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Diagnostic Challenges and Management Considerations for Aortic Root Aneurysm in Adult Suspected with Marfan Syndrome: A Case Report

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Abstract. Aortic aneurysm is an abnormal dilatation of the aorta commonly associated with hereditary genetic disorders such as Marfan syndrome, with an incidence of approximately 5–10 cases per 100,000 people per year, predominantly involving the ascending aorta. Diagnosing Marfan syndrome remains challenging in clinical practice, especially in settings with limited diagnostic resources such as rural areas in Indonesia. This study is a case report describing the diagnostic process and management of a patient with an aortic root aneurysm suspected to be associated with Marfan syndrome. Data were collected from medical records, physical examinations, and supporting investigations such as transthoracic echocardiography (TTE), and were compared with relevant literature and updated clinical guidelines (ESC Guidelines 2024 and Revised Ghent Criteria 2010). The findings showed that a patient presenting with clinical features of Marfan syndrome, including Corrigan's sign, diastolic murmur, and a systemic score ≥7—had significant aortic root dilatation (7.08 cm) accompanied by severe aortic regurgitation and decreased left ventricular function. Conservative therapy with bisoprolol, candesartan, and standard heart failure medications was administered to stabilize the condition before referral to a tertiary hospital for advanced imaging and surgical planning. Conclusion: This case highlights the importance of comprehensive history taking, careful physical examination, and echocardiography as essential tools for the early diagnosis of aortic aneurysm related to Marfan syndrome, particularly in healthcare facilities with limited diagnostic resources. Early detection and proper management play a crucial role in preventing fatal complications and reducing mortality.

Keywords: Aortic Dissection; Aortic Root Aneurysm; Diagnostic; Ghent Criteria; Marfan syndrome

1. INTRODUCTION

Aortic aneurysm is a condition where the aorta dilates more than its normal size and noted as one of the most common aortic root diseases. Aortic aneurysm carries high risk of mortality if followed by complications such as aortic rupture and aortic dissection. This condition is usually worsened by aortic valve regurgitation, which causes left ventricle dilatation, leading to decreased left heart function (Du et al., 2024). The etiology of aortic aneurysm can be caused by anatomical abnormalities such as bicuspid aortic valve, aortic valve stenosis, inflammatory diseases such as Takayasu disease, genetic disorders such as Marfan syndrome, and diseases involving other connective tissue such as Ehlers-Danlos syndrome and Loeys-Dietz syndrome. An aortic diameter exceeding twice the normal standard deviation can not currently be used as a pure reference to establish a diagnosis of an aortic aneurysm, instead further evaluation of other anatomical abnormalities that might be accompanying each individual is needed. In clinical practice, aortic root dilatation can be suspected in men with a diameter > 40 mm and women > 36 mm (Mazzolai et al., 2024). Aortic aneurysms occur in 5-10 cases per 100,000 people per year, predominantly in the root/ascending aorta (±60%), the

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aortic arch (±10%), and the descending aorta (±30%). Aortic root/ascending aneurysms are mostly caused by an inherited genetic disorder, namely Marfan Syndrome (Isselbacher et al., 2022).

Marfan syndrome is an autosomal dominant genetic disorder of connective tissue. Clinical manifestation involving multiple system such as cardiovascular, skin and skeletal, ocular, pulmonary and dura mater (Baumgartner et al., 2010). Marfan syndrome is caused by a mutation in the FBN1 gene. According to case report by Siswanto et al., 39 cases of Marfan syndrome were reported between 2006 and 2012 at the Harapan Kita Heart Center in Jakarta, Indonesia (Mahavira & Siswanto, 2013).

