Virchows Arch (1999) 435:37–42

ORIGINAL ARTICLE

J. Lüttges · T. Mentzel · G. Hübner · G. Klöppel

Solitary fibrous tumour of the pancreas: a new member of the small group of mesenchymal pancreatic tumours

Received: 14 December 1998 / Accepted: 24 March 1999

Abstract Solitary fibrous tumours usually occur in the pleura, but occasionally they appear in extraserosal soft tissues or parenchymatous organs, where their diagnosis often causes problems. This report describes a solitary fibrous tumour (SFT) of the pancreas in a 50-year-old woman treated by left-side pancreatectomy. The tumour showed immunocytochemical reactivity for CD34, CD99 and bcl-2. Because of its favourable prognosis, SFT must be clearly distinguished from leiomyosarcoma, the most frequent nonepithelial tumour of the pancreas. Other mesenchymal tumours that may occur in the pancreas include tumours of the peripheral nerve sheath, fibrous histiocytic tumours and rare vascular tumours.

Key words Soft tissue tumours · Pancreas · Solitary fibrous tumour

Introduction

Nonepithelial tumours of the pancreas are exceedingly rare, accounting for less than 1% of all pancreatic tumours [3], or if only malignant tumours are considered for less than 0.6% [48]. The most common are leiomyosarcomas [20], followed by malignant peripheral nerve sheath tumours (MPNST) [23].

The group of nonepithelial tumours with spindle cell features includes solitary fibrous tumour (SFT). Formerly this entity had been described only in the pleura [25, 42], where it was called benign mesothelioma. However, more recent immunocytochemical findings suggested a nonmesothelial, fibroblastic/myofibroblastic differentiation [14, 21, 39, 69]. This tumour entity has also been described in extraserosal sites, such as soft tissues [69], as well as in various parenchymatous organs [34, 50], especially the major salivary glands [28]. We present a case of SFT in the pancreas, where it has not yet been reported. The tumour's features are discussed in relation to other nonepithelial tumours that have been described in the pancreas (Table 1).

J. Lüttges (✉) · G. Klöppel
Department of Pathology, University of Kiel,
Michaelisstrasse 11, D-24105 Kiel, Germany
e-mail: jluettges@path.uni-kiel.de
Tel.: +49-0431/5973422
Fax: +49-0431/5973428

T. Mentzel
Department of Pathology, Friedrich Schiller University, Jena, Germany

G. Hübner
Department of Pathology, General Hospital, Fürth, Germany

Clinical history

The patient was a 50-year-old woman with a recent history of bilateral adnectomy for hydrosalpinx with perforation of the ileum and resultant peritonitis. Subsequently the perforated ileal segment was also resected. Perioperative ultrasound findings revealed a neoplastic enlargement of the corpus of the pancreas. When the perforated intestinal segment was resected, a biopsy was taken from this tumour. The histological specimen was too small to allow a definitive classification of the lesion, but tissue of mesenchymal origin could be clearly identified, and an ordinary adenocarcinoma of the pancreas was ruled out. The CT scan revealed a neoplasm with enhanced contrast fluid uptake in both the arterial and the venous phase, suggesting an endocrine neoplasm. There were no signs of pancreatic duct obstruction or jaundice. A left-side pancreatectomy was performed. Intraoperatively the corpus of the pancreas was found to be enlarged owing to a tumour measuring 5 cm in its greatest dimension. Lymph node metatastases were not detected.

Pathological findings

The cut surface of the resection specimen of the pancreas revealed a tumour with a diameter of 5.5 cm (Fig. 1). The distance from the resection margin was 2.5 cm; the tumour was R0 resected. The cut surface appeared grey and fasciculated and was sharply demarcated from the normal parenchyma. For immunohistochemical studies, paraffin-embedded tissue sections were incubated with antibodies against broad-spectrum keratin (Kl1, 1:10, Immunotech), vimentin (V9 1:20, DAKO), CD31 (JC-

Table 1 Nonepithelial neoplasms described in the pancreas (*lei-sarc* leiomyosarcoma, *lip-sarc* liposarcoma, *fib-sarc* fibrosarcoma, *MFH* malignant fibrous histiocytoma, *inflam p* inflammatory pseudotumour, *HA* haemangioendothelioma, *HP* haemangiopericytoma, *CCST* clear cell sugar tumour, *PNET* peripheral neuroectodermal tumour, *PNST* peripheral nerve sheath tumour, *MPNST* malignant peripheral nerve sheath tumour, *NFR* neurofibromatosis von Recklinghausen, *SFT* solitary fibrous tumour, *f* female, *m* male, *med* median age, *DOD* dead of disease, *aut.* autopsy *d.* dead, *n.d.* no details; *A.*, *a.* alive, *recurr.*recurrence, *w.* well, *Met, met* metastases, *d.f.* diseases free. One case of leiomyosarcoma [45], one granular cell tumour [65], and one case of peripheral nerve sheath tumour [44] are not listed in the table because the data were not informative)

