Case Report

Recurrent Cardiac Myxoma Treated by Orthotopic Heart Transplantation: A Case Report and Literature Review of Heart Transplantation for Primary Cardiac Tumor

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Primary cardiac myxoma is the most common primary cardiac tumor. Tumor resection is the treatment of choice and overall long-term prognosis is good and recurrence is rare. This report presents a case of a young girl who presented with multiple recurrent cardiac myxoma. She underwent 3 sternotomy surgeries of 3 separated episodes of cardiac myxoma resection. On the fourth recurrence, the patient underwent orthotopic heart transplant. The patient tolerated the procedure well and is alive 6 months after the procedure with NYHA class I. We reviewed evidences and summarized reported cases of orthotopic heart transplant operation for primary cardiac tumor in the literature.

1. Introduction

Primary cardiac myxoma (CM) is the most common type of primary cardiac tumor with an estimated incidence around 0.5-1.0 per million cases per year [1]. Most of CM is sporadic and located in the left atrium (LA). Patients typically present with obstructive cardiac symptoms and nonspecific systemic signs [2]. Two of the most feared consequences of CM are systemic embolism and postoperative recurrence. Studies found that the recurrence rate of CM is around 2-7% [1, 3, 4]. The incidence of recurrent CM was found more commonly in Carney complex and patients who were presented with multiple lesions, positive family history, younger age, and incomplete resection [3, 5]. The standard of care for CM is surgical excision of the tumor. However, the treatment for patients with recurrent CM is unclear.

Orthotopic heart transplantation (OHT) is a treatment choice primarily reserved for patients with end-stage heart failure due to causes such as viral, ischemia, valvular, or idiopathic [6]. Nevertheless, OHT for primary cardiac tumor had also been reported. Indications for OHT in patients with primary cardiac tumor include unresectable benign or malignant tumor. We present a case of a recurrence CM who was treated with cardiac transplant and a literature review of OHT for primary cardiac tumor.

2. Case

A 17-year-old girl with a recurrent cardiac tumor presented for the heart transplant evaluation. Initially, at the age of 10, she first presented with dyspnea and holosystolic murmur at apex. She did not have any significant medical history, other
than a first-degree relative family history of CM. Echocardiography revealed a 3.5 × 4.8-cm LA mass. The mass was mobile, heterogeneous, and protruded from atrial septum into LA, suspected for CM and causing mitral regurgitation (Figure 1). The patient underwent tumor removal surgery via midline sternotomy. The pathology showed myxoid stroma with clusters of spindle cells and small blood vessels confirming the diagnosis of CM.

A year after the surgery, at the age of 12, she presented to the emergency department with sudden abdominal and right leg pain. The abdominal examination showed left upper abdominal tenderness and guarding. There were also signs of arterial occlusion in her right leg. Echocardiogram showed multiple cardiac masses in LA (2.5 × 1.9 cm) and left ventricular (LV) (1.8 × 1.0 cm) (Figure 1). A computed tomography of the abdomen and lower extremities confirmed the diagnosis of splenic infarction and femoral arterial embolism. She underwent splenectomy and embolectomy. An open heart operation revealed 5 cardiac masses (3 in LA, and 2 in LV) which all were removed. All specimens including the tissue from embolectomy were reported as a CM. The surgery was uneventful and echocardiography afterward did not show tumor residual. The repeat physical examination did not reveal signs of Carney complex.

Unfortunately, at the age of 13, a right ventricular (RV) mass sized 1.7 × 1.6 cm was detected on the echocardiography. She was asymptomatic but with the follow-up echocardiogram showing increasing in size of the mass to 2.8 × 4.7 cm extended into RV outflow tract causing obstruction (peak RV outflow velocity of 3.8 m/s) (Figure 1). After discussion, she underwent a third sternotomy for tumor resection and specimens were reported as CM. The surveillance echocardiography was performed every 6 months and at the age of 15. There were recurrent of cardiac masses in LA, LV, and RV, sized 2.4 cm, 2.1 cm, and 2.4 cm, respectively (Figure 1).

