Eur J Pediatr (1999) 158: 631–637

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Paediatric Castleman disease: report of seven cases and review of the literature

Received: 14 November 1997 / Accepted in revised form: 9 September 1998

Abstract Castleman disease is a distinct lymphoproliferative disorder of unknown origin. Seven new cases in children are reported here and 76 cases from the paediatric literature are reviewed. The disease has been reported in 46 females and 37 males, their age ranging from 2 months to 17 years. The disease was localized in 72 cases and multicentric in 11 cases. The hyalinovascular type was more frequently encountered (54%) than the plasma cell type (24%). Laboratory abnormalities were more often associated with the plasma cell type and were mainly represented by anaemia and hypergammaglobulinaemia. Treatment of the localized tumour consisted of surgical excision, whereas treatment of the multicentric form was medical, comprising prednisone and other immunosuppressor drugs. The disease in the paediatric population seems to have a more favourable course than in adults.

Conclusion The paediatric features of the disease suggest that Castleman disease in this population could represent an earlier form of the pathology or even suggest a benign lymphoproliferative disorder.

Key words Castleman disease · Lymphoproliferative disorder

Abbreviation *CD* Castleman disease

Introduction

Castleman disease (CD) is a lymphoproliferative disorder of unknown and controversial aetiology. It has two clinical expressions. The localized form which usually presents as a slow growing mass, has a relatively benign clinical course. The multicentric form, where tumoural involvement is multilocated, holds significant morbidity and mortality [22, 34, 18]. Two pathological types are defined. The hyalinovascular type is characterized by small hyalinized follicule centres and by prominent interfollicular vascular proliferation. The plasma cell type is characterized by an abundance of plasma cells [21, 33]. In some cases, features of both types are present in a so-called mixed type. The diagnosis of CD is based on pathological features supported by clinical clues and follow up [20, 54]. There is no evidence of identifiable risk factors or causative agents in the development of the disorder. The immune response to viral infection has been proposed but viral cultures have been consistently negative and demonstration by polymerase chain reaction of the Epstein-Barr virus genome [55] and human herpes virus type 8 genome [6] in CD has not allowed any conclusion whether the virus is associated with or is the factor responsible for the disease. Nevertheless, it has been demonstrated that CD is consistently associ-

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ated with a particular pattern of interleukin-6 gene expression [38]. It was also demonstrated that serum interleukin-6 levels are correlated with clinical and biological abnormalities in CD [23]. The increased interleukin-6 production in CD follicules is responsible for the marked plasma cell infiltration in lymph nodes but cannot explain by itself the clinical and histological heterogeneity of the disease [30]. Complete recovery occurs when the localized tumour is completely resected or treated with local radiotherapy. The multicentric form has a more variable clinical course. Its treatment is still not well defined and is based on prednisone, either singly or in combination with other immunosupressive modalities. The prognosis of the multicentric form is worse than the localized form since malignancies and severe infections may lead to a rapidly fatal outcome [21, 22, 34, 68].

Materials and methods

We report seven new paediatric observations. The first two patients came from the Paediatric Department of Bicetre Hospital, Paris, France and the five other cases from the Paediatric Department of Sainte Justine Hospital, Montreal, Canada. Literature review was accomplished by Medline search: only 76 paediatric cases of CD have been reported since its first description in 1954 [13].

Results

Clinical findings

Our seven new cases are presented in Table 1. The literature review is summarized in Table 2. The disease has been reported in 46 females and 37 males. Their age ranged from 2 months to 17 years, with a predominant occurrence in teenagers, (14% cases before age 4, 14% between 4 and 10 and 72% between 10 and 17, mean age = 10.8 ± 4.7 years). We only found two cases under 1 year of age. There was no racial difference. Only 11 cases of multicentric CD were reported.

The interval between onset and diagnosis may be as long as 13 years (case 67). Disease discovery was fortuitous in 19 out of 75 cases (25%). Clinical presentation was a slow growing mass in 21 cases (26%) and general symptoms in 35 cases (45%). The mass was the only clinical manifestation of the disease in 38 cases and was palpable in 24 cases. General symptoms were represented by fever (19), failure to thrive (11), weight loss (7) and fatigue (7). Other complaints were: pain (5), recurrent infections (3), diarrhoea (2), dyspnoea (2), and amenorrhoea (1). The tumour was localized in the thorax in 33% cases (mediastinum: 16, hilum: 7, lung: 1, mean age = 11.4 ± 5.5 years), in the abdomen in 30% cases (mesentary: 14, peritoneum: 3, retroperitoneal area: 4, mean age = 11.1 ± 3.3 years) and peripheral adenopathies in 30% cases (cervical: 14, axillary: 5, supraclavicular: 2, mean age = 8.9 ± 5.0 years). Other locations were represented by pelvis (2) and various

