



Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/17609
DOI URL: <http://dx.doi.org/10.21474/IJAR01/17609>



RESEARCH ARTICLE

INTRACARDIAC TUMORS: LITERATURE REVIEW OF INTRACARDIAC TUMORS IN ADULTS, BASED ON A CLINICAL CASE OF A LARGE LEFT ATRIAL MYXOMA REVEALED BY CHRONIC PRODUCTIVE COUGH IN A 58-YEAR-OLD WOMAN

Dr. Abdelouahhab Bazzout, Dr. Otman Bouzouba, Dr. Innam El Hassan Bazzout, Prof. Said Moughil, Prof. Mohamed Cherti and Dr. Jaafari Mohammed
IBN SINA University Hospital, Rabat, Morocco.

Manuscript Info

Manuscript History

Received: 28 July 2023

Final Accepted: 31 August 2023

Published: September 2023

Abstract

We report the clinical case of a 58-year-old woman with chronic productive cough, who allowed us to highlight a tumoral formation in the left atrium suggestive of a myxoma. Based on a literature review, we discuss the chapter on intracardiac tumors.

Copy Right, IJAR, 2023,. All rights reserved.

Observation:-

This is a 58-year-old menopausal woman with no known medical history. The disease history dates back 6 months with the onset of a frothy, whitish cough in a context of preserved general condition and afebrile status, which motivated her initial consultation with a general practitioner where a chest X-ray was requested, revealing a bulging of the right lower arch (Figure 1). She was then referred to a cardiologist, where she underwent a trans-thoracic echocardiography revealing a large (60*55 mm), sessile, homogenous mass protruding from the septum of the left atrium (LA) and prolapsing into the mitral orifice in diastole, suggestive of a myxoma (Figure 2). She also presented with right heart chamber dilatation with a VD/VG ratio of $45/32 = 1.4$, massive atrium with a surface area of OD/OG of 20/29 cm², significant pulmonary hypertension with PAPs estimated at 90 mmHg, and circumferential pericardial effusion of 7 mm. She was admitted to the cardiovascular surgery department for asymptomatic left atrial myxoma resection.

The surgical indication was made for a probable asymptomatic myxoma. The intervention was performed by sternotomy, under extracorporeal circulation by double venous cannulation, and cardioplegia was ensured by antegrade crystalloid infusion. The resection consisted of removing the tumor and its base of implantation, which was friable (Figure 3).

The postoperative course was uneventful, and she was discharged on the fourth day after surgery. The pathological examination confirmed the myxoma, and regular echocardiographic follow-up was performed every 6 months (Figure 4)

Corresponding Author:- Abdelouahhab Bazzout

Address:- IBN SINA University Hospital, Rabat, Morocco.



Figure 1:- Chest X-ray showing a bulging of the right inferior arch (arrow) with a double contour appearance.



Figure 2:- Cardiac ultrasound showing a large left atrial mass.



Figure 3:- Resected operative specimen of the left atrium suggestive of a myxoma.



Figure 4:- Postoperative follow-up echocardiography.

Discussion:-

We will discuss successively: benign primary intracardiac tumors, primary malignant intracardiac tumors in adults, and more briefly, intracardiac metastatic locations.

Benign tumors in adults :

Myxomas :

Myxoma is the most frequent primary benign cardiac-pericardial tumor, representing about 63% of cardiac tumors in Meng's series (1) and 85% in the 2015 WHO International Classification of Cardiac and Pericardial Tumors (2). Papillary fibroelastomas are the second most frequent tumor, followed by hemangiomas, lipomas, fibromas, teratomas (1%), and granular cell tumors (1%). Neurofibromas, lymphangiomas, and rhabdomyomas each represent less than 1% of primary cardiac-pericardial tumors.

Histologically:

"The myxoma is the most frequent of the primary benign cardiac-pericardial tumors, representing approximately 63% of cardiac tumors in the Meng series (1) and 85% in the 2015 WHO International Classification of Cardiac and Pericardial Tumors (2). In second place, papillary fibroelastomas are found, followed by hemangiomas, lipomas, fibromas, teratomas (1%), and granular cell tumors (1%). Neurofibromas, lymphangiomas, and rhabdomyomas represent less than 1%."