Even though CM is considered benign, due to the infrequent recurrence, fast growing, and the complications from the neoplasm including valve regurgitation and obstruction, and embolic event, the heart transplant was proposed with the fourth recurrence of CM. Other than elevated panel reactive antibody with multiple significant anti-human leukocyte antibodies, there were no other contraindications. She was on the waiting list for 11 months. She was treated with warfarin while on the waitlist without new events. Of note, at the time of heart transplant operation, she was 17 years old. The heart transplant was performed with a bicaval anastomosis. Attention was given to maximally excise the recipient cardiac tissue. The gross examination of the excision heart showed 4,
Figure 2: The gross examination of the explant heart showing multiple gelatinous masses (arrows).

1, and 1 masses in RV, LA, and LV (Figure 2). These masses showed homogenous tan white, gelatinous, rubbery cut surface. The masses were reported as CM.

The clinical course was uneventful. Regarding immunosuppression, she was given standard regimen of our institution for high risk patient including perioperative plasmapheresis and induction therapy with basiliximab, then maintenance regimen with a combination of cyclosporine, mycophenolate, and prednisone. Now, 6 months after the surgery, the patient is doing well with New York Heart Association functional class I. The steroid was weaned off. There was no episode of treated rejection. The physical examination and echocardiogram did not reveal signs of recurrent masses. The echo was planned in a 6-month interval.

The details of each episode of tumor presentation and operations are summarized in Table 2.

3. Discussion

CM is the most common primary tumor of the heart. Histologically, it originates from endocardial and consists of myxoid stroma and variable myxoma cells. The most common location of CM is in the LA. Size of the tumor varied from 3 cm to 7 cm [34]. Although the tumor usually presented in a sporadic form, a familial form was also rarely found with most patients presented as Carney syndrome [1]. The tumor itself is histologically benign, but it can cause significant symptoms and morbidity due to a large size and an insecure location. Therefore, patients with CM need aggressive intervention. The gold standard treatment of CM is complete surgical resection of the tumor, with or without the adjacent endocardium tissue. Most of the patients did not require reoperation and prognosis is generally good [2, 3, 35].

Recurrent CM was relatively common in patients with multiple lesions, tumor location other than the LA, family history, and younger age. Possible mechanisms of recurrence were suggested such as incomplete resection, growth from another focus, familial inheritance, or implantation of a fragment from the original tumor. The overall rate of the recurrence was reported to be 2-7% and usually treated with reexcision. In familial type, the recurrent rate was found to be as high as 12% [36]. In our case, based on the young age at presentation and family history of CM, it is likely that the recurrence was due to the inheritance.

However, recurrence for the second time or more is extremely rare and several cases of multiple recurrent of CM had been reported. Herman et al. published a case report of a patient who had three-time recurrence 14 years after the second episode. Conservative treatment of anticoagulant was chosen due to the patient’s comorbidity and unwillingness to receive another surgery [37]. Azzam et al. showed a patient with Carney complex who had four recurrent of CM, all in the LA. The patient underwent excision four times and was tumor-free at 36-month follow-up [38].

Although there were cases of recurrent CM that were successfully treated with reexcision, this patient had four recurrent CM and had a high chance of another recurrence. The patient was young and had a family history of CM, which are established risk factors for tumor recurrence. Despite being highly sensitized from previous sternotomy, we believe that OHT may provide better long-term survival. Orthotopic heart transplantation has been considered a final treatment option when others are not available. The use of OHT has been implemented in patients with unresectable cardiac tumor, both benign and malignant. According to the published data, there has been only one case of CM patient who was treated with OHT. Goldstein et al. performed OHT on a patient with recurrent CM due to extensive involvement of the tumor [18].

We reviewed patients with a primary cardiac tumor that underwent OHT as a treatment. A review of the literature showed that there have been 46 patients who underwent OHT due to primary cardiac tumor (Table 1). The most common histologic type of tumor was sarcoma (50%) and the most common location of tumors was left ventricle (43%) (Figures 3 and 4). With limited data availability and follow-up time, there was one patient who had a recurrence of the tumor following OHT. Metastasis of the tumor occurred in 11 (23.9%) patients. Mean follow-up time was 29.3 months with a mortality rate of 47.8%.