Table 1 Seven new paediatric cases of Castleman disease. (*CRP* C-reactive protein, *ESR* erythrocyte sedimentation rate, *G-glob* G-globulinaemia, *Hb* initial haemoglobin, *HV* hyalinovascular, *m* months, *MCV* mean corpuscular volume, *PC* plasma cell, *WBC* white blood cells, – unavailable)

Case	Sex F/M	Age at diagnosis (years)	Duration (months)	Clinical presentation	General symptoms	Physical findings	Hb g/dL 12.5–15	MCV fL 75–85	WBC 10^9/L 4.5–10	Platelets 10^9/L 150–400	ESR mm/1h <20	CRP mg/L <3	Albumin g/L 45–50	G-glob g/L 8.5–15	Location	Size (cm)	Histological type	Treatment	Evolution	Follow up (years)
1.	M	11	36	Abdominal pain	Fever, fatigue weight loss	Pallor	10.4	69	6.5	295	82	64	34	20	Mesenteric	6 × 4 × 2	HV	Complete resection	Complete recovery	3.5
2.	M	4.5	4	Prolonged fever of unknown origin	Fever, fatigue weight loss	None	9.9	72.3	14.6	392	107	109	40	21	Retro-peritoneal	2 × 1	HV/PC	Complete resection	Complete recovery	5
3.	M	9	48	Cervical mass	Asymptomatic	Mandibular mass	13.7	77.3	6	281	–	–	–	–	Sub-mandibular	4 × 4 × 4	HV	Complete resection	Complete recovery	4
4.	F	16	0.5	Incidental finding on chest X-ray	Asymptomatic	None	13.9	95.7	4.3	195	3	–	33.4	12	Mediastinal	3.5 × 2.5	HV	Resection	Unknown	lost
5.	M	11	3	Axillary mass	Asymptomatic	None	13	84.9	7.9	328	–	–	–	–	Axillar	4 × 4	HV	Complete resection	Complete recovery	>5
6.	M	13	6	Abdominal pain	Fatigue	Pallor	7.6	56.5	10.8	788	60	133	28.8	10	Intra-peritoneal	4.5	HV	Resection	Complete recovery	4
7.	M	20m	1	Incidental finding on chest X-ray	Asymptomatic	None	11.6	69.4	8.6	348	12	–	45	18	Mediastinal	3	HV	Complete resection	Complete recovery	1

Table 2 Castleman disease. Review of the paediatric literature. (*H* hypergammaglobulinaemia, *HV* hyalinovascular, *L* anaemia, *M* medical treatment, *m* months, *N* normal, *O* spontaneous regression, *PC* plasma cell, *R* radiotherapy, *S* surgery, *Trt* treatment, – unavailable)