Author	Year	Tumour type	Age/sex	Site	Size (cm)	Follow-up
Ross [63]	1951	Lei-sarc	8o m	Diffuse	>20	DOD aut.
Berman & Levene [8]	1956	Lei-sarc	47 m	Head	5.5	n.d.
Feinberg et al. [26]	1957	Lei-sarc	14 m	Head	11	n.d.
Becker et al. [6]	1965	Lei-sarc	n.d.	Head	Large	n.d.
Oyamada et al. [56]	1970	Lei-sarc	74 m	Diffuse	~ 20	n.d.
Baylor & Berg [5]	1973	Lei-sarc (5 cases)	51 med (3 m/2f)	Head	n.d.	Met. (3)
Carda Abella et al. [12]	1976	Lei-sarc	56 f	Diffuse	“large”	n.d.
Ishikawa et al. [38]	1981	Lei-sarc	44 m	Head	10	4 years, DOD
Tulha et al. [72]	1982	Lei-sarc	n.d.	n.d.	n.d.	n.d.
Murata et al. [53]	1990	Lei-sarc	55 f	Head+tail	Two tu	No met.
de Alava et al. [20]	1993	Lei-sarc	71 f	Body	3.6	n.d.
Peskova & Fried [59]	1994	Lei-sarc	66 m	Head	15	6 months, a.
Ishii et al. [37]	1994	Lei-sarc	66 m	n.d.	n.d.	DOD aut.
Lüttges et al. [48]	1997	Lei-sarc	43 m	Head	8	n.d.
Zalatnai et al. [81]	1998	Lei-sarc	57 m	Head	6×5x4	DOD, aut.
Elliott et al. [24]	1980	Lip-sarc	59 f	Total	16×10×11	n.d.
Brooke & Maxwell [9]	1966	Fib-sarc	44 m	Head	6	8 years, a.
Garvey et al. [32]	1989	MFH	77 m	Head	12.5×10×6	4 years, a.w.
Pascal et al. [58]	1989	MFH	39 f	Head	9×8x6	D. no met., aut.
Suster et al. [68]	1989	MFH	71 m	Head	5	No met.
Allen et al. [2]	1990	MFH	n.d.	n.d	n.d	n.d.
Tsujimura et al. [71]	1992	MFH+cyst.ad	43 f	Tail	15×14×12	5 months, a.
Ben Jilani et al. [7]	1993	MFH	72 m	n.d.	n.d.	1 year, DOD
Abrebanel et al. [1]	1984	Inflam p	12 f	Body	12×10×6	n.d.
Remberger et al. [61]	1987	Inflam p	41 f	Diffuse	13×6x5	A.w.
Palazzo & Chang [57]	1993	Inflam p	52 f	Tail	3×4	A.w.
Chappell [15]	1973	Benign HA	Child	Head	n.d.	n.d.
Tunell [73]	1976	HA	6 mo	Head	n.d.	n.d.
Wrezlewicz et al. [79]	1989	Mal.HP	76 m	Tail	9×11	Met.
Zamboni et al. [82]	1996	CCST	60 m	Tail	2	A.w.
Burd et al. [10]	1992	PNST	73 m	Body	2	n.d.
Urban et al. [74]	1992	PNST	56 f	Body	3×4	n.d.
David & Barkin [19]	1993	PNST	46 m	Head	6×5	n.d.
Melato et al. [49]	1993	PNST	87 m	Body/tail	20	n.d.
Steven et al. [67]	1994	PNST	59 m	Head	4	A.w.
Ferrozzi et al. [29]	1995	PNST	47 m	Body	3.5	A.w.
		(3 cases)	63 m	Body	n.d.	n.d.
			68 f	Body/tail	n.d	A.w.
Feldman et al. [27]	1997	PNST	63 f	Body	2	A.w.
		(2 cases)	54 f	Head	2	A.w.
Møller Pedersen et al. [52]	1982	MPNST	60 m	Body/tail	15–20	A.
Eggermont et al. [23]	1987	MPNST	40 f	Head	>10	n.d.
Walsh & Brandspigel [76]	1989	MPNST (NFR)	35 f	Head	Large	A.w.
Coombs [16]	1990	MPNST (NFR)	74 f	Head	7	n.d.
Liessi et al. [47]	1990	MPNST	75 f	Head	7	7 months, a.w.
Lüttges et al. [48]	1997	MPNST	43 m	Tail	8	n.d.
Danner et al. [18]	1994	PNET	17 m	Head	8	8 months, a.
Lüttges et al. [48]	1997	PNET	13 f	Body/tail	22×8×110	1.5years, recurr.
		(2 cases)	31 m	Body	>20	15 months, a.
Present case	1997	SFT	50 f	Tail	5.5	d.f.