In summary, heart transplant is one of the treatment options in patients with primary cardiac tumor. This may be considered early, rather than last options, in a tumor type which is highly invasive or has a high likelihood of recurrence.


| Study                  | Sex | Age (year) | Tumor histology | Location | Metastasis/Recurrence | Follow-up, months | Death |
|------------------------|-----|------------|-----------------|----------|------------------------|-------------------|-------|
| Jamieson et al. [7]    | F   | 17         | Fibroma         | LV       | No                     | 75                | No    |
| Aravot et al. [8]      | F   | 43         | Neurofibrosarcoma | RV      | No                     | 66                | No    |
| Siebermann et al. [9]  | F   | 31         | Synovial sarcoma | RA, RV   | Metastasis             | 2                 | Yes   |
| Horn et al. [10]       | M   | 13         | Angiosarcoma    | RA       | Metastasis             | 15                | Yes   |
| Mark et al. [11]       | F   | 2          | Fibroma         | LV       | No                     | 8                 | Yes   |
| Auferio et al. [12]    | F   | 31         | Fibrosarcoma    | LV       | No                     | 12                | No    |
| Crespo et al. [13]     | M   | 31         | Angiosarcoma    | RA       | Metastasis             | 8                 | Yes   |
|                       | M   | 32         | Angiosarcoma    | RA       | Metastasis             | 9                 | Yes   |
| Valente et al. [14]    | F   | 1 month    | Fibroma         | LV       | No                     | 36                | No    |
|                       | F   | 40         | Fibroma         | LV       | No                     | 28                | No    |
| Yuh et al. [15]        | F   | 57         | Lymphoma        | LV       | Metastasis             | 14                | No    |
| Baay et al. [16]       | M   | 34         | Angiosarcoma    | RA       | No                     | 33                | No    |
| Bachet et al. [17]     | M   | 35         | Fibrosarcoma    | RA, LA   | Recurrence             | 18                | Yes   |
| Goldstein et al. [18]  | F   | 47         | Myxoma          | LA       | No                     | 18                | No    |
| Demkow et al.          | M   | 4 months   | Rhabdomyoma     | LV       | No                     | 8                 | No    |
| Almenar et al. [19]    | F   | 29         | Angiosarcoma    | n/a      | Metastasis             | 2                 | Yes   |
|                       | F   | 42         | Sarcoma         | LA       | No                     | 6                 | No    |
|                       | 49  | Myxosarcoma | LA               | No       | 34                     | No                |       |
|                       | 26  | Pheochromocytoma | n/a           | No       | 60                     | No                |       |
|                       | 49  | Fibroma     | LA               | Metastasis | 38                   | No                |       |
|                       | 39  | Rhabdomyosarcoma | LV          | No       | 3.5                    | Yes               |       |
|                       | M   | 3 months   | Fibroma         | LV       | No                     | 105               | No    |
| Noirclerc et al. [21]  | n/a | n/a        | Sarcoma         | n/a      | No                     | 20                | No    |
| Gowdamarajan et al. [22]| M  | 64         | Sarcoma         | n/a      | No                     | 3                 | Yes   |
|                       | M   | 7          | Leiomyosarcoma  | n/a      | n/a                    | 11.5              | No    |
|                       | F   | 28         | Osteosarcoma    | n/a      | n/a                    | 11.5              | Yes   |
|                       | M   | 9          | Leiomyosarcoma  | n/a      | n/a                    | 11.5              | Yes   |
|                       | F   | 61         | Histosarcoma    | n/a      | n/a                    | 36                | Yes   |
|                       | M   | 8          | Lymphoma        | n/a      | n/a                    | 21                | Yes   |
|                       | M   | 33         | Rhabdomyosarcoma | RA      | No                     | 102               | No    |
| Grandmougin et al. [23]| M   | 40         | Sarcoma         | RV, PA   | Metastasis             | 48                | Yes   |
|                       | F   | 39         | Sarcoma         | PA       | No                     | 49                | No    |
|                       | F   | 37         | Sarcoma         | LA       | Metastasis             | 16                | Yes   |
|                       | M   | 45         | Sarcoma         | LA       | Metastasis             | 5                 | Yes   |
| Talbot et al. [24]     | n/a | n/a        | Fibroma         | LV       | No                     | 135               | Yes   |
|                       | F   | 1 month    | Fibroma         | LV       | No                     | 38                | Yes   |
|                       | n/a | n/a        | Fibroma         | LV       | No                     | n/a               | No    |
|                       | n/a | n/a        | Rhabdomyoma     | LV       | No                     | n/a               | No    |
| Padalino et al. [25]   | F   | 7 months   | Fibroma         | LV       | No                     | 36                | No    |
|                       | F   | 6 months   | Fibroma         | LV, RV   | No                     | 19                | No    |
| Kobayashi et al. [26]  | F   | 36         | Sarcoma         | RA       | No                     | 3                 | No    |
| Agaimy et al. [27]     | F   | 21         | Lymphoma        | LV       | No                     | 26                | No    |
| Ried et al. [28, 29]   | F   | 45         | Plasmocytoma    | RV       | n/a                    | No                | Yes   |
| Fouquet et al. [30]    | M   | 53         | Lymphoma        | RA, RV   | Metastasis             | 12                | No    |
| Yang et al. [31]       | n/a | n/a        | Fibroma         | LV       | No                     | 42                | Yes   |
| Padalino et al. [32]   | n/a | n/a        | Fibroma         | LV       | No                     | 18                | No    |
| Rajakumar et al. [33]  | M   | 7          | Fibroma         | LA, LV   | No                     | 18                | No    |