Working up on diagnosis of Marfan syndrome is quite challenging because it requires genetic test that still not accessible. However, with the revised 2010 Ghent criteria, several clinical manifestations can support a diagnosis of Marfan syndrome. Although in Indonesia it is still not widely implemented yet in clinical practice. Here Marfan syndrome manifestations are found through aortic dilation and aortic dissection finding (Abolla & Saputra, 2023). Delays in diagnosis can increase patient mortality and hinder management measures. Therefore, in this case report entitled "Diagnostic Challenges and Management Considerations for Aortic Root Aneurysm in Adult Suspected with Marfan Syndrome" we discuss the urgency of establishing a diagnosis of Marfan syndrome, especially in rural areas in Indonesia, to avoid the delays of patient management and stabilization.

2. METHOD

This study employed a qualitative descriptive approach with a case report design aimed at describing the diagnostic process and management of a patient with an aortic root aneurysm suspected to be associated with Marfan syndrome. Data were obtained from medical records, clinical examinations, and supporting investigations such as Transthoracic Echocardiography (TTE) and thoracic CT scans, and supported by scientific literature and clinical guidelines, including the 2024 ESC Guidelines and the Revised Ghent Nosology Criteria 2010. The diagnosis was established based on the 2010 Ghent criteria, with systemic score assessment including wrist and thumb signs, pes planus, arm-to-height ratio, limited elbow extension, and skin striae, where a score of ≥7 supports the diagnosis of Marfan syndrome even without a clear family history. The patient received conservative therapy consisting of bisoprolol, candesartan, furosemide, and spironolactone to stabilize hemodynamics and slow aortic dilation progression, with routine TTE monitoring every 6–12 months to evaluate changes in aortic diameter and ventricular function. The findings of this case were then compared with

existing literature and previous clinical reports to assess the alignment of clinical manifestations, cardiovascular complications, and the effectiveness of patient management in cases of Marfan syndrome in Indonesia, particularly in regions with limited diagnostic resources.

3. RESULT AND DISCUSSION

The diagnosis and management of aortic root aneurysm associated with Marfan syndrome remain clinically challenging, especially in settings with limited diagnostic resources. Early identification and comprehensive evaluation are essential to prevent life-threatening complications such as aortic dissection and rupture. In this case, we present an adult male patient suspected of having Marfan syndrome who was diagnosed with an aortic root aneurysm in a rural hospital. The following section describes the clinical presentation, diagnostic findings, and management approach in detail.

Case Illustration

A 48-year-old man came to RSUD Bima's heart clinic as an outpatient complaining of shortness of breath that had been getting worse over the past 3 months, with symptoms worsening during activity. No symptoms of orthopnea and paroxysmal nocturnal dyspnea were reported. He also complained of fatigue and weakness. In the past month, he had felt palpitations more frequently, especially after strenuous activity. He also complained of left chest pain radiating to the neck and head for the past 3 weeks, accompanied by a feeling of pressure, shortness of breath, and cold sweats. He denied any history of fainting, nausea, vomiting, fever, cough, or weight loss. His mother died at the age of 60 due to heart disease.

Physical examination showed that the patient's physique looked thin with a body weight of 47 kg, height of 173 cm, and a BMI of 15.7 kg/m². The patient's vital signs were stable, with a blood pressure of 135/37 mmHg, heart rate of 85 beats per minute, temperature of 37°C, and respiratory rate of 22 breaths per minute. General physical examination of the head was within normal limits; no enlarged lymph nodes were found in the neck. Corrigan's sign was positive. The thorax appeared within normal limits with symmetrical chest movements. Lung sounds were vesicular in both lung fields, and no wheezing or rhonchi were found.

Single S1 and S2 heart sounds were normal and regular. Diastolic murmurs could be heard at the heart base and the second right intercostal space (ICS II right parasternal line). No gallop sounds were heard. Abdominal examination was within normal limits. No signs of peripheral edema or clubbing fingers were found. Positive wrist and thumb signs were observed.