70 A,1:400 DAKO), CD34 (QBEND 10, 1:1500 Immunotech), smooth muscle antigen (1A4, 1:100, DAKO), O13 (O13, 1:20, WAK-Chemie), S-100 protein (1:500, DAKO), NSE (BBS/NC/VI-H14, 1:500, DAKO), Ki-S5 (antibody against a formalin-resistant epitope of the Ki-67 antigen, 1:20 [43], provided by Prof. R. Parwaresch, Dept. of Pathology, University of Kiel), chromogranin A (CK2H10, 1:2, Linaris), synaptophysin (1:500, Biometra), insulin (HB 125, 1:40, Biogenex), CK7 (OV-TL 12/30, 1:25 DAKO) and p53 (DO7, 1:100, Novo Castra) and stained with the APAAP method or vectastain. Immunohistochemical staining was preceded by epitope retrieval based on either heat pressure or 5’-protease digestion (CK7).

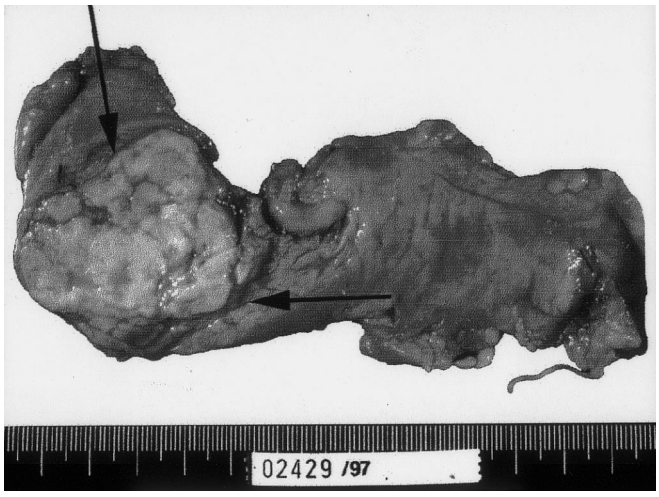

Fig. 1 Distal pancreatectomy specimen showing a well-demarcated solid fibrous tumour on cut section

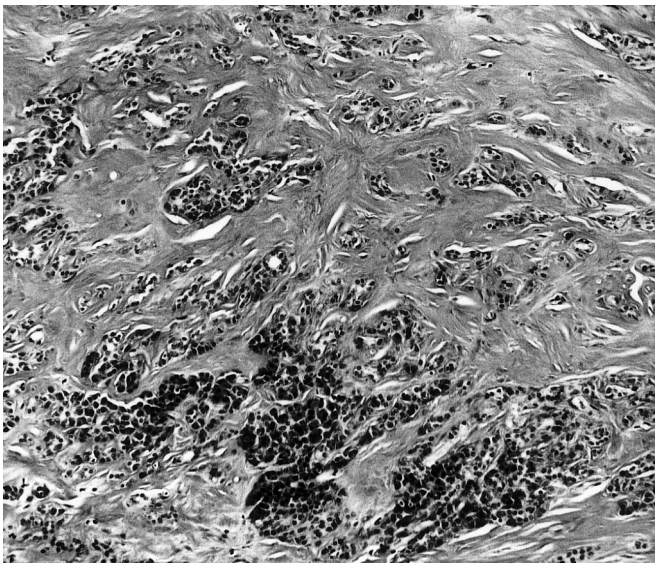

Fig. 3 Solitary fibrous tumour (SFT): entrapped acinar and ductal tissue within the dense tumour stroma. Note the absence of islets. H&E, ×125

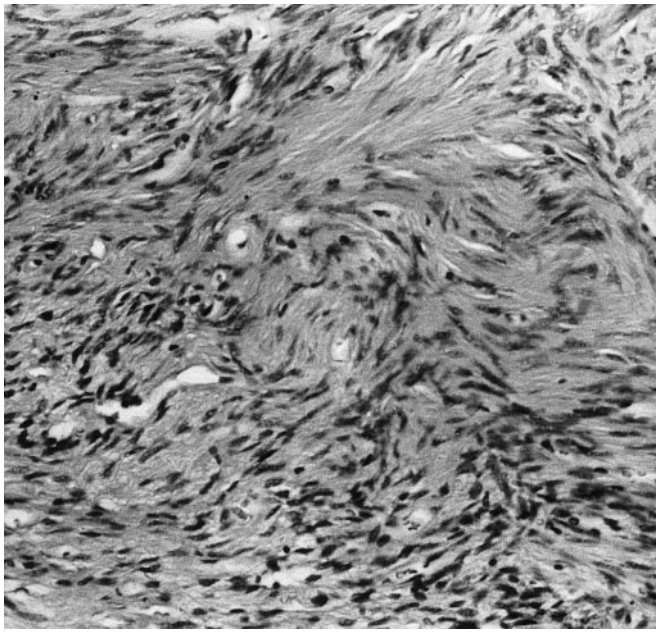

Fig. 2 Solid fibrous tumour showing spindle cells in fascicular and haphazard arrangement H&E, ×250