Clinically:

Myxomas represent two-thirds of these benign tumors, with a female predominance of 70% (3,4).

The symptoms of myxomas are polymorphic, ranging from insidious and asymptomatic cases in 10 to 15% of cases (2,9), with an average delay between the onset of symptoms and diagnosis of myxoma of 16 months on average for ST John Sutton(10), to simple dyspnea or asystole due to valve obstruction. Dyspnea is present in 50 to 80% of cases (10), while chest pain is observed in 10 to 20% of patients (2). Lakhdar even reports a case of right atrial myxoma revealed by a mood disorder that led the patient to seek psychiatric consultation (12). Fluctuating valve obstruction is present in 40% of cases, while embolic episodes occur in 30 to 40% (4,13,15), which may be related to thrombotic material detached from the surface of the myxoma, a fringe of the myxoma, or even the entire myxoma that has broken off at its pedicle. Approximately half of the emboli affect cerebral arteries (16), including retinal (17), left Sylvian and left humeral arteries.

Paraclinical plan:

The systematic discoveries are made by echocardiography or transesophageal echocardiography, CT or cardiac MRI.

According to the literature, ECG and chest X-ray have no diagnostic value.

The diagnosis of myxoma is mainly based on cardiac ultrasound, which is the key examination, with a sensitivity of 93.3% and a specificity of 96.8% (18).

1. Typically, transthoracic echocardiography ETT reveals a mobile mass connected to the interatrial septum by a thin pedicle (18). Myxomas are usually heterogeneous, sometimes with calcifications. Most myxomas develop mainly in the left atrium in 70-80% of cases or in the right atrium in 15-20% of cases (3,4). Ventricular

localization is rarer, accounting for 2% of myxomas according to Meng et al (1) and 2-4% according to Reynen et al (6). Multiple lesions are rare and are often familial and sometimes associated with cutaneous manifestations (7). Its implantation by a wide base or a long pedicle at the level of the interatrial septum near the fossa ovalis (19) allows it to be differentiated from other intracardiac masses (thrombi). It consists of friable, lobulated masses 1-15 cm in diameter, with an average size of 5-6 cm (2,8).

2. L'ETO allows for a better analysis of the tumor's implantation base, its relationship with the mitral valve, and a precise morphological study of the cardiac chambers, particularly the right atrium.
3. MRI and cardiac CT scans allow the identification of small tumors (between 0.5 and 1 cm), the tumor's tissue composition (solid, liquid, hemorrhagic, or necrotic), and visualization of the tumor's base of insertion (22).

Treatment:

The treatment is based on complete resection, removing the myxoma, its pedicle, and its base of implantation, all with a minimum of manipulation to avoid fragmentation and any risk of embolic migration. There are still controversies regarding the extent of resection necessary to prevent recurrence of the myxoma. Myxoma of the right atrium is approached by right atriotomy. Myxomas of the ventricles are exceptional, complete surgical resection is difficult, it is done by atriotomy if the myxoma is located near the atrioventricular valve, otherwise through the great vessels for those located in the outflow tract.

Prognostic:

Myxomas have a good prognosis, with early mortality of less than 5%, and a risk of recurrence in 1 to 4% of cases (23, 24). Several hypotheses have been proposed to explain tumor recurrence, including incomplete surgical resection, preoperative dissemination of tumor material, malignant transformation of the tumor, or the multimodality of myxoma genesis (25, 27, 28). However, for sporadic forms, incomplete resection is the most common reason (25, 27, 28). The decrease in the frequency of recurrences in recent series is likely due to advances in surgical techniques and equipment, as well as the experience of surgeons (13). A semi-annual echocardiographic surveillance of any patient who has undergone surgery for cardiac myxoma is recommended (28).

Other benign tumors:

In decreasing order, papillary fibroelastomas are found first, followed by hemangiomas, lipomas, fibromas, teratomas (1%), and granular cell tumors (1%). Neurofibromas, lymphangiomas, and rhabdomyomas represent less than 1%, and are most often discovered post-mortem (29).

