TFE3-expressing malignant perivascular epithelioid cell tumor of the mesentery: A case report and review of literature

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Abstract

BACKGROUND
Perivascular epithelioid cell tumor (PEComa) is a rare mesenchymal tumor that exhibits an epithelioid and spindle cell morphology. The tumor is characterized by immunoreactivity for melanocytic and myogenic markers but can be misdiagnosed as more common tumors with similar characteristics, including gastrointestinal stroma tumors or leiomyosarcomas. Recently, a subset of PEComas has been reported to harbor a transcription factor binding to TFE3 fusion. Herein, we report a rare case of TFE3-expressing malignant PEComa arising from the mesentery.

CASE SUMMARY
A 50-year-old woman presented with abdominal discomfort for 3 months. Results of laboratory tests were all within the normal ranges, and the patient had no notable medical history. Magnetic resonance imaging revealed a large tumor on the right side of the pelvic floor, which was originally suspected to be a primary ovarian tumor. However, during surgery, the tumor was revealed to have originated from the mesentery. Histologically, the tumor was composed of bundles of spindle cells and sheets of epithelioid cells. Extensive coagulative necrosis and numerous mitotic figures were observed. Immunohistochemistry revealed that the tumor cells were positive for smooth muscle actin, HMB-45, and TFE3 expression. Tumor involvement of the rectal serosa was identified, leading to a final diagnosis of malignant PEComa of the mesentery. Surgical resection was followed by adjuvant chemotherapy. No recurrence or metastasis was observed over a 6-month follow-up period.
CONCLUSION

Malignant PEComa of the mesentery is extremely rare and should be distinguished from morphological mimics through differential diagnosis and immunohistochemistry.

Key Words: Perivascular epithelioid cell tumor; TFE3; Differential diagnosis; Mesentery; Histology; Case report

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Core Tip: Primary mesenchymal tumors originating from the mesentery are rare and can only be diagnosed histologically. Broad differential diagnoses and immunohistochemical analyses are required along with consideration of perivascular epithelioid cell tumor among differential diagnoses.

INTRODUCTION

Perivascular epithelioid cell tumor (PEComa) is an uncommon mesenchymal neoplasm. Bonetti et al.[1] first described this rare tumor type in 1992, and Zamboni et al.[2] subsequently coined the term “PEComa” in 1996. The World Health Organization recognized PEComa as a distinct tumor entity in 2002.[3] In 2005, Folpe et al.[4] first reported four patients with PEComa of the mesentery. Including this first case series, to the best of our knowledge, only nine cases of primary PEComa of the mesentery have been reported to date[5-10]. Since PEComa is a rare disease, other more common tumors such as gastrointestinal stroma tumor or leiomyosarcoma that show similar morphological characteristics will first be considered in the context of a differential diagnosis.

Histologically, PEComas are composed of epithelioid and spindle cells with radial growth around blood vessels. The characteristic expression of myogenic and melanocytic markers supports a diagnosis of PEComa.[11] Recently, molecular studies identified a subset of PEComas with transcription factor binding to TFE3 rearrangement, suggesting that PEComas harboring TFE3 fusions may represent a distinct disease entity.[12]

Herein, we describe a rare case of malignant PEComa originating from the mesentery and provide guidance for improving differential diagnosis of this tumor along with a review of the relevant literature.

CASE PRESENTATION

Chief complaints

A 50-year-old woman was admitted to the gynecology department of Chonnam National University Hospital with complaints of abdominal discomfort.

History and present illness

The patient exhibited symptoms 3 months prior to admission, and initial sonography performed in a primary health care center revealed an ovarian tumor of 8 cm × 6 cm × 6 cm at that time. The patient was then referred to a tertiary hospital for further evaluation and treatment.

History of past illness

The patient had no history of diabetes, hypertension, or other gynecological disease.
**Personal and family history**
The patient had no significant personal or family medical history.

**Physical examination**
The patient did not exhibit weight loss, palpable lymphadenopathy, or organomegaly.

**Laboratory examinations**
Results of laboratory tests, including carcinoembryonic antigen and cancer antigen 125 levels, and Risk of Ovarian Malignancy Algorithm score were all in the normal range.

**Imaging examinations**
Magnetic resonance imaging revealed a large heterogeneous mass (8 cm × 6.5 cm × 7 cm) occupying the pelvic cavity (Figure 1). Based on this finding and location, the preoperative diagnosis was malignant ovarian tumor. A chest computed tomography (CT) scan showed no evidence of distant metastasis to the thorax.