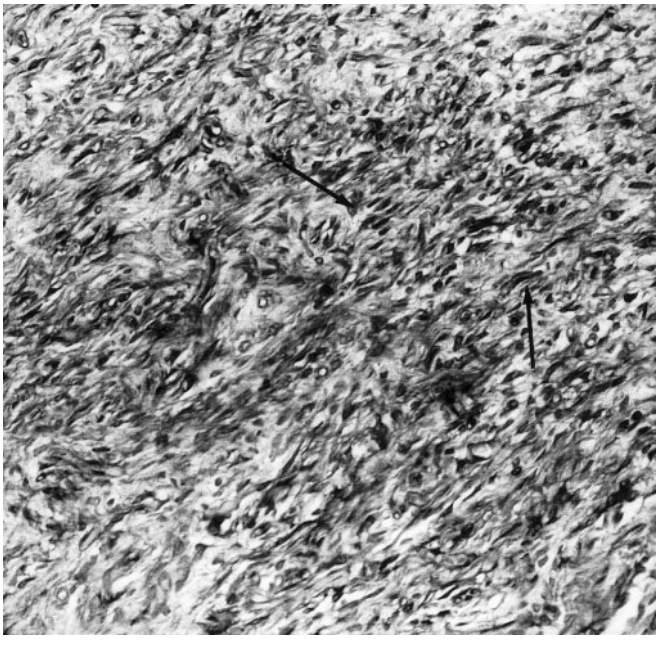

Fig. 4 SFT: positive immunostaining for CD34. ×250

On histological examination the tumour was well demarcated in most areas, except for a few regions with focal infiltration of the pancreatic tissue. It was characterized by variable cellularity: the main cell type was spindled, and few cells exhibited epithelioid features. There was a typical “patternless growth” of short fascicles and a short storiform arrangement of the cells in a stroma with varying degrees of collagenization (Fig. 2). Further features were vascularization with focal haemorrhage and slit-like spaces. Exocrine, and to a surprisingly lesser extent endocrine, parenchyma was entrapped (Fig. 3). The slender, wavy nuclei showed moderate pleomorphism but did not exhibit any mitotic figures.

Immunocytochemically, all tumour cells stained strongly for CD34 (Fig. 4), O13 (CD99) and for bcl-2, and less strongly for vimentin. Some stromal cells of the perilobular connective tissue of the surrounding normal pancreas also stained for bcl-2. Less than 2% of the nuclei were positive for Ki-S5. All other markers were negative. In particular, there was no positive staining for

smooth muscle antigen or for S-100 protein. Therefore, the tumour was classified as SFT of the pancreas with ill-defined borders in some parts. Close monitoring of the clinical follow-up was recommended. Twenty months postoperatively the patient was disease free and well.

Discussion

SFT is characterized histologically by spindle cells growing in a "patternless", haemangiopericytomatous, herringbone or storiform arrangement and exhibiting a stroma with strongly differing amounts of collagen [25, 35, 51]. The concept of fibroblastic/myofibroblastic differentiation has been accepted and was supported here by the immunohistochemical demonstration of CD34, CD99 [22, 39, 62, 69, 78] and bcl-2 oncoprotein [70] in the absence of other relevant markers. This entity has been described at extraserosal sites in the soft tissue [34, 36, 50, 69, 78] and in parenchymatous organs including the lung [34, 40], the thyroid [11, 41], the liver [4, 46], the kidney and perirenal tissue [31, 33], the adrenal glands [60], the breast [17], the meninges [13] and the salivary glands [28]. The pancreas can now be added as a further site.

In contrast to most parenchymatous organs, the pancreas is rarely affected by mesenchymal tumours [66]. Leiomyosarcomas are the most common of the nonepithelial tumours that have been reported in the literature so far and have to be differentiated from SFT (Table 1) and the histological appearance of our tumour initially suggested the diagnosis of a highly differentiated leiomyosarcoma or atypical leiomyoma. However, immunostaining revealed reactivity for CD34, CD99 and bcl-2 only, ruling out a myogenic or neural differentiation of the neoplasm. A desmoid tumour was also excluded, because the cells of a desmoid tumour are uniformly arranged in broad fascicles and do not have the haemangiopericytoma-like vascular pattern that is typical of SFT. The lack of a suggestive inflammatory component, together with the immunohistochemical findings, made it possible to exclude an inflammatory myofibroblastic tumour, which has also been described for the pancreatobiliary region [57, 77].

