chest wall and the right lung, encasing the entire right lung (Figure 4A). Macroscopically, the tumor invaded into both the right chest wall and the right lung parenchyma in places. Histologically, spindle cells with relatively low atypia proliferated with cartilaginous and osseous foci (Figure 5 A-D). The osseous foci were composed

of osteoid enclosing cells with nuclear atypia and surrounding atypical spindle cells. The number of mitotic figures per 10 high power (400 magnification) fields was six. The atypical spindle cells expressed WT-1 (Figure 6A) and D2-40 (Figure 6B), but did not express CK, mesothelioma markers such as TM and calretinin, or lung adenocarcinoma markers such as TTF-1, CEA and BerEp-4 (Table 2). Asbestos bodies were found in the non-neoplastic lung tissues (Figure 5E), and pleural plaque was also observed (Figure 5F). Macroscopic metastases were found in the stomach, jejunum (Figure 4B) and vertebrae (Figure 4C). The histology evaluation of the metastases showed sarcomatoid mesothelioma without osseous or cartilaginous differentiation (Figure 5G).

## Discussion

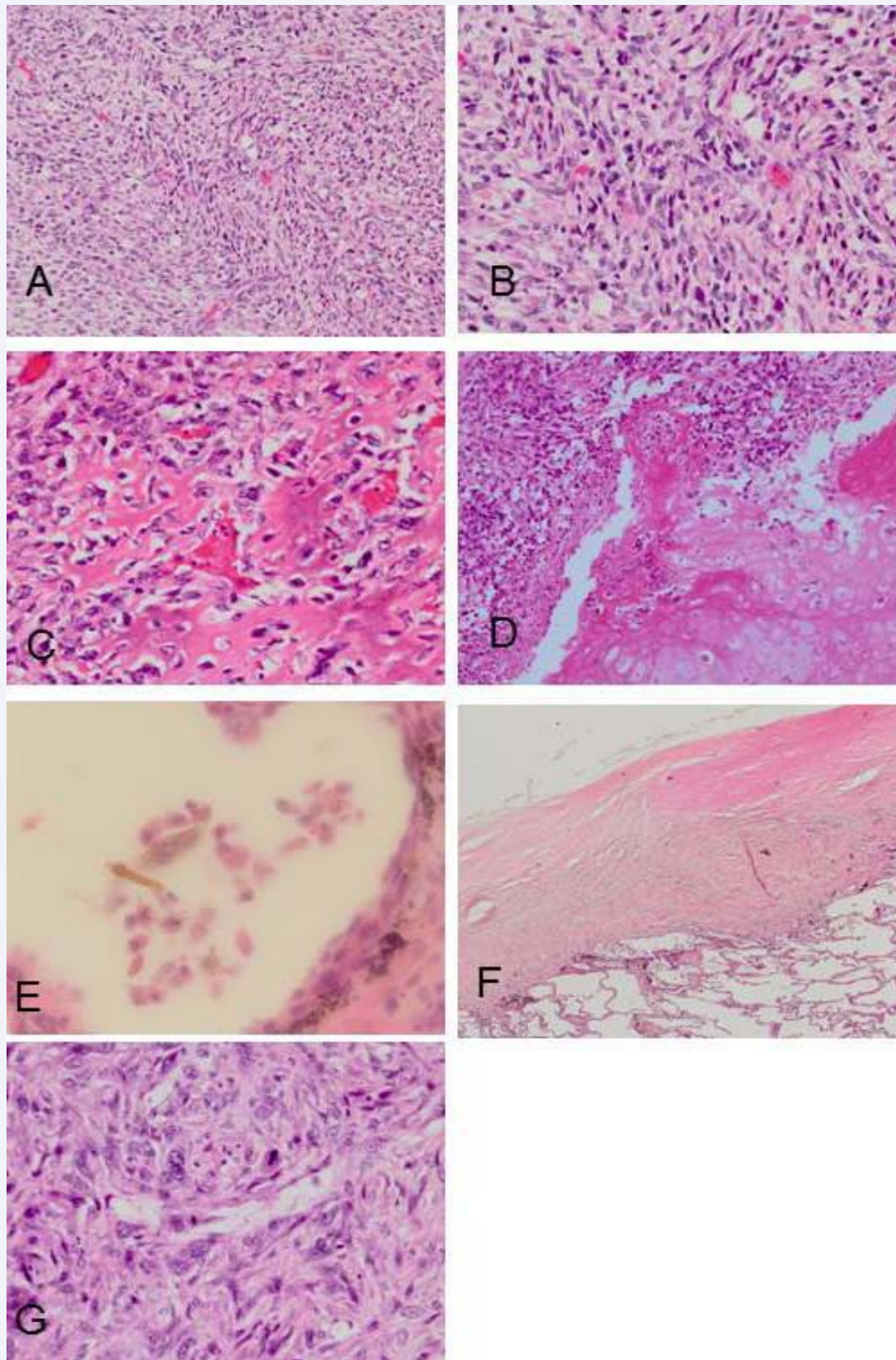
The history of asbestos exposure, macroscopic appearance and expression of pancytokeratin, WT-1 and D2-40 indicate that the tumor of the present case was a sarcomatoid malignant mesothelioma with osseous and cartilaginous foci which is extremely rare [10-14].