**FINAL DIAGNOSIS**
The final diagnosis was malignant PEComa of the mesentery with rectal involvement.

**TREATMENT**
The patient underwent total hysterectomy with bilateral salpingo-oophorectomy and pelvic lymph node dissection. A large mass was identified on the right side of the pelvic cavity, which was attached to the mesentery. The right ovary and fallopian tube were grossly normal. The rectum was also partially resected owing to suspicion of tumor involvement in the serosa.

Upon macroscopic examination, the lesion appeared as a white-to-tan solid mass. A cross section of the tumor revealed that the mass was lobulated, did not have a fibrous capsule, and had a focal area of necrosis (Figure 2).

Histologically, the tumor appeared as a high-grade spindle cell sarcoma with involvement of the rectal serosa. No metastases were found in the regional lymph nodes. The tumor was composed of fascicles of spindle cells with an infiltrative growth pattern. The majority of the tumor cells exhibited marked atypia with dispersed chromatin and macronucleoli. Extensive coagulative necrosis was observed with substantial mitotic activity detected reaching up to 40 mitoses per 10 high-power fields. Epithelioid foci were also identified. Nests of large epithelioid cells were surrounded by a delicate vasculature in a radial manner. The tumor cells displayed large, vesicular nuclei with prominent nucleoli and an abundant eosinophilic granular cytoplasm with striking pleomorphism (Figure 3).

Immunohistochemistry revealed that the tumor expressed HMB45, smooth muscle actin, and TFE3, but was negative for Melan A, Desmin, CD117, CD34, CD68, Myogenin, S100, MDM2, and CDK4 (Figure 3). Thus, histopathological and immunohistochemical examinations confirmed the diagnosis of malignant PEComa.

Subsequently, whole-body positron emission tomography/CT scan were performed to check for possible metastases; however, no abnormality was found. Following surgery, the patient was treated with sirolimus chemotherapy.

**OUTCOME AND FOLLOW-UP**
No recurrence or metastasis was observed during a 6-month follow-up period.

**DISCUSSION**
PEComa is a rare mesenchymal tumor composed of histologically and immunohistochemically distinct perivascular epithelioid cells. The tumor cells exhibit an epithelioid and spindle morphology and express melanocytic and myogenic markers. Although the histogenesis and the normal counterpart of PEComa remain unknown, the term “PEComa” is widely accepted to include angiomyolipoma of the
PEComas have been described in various organs; however, the majority are gynecological and gastrointestinal in origin. Mesenteric PEComas are extremely rare, with only nine cases reported to date. A literature review revealed that mesenteric PEComas affect women more often than men (male:female = 20:80), regardless of age. Seven out of ten reported cases, including the present case, were considered to be malignant PEComa exhibiting worrisome features, with only one case showing lymph node involvement. The majority of cases diagnosed as malignant PEComa were treated by surgical resection followed by adjuvant chemotherapy; however, the tumors recurred within 6-22 months in two cases (Table 1).

Microscopically, these tumors consist of bundles of spindle cells and sheets of epithelioid cells located around the blood vessels, and the tumor cells show striking pleomorphism with elevated mitotic activity. Such tumors with unusual locations and histopathological features may pose a diagnostic challenge, and differential diagnoses...
| No. | Ref. | Age/sex | Diagnosis | Size (cm) | Nuclear grade | Cellularity | MF / 50 HPF | Invasion | Necrosis | LN status | Morphology | Treatment | Outcome                  |
|-----|------|---------|-----------|-----------|---------------|-------------|-------------|----------|----------|-----------|------------|-----------|---------------------------|
| 1   | Folpe et al. | 67/F    | PEComa with UMP | 13        | High          | Moderate 0 | No          | No        | Uninvolved | Epithelioid | SE only    | NED at 84 months        |
| 2   | 97/F  | PEComa  | 4         | Intermediate | Moderate 0 | No          | No          | Uninvolved | Epithelioid | SE only    | NED at 38 months        |
| 3   | 80/F  | Malignant PEComa | 9.5      | High       | High > 50  | Vascular invasion | Yes        | Uninvolved | Epithelioid and spindle | SE only    | NED at 19 months        |
| 4   | 46/F  | Malignant PEComa | 12       | Intermediate | Moderate 5 | Vascular invasion | Yes        | Uninvolved | Epithelioid | SE + CT    | Recur and liver metastases at 22 months; die at 27 months |
| 5   | Gross et al. | 5.5/M  | Malignant PEComa | 5         | High       | Moderate NA | Surrounding tissue invasion | No        | Uninvolved | Spindle | SE only    | NED at 24 months        |
| 6   | Lai et al. | 59/M   | Malignant PEComa | 11        | High       | High 3      | Vascular invasion | Yes        | Uninvolved | Epithelioid and spindle | SE + CT    | Recur at 6 months; alive |
| 7   | Fu et al. | 38/F   | Malignant PEComa | 10        | Intermediate | Moderate 2 | Surrounding tissue invasion | Yes        | Involved | SE + CT    | NED at 6 months        |
| 8   | Shi et al. | 48/F   | Malignant PEComa | 14        | High       | Elevated No | Yes         | Uninvolved | Epithelioid | SE + CT    | NED at 60 months        |
| 9   | Wejman et al. | 67/F  | PEComa  | 3.5       | Mild       | Moderate 1-2 | No          | No        | Uninvolved | Epithelioid and spindle | SE + CT    | NA                     |
| 10  | Present case | 50/F   | Malignant PEComa | 8         | High       | High 40     | Surrounding tissue invasion | Yes        | Uninvolved | Epithelioid and spindle | SE + CT    | NED at 6 months        |