Cardiac Fibroelastomas:

Fibroelastomas are rare and represent 5-10% of cardiac tumors. In the general population, their incidence is 0.02%. Papillary fibroelastomas (PFE) are the most common of primary valvular tumors, constituting 70 to 90% of them (31).

Sur le plan Anatomie pathologique :

The macroscopic appearance (Figure 5) is that of a soft, translucent, vegetative tumor with a gelatinous appearance, resembling a sea anemone when in a liquid environment (Figure 6). Fibroelastomas can occur in various locations (31), but in most cases they are located in the middle of the valve body, on both sides of the semilunar and atrioventricular valves, on the chordae tendineae, and the atrial and ventricular endocardium (33). They are often attached to the endocardium via a more or less long pedicle, usually solitary, but can be multiple in 10% of cases (31, 33, 34). Their size can vary from 2 mm to 7 cm.



Figure 5:- Anatomical specimen. Papillary fibroelastoma: macroscopic appearance (32).



Figure 6:- Operative specimen: typical appearance of a "sea anemone" fibroelastoma.

Cardiomyomas:

They represent 4% of benign tumors in adults [38], and they are of vascular origin, developing from a benign proliferation of endothelial cells. It is a very rare tumor, which can be intramural and often well-defined (39), subendocardial and polypoid, or sessile, or pericardial and often poorly defined (4) (figure 7).



Figure7:- Pièce opératoire d'hémangiome cardiaque (44).

Most often isolated, cardiac hemangioma can be associated with cutaneous or hepatic hemangiomas, or Kasabach-Merritt syndrome (multiple hemangiomas, thrombocytopenia, and coagulation disorders) (39).

Histologically :

Histologically, they can be classified into three types: the cavernous type composed of multiple and dilated vessels, the capillary type with smaller vessels, and the arteriovenous type made up of dysplastic arteries and veins, a combination of the cavernous and capillary types is frequently reported (40).

Clinically :

The clinical signs are highly variable, ranging from simple dyspnea to sudden death, obstruction of the cardiac chamber, conduction disorders, syncope, supraventricular arrhythmias, and even pericardial effusion (41).

Paraclinical :

1. **Echocardiography** reveals a tumor without any specific signs, and MRI with contrast injection plays an important diagnostic role, allowing for the precise localization, vascular nature, and anatomical relationships of the tumor to be determined (42).
2. On MRI, the hemangioma appears as hyperintense on T1-weighted and T2-weighted images due to the presence of slowed blood flow (figure 8). Contrast injection during cardiac catheterization results in a marked increase in signal intensity, confirming the vascular nature of the tumor (43)