With regard to the origin of osseous and cartilaginous foci, there are three possibilities: 1) these foci are produced by the differentiation of neoplastic spindle cells, 2) these foci originate from non-neoplastic cells, and 3) these foci represent another neoplasia that developed separately [13,14]. However, in the present case, the cells forming the osteoid and surrounding osteoid showed nuclear atypia, and the osseous foci were limited. Therefore, the osseous foci in the present case seem to have been neoplastic and to have originated from a sarcomatoid malignant mesothelioma.

## Case 3

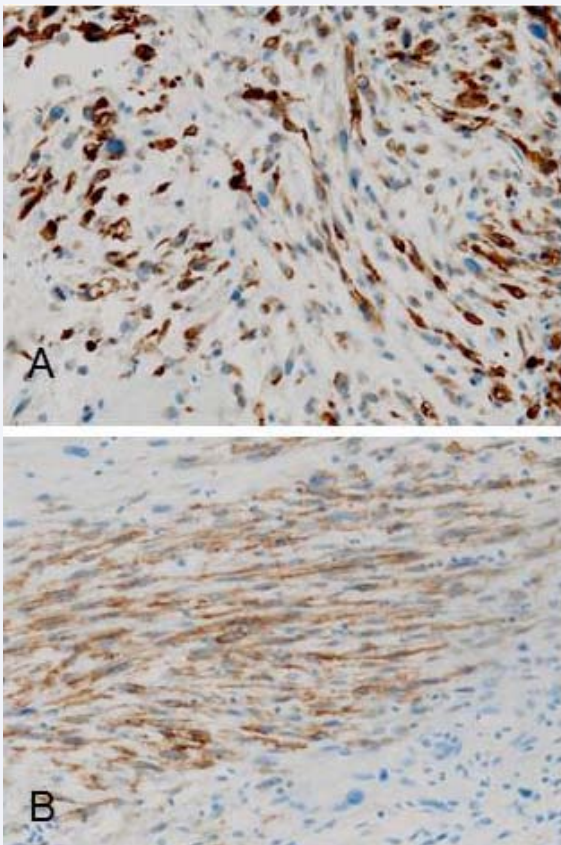
Desmoplastic mesothelioma. An annual checkup revealed that the 75-year-old male patient had right pleural effusion. However, a definitive diagnosis was not obtained despite the cytological examination of the pleural effusion and the pleural biopsy under thoracoscopy. He died nine months after the point-out of the right pleural effusion had been observed. He had worked for a construction company, but his occupational exposure to asbestos was unknown.