Case	Reference	Sex F/M	Age (years)	Clinical presentation	Duration (months)	Location	Size (cm)	Pathology	Hb g/dL	G-glob	Trt	Follow up (years)
1	[1]	F	14	Asymptomatic	3	Thorax	3 × 3 × 2	–	–	–	S	4
2	[15]	F	14	Pain, cough	30	Muscle	5.5 × 4 × 3	–	–	–	S	3
3	[32]	F	14	Asymptomatic	0	Hilum	"Hen's egg"	–	–	–	S	–
4	[42]	M	13	Cough	–	Hilum	5 × 4 × 3	–	–	–	S	–
5	[28]	M	15	Asymptomatic	48	Hilum	3.8 × 3 × 2.4	–	–	–	S	–
6	[36]	F	17	Asymptomatic	–	Muscle	4 × 2 × 2	–	–	–	S	30
7	[36]	M	16	Asymptomatic	0	Mediastinal	3.5 × 3.5 × 2	–	–	–	S	4
8	[36]	F	16	Asymptomatic	0	Mediastinal	7 × 3 × 2	–	–	–	S	4
9	[27]	F	14	Asymptomatic	0	Lung	6 × 4 × 4.5	–	–	–	S	6
10	[37]	M	8	Anaemia, failure to thrive, fever	36	Mediastinal	7.5 × 6.5 × 3	PC	7	H	S	1.2
11	[47]	M	16	Growth failure, pallor	12	Mesenteric	10 × 5 × 4	HV/PC	8.4	H	S	1.2
12	[18]	F	11	Asymptomatic	60	Neck	7 × 3 × 2	HV	10	N	S	1
13	[7]	M	11	Abdominal pain, fever, pallor	54	Pelvis	3 × 3 × 5	HV/PC	9.2	H	S	1
14	[3]	F	12	Asymptomatic	0	Hilum	7 × 4 × 3.5	HV/PC	N	H	S	–
15	[63]	F	12	Anaemia, recurrent infections	96	Mesenteric	4.5	PC	9	H	S	0.8
16	[9]	F	11	Growth retardation, pallor	54	Intraperitoneal	3 × 4 × 5	PC	7.8	H	S	0.7
17	[44]	F	15	Hightly fever, amenorrhoea	30	Mesenteric	5	PC	8	H	S	2
18	[5]	F	17	Asymptomatic	5	Mediastinal	8 × 6.5 × 6	HV/PC	–	–	S	2
19	[67]	M	3.5	Asymptomatic	–	Neck	4 × 2.5 × 1.8	HV	N	N	S	–
20	[65]	M	15	Failure to thrive, fever, pallor	–	Mesenteric	5 × 5 × 4	PC	6	H	S	1.3
21	[48]	M	17	Asymptomatic	0	Mediastinal	15 × 2.5	HV	–	–	–	–
22	[58]	F	9	Hepatosplenomegaly	–	Mediastinal	–	–	–	N	–	–
23	[58]	M	17	Splenomegaly	–	Axillar	–	–	–	N	–	–
24	[8]	M	11	Severe anaemia, failure to thrive	84	Retroperitoneal	5 × 7	HV/PC	8.5	H	S	3
25	[64]	M	14	Asymptomatic	1.5	Neck	3 × 2	HV/PC	–	–	O	–
26	[6]	M	8	Anaemia, growth retardation	12	Mesenteric	6.5	HV/PC	9.8	H	S	0.5
27	[11]	F	6	Asymptomatic	1	Axillar	4 × 3.5 × 5	HV	N	N	S	0.5
28	[52]	F	3.5	Fever, abdominal pain	6	Mesenteric	4 × 3.5 × 2.5	HV/PC	9.1	H	S	4
29	[52]	M	12	Asymptomatic	0	Hilum	4 × 3	HV	N	N	S	4
30	[69]	F	6	–	–	Neck	–	HV	–	–	–	–
31	[56]	M	10	–	–	Pelvis	–	PC	–	–	–	–
32	[51]	M	11	Weight loss, fatigue	2	Mesenteric	4	PC	–	H	S	2
33	[2]	M	9	Abdominal pain, fever, weight loss	0.5	Mesenteric	6 × 5 × 4	PC	9.5	H	S	3
34	[71]	F	13	Fever, anaemia	5	Mediastinal	5 × 3 × 3	HV/PC	9.1	H	S	0.1
35	[29]	F	2m	Asymptomatic	30	Supraclavicular	1 × 3	HV	–	–	S	0.1
36	[17]	F	11	Asthenia, anorexia	12	Mesenteric	6 × 5	PC	–	H	S	–
37	[17]	M	11	Diarrhoea, vomiting	–	Intraperitoneal	2 × 3	HV	–	H	S	–
38	[72]	F	13	Asthenia, anorexia, fever	6	Gastric	6 × 4 × 3	HV	9.6	H	S	6

Table 2 (Cont.)