The patient then underwent an electrocardiogram (ECG), posteroanterior (PA) chest X-ray, and echocardiography. ECG showed normal sinus rhythm with left ventricular hypertrophy. The chest X-ray showed normal results. Echocardiography revealed dilation of the left ventricular chamber, decreased left ventricular systolic function with EF Teich 48%, normal right ventricular systolic function with TAPSE 2.07 cm, grade I diastolic dysfunction, and severe aortic regurgitation. The mitral, tricuspid, and pulmonary valves were within normal limits. An aneurysm of the aortic sinus of Valsalva was found with a diameter (inner to inner edge) of 7.08 cm (Figure 1).

Based on history taking and examination, the patient was diagnosed with aortic root aneurysm and suspect marfan syndrome. Patient is currently treated as an outpatient with Bisoprolol 5mg OD, Candesartan 8mg OD, Furosemide 40mg OD and Spironolactone 25mg OD while we also suggest patient to be refer to higher hospital at RSUP Nusa Tenggara Barat for further diagnostic work up and management. The patient was referred on an outpatient basis and advised to undergo a CT scan of the aorta with contrast to confirm the diagnosis of an aortic aneurysm and determine the presence of complications such as aortic dissection. Through follow up in RSUP Nusa Tenggara Barat, CT-Scan aorta result showed aortic dissection De-bakey type I, Stanford A (Figure 2). Patient then suggested to do further invasive management in Jakarta, but refused as he feels better with medication and find it difficult to cover the cost of treatment in Jakarta. He now stable and referred back to do routine control in RSUD Bima.

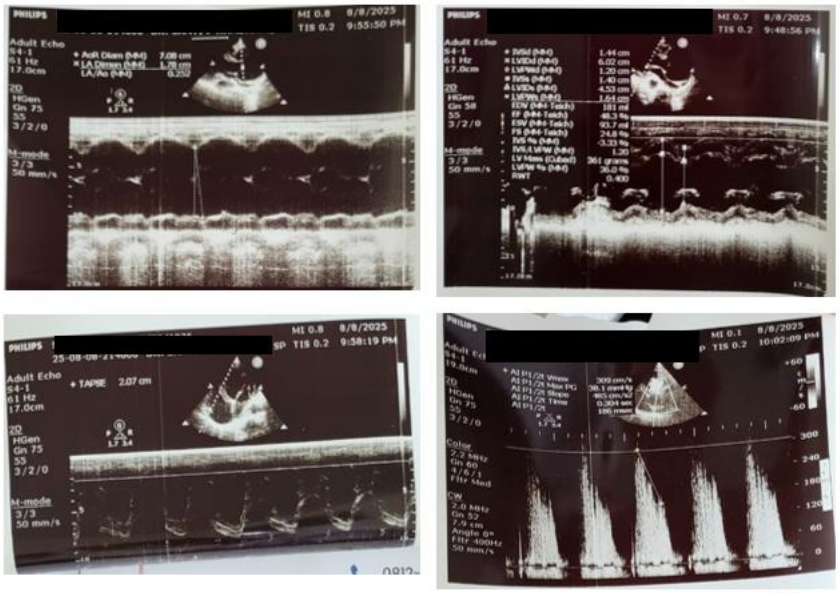

Figure 1. Echocardiography showed LV enlargement, EF Teich 48%, TAPSE 2.07 cm, grade I diastolic dysfunction, severe AR. aortic sinus valsalva diameter (inner to inner edge) 7.08 cm.