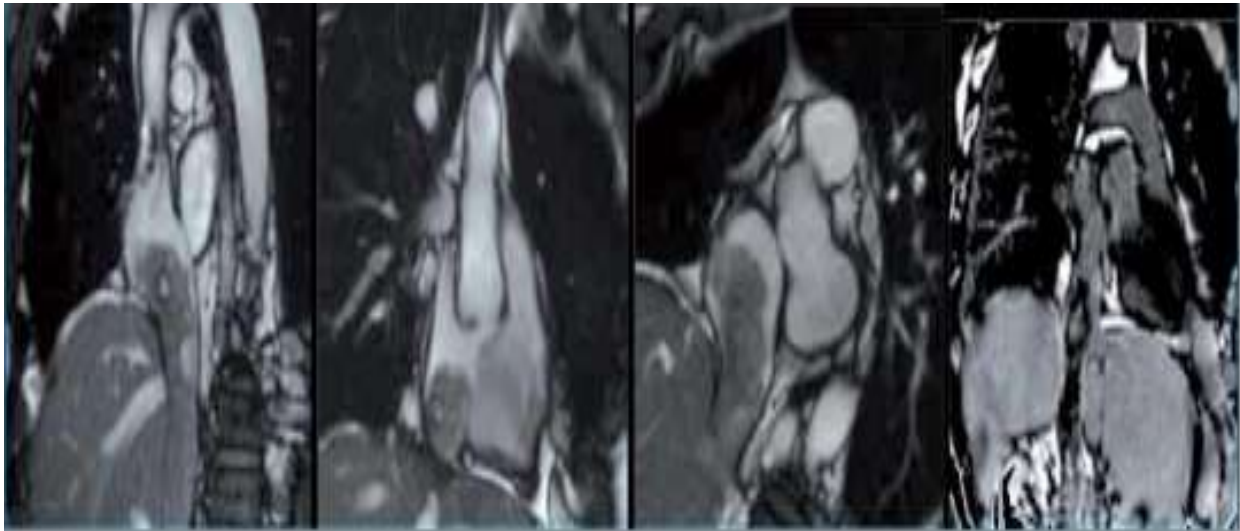


Figure 8:- Cardiac MRI: mass located at the level of the inferior vena cava extending from the right atrium to the tricuspid valve (44).

The treatment relies on complete surgical resection. Late neoplastic recurrence cannot be ruled out, and patients require regular ultrasound follow-up (38).

The long-term prognosis is favorable for respectable forms. However, there is a risk of tamponade, ventricular tachycardia, local progression, or systemic dissemination.

Les lipomas:

After myxomas, the most common benign tumors are lipomas (20%), which are masses of encapsulated fat cells (adipocytes). These lipomas mainly develop in the epicardium, pericardium, or septal walls (Figure 8) (30).

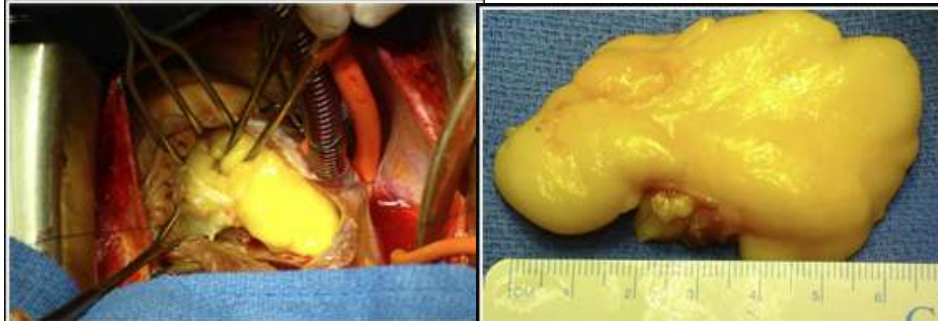


Figure 8:- Operative specimen of large cardiac lipomas (30).

Teratomas:

Teratomas in adults are very rare, accounting for only 1% of benign tumors in adults.

Primary malignant tumors in adults:

Primary malignant tumors are extremely rare, representing 0.001 to 0.003% of cases observed in autopsy series of intracardiac tumors (45,47). According to the latest version of the World Health Organization (WHO) classification of cardiac tumors published in 2015, angiosarcoma and cardiac sarcoma are the most common malignant tumors, followed by fibro myosarcoma, rhabdomyosarcoma, and cardiac lymphomas (46). Their prognosis is very poor in the absence of early diagnosis and timely surgical resection (47).

Sarcomas

According to the new WHO classification of cardiac tumors published in 2015, undifferentiated pleomorphic cardiac sarcomas are the most common cardiac sarcomas, accounting for 70 to 80% of cases and arising from cardiac connective tissue. Sarcomas can occur at any age, but are more common in young adults aged between 30 and 50 years. They preferentially affect the right heart and, in descending order of frequency, the right atrium, left atrium, right ventricle, left ventricle, and interventricular septum, often resulting in hemorrhagic tamponade syndrome. Sarcomas metastasize in 80% of cases, most commonly to the lungs [46, 48, 49].

Angiosarcomas

They represent 12 to 33% of malignant intracardiac tumors in adults, and are twice as common in men. In 75% of cases, these tumors originate from the right atrium or the pericardium. Histologically, they are either polypoid or infiltrative in nature and are hypercellular with areas of necrosis and hemorrhage. Their clinical presentation is typically right-sided heart failure with pericardial effusion, and sometimes tamponade, with a very poor prognosis, with a mortality rate of 90% at 9 months.