Case	Reference	Sex F/M	Age (years)	Clinical presentation	Duration (months)	Location	Size (cm)	Pathology	Hb g/dL	G-glob	Trt	Follow up (years)
39	[25]	F	8	Asymptomatic	–	Axillar	4	HV	N	N	S	2
40	[62]	M	10	–	–	Neck	–	PC	–	–	–	–
41	[23]	F	9m	Recurrent pneumonia	–	Mediastinal	–	HV	N	N	R	22
42	[23]	F	1	Wheezing	0.5	Mediastinal	–	HV	N	N	O	0.5
43	[54]	M	5	Asymptomatic	2	Neck	4 × 2.5 × 2.5	HV	–	–	S	1
44	[12]	M	16	Bleeding gums	1	Multicentric	–	HV/PC	12.8	H	M	–
45	[43]	F	15	Anaemia, growth retardation	1	Mediastinal	–	HV/PC	7	H	R	–
46	[50]	M	11	Asymptomatic	132	Neck	3	HV	–	–	S	–
47	[4]	F	1	Asymptomatic	0	Supraclavicular	–	HV	N	N	S	5
48	[4]	M	1.5	Asymptomatic	0	Mediastinal	5 × 4	HV/PC	10.6	N	–	–
49	[4]	F	1.5	Asymptomatic	0	Neck	0.5	HV/PC	N	N	–	–
50	[24]	F	10	Abdominal pain	6	Mesenteric	4	PC	7.9	H	S	–
51	[70]	F	13	Asymptomatic	1	Neck	3 × 5	HV	N	N	S	3
52	[41]	F	14	Asymptomatic	–	Neck	4 × 3	HV	N	N	–	–
53	[14]	M	12	Asymptomatic	1	Neck	4.5 × 3	HV	N	N	S	–
54	[31]	M	11	Growth retardation, weight loss	2	Mesenteric	5 × 5 × 8	PC	5.2	H	S	1.2
55	[10]	M	14	Anaemia, failure to thrive	9	Mesenteric	8 × 6 × 3	HV	9.9	H	S	
56	[66]	F	17	Asymptomatic	–	Mediastinal	6 × 4 × 1.5	HV	N	N	S	8
57	[53]	M	14	Fever, anaemia, nephrotic syndrome	1	Multicentric	–	PC	8.8	H	M	5
58	[16]	F	16	Asymptomatic	–	Axillar	3	HV	N	N	S	1
59	[19]	F	16	Right-sided hearing loss, otalgia	12	Pharyngeal	4	HV	–	–	S	–
60	[45]	F	15	Diarrhoea, anaemia	0	Retroperitoneal	–	–	–	H	S	–
61	[49]	M	10	Asymptomatic	–	Mediastinal	4	HV	N	N	–	–
62	[35]	M	21m	Glomerulonephritis, polyarthritis	–	Multicentric	–	PC	–	–	M	–
63	[46]	F	9	Asymptomatic	–	Mediastinal	–	HV	–	–	S	8
64	[46]	F	3	Fever, hepatosplenomegaly	–	Retropancreatic	3 × 3 × 5	PC	–	H	S	0.5
65	[26]	F	11	Asymptomatic	3	Neck	3.2 × 2.5 × 1.6	HV	N	–	S	–
66	[59]	F	9	Fever, growth retardation	30	Mesenteric	8	PC	6.3	–	S	–
67	[40]	F	16	Asymptomatic	156	Parotid	4 × 3 × 3.2	HV	N	–	S	1
68	[60]	F	2	Fever, growth retardation	–	Multicentric	–	PC	L	H	M	–
69	[60]	F	3	Fever, pneumonia	–	Multicentric	–	PC	L	H	M	–
70	[60]	F	6	Fever, ascites, skin rash	–	Multicentric	–	HV	L	N	M	–
71	[60]	F	10	Fever, skin rash	–	Multicentric	–	HV	L	H	M	–
72	[60]	F	12	Fever, mediastinal mass	–	Multicentric	–	PC	L	H	S	–
73	[60]	M	15	Fever, gingivitis	–	Multicentric	–	PC	N	H	M	–
74	[60]	F	16	Fever, hydronephrosis, arthralgias	–	Multicentric	–	PC	L	H	M	–
75	[60]	M	17	Fever, ascites, skin rash	–	Multicentric	–	HV	L	H	M	–
76	[39]	M	13	Paraneoplasic pemphigus	1	Mediastinal	–	–	–	–	S	–

organs (muscle: 2, stomach: 1, pharynx: 1) in only 10% cases. The localized tumour was not associated with other diseases. Two patients with multicentric disease (cases 57 and 62) also had glomerulonephritis.

Laboratory findings

Laboratory abnormalities were present in 55% of localized cases, 23% of hyalinovascular types (6/26), all plasma cell types (12/12) and 82% of mixed types (9/11). They were represented by anaemia (26/46), hypergammaglobulinaemia (27/43), hypo-albuminaemia, inflammatory syndrome (elevated ESR and CRP, leucocytosis and thrombocytosis), leucopenia and thrombopenia. Anaemia may be severe (serum haemoglobin 5.2 g/dl (case 54), mean $= 8.73 \pm 1.71$), but was most often asymptomatic except for excessive fatigue during efforts. The particular association anaemia – hypergammaglobulinaemia – failure to thrive was present in 21% of cases (14/66). All multicentric cases presented with laboratory abnormalities: anaemia (8/11), hypergammaglobulinaemia (9/11), elevated ESR, neutropenia and thrombopenia.

Pathological findings

The tumour was localized in 72 cases (87%) and multicentric in only 11 cases (cases 44, 57, 62, 68–75). The tumour size ranged from 0.5 to 15 cm with no size difference between mediastinal and mesenteric sites. Among the 59 localized masses where histological description was available, 32 cases were of the hyalinovascular type (54%), 14 cases of the plasma cell type (24%) and 13 were of the mixed type (22%).