MF: Mitotic figure; HPF: High power field; LN: Lymph node; M: Male; F: Female; PEComa: Perivascular epithelioid cell tumor; UMP: Unknown malignant potential; SE: Surgical excision; NED: No evidence of disease; CT: Chemotherapy; NA: Not available.

can include leiomyosarcoma, clear cell sarcoma of the soft tissue, alveolar soft part sarcoma (ASPS), malignant melanoma, gastrointestinal stromal tumor, and dedifferentiated liposarcoma.

Leiomyosarcomas should be considered according to the location and histological features of the tumor. PEComas and leiomyosarcomas are morphologically similar as they are both composed of spindle and/or epithelioid cells displaying varying degrees of atypia with positive reactivity for smooth muscle markers. However, leiomyosarcomas are consistently negative for melanocytic markers.

Clear cell sarcoma of the soft tissue and malignant melanoma may also exhibit similar histological features to PEComa, along with positive immunohistochemical staining of melanocytic markers. However, clear cell sarcomas of the soft tissue display cellular nests separated by a fibrocollagenous network and strong S100
expression, whereas PEComas typically show a delicate vascular rich stroma and do not express S100. ASPS is a rare malignant soft tissue neoplasm with a strong predilection to develop in young adults and adolescents. The tumor shares both histological and immunohistochemical features with PEComa. ASPS is composed of large epithelioid cells with abundant cytoplasm, arranged in nests or sheets that are separated by a delicate vascular network of capillaries. However, ASPS can be differentiated from PEComa by immunohistochemical staining based on negative staining for melanocytic markers, which aids in differentiating from PEComa. The differential diagnosis of PEComa from gastrointestinal stromal tumors and dedifferentiated liposarcomas is based on the absence of CD117, DOG-1, MDM2, and CDK4 expression.

The tumor in the present case showed positive immunoreactivity for melanocytic and myogenic markers and was negative for S100, Desmin, CD34, CD117, MDM2, and PAX-8. Further investigation of TFE3 immunoreactivity and its nuclear expression led to the ultimate diagnosis of malignant PEComa of the mesentery.

TFE3 is a member of the microphthalmia-associated transcription factor family, and its expression is upregulated in ASPS and translocation-associated renal cell carcinomas. Since Folpe et al. first described TFE3 expression in PEComa, molecular analyses have identified a subgroup of PEComas with TFE3 gene rearrangement, suggesting that PEComas harboring TFE3 fusions may represent a distinct disease.

The majority of PEComas are composed of epithelioid and spindle cells, exhibiting positive myogenic expression and the presence of spindle cell components. In addition, PEComas are typically associated with tuberous sclerosis, whereas the subsect of PEComas with TFE3 translocation have different histological features, exhibiting a predominantly epithelioid nested or alveolar architecture without spindle cell components, and immunohistochemistry reveals a lack of myogenic markers. Compared with the conventional type, TFE3-translocated PEComas typically have been reported in younger patients without a history of tuberous sclerosis complex. However, Williamson et al. reported a TFE3-rearranged PEComa showing both an epithelioid and spindle morphology with expression of smooth muscle actin, which are consistent with the findings of the present case.