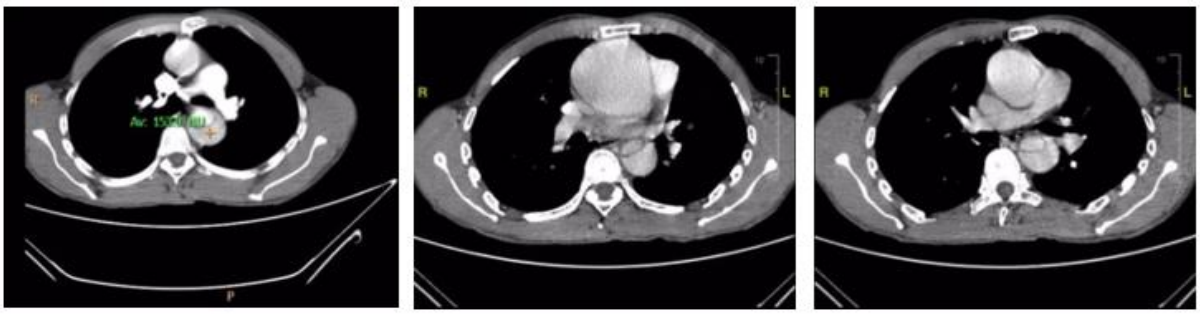

Figure 2. MSCT Angiography Thorax Axial View; Aortic dissection (ascenden-arcus-descenden), De-Bakey type I, Stanford A, entry tear arcus aorta, aortic aneurysm (+).

Discussion

Aortic root aneurysms are one of the most common aortic root diseases in clinical practice, involving the aortic valve, aortic sinus, bilateral coronary arteries, and part of the ascending aorta. It is a life threatening disease with a high mortality rate of over 80% due to aortic aneurysm rupture and dissection (Cho et al., 2023). The etiology of aortic root aneurysm is not completely understood yet and mainly related to hereditary thoracic aortic disease (HTAD) such as Marfan syndrome, congenital abnormality bicuspid aortic valve or sporadic cause such as hypertension (Du et al., 2024). According to ESC guideline 2024, aortic dilatation is defined as aortic diameter >2 standard deviations predicted based on the patient's age, gender, weight, and height (z-score >2). In clinical practice, aortic root dilatation can be suspected in adult male patients with an aortic root diameter >40 mm and in females with >36 mm. An aortic aneurysm is considered if the aortic diameter is >1.5 times (>50%) larger than the predicted size and using the z-score reference. However, many cases of aortic dilatation meet the criteria for operative indications before reaching the aneurysm diameter, so the use of the definition of aneurysm based on this size is rarely used, but rather the definition of significant aortic dilatation. If an aneurysm is found in a single location, the entire aorta must be examined (Mazzolai et al., 2024).

Untreated aortic aneurysms have a poor prognosis, with mortality rates increasing as the aorta grows larger. Several cohort studies have shown that the risk of complications increases dramatically after the aortic diameter reaches 5.5–6 cm, with an annual risk of approximately 20–23% per year (Isselbacher et al., 2022). Meanwhile, the morbidity rate of post-operative patients is influenced by the anatomical complications that arise, such as aortic valve regurgitation, heart failure, and aortic dissection (Zhu et al., 2021). Therefore, the management approach for aortic aneurysms depends on the etiology and complications of the patient. If condition is accompanied by complications or is caused by a genetic disorder such as marfan

syndrome, which is caused by mutations in the FBN1 gene, more rapid action is needed to reduce patient mortality. In this patient, the etiology of the aortic aneurysm is likely Marfan syndrome, which clinically meets several systemic criteria of the Ghent nosology criteria. However, it does not rule out the possibility that the aortic aneurysm could be idiopathic or due to other genetic disorders. However, it is certain that this patient does not have risk factors for hypertension, congenital bicuspid aortic valve abnormalities, or inflammatory diseases that cause the aortic aneurysm.

Cardiovascular complications are the most critical challenges in patients with Marfan syndrome, crucially influencing both prognosis and survival rates. Incidence of marfan syndrome is estimated around 1 per 5.000 individuals, with 26% of it lacks any familial history of marfan syndrome, means most of marfan syndrome relies on Ghent criteria to assess systematic involvement (Yanamadala et al., 2025). Usually, patients with Marfan syndrome are asymptomatic when the dilated aorta remains stable (Shen et al., 2020). These complications encompass a range of abnormalities, including dilatation of aortic root, aortic regurgitation, aortic dissection, and the occurrence of aortic aneurysm (Parwanto et al., 2020). In our patient, severe aortic regurgitation is observed.