At autopsy, both the right and left thoracic cavities contained a large amount of serous yellow effusion (left, 1500ml; right, 1500ml). The lower lobe of the right lung was encased by the thick fibrous tissue. The fibrous tissue invaded into the lung parenchyma in places and spread throughout the right diaphragm which adhered to the liver (Figure 7A). Multiple nodules were found on the cut surface of the liver (Figure 7B). Microscopically, the thick fibrous tissue consisted of anastomosing collagen bundles and spindle cells with mild nuclear atypia and hyperchromasia intervening with collagen bundles (Figure 8A). Whorled or storiform patterns of collagen bundles were also observed in relatively hypercellular areas (Figure 8B). Elongation of nuclei of spindle cells (Figure 8C) and small clefts in hypocellular hyalinized collagen areas (Figure 8D) were also observed. The spindle cells spread into the diaphragm, lung parenchyma and adipose tissue adjacent to the chest wall (Figure 8E). There were multiple nodules in the liver that consisted of relatively abundant spindle cells and mixed collagen bundles (Figure 8F).

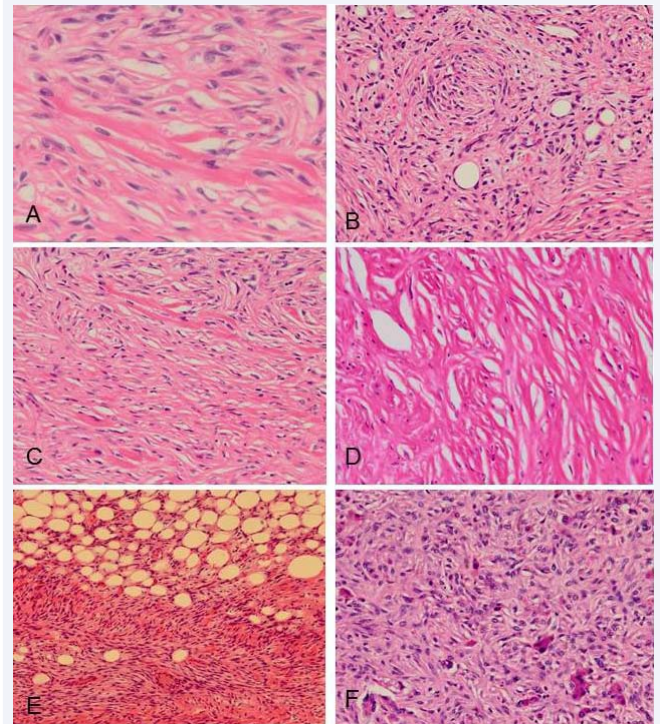


**Figure 5** The histological findings of case 2. (A) The sarcomatoid pattern showing the proliferation of spindle cells, (B) A high power view of (A), (C) An osseous focus, (D) Cartilaginous focus, (E) An asbestos body, (F) Plaque adhered to the pleura, (G) Sarcomatoid tumor cells in a metastatic site of the liver.