F: female, M: male, RA: right atrium, LA: left atrium, RV: right ventricle, LV: left ventricle, and PA: pulmonary artery.
### Table 2: Tumor characteristic and operations detail.

| No. of surgery (year) | Location and size | Surgical Method | Non-resectable mass | Complication | Residual mass | Pathology |
|-----------------------|-------------------|-----------------|---------------------|--------------|---------------|-----------|
| 1st surgery (2008)    | Echocardiography: Endocardial cardiac mass (3.5x4.8 cm) protruded from LA septum and MV anterior leaflet to LA cavity | Open midline- sternotomy for tumor removal | NA | None | Echocardiography (4 days after operation): Tumor remnant (4mm) and mild MV regurgitation. | Myxoma at LA mass. Margin: N/A |
|                       | Intra-op: 5x6x6 cm mass attached to the septum of the LA with no involvement of MV |                |                     |              |               |           |
| 2nd surgery (2010)    | Echocardiography: LA mass (2.5x1.9 cm) obstructing MV inflow. LV mass (1.78x0.97 cm) was detected at LV free wall near apex | Open midline- sternotomy for tumor removal | None | None | Echocardiography (1 week after the operation): No tumor residual. | Myxoma at LA, right superior PV, lower interatrial septum, LV masses. Clear margin. |
|                       | Intra-operation: A 4-cm LA mass attached to LA wall, a 1-cm mass attached to wall of right superior PV, a 0.5-cm mass attached to interatrial septum and 1-cm and 2-cm LV masses |                |                     |              |               |           |
| 3rd surgery (2012)    | Echocardiography: RV mass (2.8x4.7 cm) from RV apex extended to RV outflow tract. Intra-operation: 5-cm mass at axillary surface and multiple small mass at RV endocardium | Open midline- sternotomy for tumor removal | None | Suspected embolic stroke 1 day after the operation. Patient improved without any intervention | Echocardiography (1 week after the operation): No tumor residual. | Myxoma at RV mass Clear margin. |

RA: right atrium, LA: left atrium, RV: right ventricle, LV: left ventricle, PA: pulmonary artery, PV: pulmonary vein, MV: mitral valve, and intra-op: intra-operation.
Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] G. Lamba and W. H. Frishman, “Cardiac and pericardial tumors,” Cardiology in Review, vol. 20, no. 5, pp. 237–252, 2012.

[2] A. D’Alfonso, S. Catania, M. D. Pierri et al., “Atrial myxoma: A 25-year single-institutional follow-up study,” Journal of Cardiovascular Medicine, vol. 9, no. 2, pp. 178–181, 2008.

[3] Z. Wang, S. Chen, M. Zhu et al., “Risk prediction for emboli and recurrence of primary cardiac myxomas after resection,” Journal of CardioThoracic Surgery, vol. 11, no. 1, article no. 22, 2016.

[4] Z. Ansari Aval, H. Ghaderi, H. Tatari et al., “Surgical Treatment of Primary Intracardiac Myxoma: 20-Year Experience in ‘shahid Modarres Hospital’ - A Tertiary University Hospital - Tehran, Iran,” The Scientific World Journal, vol. 2015, 2015.

[5] C. Selkane, B. Amahzoune, N. Chavannis et al., “Changing Management of Cardiac Myxoma Based on a Series of 40 Cases with Long-Term Follow-Up,” The Annals of Thoracic Surgery, vol. 76, no. 6, pp. 1935–1938, 2003.