Unlike cases of SFT in the salivary glands [28], this SFT showed considerable invasion of the pancreatic parenchyma – a feature that can be interpreted as an indication of more aggressive behaviour. Therefore, close follow-up checks were recommended. However, clear features of malignancy [55, 75], such as angioinvasion, increased mitotic rate and necrosis, were absent. Moreover, the CD34 immunoreactivity was distributed equally throughout the tumour and staining for p53 was negative. An irregular distribution of CD34-positive cells and positive staining for p53 were reported by Yokoi et al. [80] as characteristic of malignant transformation of SFTs.

A hamartomatous lesion, which may harbour considerable amounts of fibrous tissue and may lack endocrine tissue [30], was also excluded. Our tumour included fibrous areas with entrapped pancreatic parenchyma containing only few islets. Hamartomas, however, show cystic areas and are clinically manifest at a very young age.

SFTs are generally characterized by immunoreactivity for CD34, an antigen that is detected on haematopoetic stem cells and also on endothelium of blood vessels or fibroblastic/mesenchymal cells [14, 39]. The focally developed slit-like vessels with scattered haematopoetic cells seen in our case have not previously been described for SFTs. In the context of CD34 immunoreactivity, a gastrointestinal stroma tumour (GIST) must also be considered. SFT and GIST differ in their sites of manifestation and in the expression of some other markers. CD117 (c-kit receptor) is expressed in GIST only [54, 64]. However, they have many features in common, such as the variable growth pattern of the spindle cells, the varying collagenization of the stroma and the immunostaining for CD34, CD99 and bcl-2.

CD34 has been found in a ubiquitous subpopulation of stromal cells in connective tissue. In the pancreas these cells are also part of the periductal and perilobular stroma, as was demonstrated by the immunostaining of some cells in the normal surrounding pancreatic tissue in our case. Hence we favour a differentiation from this type of cells and not from ductal myoepithelial cells. Because the pancreas is an exceptional localization for SFT, the diagnosis will remain difficult, as it is for other rare organ sites [34]. In particular, preoperative diagnosis will be crucial, as for all other mesenchymal neoplasms of the pancreas, because clinically they share the majority of symptoms otherwise associated with the far more common carcinomas or endocrine tumours. However, after adequate resection the prognosis is incomparably better.

Acknowledgements The authors would like to thank Prof. Dr. R. Böttcher and Dr. Hümmer, Department of Surgery, Fürth, for kindly providing us with the clinical findings and records. We are also grateful to C.D.M. Fletcher, Department of Pathology, Brigham and Women's Hospital, Boston, for discussing the diagnosis with us. We thank M. Pacena for her expert technical assistance and K. Dege for her careful editing of the manuscript.

References

1. Abrebanel P, Sarfaty S, Gal R, Chaimoff C, Kessler E (1984) Plasma cell granuloma of the pancreas. Arch Pathol Lab Med 108:531–532
2. Allen KB, Skandalakis LJ, Brown BC, Gray SW, Skandalakis JE (1990) Malignant fibrous histiocytoma of the pancreas. Am Surg 56:364–368
3. Axelson J, Dawiskiba S, Akerman M, Ihse I (1998) Connective tissue tumours. In: Howard J, Idezuki Y, Ihse I, Prinz R (eds) Surgical diseases of the pancreas, 3rd ed. Williams & Wilkins, Baltimore, pp 633–636
4. Barnoud R, Arvieux C, Pasquier D, Pasquier B, Letoublon C (1996) Solitary fibrous tumour of the liver with CD34 expression. Histopathology 28:551–554
5. Baylor SM, Berg JW (1973) Cross classification and survival characteristics of 5000 cases of cancer of the pancreas. J Surg Oncol 5:355–358