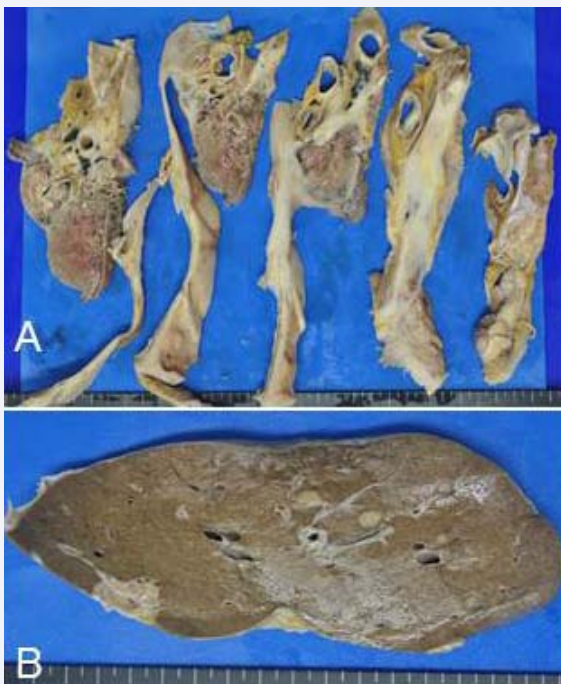




**Figure 6** The immunohistochemical findings of case 2. (A) Nuclear expression of WT-1, (B) D2-40 expression.



**Figure 8** The histological findings of case 3 (A) Anastomosing collagen bundles with spindle cells showing mild nuclear atypia and hyperchromasia, (B) The whorled or storiform pattern in a relatively hypercellular area, (C) Spindle cells with elongated nuclei, (D) Small clefts in hyalinized collagen bundles, (E) The tumor had invaded into the adjacent adipose tissue, (F) A metastatic tumor in the liver showing the sarcomatoid pattern.



**Figure 7** (A) The macroscopic appearance of case 3. (A) The tumor encased the lower lobe of the right lung invading the lung parenchyma and the diaphragm. (B) Multiple metastatic nodules in the liver.

The spindle cells weakly expressed TM, and strongly expressed CK, D2-40 and vimentin (Figures 9 A and B, Table 2), whereas they did not express mesothelioma markers such as WT-1 and calretinin, or lung adenocarcinoma markers such as Ber-Ep4 and TTF-1. The fibrous pleurisy showed the zonation of CK-positive spindle cells: hypercellular towards the luminal side of the pleura, and less cellular towards the chest wall (Figures 9 C and D). However, the thick fibrous tissue of the pleura in the present case showed no zonation (Figures 9E and F).

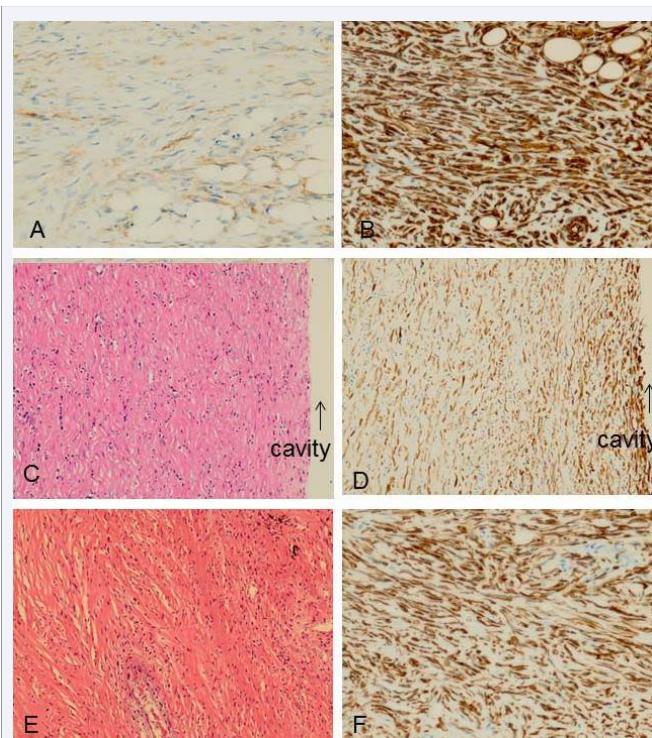
## Discussion

Kannerstein and Churg first described Desmoplastic Mesothelioma (DMM) of the pleura in 1981 [15], after which the number of reports has been increasing [16-19].

At present, the WHO classification defines DMM as a subtype of malignant mesothelioma which is characterized by dense collagenized tissue separated by atypical cells arranged in a storiform pattern or patternless pattern, present in at least 50% of the tumor [4].