Rhabdomyosarcomas

They represent 20% of malignant cardiac tumors in adults, more frequent in men, and very rare in children [48, 49, 50]. They are derived from striated muscle and can develop in both the left and right heart chambers, with multiple locations in 60% of cases. Prognosis is slightly more favorable than that of angiosarcomas.

Malignant fibrous histiocytoma

Fibrosarcomas are very rare and derived from fibroblasts and histioblasts. They are almost always located in the left atrium, with a broad base of implantation mimicking a myxoma. Valvular involvement is present in more than 50% of cases [48,49].

Fibrosarcomas and myxosarcomas

Represent 10% of primary malignant tumors in adults. At the time of diagnosis, there are visceral metastases in one-third of cases. These tumors are often multiple and involve all cardiac chambers. [50]

Other cardiac malignancies :

Cardiac lymphomas, lymphosarcomas, reticulum cell sarcomas, and Hodgkin's lymphomas represent 1% of malignant cardiac tumors. They occur mostly in immunocompromised patients, are often extracardiac, and are associated with myocardial and pericardial invasion. They are asymptomatic in half of cases or present with global

heart failure. On cardiac ultrasound, they appear very echogenic, lobulated, extensive, invading the walls, cavities, and pericardium, often with a significant pericardial effusion. Osteosarcomas represent 4% of malignant tumors and typically develop in the left atrium, often leading to left atrioventricular obstruction.

Leiomyosarcomas, liposarcomas, and synoviosarcomas are even rarer, truly exceptional.

Metastatic intracardiac tumors

According to the literature, the frequency of metastatic or secondary cardiac tumors varies depending on autopsy, surgical, histopathological, or medical series, with metastatic cardiac involvement found in 0.01 to 1% of autopsies [54].

In the initial studies, lung cancer, lymphomas, and leukemias were the most common, with a review of autopsy series published between 1933 and 1950 and comprising 52,491 cases, estimating the overall frequency of cardiac metastases at 0.7% in the general population and 4% in cancer patients [55, 56, 57].

Recent studies have noted a higher prevalence of breast cancer, pancreatic cancer, and melanoma in cardiac metastases. A study conducted by the University of Trieste in Italy between 1994 and 2003 found that cardiac metastases were present in 9.1% of all malignant tumors, with a higher relative frequency of lung adenocarcinoma showing the strongest cardiac metastatic tropism in up to 82% of patients

The mode of dissemination is usually hematological, or locoregional for adjacent tumors. However, there is little data on the mechanisms of cardiac involvement, with only one study, based on autopsies of patients who died of lung cancer, specifically dedicated to the study of different mechanisms of cardiac metastases [59].

Metastases can reach the heart through four dissemination routes: 1) by contiguity, 2) by hematogenous pathway, 3) by lymphatic pathway, 4) by intracavitary diffusion through the vena cava or pulmonary veins. The right side of the heart is more commonly affected than the left side [60]. Primary lung tumors are the most common source of cardiac metastases with cardiac involvement by contiguity and lymphatic spread [61], involving the pericardium and then the myocardium [61]. The second most frequent source of cardiac metastases is represented by hematological malignancies through hematogenous pathways [62]. Millet-like myocardial involvement could then be explained by neoplastic emboli from the coronary circulation but could also occur in cases of lymphangitis [62].

On a clinical level, the manifestations are highly variable, often subclinical, but can be classified into systemic, embolic, and cardiac manifestations. The symptoms are due to the following mechanisms: obstruction with a decrease in blood flow, damage to conduction pathways responsible for conduction disorders, pericardial invasion leading to effusion, valvular dysfunction due to intracavitary tumor prolapse responsible for arrhythmia, signs of heart failure, lipothymia and syncope, ischemia due to tumoral emboli, diffuse infiltration leading to myocarditis, general signs of paraneoplastic origin [58,63].

Conclusion:-

Primary cardiac tumors are rare conditions; most originate in the myocardium or endocardium, but they can develop in any cardiac tissue and be benign or malignant. with a frequency of 0.001 to 0.030%, in 80% of cases are benign, of which myxoma is the most common primary cardiac tumor, with a prevalence of 70% of cases. The rest are represented in descending order, rhabdomyomas, fibromas, fibroelastomas and lipomas.