PEComa is a neoplasm of uncertain malignant potential. Although the majority of PEComas show a benign course, some are potentially malignant. However, there are no established criteria or markers to predict the clinical behavior of the tumor. Folpe et al., as well as Bleeker et al., proposed criteria for the classification of PEComas.
REFERENCES

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CONCLUSION

PEComas are rare mesenchymal neoplasms and should be thoroughly distinguished from their morphological mimics. Analysis of histopathological features and immunohistochemistry are essential for a differential diagnosis. The present case further emphasizes the importance of differential diagnosis based on the correct use of immunohistochemistry along with close surveillance of this unique tumor entity. Further studies are required to gain insight into the pathogenesis of PEComa and its clinical behavior.

REFERENCES

1 Bonetti F, Pea M, Martignoni G, Zamboni G. PEC and sugar. Am J Surg Pathol 1992; 16: 307-308 [PMID: 1599021 DOI: 10.1097/00000478-199203000-00013]
2 Bonetti F, Pea M, Martignoni G, Dogliani C, Zamboni G, Capelli P, Rimondi P, Androni A. Clear cell ("sugar") tumor of the lung is a lesion strictly related to angiomyolipoma--the concept of a family of lesions characterized by the presence of the perivascular epithelioid cells (PEC). Pathology 1994; 26: 230-236 [PMID: 7991275 DOI: 10.1080/00313029400169561]
3 Zamboni G, Pea M, Martignoni G, Zanacano C, Faccioli G, Gilioli E, Pederzoli P, Bonetti F. Clear cell "sugar" tumor of the pancreas. A novel member of the family of lesions characterized by the presence of perivascular epithelioid cells. Am J Surg Pathol 1996; 20: 722-730 [PMID: 8651352 DOI: 10.1159/00000478-19960600-00010]
4 Fletcher CDM, Unni KK, Mertens F. World Health Organization Classification of Tumors: Pathology and Genetics of Tumors of Soft Tissue and Bone. 3rd ed. Lyon: IARC Press, 2002: 221-222
5 Folpe AL, Mentzel T, Lehr HA, Fisher C, Balzer BL, Weiss SW. Perivascular epithelioid cell neoplasms of soft tissue and gynecologic origin: a clinicopathologic study of 26 cases and review of the literature. Am J Surg Pathol 2005; 29: 1558-1575 [PMID: 16327428 DOI: 10.1097/01_pas.0000173232.22117.37]
6 Gross E, Vernea F, Weintraub M, Koplewitz BZ. Perivascular epithelioid cell tumor of the ascending colon: a case report and review of the literature. J Pediatr Surg 2010; 45: 830-833 [PMID: 20385296 DOI: 10.1016/j.jpedsurg.2010.01.015]
7 Lai CL, Hsu KF, Yu JC, Chen CJ, Hsieh CB, Chan DC, Li HS, Hsu HM. Malignant perivascular epithelioid cell tumor of the mesentery: a case report and literature review. Oncol Lett 2012; 35: 114-117 [PMID: 22414975 DOI: 10.1515/ol.2012.157]
8 Fu X, Jiang JH, Gu X, Li Z. Malignant perivascular epithelioid cell tumor of the mesentry with lymph node involvement: a case report and review of literature. Diagn Pathol 2013; 8: 60 [PMID: 23587410 DOI: 10.1186/1746-1596-8-60]
9 Shi Y, Geng J, Xie H, Wang B. Malignant perivascular epithelioid cell tumor arising in the mesentry: A case report. Oncol Lett 2015; 9: 2189-2192 [PMID: 26157038 DOI: 10.3892/ol.2015.3037]
10 Wejman J, Nowak K, Gielniewska L, Komorowska M, Dąbrowski W. PEComa of the mesentery coexisting with colon cancer: a case report. Diagn Pathol 2015; 10: 31 [PMID: 25896860 DOI: 10.1186/s13000-015-0265-5]
11 Thway K, Fisher C. PEComa: morphology and genetics of a complex tumor family. Ann Diagn Pathol 2015; 19: 359-368 [PMID: 26144278 DOI: 10.1016/j.anndiagpath.2015.06.003]
12 Argani P, Aulmann S, Ileii PB, Netto GJ, Ro J, Cho HY, Dogan S, Ladanyi M, Martignoni G, Goldblum JR, Weiss SW. A distinctive subset of PEComas harbors TFE3 gene fusions. Am J Surg Pathol 2010; 34: 1395-

with worrisome features, including a tumor size > 5 cm, infiltrative growth pattern, high nuclear grade, cellularity, necrosis, vascular invasion, and a mitotic rate > 1/50 high-power fields. The tumor in the present study was 7 cm in size, had extensive coagulative necrosis, and showed a mitotic rate of 40/10 high-power fields. Therefore, the tumor met the aforementioned criteria for high risk of malignancy. Furthermore, the tumor involved the rectal serosa but no lymph node metastasis was observed. Therefore, a diagnosis of malignant PEComa was made based on the histopathological and immunohistochemical features.