Because of the histological features of DMM, the differential diagnosis of DMM from fibrous pleurisy (FP) is very difficult. Mangan et al. [18] have proposed the following histological criteria of DMM for diagnosing: 1) the invasion of the chest wall or lung parenchyma by neoplastic spindle cells, 2) bland necrosis within the lesion, 3) the presence of a frankly sarcomatoid





**Figure 9** The immunohistochemical findings of case 3. (A) Focal staining of D2-40, (B) Strong expression of vimentin, (C and D) Fibrous pleurisy showing zonation (HE stain) (C) and the CK staining of fibrous pleurisy (D), (E and F) Desmoplastic mesothelioma without cell zonation (HE stain) (E) and the CK staining of desmoplastic mesothelioma (F).

and, 4) the presence of distant metastasis. In addition, it has been reported that in FP, the most cellular areas are oriented towards the luminal side of the pleura, and areas closer to the chest wall tend to be less cellular (zonation) while such zonation is not seen in DMM [18]. In the present case, the invasion of the lung parenchyma by neoplastic spindle cells, the presence of a sarcomatoid area and distant metastasis were found. Furthermore, no zonation was observed in the thick fibrous tissue of the pleura. Thus, the present case supports the usefulness of these histological criteria for the differential diagnosis of DMM from FP.

A definitive diagnosis was not obtained until death the cytological examination of the pleural effusion and the pleural biopsy under thoracoscopy until the death. The diagnosis of DMM by pleural biopsy specimens is much more difficult compared to that during autopsy. Therefore, Mangano et al. [18] recommended a through sampling of thorascopic or open biopsy specimens for obtaining a diagnosis of DMM.

In the present case, the neoplastic spindle cells weakly expressed TM and strongly expressed CK and D2-40. The immunohistochemical staining of CK is not useful, because CK is also expressed by non-neoplastic spindle cells in fibrous pleurisy [17]. Chirieac et al [20] have reported that D2-40 and prodoplanin are highly sensitive immunohistochemical markers for sarcomatoid mesothelioma. In the present case, the neoplastic cells expressed D2-40. In addition, Horiuchi et

al. [21] have reported that CLUT-1 is a useful mesothelioma marker for DMM, and can be used for the differential diagnosis from fibrous pleurisy. Therefore, mesothelioma markers such as D2-40, prodoplanin and GLUT-1 may be useful markers for the differential diagnosis of DMM from fibrous pleurisy.

## CONCLUSION

We herein presented three unusual cases of malignant mesotheliomas which we experienced at our institution. Such unusual cases should be kept in mind when making a differential diagnosis of lung lesions.

## ACKNOWLEDGEMENT

The authors thank Mr. Akira Kimura and Mr. Hiroshi Yamada for their valuable technical assistance, and Ms. Yuko Ito for her secretarial help.