Primary malignant tumors of the heart are very rare conditions, in 95% of cases are sarcomas, then in the remaining 5% are lymphomas. Dominated by undifferentiated sarcomas followed by angiosarcomas, leiomyosarcomas and rhabdomyosarcomas.

Manifestations depend on the location and type of tumor, but include constitutional, valvular or entry-exit tract obstruction, thromboembolism, and arrhythmias.

Secondary malignant tumors of the heart are more frequent than primary tumors, in lung, breast, kidney cancers and melanomas, representing the common starting point of cardiac metastases, as well as lymphomas and leukemias, and exceptionally the Kaposi's sarcoma.

The diagnosis is based on echocardiography and often a cardiac MRI, confirmed by anatomopathological study.

For benign tumors, treatment is based on surgical excision, however despite therapeutic progress, primary and secondary malignant tumors limit therapeutic management, with complete surgical excision is rare, often resorting to palliative treatment.

The prognosis for benign tumors is excellent. On the other hand, malignant tumors have a very poor prognosis with an average life expectancy of one year after their diagnosis.

Bibliography:-

1. Meng Q, Lai H, Lima J, Tong W, Qian Y and Lai S. *Int J Cardiol* 84; 2002: 69–75.
2. The 2015 WHO Classification of Tumors of the Heart and Pericardium Allen Burke, MD, a, Fabio Tavora, MD, PhD ba University of Maryland Medical Center, University of Maryland, Baltimore, Maryland b Messejana Heart and Lung Hospital, Fortaleza, Brazil , Received 12 April 2015; revised 10 November 2015; accepted 21 November 2015
3. Ferrans VJ, Roberts WC. *Hum Pathol* 1973; 4:111.
4. Denguir R et al. *Am J Cardiol* 2002; 90: 563–65.
5. St John Sutton MG, Mercier LA, Guiliani ER, Le JT. *Mayo Clin Proc* 1980;55:3716.
6. Reynen K. *N Engl J Med* 1995; 333: 1610–17.
7. O'NEIL MB, GREHL TM, HURLEY EJ. Cardiac myxomas : a clinical diagnostic challenge. *Am J Surg*, 1979 ; 138 : 68
8. READ RC, WHITE HG, MURPHY ML. The malignant potentiality of left atrial myxomas. *J Thorac Cardiovasc Surg*, 1974 ; 68 : 857.
9. Greenwood WF. *Am J Cardiol* 1968; 21:367.
10. 3. Denguir R et al. *Am J Cardiol* 2002; 90: 563–65.
11. Lakhdar R, Siala F, Khouaja A. *Tunisie Med* 2003;81:666–9.
12. HANFLING SM. Metastatic cancer to the heart ; review of the literature and report of 127 cases. *Circulation*, 1960 ; 22 : 474.
13. Reynen K. *N Engl J Med* 1995; 333: 1610–17
14. McAllister HA, Fenoglio JJ Jr. Washington DC, Armed Forces Institute of Pathology, 1978.
- 15 . Greenwood WF. *Am J Cardiol* 1968; 21:367.
- 16 .Desousa AL, Muller J, Campbell RL, et al. *J Neurol Neurosurg Psychiatr* 1978; 41:1119. Rechercher l'abstract
17. Furlong BR, Verdile VP. *Am J Emerg Med* 1995; 13:46. Rechercher l'abstract
18. Masses, tumors, and source of embolus. In Feigenbaum H, Armstrong WF, Ryan T. Lippincott Williams & Wilkins; 2005. 701–733. Rechercher l'abstract
- 19 .Ensberding R, Erbel DR, Kaspar W, et al. *Eur Heart J* 1993; 14:1223. Rechercher l'abstract
20. Hall RJ, Cooley DA, McAllister HA Jr, Frazier OH. The heart, arteries and veins. 7th ed. New York: McGraw-Hill, 1990:1382-403.
- 21 . Keeling IM, Oberwalder P, Anelli-Monti M. *Eur J Cardiothorac Surg* 2002; 22:971–7.
- 22 .Kosuga T, Fukunaga S, Kawara T, et al. *J Cardiovasc Surg (Torino)* 2002;43:581-7. Rechercher l'abstract
- 23 .Bortolotti U, Maraglino G, Rubino M. *Ann Thorac Surg* 1990;49: 449–53.
- 24 . Jones DR, Warden HE, Murray GF. *Ann Thorac Surg* 1995;59: 851–6.
- 25 . McCarthy PM, Piehler JM, Schaff HV, et al. *J Thorac Cardiovasc Surg* 1986; 91:389. Rechercher l'abstract
- 26 .Dato GMA, Benedictus M, Dato AA, et al. *J Cardiovasc Surg* 1993; 34:141. Rechercher l'abstract
- 27 . Gray IR, Williams WG. *Br Heart J* 1985;53: 645-9. Rechercher l'abstract
- 28 .ErdölC, Öztürk C, Öcal A, Bozat T, Koca V, Özdemir A. *Paediatr Cardiol* 2001;8:3-9. Rechercher l'abstract
- 29 . TABRY IF, NASSAR VH, RIZK G et al. Cavernous hemangioma of the heart ; case report review of the literature. *J Thorac Cardiovasc Surg*, 1975 ; 69 : 415.
30. Les tumeurs cardiaques primitives chez l'adulte Unité de Cardiologie et de Chirurgie Cardiaque Jacques Cartier 2013
- 31 .Gowda RM et al. Cardiac papillary fibroelastoma : A comprehensive analysis of 725 cases. *Am Heart J* 2003;146:404-10
- 32 . FIBROÉLASTOME : UNE CAUSE RARE MAIS CURABLE D'AVC - À PROPOS D'UN CAS , L. FUCHS et S. GODARD, Centre Hospitalier de Gonesse, P. MESNILDREY et J. FEIGNOUX, Centre cardiologique du Nord, Saint-Denis