Treatment

Complete excision of the mass was performed in all localized cases where treatment was discussed, except in two cases where radiation therapy was used (cases 41 and 45) because of the tumour location. Two additional cases had spontaneous regression (cases 25 and 42). Medical treatment of the multicentric cases consisted of prednisone (8/11) either singly or in combination with other modalities: methotrexate, intravenous immunoglobulins, interferon and plasmapheresis.

Follow up

Localized tumours

Thirty-six patients were followed up for more than 1 year and nine patients for more than 5 years. Clinical symptoms resolved within a few days in every case. Biological abnormalities resolved within a period ranging from 1 week to 1 month. Complete and permanent recovery occurred when the tumour was completely resected. The two cases with radiation therapy also completely recovered. Progression to malignant lymphoma from a localized CD was reported in one paediatric case (case 56) [12].

Multicentric cases

Maximum follow up was for 5 years. One early death was reported shortly after excision of the mediastinal mass (case 72). Four patients (cases 57, 70, 74, 75) attained complete remission after a period of 22, 13, 18 and 24 months respectively. The other six patients attained partial remission both with and without maintenance therapy.

Discussion

CD is a lymphoproliferative disorder of unknown and controversial aetiology and has been mainly reported in adults. It has two clinical expressions: the localized form with a relatively benign clinical course and the multicentric form which has significant morbidity and mortality. Two pathological types are defined: the hyalinovascular type, characterized by small hyalinized follicule centres and by prominent interfollicular vascular proliferation, and the plasma cell type characterized by an abundance of plasma cells. In some cases, features of both types are present in a so-called mixed type. There is no evidence of identifiable risk factors or causative agents in the development of the disorder. The treatment of the localized form is based on surgical excision of the mass while the multicentric form has variable outcomes despite its medical treatment.

Our seven cases confirm that CD in children is mainly a localized and benign condition. Case 1 (Table 1) had a negative abdominal ultrasound but the mass was evidenced by CT scan. This patient confirms the interest of abdominal CT scan in the work up of fever of unknown origin in children. This case also emphasizes the sensitivity of CT for the hyalinovascular type of CD because of its rich vascularization.

CD in children is differentiated from the disease in adults mainly because of the rare occurrence of the multicentric forms (13% in our study vs. more than 25% in the adult literature). Few minor differences are underlined in this report. Intrathoracic locations of the localized tumour in children are not as frequent as in adult cases (33% vs. 70% respectively) [35]. Mesenteric location of the tumour is more often encountered in children. Cases 1 and 2 (Table 1) illustrate a particular expression of CD in the paediatric population which is the triade ''anaemia – hypergammaglobulinaemia – failure to thrive''. AIDS or other immunodeficiency are not reported in localized CD in children. Moreover, the paediatric localized disease is a benign disorder where

systemic therapies such as corticosteroid, alpha interferon and immunosuppressive treatment have no place. The response to treatment and the clinical outcome of the multicentric disease seem also to be more favourable in children.

The rare occurrence of multicentric forms in children support the hypothesis that paediatric CD could represent an earlier form where environmental events could play a major role in the development of the disease.

Finally, CD must be considered in the work up of a prolonged fever in children.

CD is a different condition in children than in adults. Although the clinical expression of the disease in this population is now well described, further investigations are needed to clarify the pathophysiology of this condition which is considered a benign form of lymphoproliferative disorder.