Since PEComa is a very rare neoplasm, there are currently no effective therapies or management strategies. Surgical resection is the most common approach for curative treatment, and adjuvant chemotherapy is recommended for patients with tumors exhibiting malignant features. This unusual case of malignant PEComa of the mesentery further expands this field to help inform the diagnosis and treatment of this rare entity.
LY. TFE3-Expressing Epithelioid Rich Perivascular Epithelioid Cell Neoplasm (PEComa) of the Bladder

Chen XF, 1619-1626 [PMID: 29220301]. TFE3 gene fusion: report of a unique case expanding the gene fusion spectrum. 

Wang XT, 2008; 16: 2315-2322 [PMID: 15118077]. Transcription factor (MiTF) family.

Dickson BC, 2015; 8: 309-329 [PMID: 26297059]. TFE3 expression in tumors of the microphthalmia-associated transcription factor family (MiTF). 

James AW, 2018; 3: 23797724. TFE3 expression in tumors of the microphthalmia-associated transcription factor family (MiTF).

George S, 2016; 26516944. TFE3-Expressing Epithelioid Rich Perivascular Epithelioid Cell Neoplasm (PEComa) of the Bladder with Unusual Benign Course.

Chen XF, Yeong J, Chang KTE, Lim AST, Kuick CH, Lim TH, Sudhanshi J, Selvarajan S, Gan VHL, Khor JI, Quevedo JF, Folpe AL. "Malignant" perivascular epithelioid cell neoplasm: risk stratification and treatment strategies. Sarcoma 2012; 2012: 541626 [PMID: 22619565]. DOI: 10.1155/2012/541626

Kim NI et al. Malignant PEComa of the mesentery

1406 [PMID: 20871214]. DOI: 10.1097/PAS.0b013e3181f17ac0

Tazelaar HD, Battis KP, Stiegley JR. Primary extrapulmonary sugar tumor (PETS): a report of four cases. Mod Pathol 2001; 14: 615-622 [PMID: 11406665]. DOI: 10.1038/modpathol.3880360

Hornick JL, Fletcher CD. PEComa: what do we know so far? Histopathology 2006; 48: 75-82 [PMID: 16359539]. DOI: 10.1111/j.1365-2559.2005.02316.x

Doyle LA, Hornick JL, Fletcher CD. PEComa of the gastrointestinal tract: clinicopathologic study of 35 cases with evaluation of prognostic parameters. Am J Surg Pathol 2013; 37: 1769-1782 [PMID: 24061520]. DOI: 10.1097/PAS.0b013e31829caceb3

Xu J, Yan Y, Xiang X, Jiang P, Hu X, Yang W. Gastric Perivascular Epithelioid Cell Tumor (PEComa). Mod Pathol 2014; 27 Suppl 1: S17-S29 [PMID: 24384850]. DOI: 10.1038/modpathol.2013.178

Shi HY, Wei LX, Sun L, Guo AT. Clinicopathologic analysis of 4 perivascular epithelioid cell tumors (PEComas) of the gastrointestinal tract. Int J Surg Pathol 2010; 18: 243-247 [PMID: 19124450]. DOI: 10.1177/1066896909330481

Miettinen M. Smooth muscle tumors of soft tissue and non-uterine viscera: biology and prognosis. Mod Pathol 2014; 7: 10.1038/modpathol.2013.178

George S, Serrano C, Hensley ML, Ray-Coquard I. Soft Tissue and Uterine Leiomyosarcoma. J Clin Oncol 2018; 36: 144-150 [PMID: 29220301]. DOI: 10.1200/JCO.2017.75.9642

James AW, Dry SM. Diagnostically Challenging Epithelioid Soft Tissue Tumors. 