6. Becker WF, Welsh RA, Pratt HS (1965) Cystadenoma and cystadenocarcinoma of the pancreas. Ann Surg 161:845–860
7. Ben Jilani S, el Mezni F, Dziri C, Khatteche A, Zermani R, Najeh N (1993) Primary malignant histiocytofibroma of the pancreas. Apropos of a case (in French). Arch Anat Cytol Pathol 41:167–170
8. Berman JK, Levene N (1956) Sarcoma of the pancreas. AMA Arch Surg 73:894–896
9. Brooke WS, Maxwell JG (1966) Primary sarcoma of the pancreas. Eight year survival after pancreatoduodenectomy. Am J Surg 112:657–661
10. Burd DA, Tyagi G, Bader DA (1992) Benign schwannoma of the pancreas (letter). AJR Am J Roentgenol 159:675
11. Cameselle-Teijeiro J, Varela-Duran J, Fonseca E, Villanueva JP, Sobrinho-Simoes M (1994) Solitary fibrous tumour of the thyroid. Am J Clin Pathol 101:535–538
12. Carda Abella P, Herbrero San Martin J, Benita Leon V, Rodriguez Agullo L, Moreno Gonzalez E (1976) Leimyosarcoma of the pancreas associated with a pseudocyst (in Spanish). Rev Esp Enferm Apar Dig 48:731–738
13. Carneiro SS, Scheithauer BW, Nascimento AG, Hirose T, Davis DH (1996) Solitary fibrous tumour of the meninges: a lesion distinct from fibrous meningioma. A clinicopathologic and immunohistochemical study. Am J Clin Pathol 106:217–224
14. Chan JKC (1997) Solitary fibrous tumour – everywhere, and a diagnosis in vogue. Histopathology 31:568–576
15. Chappell JS (1973) Case reports. Benign hemangioendothelioma of the head of the pancreas treated by pancreaticoduodenectomy. J Pediatr Surg 8:431–432
16. Coombs RJ (1990) Case of the season. Malignant neurogenic tumour of duodenum and pancreas. Semin Roentgenol 25: 127–129
17. Damiani S, Miettinen M, Peterse JL, Eusebi V (1994) Solitary fibrous tumour (myofibroblastoma) of the breast. Virchows Arch 425:89–92
18. Danner DB, Hruban RH, Pitt HA, Hayashi R, Griffin CA, Perlman EJ (1994) Primitive neuroectodermal tumour arising in the pancreas. Mod Pathol 7:200–204
19. David S, Barkin JS (1993) Pancreatic schwannoma. Pancreas 8:274–276
20. de Alava E, Torramade J, Vazquez JJ (1993) Leiomyosarcoma of the pancreas. Virchows Arch [A] 422:419–422
21. Dervan PA, Tobin B, O'Connor M (1986) Solitary (localized) fibrous mesothelioma: evidence against mesothelial cell origin. Histopathology 10:867–875
22. Dorfman DM, To K, Dickersin GR, Rosenberg AE, Pilch BZ (1994) Solitary fibrous tumour of the orbit. Am J Surg Pathol 18:281–287
23. Eggermont A, Vuzevski V, Huisman M, DeJong K, Jeekel J (1987) Solitary malignant schwannoma of the pancreas: report of a case and ultrastructural examination. J Surg Oncol 36: 21–25
24. Elliott TE, Albertazzi VJ, Danto LA (1980) Pancreatic liposarcoma. Case report with review of retroperitoneal liposarcomas. Cancer 45:1720–1723
25. England DM, Hochholzer L, McCarthy MJ (1989) Localized benign and malignant fibrous tumours of the pleura. A clinicopathologic review of 223 cases. Am J Surg Pathol 13:640–658
26. Feinberg SB, Margulis AR, Lober P (1957) Roentgen findings in leiomyosarcoma of the pancreas. Minn Med 36:505–506
27. Feldman L, Philpotts LE, Reinhold C, Duguid WP, Rosenberg L (1997) Pancreatic schwannoma: Report of two cases and review of the literature. Pancreas 15:99–105
28. Ferreiro JA, Nascimento AG (1996) Solitary fibrous tumour of the major salivary glands. Histopathology 28:261–264
29. Ferrozi F, Bova D, Garlaschi G (1995) Pancreatic schwannoma: report of three cases. Clin Radiol 50:492–495
30. Flaherty MJ, Benjamin DR (1992) Multicystic pancreatic hamartoma: a distinctive lesion with immunohistochemical and ultrastructural study. Hum Pathol 23:1309–1312
31. Fukunaga M, Nikaido T (1997) Solitary fibrous tumour of the renal peripelvis. Histopathology 30:451–456
32. Garvey JF, Ng A, England JF, Sheldon DM (1989) Malignant fibrous histiocytoma of the pancreas. HPB Surg 1:233–237