References

1. Abell MR (1957) Lymphnodal hamartoma versus thymic choristoma of pulmonary hilum. AMA Arch Path 64:584–588
2. Anagnostopoulos D, Miliaras E, Miliaras D, Manios S, Tekneji P (1988) La pseudo-tumeur de Castleman chez I'enfant. A propos d'un cas rare. Chir Pediatr 29:269–272
3. Ballow M, Park BH, Dupont B, Caldwell RR, Lonsdale D, Good RA (1974) Benign giant lymphoid hyperplasia of the mediastinum with associated abnormalities of the immune system. J Pediatr 84:418–420
4. Baruch Y, Ben-Arie Y, Kerner H, Lorber M, Best LA, Gershoni-Baruch R (1991) Giant lymph node hyperplasia (Castleman's disease). A clinical study of eight patients. Postgrad Med J 67:366–370
5. Bientz M, Daussy M, Dessirier JL, Tricot G, Reynes M, Rochemaure J, Diebold J (1977) Hyperplasie lymphoide angiofolliculaire (tumeur de Castleman) de localisation médiastinale. Sem Hôp Paris 53:669–671
6. Bjarnason I, Cotes PM, Knowles S, Reid C, Wilkins R, Peters TJ (1984) Giant lymph node hyperplasia (Castleman's disease) of the mesentery. Gastroenterology 87:216–223
7. Boxer LA, Jordison Boxer G, Flair RC, Engstrom PF, Brown GS (1972) Angiomatous lymphoid hamartoma associated with chronic anemia, hypoferremia and hypergammaglobulinemia. J Pediatr 81:66–70
8. Buchanan G, Chipman JJ, Hamilton BL, Daughaday WH (1981) Angiomatous lymphoid hamartoma: inhibitory effects on erythropoiesis, growth and primary hemostasis. J Pediatr 99:382–388
9. Burgert EO, Gilchrist GS, Fairbanks VF, Lynn HB, Dukes PP, Harrison EG Jr (1975) Intra-abdominal, angiofollicular lymph node hyperplasia (plasma-cell variant) with an antierythropoietic factor. Mayo Clin Proc 50:542–546
10. Burke GJ, Wei J (1992) Retroperitoneal mass and anemia in an adolescent. Invest Radiol 27:748–750
11. Carbone A, Manconi R, Volpe R, Poletti A, Paoli P de, Tirelli U, Santini G (1986) Immunohistochemical, enzyme histochemical, and immunologic features of giant lymph node hyperplasia of the hyaline-vasular type. Cancer 58:908–916
12. Carrington P, Anderson H, Harris M, Walsh S, Houghton J, Morgenstern G (1990) Auto-immune cytopenias in Castleman's disease. Am J Clin Pathol 94:101–104
13. Castleman B, Towne VW (1954) Case records of the Massachusetts General Hospital: case 32-1984. N Eng J Med 311:388–398
14. Chevalier B, Ménard P, Franc B, Bertrand JC, Lagardère B, Gallet JP (1992) Maladie de Castleman cervicale chez un enfant de 12 ans. Arch Fr Perdiatr 49:39–41
15. Cohen H (1957) Tumor-like proliferation of lymphoid tissue. Occurrence in deltoid muscle and mediastinum. J Mount Sinai Hosp 24:750–760
16. Elizalde JM, Eizaguirre B, Lopez JI (1993) Angiofollicular giant lymph node hyperplasia that presented with an axillary mass. Case report. Eur J Surg 159:183–184
17. Ferreiros J, Gomez LN, Mata MI, Casanova R, Pedrosa CS, Cuevas A (1989) Computed tomography in abdominal Castleman's disease. J Comput Asist Tomogr 13:433–436
18. Fisher ER, Sieracki JC, Goldenberg DM (1970) Identity and nature of isolated lymphoid tumors (so-called nodal hyperplasia, hamartoma, and angiomatous hamartoma) as revealed by histologic, electron microscopic, and heterotransplantation studies. Cancer 25:1286–1300
19. Freeman SJ, Irvine GH, Glew D (1994) Case report: cervical Castleman's disease shown by CT and MRI. Clin Radiol 49:721–723
20. Frizzera G (1988) Castleman's disease and related disorders. Semin Diagn Pathol 5:346–364
21. Frizzera G, Banks P, Massarelli G, Rosai J (1983) A systemic lymphoproliferative disorder with morphologic features of Castleman's disease. Am J Surg Pathol 7:211–231
22. Frizzera G, Peterson BA, Bayrd ED, Goldman A (1985) A systemic lymphoproliferative disorder with morphologic features of Castleman's disease: clinical findings and clinicopathologic correlations in 15 patients. J Clin Oncol 3:1202–1215
23. Gagliardi RA, Meza MP, Maldonado V, Steele RD (1990) Castleman's disease in a mother and daughter. Am J Roentgenol 154:899–900
24. Garber SJ, Shaw DG (1991) Case report: the ultrasound and computed tomography appearance of mesenteric Castleman disease. Clin Radiol 43:429–430
25. Gerald W, Kostianovsky M, Rosai J (1990) Development of vascular neoplasia in Castleman's disease-Report of seven cases. Am J Surg Pathol 14:603–614
26. Glazer M, Rao VM, Reiter D, McCue P (1995) Isolated Castleman disease of the neck: MR findings. Am J Neuroradiol 16:669–671
27. Hirst E, Williams HBL (1964) Intrathoracic lymphoid hamartoma. Thorax 19:469–476
28. Horie A (1962) On the so-called "lymph node hyperplasia" (Castleman). Kyuschu J Med Sci 13:105–110
29. Hunt SJ, Anderson WD (1989) Giant lymph node hyperplasia of the hyaline-vascular type with plasmacytoid T-cells and presentation in infancy. Am J Clin Pathol 91:344–347
30. Hsu Sm, Waldron JA, Xie SS, Barlogie B (1993) Expression of interleukine-6 in Castleman's disease. Hum Pathol 24:833–839
31. Hung IJ, Kuo TT, Lin JN (1992) New observations in a child with angiofollicular lymph node hyperplasia (Castleman's disease) originated from the mesenteric root. Ar J Pediatr Hematol Oncol 14:255–260
32. Inada K, Hamazaki M (1958) Localized mediastinal lymph node hyperplasia resembling thymoma. A case report. Ann Surg 147:409–413
33. Keller AR, Hochholzer L, Castleman B (1972) Hyaline-vasucular and plasma-cell types of giant lymph node hyperplasia of the mediastinum and other locations. Cancer 29:670–683
34. Kessler E (1985) Multicentric giant lymph node hyperplasia. Report of seven cases. Cancer 56:2446–2451
35. Kinney MC, Hummell DS, Villiger PM, Hourigan A, Rollins-Smith L, Glick AD, Lawton AR (1994) Increased interleukine-6 (IL-6) production in a young child with clinical and pathological features of multicentric Castleman's disease. J Clin Immunol 14:382–391
36. Lattes R, Pachter MR (1962) Benign lymphoid masses of probable hamartomatous nature. Analysis of 12 cases. Cancer 15:197–214