Jaber OL, Kirby PA. Alveolar Soft Part Sarcoma. Arch Pathol Lab Med 2015; 139: 1459-1462 [PMID: 26516944]. DOI: 10.5858/arpa.2014-0385-RS

Keneder HI, Folpe AL, Takayama TK, Yeung RS. Activation of the mTOR pathway in sporadic angiomyolipomas and other perivascular epithelioid cell neoplasms. Hum Pathol 2007; 38: 1361-1371 [PMID: 17521703]. DOI: 10.1016/j.humpath.2007.01.028

Kaiser RP, Schepens M, Thijssen J, Schoenmakers EF, van Kessel AG. Regulation of the MiTF/TFE bHLH-LZ transcription factors through restricted spatial expression and alternative splicing of functional domains. Nucleic Acids Res 2004; 32: 2315-2322 [PMID: 15118077]. DOI: 10.1093/nar/gkh6571

Agaram NP, Sung YS, Zhang L, Chen CL, Chen HW, Singer S, Dickson MA, Berger MF, Antonescu CR. Dichotomy of Genetic Abnormalities in PEComas With Therapeutic Implications. Am J Surg Pathol 2015; 39: 813-825 [PMID: 25651471]. DOI: 10.1097/PAS.0000000000000389

Schoolmeester JK, Diao LN, Sukov WR, Wang L, Park KJ, Murali R, Hameed MR, Soslowsky LA. TFE3 translocation-associated perivascular epithelioid cell neoplasm (PEComa) of the gynecologic tract: morphology, immunophenotype, differential diagnosis. Am J Surg Pathol 2013; 39: 394-404 [PMID: 25517951]. DOI: 10.1097/PAS.0b013e31824a8a37

Shen Q, Rao Q, Xia QY, Yu B, Shi QL, Zhang RS, Zhou XF. Perivascular epithelioid cell tumor (PEComa) with TFE3 gene rearrangement: clinicopathological, immunohistochemical, and molecular features. Virchows Arch 2014; 465: 607-613 [PMID: 25239799]. DOI: 10.1007/s00428-014-1655-x

Cho HY, Chung DH, Khurana H, Zhai QJ, Ro JY. The role of TFE3 in PEComa. Histopathology 2008; 53: 236-249 [PMID: 18510571]. DOI: 10.1111/j.1365-2559.2008.03057.x

Malinowska I, Kwiecikowski DJ, Weiss S, Martignoni G, Netto G, Argani P. Perivascular epithelioid cell tumors (PEComas) harboring TFE3 gene rearrangements lack the TSC2 alterations characteristic of conventional PEComas: further evidence for a biological distinction. Am J Surg Pathol 2012; 36: 783-784 [PMID: 22455611]. DOI: 10.1097/PAS.0b013e3182a8a37

Dickson BC, Brooks JS, Pasha TL, Zhang PJ. TFE3 expression in tumors of the microphthalmia-associated transcription factor (MiTF) family. Int J Surg Pathol 2011; 19: 26-30 [PMID: 2164056]. DOI: 10.1177/1066896909352861

Righi A, Dimosthenous K, Rosati J. PEComa: another member of the MiTF tumor family? Int J Surg Pathol 2008; 16: 16-20 [PMID: 18203778]. DOI: 10.1089/0163e318293729d

Wang XT, Xia QY, Ni H, Wang YZ, Ye SB, Li R, Wang X, Lv JH, Shi SS, Ma HH, Lu ZF, Shen Q, Zhou XF, Rao Q. Xpl1 neoplasm with melanocytic differentiation of the prostate harboring the novel NONO-TFE3 gene fusion: report of a unique case expanding the gene fusion spectrum. Histopathology 2016; 69: 450-458 [PMID: 26844676]. DOI: 10.1111/his.12949

Williamson SR, Bunde PJ, Montironi R, Lopez-Beltran A, Zhang S, Wang M, Macleman GT, Cheng L. Malignant perivascular epithelioid cell neoplasm (PEComa) of the urinary bladder with TFE3 gene rearrangement: clinicopathologic, immunohistochemical, and molecular features. Am J Surg Pathol 2013; 37: 1619-1624 [PMID: 23747792]. DOI: 10.1097/PAS.0b013e318293729d

Chen XF, Yeong J, Chang KTE, Lim AST, Kuich CH, Lim TH, Sudhanshi J, Selvarajan S, Gan VHL, Khor LY. TFE3-Expressing Epithelioid Rich Perivascular Epithelioid Cell Neoplasm (PEComa) of the Bladder with Unusual Benign Course. Ann Clin Lab Sci 2018; 48: 110-115 [PMID: 29531060]. DOI: 10.1097/ACLS.0000000000000530

Bleeker JS, Quevedo JF, Folpe AL. "Malignant" perivascular epithelioid cell neoplasm: risk stratification and treatment strategies. Sarcoma 2012; 2012: 541626 [PMID: 22619565]. DOI: 10.1155/2012/541626

Sarcoma