33. Gelb AB, Simmons ML, Weidner N (1996) Solitary fibrous tumour involving the renal capsule. Am J Surg Pathol 20: 1288–1295
34. Goodlad JR, Fletcher CDM (1991) Solitary fibrous tumour arising at unusual sites: analysis of a series. Histopathology 19:515–522
35. Hanau CA, Miettinen M (1995) Solitary fibrous tumour: histological and immunohistochemical spectrum of benign and malignant variants presenting at different sites. Hum Pathol 26: 440–449
36. Hasegawa T, Hirose T, Seki K, Yang P, Sano T (1996) Solitary fibrous tumour of the soft tissue. An immunohistochemical and ultrastructural study. Am J Clin Pathol 106:325–331
37. Ishii H, Okada S, Okazaki N, Nose H, Yoshimori M, Aoki K, Tsuda H, Hirohashi S (1994) Leiomyosarcoma of the pancreas: report of a case diagnosed by fine needle aspiration biopsy. Jpn J Clin Oncol 24:42–45
38. Ishikawa O, Matsui Y, Aoki Y, Iwanaga T, Terasawa T, Wada A (1981) Leiomyosarcoma of the pancreas. Report of a case and review of the literature. Am J Surg Pathol 5:597–602
39. Katenkamp D, Mentzel T, Kosmehl H (1996) CD34-Nachweis – ein immunhistochemischer Beitrag zur Differentialdiagnose von Weichgewebstumouren. Pathologe 17:195–201
40. Khalifa MA, Montgomery EA, Azumi N, Gomes MN, Zeman RK, Min KW, Lack EE (1997) Solitary fibrous tumours: a series of lesions, some in unusual sites. South Med J 90:793–799
41. Kie JH, Kim JY, Park YN, Lee MK, Yang WI, Park JS (1997) Solitary fibrous tumour of the thyroid. Histopathology 30: 365–368
42. Klemperer P, Rabin CB (1931) Primary neoplasms of the pleura: a report of five cases. Arch Pathol 11:385–412
43. Kreipe H, Wacker HH, Heidebrecht HJ, Haas K, Hauberg M, Tiemann M, Parwaresch R (1993) Determination of the growth fraction in non-Hodgkin's lymphoma by monoclonal antibody Ki-S5 directed against a formalin-resistant epitope of the Ki-67 antigen. Am J Pathol 142:1689–1694
44. Ladouce P, Ravisse P, Triquet J, Wermynck J (1978) An isolated neurinoma in the pancreas (in French). J Chir (Paris) 115: 285–288
45. Lakhoo K, Mannell A (1991) Pancreatic leiomyosarcoma. A case report. S Afr J Surg 29:59–60
46. Levine TS, Rose DS (1997) Solitary fibrous tumour of the liver. Histopathology 30:396–397
47. Liessi G, Barbazza R, Sartori F, Sabbadin P, Scapinello A (1990) CT and MR imaging of melanocytic schwannomas; report of three cases. Eur J Radiol 11:138–142
48. Lüttges J, Pierré E, Zamboni G, Weh G, Lietz H, Kussmann J, Klöppel G (1997) Maligne nicht-epitheliale Tumouren des Pankreas. Pathologe 18:233–237
49. Melato M, Bucconi S, Marus W, Spivach A, Perulli A, Mucelli RP (1993) The schwannoma: an uncommon type of cystic lesion of the pancreas. Ital J Gastroenterol 25:385–387
50. Mentzel T, Bainbridge TC, Katenkamp D (1997) Solitary fibrous tumour: clinicopathological, immunohistochemical, and ultrastructural analysis of 12 cases arising in soft tissues, nasal cavity and nasopharynx, urinary bladder and prostate. Virchows Arch 430:445–453
51. Moran CA, Suster S, Koss MN (1992) The spectrum of histologic growth patterns in benign and malignant fibrous tumours of the pleura. Semin Diagn Pathol 9:169–180
52. Møller Pedersen V, Hede A, Graem N (1982) A solitary malignant schwannoma mimicking a pancreatic pseudocyst. A case report. Acta Chir Scand 148:697–698
53. Murata K, Tsuchiya T, Ayakawa Y, Miyata N, Suzuki M, Kato K (1990) Primary leiomyosarcoma of the pancreas (in Japanese). Nippon Igaku Hoshasen Gakkai Zasshi 50:1215–1223
54. Nakahara M, Isozaki K, Hirota S, Miyagawa JI, Hase-Sawada N, Taniguchi M, Nishida T, Kanayama S, Kitamura Y, Shinomura Y, Matsuzawa Y (1998) A novel gain-of-function mutation of c-*kit* gene in gastrointestinal stromal tumours [in Process Citation]. Gastroenterology 115:1090–1095