[6] D. C. Chambers, R. D. Yusen, W. S. Cherikh et al., “The Registry of the International Society for Heart and Lung Transplantation: Thirty-fourth Adult Lung and Heart-Lung Transplantation Report—2017; Focus Theme: Allograft ischemic time,” The Journal of Heart and Lung Transplantation, vol. 36, no. 10, pp. 1047–1059, 2017.

[7] S. W. Jamieson, V. A. Gaudiani, B. A. Reitz, P. E. Oyer, E. B. Stinson, and N. E. Shumway, “Operative treatment of an unresectable tumor of the left ventricle,” The Journal of Thoracic and Cardiovascular Surgery, vol. 81, no. 5, pp. 797–799, 1981.

[8] D. J. Aravot, N. R. Banner, B. Madden et al., “Primary cardiac tumours - Is there a place for cardiac transplantation?” European Journal of Cardio-Thoracic Surgery, vol. 3, no. 6, pp. 521–524, 1989.

[9] R. Siebenmann, R. Jenni, M. Makek, O. Oelz, and M. Turina, “Primary synovial sarcoma of the heart treated by heart transplantation,” The Journal of Thoracic and Cardiovascular Surgery, vol. 99, no. 3, pp. 567-568, 1990.

[10] M. Horn, C. Phebus, and J. Blatt, “Cancer chemotherapy after solid organ transplantation,” Cancer, vol. 66, no. 7, pp. 1468–1471, 1990.

[11] M. Marx, P. Buxbaum, M. Wimmer, and A. Laczkovics, “Heart transplantation in childhood,” Wiener Klinische Wochenschrift, vol. 103, no. 22, pp. 669–672, 1991.

[12] T. X. Auferro, W. E. Pae Jr., B. S. Clemson, D. G. Pawlush, and D. Davis, “Heart transplantation for tumor,” The Annals of Thoracic Surgery, vol. 56, no. 5, pp. 1174–1176, 1993.

[13] M. G. Crespo, L. A. Pulpon, G. Pradas et al., “Heart transplantation for cardiac angiosarcoma: Should its indication be questioned?” The Journal of Heart and Lung Transplantation, vol. 12, no. 3, pp. 527–530, 1993.

[14] M. Valente, P. Cocco, G. Thiene et al., “Cardiac fibroma and heart transplantation,” The Journal of Thoracic and Cardiovascular Surgery, vol. 106, no. 6, pp. 1208–1212, 1993.

[15] D.D. Yu, SH. Kubo, GS. Francis, A. Bank, KM. McDonald, and J. Jessurun, “Primary cardiac lymphoma treated with orthoptic heart transplantation: a case report,” The Journal of Heart and Lung Transplantation: The Official Publication of the International Society for Heart Transplantation, vol. 13, no. 3, pp. 538–542, 1994.

[16] P. Baay, S. V. Karwande, J. P. Kushner, S. Olsen, and D. G. Renlund, “Successful treatment of a cardiac angiosarcoma with combined modality therapy,” The Journal of Heart and Lung Transplantation, vol. 13, no. 5, pp. 923–925, 1994.

[17] J. Bachet, C. Banfi, L. Martinelli, D. Brodaty, and D. Guilmet, “Heart transplantation and primary cardiac tumors,” The Annals of Thoracic Surgery, vol. 59, no. 1, pp. 262–263, 1995.

[18] D. J. Goldstein, M. C. Oz, and R. E. Michler, “Radical excisional therapy and total cardiac transplantation for recurrent atrial myxoma,” The Annals of Thoracic Surgery, vol. 60, no. 4, pp. 1105–1107, 1995.

[19] V. M. Rodriguez Blanco, V. Barrailes Álvarez, E. Segovia Martínez, C. M. de la Tassa, R. Barrailes Villa, and A. C. Llosa, “Reversible dilated cardiomyopathy and thyrotoxicosis,” Revista Espa ñola de Cardiología, vol. 49, no. 10, pp. 770–772, 1996.

[20] R. E. Michler and D. J. Goldstein, “Treatment of cardiac tumors by orthoptopic cardiac transplantation,” Seminars in Oncology, vol. 24, no. 5, pp. 534–539, 1997.