33. Ngaage DL et al. Surgical Treatment of Cardiac Papillary Fibroelastoma : A Single Center Experience With Eighty-Eight Patients. *Ann ThoracSurg*2005;80:1712-8. Rechercherl'abstract
- 34 .Vagefi PA et al. Valve-sparing excision of aortic valve papillary fibroelastoma. *J ThoracCardiovascSurg*2006;131:1177-8.
- 35 .Bottio T et al. Echocardiographic Diagnostic of Aortic Valve Papillary Fibroelastoma. *Tex Heart Instit J*. 2004;31(3):322-3.
36. Rbaibi A et al. Intérêt de l'échocardiographie transoesophagienne et du scanner multicoupes dans la démarche diagnostique d'un cas de fibroélastome papillaire révélé par un accident neurologique. *Arch Mal Cœur* 2002 ;95 :601-5
37. VALVES CARDIAQUES : UNE NOUVELLE APPLICATION DU SCANNER MULTICOUPES . E. BOUVIER, Clinique Ambroise Paré et Centre Hospitalier de Neuilly-sur-Seine J.-L. SABLAYROLLES, J. FEIGNOUX et J.-M. TREUTENAERE, Centre Cardiologique du Nord, Saint-Denis .le 18 sep 2007
38. .Colli A et al. Recurrence of right ventricular hemangioma. *J ThoracCardiovascSurg*2003 ; 126 : 881-3.
- 39 . Matsumoto Y et al. Surgical treatment of a cavernous hemangioma of the left atrial roof. *Eur J CardiothoracSurg*2001 ; 20 : 633-5.
40. Garcia Zanati S et al. Cardiac hemangioma of the right atrium. *Eur J Echocardiogr*2008 ; 9 : 52-3.
41. Sata N et al. Recurrent pericardial tamponade from atrial hemangioma. *Ann ThoracSurg*2004 ; 78 : 1 472-5.
42. Ros. er M et al. Left ventricular cardiac hemangioma presenting with atypical chest pain. *Circulation* 2008 ; 117 : 2 958-60.
43. Kemp JL et al. MR and CT appearance of cardiac hemangioma. *J Comput AssistTomogr* 1996 ; 20 : 481-3.
44. UN HÉMANGIOME CAVERNEUX DE L'OREILLETTE DROITE . T. REGGANY, C. ALEXANDRESCUS, N. HUGUES, P. ROSSI, F. BOURLON, Centre cardio-thoracique de Monaco 14 oct 2014
45. McAllister HA Jr. Primary tumors of the heart and pericardium. *PatholAnnu* 1979;14 Pt 2:325-55.
46. A. Burke et al. The 2015 WHO classification of tumors of the heart and pericardium ; *J ThoracOncol* 2016
47. Lam KY, Dickens P, Chan AC. Tumors of the heart. A 20-year experience with a review of 12,485 consecutive autopsies. *Arch Pathol Lab Med* 1993; 117:1027-31.
48. Neragi-Miandoab S, Kim J, Vlahakes GJ. Malignant tumours of the heart: a review of tumour type, diagnosis and therapy. *ClinOncol (R CollRadiol)* 2007;19:748-56.