## REFERENCES

- Churg A, Cagle PT, Roggli VL. Tumors of the Serosal Membranes. Armed Forces Institute of Pathology. Washington, DC. 2006; 33-82.
- Peto J, Decarli A, La Vecchia C, Levi F, Negri E. The European mesothelioma epidemic. *Br J Cancer*. 1999; 79: 666-672.
- Robinson BM. Malignant pleural mesothelioma: an epidemiological perspective. *Ann Cardiothorac Surg*. 2012; 1: 491-496.
- Churg A, Inai K, Samet JM, Roggli V, Praet M, Weill H, et al. World Health Organization Classification of Tumours. Pathology and Genetics of Tumours of the Lung, Pleura, Thymus and Heart. IARC press. Lyon. 2004; 128-136.
- Hirano H, Maeda H, Takeuchi Y, Susaki Y, Kobayashi R, Hayashi A, et al. Association of cigarette smoking with the expression of nuclear survivin in pathological Stage IA lung adenocarcinomas. *Med Mol Morphol*. 2013 (accepted).
- Ordóñez NG. Pleomorphic mesothelioma: report of 10 cases. *Mod Pathol*. 2012; 25: 1011-1022.
- Itami H, Ohbayashi C, Sakai Y, Kajimoto K, Sakuma T. Pleural malignant mesothelioma with osteoclast-like giant cells. *Pathol Int*. 2010; 60: 217-221.
- Kadota K, Suzuki K, Sima CS, Rusch VW, Adusumilli PS, Travis WD. Pleomorphic epithelioid diffuse malignant pleural mesothelioma: a clinicopathological review and conceptual proposal to reclassify as biphasic or sarcomatoid mesothelioma. *J Thorac Oncol*. 2011; 6: 896-904.
- Galateau-Salle F, Le Stang N, Astoul P, et al. Malignant mesothelioma of the pleura with pleomorphic features: A series of 44 cases. *Modern Pathol*. 2010; 23: 402A.
- Nakao M, Hishida T, Ishii G, Nagai K. Malignant pleural mesothelioma with osteosarcomatous differentiation: characteristic bone scintigraphy findings associated with enhanced tumorous osteogenesis. *Eur J Cardiothorac Surg*. 2011; 39: 421.
- Shiba N, Kusumoto M, Tsuta K, Watanabe H, Watanabe S, Tochigi N, et al. A case of malignant pleural mesothelioma with osseous and cartilaginous differentiation. *J Thorac Imaging*. 2011; 26: W30-32.
- Yousem SA, Hochholzer L. Malignant mesotheliomas with osseous and cartilaginous differentiation. *Arch Pathol Lab Med*. 1987; 111: 62-66.
- Kiyozuka Y, Miyazaki H, Yoshizawa K, Senzaki H, Yamamoto D, Inoue K, et al. An autopsy case of malignant mesothelioma with osseous and cartilaginous differentiation: bone morphogenetic protein-2 in mesothelial cells and its tumor. *Dig Dis Sci*. 1999; 44: 1626-1631.



14. Goldstein B. Two malignant pleural mesotheliomas with unusual histological features. *Thorax*. 1979; 34: 375-379.
15. Kannerstein M, Churg J. *Progress in surgical pathology*. Masson Publishing. New York. 1980; 19-29.
16. Hirano H, Maeda H, Sawabata N, Okumura Y, Takeda S, Maekura R, et al. Desmoplastic malignant mesothelioma: two cases and a literature review. *Med Electron Microsc*. 2003; 36: 173-178.
17. Wilson GE, Hasleton PS, Chatterjee AK. Desmoplastic malignant mesothelioma: a review of 17 cases. *J Clin Pathol*. 1992; 45: 295-298.
18. Mangano WE, Cagle PT, Churg A, Vollmer RT, Roggli VL. The diagnosis of desmoplastic malignant mesothelioma and its distinction from fibrous pleurisy: a histologic and immunohistochemical analysis of 31 cases including p53 immunostaining. *Am J Clin Pathol*. 1998; 110: 191-199.
19. Cantin R, Al-Jabi M, McCaughey WT. Desmoplastic diffuse mesothelioma. *Am J Surg Pathol*. 1982; 6: 215-222.
20. Chirieac LR, Pinkus GS, Pinkus JL, Godleski J, Sugarbaker DJ, Corson JM. The immunohistochemical characterization of sarcomatoid malignant mesothelioma of the pleura. *Am J Cancer Res*. 2011; 1: 14-24.
21. Horiuchi T, Ogata S, Tominaga S, Hiroi S, Kawahara K, Hebisawa A, et al. Immunohistochemistry of cytokeratins 7, 8, 17, 18, and 19, and GLUT-1 aids differentiation of desmoplastic malignant mesothelioma from fibrous pleuritis. *Histol Histopathol*. 2013; 28: 663-670.

**Cite this article**

Hirano H, Ninaka M, Kuroyama M, Satomi A, Yokota S, et al. (2014) Pleomorphic and Desmoplastic Malignant Mesotheliomas and a Malignant Mesothelioma with Osseous and Cartilaginous Differentiation: Case Reports. *J Cancer Biol Res* 2(1): 1024.