The Revised Ghent Nosology Criteria 2010 help clinicians in diagnosing Marfan syndrome, particularly in Indonesia and other rural areas where genetic testing is rarely performed. These criteria are divided into two groups: patients with a known family history of Marfan syndrome and those with unknown or no family history. Two major criteria can directly diagnose Marfan syndrome which are the presence of an aortic aneurysm accompanied by sign of ectopia lentis, even if there is no family history of Marfan syndrome. In this patient, the family history of Marfan syndrome is unknown, while TTE examination revealed an aortic root aneurysm with a diameter of 7.08 cm (z-score 14.47). Based on these data, we should assess the score for other systemic organ involvement as shown in table 2 to confirm diagnosis of Marfan syndrome.

I - Revised Ghent criteria for the diagnosis of Marfan syndrome (MFS) and related conditions

(Loeys BL et al., J Med Genet 2010; 47:476-485 doi:10.1136/jmg.2009.072785)

In the absence of a family history:
(1) Ao ($Z \geq 2$) AND EL = MFS
(2) Ao ($Z \geq 2$) AND *FBN1* = MFS
(3) Ao ($Z \geq 2$) AND Syst (≥7 points) = MFS[a]
(4) EL AND *FBN1* with known Ao = MFS

EL with or without Syst AND with an *FBN1* not known with Ao or no *FBN1* = ELS
Ao ($Z < 2$) AND Syst (≥5) with at least one skeletal feature without EL = MASS
MVP AND Ao ($Z < 2$) AND Syst (>5) without EL = MVPS

In the presence of a family history:
(5) EL AND FH of MFS (as defined above) = MFS
(6) Syst (≥ 7 points) AND FH of MFS (as defined above) = MFS[a]
(7) Ao ($Z \geq 2$ above 20 years old, ≥ 3 below 20 years) + FH of MFS (as defined above) = MFS[a]

Figure 3. Revised Ghent Criteria 2010, (Loeys et al., 2010).

Systemic score

- Wrist AND thumb sign –3 (Wrist OR thumb sign –1)
- Pectus carinatum deformity –2 (pectus excavatum or chest asymmetry –1)
- Hindfoot deformity –2 (plain pes planus –1)
- Pneumothorax –2
- Dural ectasia –2
- Protrusio acetabuli –2
- Reduced US/LS AND increased arm/height AND no severe scoliosis –1
- Scoliosis or thoracolumbar kyphosis –1
- Reduced elbow extension –1
- Facial features (3/5) –1 (dolichocephaly, enophtalmos, downslanting palpebral fissures, malar hyoplasia, retrognathia)
- Skin striae –1
- Myopia > 3 diopters –1
- Mitral valve prolapse (all types) –1

Maximum total: 20 points; score ≥ 7 indicates systemic involvement

Ao, aortic diameter at the sinuses of Valsalva above indicated *Z*-score or aortic root dissection; EL, ectopia lentis; ELS, ectopia lentis syndrome; *FBN1*, fibrillin-1 mutation; *FBN1* not known with Ao, *FBN1* mutation that has not previously been associated with aortic root aneurysm/dissection; *FBN1* with known Ao, *FBN1* mutation that has been identified in an individual with aortic aneurysm; FH, family history; MASS, myopia, mitral valve prolapse, borderline ($Z < 2$) aortic root dilation, skeletal findings, striae; MFS, Marfan syndrome; MVPS, mitral valve prolapse syndrome; Syst, systemic score; US/LS, upper segment/lower segment ratio; *Z*, *Z*-score.
[a]Caveat: without discriminating features of Shprintzen-Goldberg syndrome (SGS), Loeys-Dietz syndrome (LDS) or vascular Ehlers-Danlos syndrome (vEDS) AND after *TGFBR1/2*, collagen biochemistry, *COL3A1* testing if indicated. Other conditions/genes will emerge with time.

Figure 4. Systemic score Ghent Criteria 2010, (Loeys et al., 2010).