[21] M. Noirclerc, O. Chavannon, E. Borrel et al., “Primary cardiac sarcoma treated by orthoptotic cardiac transplantation,” Archives
des Maladies du Coeur et des Vaisseaux, vol. 90, no. 11, pp. 1539–1543, 1997.

[22] A. Gowdamarajan and R. E. Michler, “Therapy for primary cardiac tumors: Is there a role for heart transplantation?” Current Opinion in Cardiology, vol. 15, no. 2, pp. 121–125, 2000.

[23] D. Grandmougin, G. Fayad, C. Decoene, A. Pol, and H. Warembourg, “Total orthotopic heart transplantation for primary cardiac rhabdomyosarcoma: Factors influencing long-term survival,” The Annals of Thoracic Surgery, vol. 71, no. 5, pp. 1438–1441, 2001.

[24] S. M. Talbot, R. N. Taub, M. L. Keohan, N. Edwards, M. E. Galantowicz, and L. L. Schulman, “Combined heart and lung transplantation for unresectable primary cardiac sarcoma,” The Journal of Thoracic and Cardiovascular Surgery, vol. 124, no. 6, pp. 1145–1148, 2002.

[25] M. A. Padalino, V. L. Vida, G. Boccuzzo et al., “Surgery for primary cardiac tumors in children early and late results in a multicenter european congenital heart surgeons association study,” Circulation, vol. 126, no. 1, pp. 22–30, 2012.

[26] D. Kobayashi, T. J. L’Ecuyer, and S. Aggarwal, “Orthotopic heart transplant: A therapeutic option for unresectable cardiac fibroma in infants,” Congenital Heart Disease, vol. 7, no. 4, pp. E31–E36, 2012.

[27] A. Agaimy, J. Rösch, M. Weyand, and T. Strecker, “Primary and metastatic cardiac sarcomas: A 12-year experience at a German heart center,” International Journal of Clinical and Experimental Pathology, vol. 5, no. 9, pp. 928–938, 2012.

[28] M. Ried, S. Hirt, and C. Schmid, “Over 2-year disease-free survival after multimodality therapy of a primary cardiac lymphoma,” The Journal of Heart and Lung Transplantation, vol. 31, no. 3, p. 334, 2012.

[29] M. Ried, L. Rupprecht, S. Hirt et al., “Sequential therapy of primary cardiac lymphoma in children, total artificial heart support, and cardiac transplantation,” The Journal of Heart and Lung Transplantation, vol. 29, no. 6, pp. 707–709, 2010.

[30] O. Fouquet, E. Flecher, G. Leurent, and A. Leguerrier, “Heart transplantation for cardiac plasmocytoma,” European Journal of Cardio-Thoracic Surgery, vol. 43, no. 4, Article ID ezs667, p. e104, 2013.

[31] J. Yang, J. Liu, and N. Dong, “Treatment of a primary cardiac lymphoma with orthotopic heart transplantation,” Kardiologia Polska, vol. 71, no. 11, pp. 1177–1179, 2013.

[32] M. A. Padalino, E. Reffo, A. Cerutti et al., “Medical and surgical management of primary cardiac tumours in infants and children,” Cardiology in the Young, vol. 24, no. 2, pp. 268–274, 2008.

[33] A. Prakash Rajakumar, S. Ejaz Ahmed, R. Varghese, S. Kothandam, U. C. Murmu, and R. Sethuratnam, “Pediatric heart transplant for unresectable primary cardiac tumor,” Asian Cardiovascular and Thoracic Annals, vol. 25, no. 3, pp. 207–209, 2017.

[34] J-G. Wang, Li. Y-J, H. Liu, Li. N-N, J. Zhao, and X-M. Xing, “Clinicopathologic analysis of cardiac myxomas: Seven years experience with 61 patients,” Journal of Thoracic Disease, vol. 4, no. 3, pp. 272–283, 2012.

[35] Y. Lin, J. Xiao, J. Chen et al., “Treating cardiac myxomas: A 16-year Chinese single-center study,” Journal of Cardiovascular Medicine, vol. 17, no. 1, pp. 44–53, 2016.

[36] K. Marina, K. E. Vasiliki, S. George et al., “Recurrent cardiac myxoma in a 25 year old male: A DNA study,” World Journal of Surgical Oncology, vol. 11, article no. 95, 2013.