37. Lee SL, Rosner F, Rivero I, Feldman F, Hurwitz A (1965) Refractory anemia with abnormal iron metabolism. N Engl J Med 272:761–766
38. Leger-Ravet MB, Peuchmaur M, Devergne O, Audouin J, Raphael M, Van Damme J, Galanaud P, Diebold J, Emilie D (1991) Interieukine-6 expression in Castleman's disease. Blood 78:2923–2930
39. Lemon Ma, Weston WL, Huff JC (1997) Childhood paraneoplasic pemphigus associated with Castleman's tumour. Br J Dermatol 136:115–117
40. Leocata P, Corbacelli A, Chiominto A, Cutilli T, Belli L, Ventura L (1996) Unicentric angiofollicular hyperplasia (Castleman's disease) of the parotid: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 81:328–332
41. Loftus JM, Ford CN, Hafez GR (1991) Pathologic quiz case 1. Arch Otolaryngol Head Neck Surg 117:224–225
42. Mason CB (1959) Giant intrathoracic lymph nodes. J Thorac Surg 37:251–256
43. Massey GV, Kornstein MJ, Wahl D, Huang XL, McCrady CW, Carchman RA (1991) Angiofollicular lymph node hyperplasia (Castleman's disease) in an adolescent female. Cancer 68:1365–1372
44. Miller J, Miller J (1975) Benign giant lymph node hyperplasia presenting as fever of unknown origin. J Pediatr 87:237–239
45. Molinie V, Perie G, Melo I, Melo C, Audouin J, Diebold J (1994) Association de maladie de Castleman et de maladie de Hodgkin. Ann Pathol 14:384–391
46. Moon WK, Kim WS, Yeon KM, Han MC (1994) Castleman disease in the child: CT and ultrasound findings. Pediatr Radiol 24:182–184
47. Neerhout RC, Larson W, Mansur P (1969) Mesenteric lymphoid hamartoma associated with hypoferremia, anemia, growth failure and hyperglobulinemia. N Engl J Med 280:922–925
48. Olscamp G, Weisbord G, Sanders D, Delarue N, Mustard R (1980) Castleman's disease: unusual manifestations of an unusual disorder. Radiology 135:43–48
49. Pejaver RK, Watson AH (1994) Castleman's disease. Respir Med 88:309–311
50. Penfold CN, Cottrell BJ, Talbot R (1991) Neonatal giant lymph node hyperplasia (Castleman's disease) presenting in the head and neck. Br J Oral Maxillofac Surg 29:110–111
51. Perel Y, Leverger G, D'Agay MF, Frija J (1988) Syndrome de Castleman chez I'enfant. Intérêt de la tomodensitométrie abdominale devant une fièvre prolongée. Arch Fr Pediatr 45:73–74
52. Powell RW, Lightsey AL, Thomas WJ, Marsh WL (1986) Castleman's disease in children. J. Pediatr Surg 21:678–682
53. Said R, Tarawneh M (1992) Membranoproliferative glomerulonephritis associated with multicentric angiofollicular lymph node hyperplasia. Am J Nephrol 12:466–470
54. Salisbury JR (1990) Castleman's disease in childhood and adolescence. Pediatr Pathol 10:609–615
55. Samoszuk M, Ramzi E, Ravel J (1993) Disseminated persistant lymphoid hyperplasia containing Epstein Barr virus and clonal rearrangements of DNA. Diagn Mol Pathol 2:57–60
56. Seo I, Frizzera G, Coates T, Mirkin L, Cohen M (1986) Angiomatoid malignant fibrous histiocytoma with extensive lymphadenopathy simulating Castleman's disease. Pediatr Pathol 6:233–247