55. Nielsen GP, O'Connell JX, Dickersin GR, Rosenberg AE (1997) Solitary fibrous tumour of soft tissue: A report of 15 cases, including 5 malignant examples with light microscopic, immunohistochemical, and ultrastructural data. Mod Pathol 10:1028–1037
56. Oyamada C, Abe M, Masuya T, Nagamitsu S, Maeda Y (1970) A case of a leiomyosarcoma of the pancreas with cystic formation. Diagn Ther (Jpn) 58:155–158
57. Palazzo JP, Chang CD (1993) Inflammatory pseudotumour of the pancreas. Histopathology 23:475–477
58. Pascal RR, Sullivan L, Hauser L, Ferzli G (1989) Primary malignant fibrous histiocytoma of the pancreas. Hum Pathol 20:1215–1217
59. Peskova M, Fried M (1994) Pancreatic tumour of mesenchymal origin–an unusual surgical finding. Hepatogastroenterology 41:201–203
60. Prevot S, Penna C, Imbert JC, Wendum D, de Saint-Maur PP (1996) Solitary fibrous tumour of the adrenal gland. Mod Pathol 9:1170–1174
61. Remberger K, Weiss M, Gokel JM, Landgraf R, Illner WD, Land W (1987) Entzündlicher Pseudotumour des Pankreas mit persistierender Hyperinsulinämie und Hypoglykämie nach Langzeit-Pankreastransplantation. Verh Dtsch Ges Pathol 71:328–332
62. Renshaw AA (1995) O13 (CD99) in spindle cell tumours. Reactivity with hemangiopericytoma, solitary fibrous tumour, synovial sarcoma, and meningioma but rarely with sarcomatoid mesothelioma. Appl Immunohistochem 3:250–256
63. Ross CF (1951) Leimyosarcoma of the pancreas. Case report. Br J Surg 53–56
64. Sarlomo-Rikala M, Kovatich AJ, Barusevicius A, Miettinen M (1998) CD117: a sensitive marker for gastrointestinal stromal tumours that is more specific than CD34. Mod Pathol 11: 728–734
65. Seidler A, Burstein S, Drweiga W, Goldberg M (1986) Granular cell tumour of the pancreas. J Clin Gastroenterol 8: 207–209
66. Solcia E, Capella C, Klöppel G (1997) Tumours of the pancreas. (Atlas of tumor pathology, 3rd ser, fasci 20). Armed Forces Institute of Pathology, Washington, DC
67. Steven K, Burchardt F, Holm N, Pedersen K (1994) Single stage pancreaticoduodenectomy (Whipple's procedure), radical cystectomy and bladder substitution with the urethral Koch reservoir. Case report. Scand J Urol Nephrol 28:199–200
68. Suster S, Phillips M, Robinson MJ (1989) Malignant fibrous histiocytoma (giant cell type) of the pancreas. A distinctive variant of osteoclast-type giant cell tumour of the pancreas. Cancer 64:2302–2308
69. Suster S, Nascimento AG, Miettinen M, Sickel JZ, Moran CA (1995) Solitary fibrous tumours of soft tissue. A clinicopathologic and immunohistochemical study of 12 cases. Am J Surg Pathol 19:1257–1266
70. Suster S, Fisher C, Moran CA (1998) Expression of *bcl*-2 oncoprotein in benign and malignant spindle cell tumours of soft tissue, skin, serosal surfaces, and gastrointestinal tract. Am J Surg Pathol 22:863–872
71. Tsujimura T, Kawano K, Taniguchi M, Yoshikawa K, Tsukaguchi I (1992) Malignant fibrous histiocytoma coexistent with mucinous cystadenoma of the pancreas. Cancer 70:2792–2796
72. Tulha AN, Concone H, Camargo VI, Pessoa A (1982) Pancreatic leiomyosarcoma. Report of a surgically treated case. AMB Rev Assoc Med Bras 28:188–189
73. Tunell WP (1976) Hemangioendothelioma of the pancreas obstructing the common bile duct and duodenum. J Pediatr Surg 11:827–830
74. Urban BA, Fishman EK, Hruban RH, Cameron JL (1992) CT findings in cystic schwannoma of the pancreas. J Comput Assist Tomogr 16:492–493
75. Vallat-Decouvelaere AV, Dry SM, Fletcher CDM (1998) Atypical and malignant solitary fibrous tumours in extrathoracic locations. Evidence of their comparability to intra-thoracic tumours. Am J Surg Pathol 22:1501–1511
76. Walsh MM, Brandspigel K (1989) Gastrointestinal bleeding due to pancreatic schwannoma complicating von Recklinghausen's disease. Gastroenterology 97:1550–1551
77. Walsh SV, Evangelista F, Khettry U (1998) Inflammatory myofibroblastic tumour of the pancreaticobiliary region. Morphologic and immunocytochemical study of three cases. Am J Surg Pathol 22:412–418
78. Westra WH, Gerald WL, Rosai J (1994) Solitary fibrous tumour. Consistent CD34 immunoreactivity and occurrence in the orbit. Am J Surg Pathol 18:992–998
79. Wrezlewicz P, Kozianka J, Rühl GH, Kozuschek W, Haarmann W (1989) Seltene Pankreastumouren aus der Sicht des eigenen Krankenguts. Zentralbl Chir 114:924–933
80. Yokoi T, Tsuzuki T, Yatabe Y, Suzuki M, Kuruyama H, Koshikawa T, Kuhara H, Kuroda M, Nakamura N, Nakatani Y, Kakudo K (1998) Solitary fibrous tumour: significance of p53 and CD34 immunoreactivity in its malignant transformation. Histopathology 32:423–432
81. Zalatnai A, Kovács M, Flautner L, Sipos B, Sarkady E, Bocsi J (1998) Pancreatic leiomyosarcoma. Case report with immunohistochemical and flow cytometric studies. Virchows Arch 432:469–472
82. Zamboni G, Pea M, Martignoni G, Zancanaro C, Faccioli G, Gilioli E, Pederzoli P, Bonetti F (1996) Clear cell "sugar" tumour of the pancreas. A novel member of the family of lesions characterized by the presence of perivascular epithelioid cells. Am J Surg Pathol 20:722–730