49. Butany J, Nair V, Naseemuddin A, Nair GM, Catton C, Yau T. Cardiac tumours: diagnosis and management. *Lancet Oncol*2005;6:219-28.
50. MAC ALLISTER HA, FENOGLIO JJ. Tumors of the cardiovascular system. In : Atlas of tumor pathology. Washington DC, Armed forced institute of pathology, 1978, Fasc 15, 2nd series.
- 51 . MICHU RJ, GILLAM FD, WEYMAN AE. Osteogenic sarcomas mimicking left atrial myxomas : clinical and two-dimensional echographic features. *Am J Cardiol*, 1985 ; 6 : 1 422.
52. HANFLING SM. Metastatic cancer to the heart ; review of the literature and report of 127 cases. *Circulation*, 1960 ;
53. RAFAJLOVSKI S, TATIC V, KANJUH V. Frequency of metastatic tumors in the heart. *Vojnosanit Pregl*, 2005 ; 12, 62 : 9
- 54 . Roberts W. Primary and secondary neoplasms of the heart. *Am J Cardiol*1997 ; 80 : 671-82.
55. De Loach J, Haynes J. Secondary tumors of heart and pericardium. Review of the subject and report of one hundred thirty-seven cases. *Arch Intern Med* 1953 ; 91 : 224-49.
56. Chomette G, Brocheriou C, Pinaudeau Y, Auriol M. Les métastases cardiaques des tumeurs malignes. Aspects anatomiques et fréquence statistique dans un recrutement de 2500 autopsies. *Arch Mal Cœur*1968 ; 61 : 1269-77.
57. Abraham K, Reddy V, Gattuso P. Neoplasm metastatic to the heart: review of 3314 consecutive autopsies. *Am J CardiovascPathol*1990 ; 3 : 195-8.
58. Bussani R, De-Giorgio F, Abbate A, Silvestri F. Cardiac metastases. *J ClinPathol*. 2007 Jan;60(1): 27-34
59. Tamura A, Matsubara O, Yoshimura N, Kasuga T, Akagawa S, Aoki N. Cardiac metastasis of lung cancer. *Cancer* 1992 ; 70 : 437-42.
60. Ruba Murad, RimaaBakkar, Rehab Sukkar, Fadi Mahmoud, Alwaleed Al-Dairy M. A case of Ewing sarcoma presenting with cardiac metastasis. *World Journal for Pediatric and Congenital Heart Surgery*. 2019;10(5): 632- 634. PubMed| Google Scholar
61. Reynen K, Köckeritz U, Strasser RH. Metastases to the heart. *Ann Oncol*. 2004;15(3): 375-381. PubMed
62. Robert Hartemayer, Christopher Kuo, Paul Kent. Osteosarcoma metastases with direct cardiac invasion: a case report and review of the pediatric literature. *J PediatrHematolOncol*. 2017 Apr;39(3): 188-193. PubMed| Google Scholar
63. ShimaMousavi, NedaZarrin-Khameh. An unusual metastatic tumor to the heart. *Human Pathology: Case Reports*. 2017; 9: 30-32. Google Scholar.