57. Shahidi H, Myers JL, Kvale PA (1995) Castleman's disease. Mayo Clin Proc 70:969–977
58. Shohat B, Cohen I, Fogel R, Zaizov R (1981) Suppressor mononuclear cells in giant lymph node hyperplasia and thymoma. Cancer 48:923–926
59. Shroff VJ, Gilchrist BF, DeLuca FG, MoCombs HL, Wesselhoeft CW (1995) Castleman's disease presenting as a pediatric surgical problem. J Pediatr Surg 30:745–747
60. Smir BN, Greiner TC, Weisenburger DD (1996) Multicentric lymph node hyperplasia in children: a clinicopathologic study of eight patients. Mod Pathol 9:1135–1142
61. Soulier J, Grollet L, Oksenhendler E, Miclea JM, Cacoub P, Baruchel A, Brice P, Clauvel JP, D'Agay MF, Raphael M (1995) Kaposi's sarcoma-associated herpesvirus-like DNA sequences in multicentric Castleman's disease. Blood 86:1276–1280
62. Steinberg JJ, Huang PL, Ljubich P, Lee-Huang S (1990) Antierythropoietin antibodies in hyperviscosity syndrome associated with giant lymph node hyperplasia (Castleman's disease). Br J Haematol 74:543–544
63. Van Den Ende J, Kahn L, Jacobs P (1975) Giant lymph node hyperplasia with hematological abnormality. S Afr Med J 49:170
64. Van Den Oord JJ, Wolf-Peeters C de, Tricot G, Desmet VJ (1984) Distribution of lymphocyte subsets in a case of angiofollicular lymph node hyperplasia. Am J Clin Pathol 82:491–495
65. Van Vliet G, Vainsel M, Wolter R, Heimann R (1978) Growth failure, refractory anaemia and hypergammaglobulinemia: their regression after removal of a mesenteric tumour with the features of giant lymph node hyperplasia, plasma-cell type. Acta Paediatr Belg 31:41–44
66. Vasef M, Katzin WE, Mendelsohn G, Reydman M (1992) Report of a case of localized Castleman's disease with progression to malignant lymphoma. Am J Clin Pathol 98:633–636
67. Weintruab M, Shibata C (1997) Cervical angiofollicular lymph node hyperplasia. Laryngoscope 87:1543–1547
68. Weisenburger DD, Nathwani BN, Winberg CD, Rappaport H (1985) Multicentric giant lymph node hyperplasia: a clinicopathologic study of 16 cases. Hum Pathol 16:162–172
69. Williams JL, Kaude JV (1986) Sonographic findings in a case of Castleman disease of the neck. J Ultrasound Med 5:593–594
70. Wolf M, Kessler A, Horovitz (1991) Benign angiofollicular lymph node hyperplasia (Castleman's disease) presenting as a solitary cervical mass. J Oral Maxillofac Surg 49:1129–1131
71. Yabuhara A, Yanagisawa M, Murata T, Kawai H, Komiyama A, Akabane T, Itoh M, Ishii E, Fujimoto J, Hata JI (1989) Giant lymph node hyperplasia (Castleman's disease) with spontaneous production of high levels of B-cell differentiation factor activity. Cancer 63:260–265
72. Yebra M, Vargas JA, Menendez MJ, Cabrera JR, Diaz F, Diego FJ, Durantez A (1989) Gastric Castleman's disease with a lupus-like circulating anticoagulant. Am J Gastroenterol 84:566–570
73. Yoshizaki K, Matsuda T, Nishimoto N, Kuritani T, Taeho L, Aozasa K, Nakahata T, Kawai H, Tagoh H, Komori T, Kishimoto S, Hirano T, Kishimoto T (1989) Pathogenic significance of interukine-6 (IL-6/BSF-2) in Castleman's disease. Blood 74:1360–1367