Several systemic signs were found in this patient, including the wrist and thumb sign (3 scores), plain pes planus (1 score), increased arm/height (1 score), reduced elbow extension (1 score), and skin striae (Figure 1). This supports a systemic score of ≥7 which supports the diagnosis of Marfan syndrome. Patients with aortic root aneurysm and Marfan syndrome are at high risk for complications from aortic dissection, so a CT scan or MRI of the aorta and heart is necessary to assess for complications and confirm the aortic aneurysm. These modalities are also useful for evaluating stable patients at least every 3-5 years (Mazzolai et al., 2024). On Echocardiography examination, we also found complications severe aortic regurgitation, left

ventricular dilatation and LVEF of 48%. Despite the complication, for now this patient's vital sign is stable with conservative therapy such beta-blocker bisoprolol 5mg, angiotensin receptor blocker candesartan 8mg, loop diuretic furosemide 40mg, and MRA spironolactone 25mg.

As the patient was previously asymptomatic, this resulted in delayed diagnostic workup. Furthermore, in Indonesia, especially in remote areas, cardiovascular testing remains difficult. Our current challenge is to establish a rapid and accurate diagnosis based on clinical examination. For cases such as aortic aneurysm, screening is recommended, especially for patients with risk factors such as a history of smoking, hypertension, hypercholesterolemia, and a family history of hereditary genetic disorders. The clinical manifestations of patients with aortic aneurysm vary, and can include signs and symptoms of left ventricular enlargement due to aortic regurgitation, signs of heart failure, and even signs and symptoms of aortic dissection or rupture. According to the case report published by Rasti et al. stated that some patients with aortic dissection with clinical heart failure rarely experience specific chest pain symptoms, which often leads to misdiagnosis (Rasti et al., 2024). Screening using TTE may be performed in the peripheral region. If aortic dilation is detected, conservative management and referral for further imaging such as a cardiac CT scan or MRI should be considered to assess the overall aortic condition. In addition, routine follow-up TTE examinations should be performed at least every 6 months to 1 year to determine the rate of aortic dilation (Isselbacher et al., 2022). Especially in Marfan syndrome patients who have a faster growth rate than sporadic aneurysms (Henry et al., 2025). We expected a comprehensive examination can help suspect aortic aneurysm abnormalities in asymptomatic patients in remote areas.

Management for aortic aneurysm in marfan syndrome include multidisciplinary investigation and decision making towards further invasive intervention as needed, vital stabilization using ARBs and Beta-blocker, routine TTE follow-up, blood pressure target <120/80 mmHg, exercise limitations and medication to relief heart failure symptom such as diuretics. These expected to maintain patient's stability, prevent faster aortic diameter growth and other serious complication (Hegazy et al., 2024; Hofmann Bowman et al., 2022).

Most patients with aortic aneurysms tend to be asymptomatic, but even in asymptomatic patients, certain aortic diameters require surgical intervention to reduce the risk of aortic events. Surgical intervention such as aortic root and ascending aorta replacement is recommended for patients with aortic aneurysms with Marfan syndrome with an aortic diameter ≥5.0 cm. Intervention performed before aortic dissection has been shown to improve patient survival. In patients with sporadic aortic aneurysms, an operative approach is recommended for symptomatic patients and asymptomatic patients with an aortic diameter ≥5.5 cm (Isselbacher

et al., 2022). Several operative techniques can be implicate depending on the condition of the patient's aortic valve, such as the David's procedure (reimplantation), the Yacoub technique (remodeling), or the Bentall procedure (composite replacement of aortic root and valve) (Mazzolai et al., 2024). Pre-operative evaluation to routine post-operative evaluation must be monitored with TTE to assess the possibility of complications and the function of the aortic valve. In this patient, the Bentall procedure approach is more advantageous because the condition of severe aortic valve regurgitation is a consideration. Bentall procedure has become a low-risk and durable operation with 5- and 10-year survival rates of 84% and 75%, respectively (Shen et al., 2020). However, if complications such as aortic dissection occur, the team should discuss which the management approach suite the best either surgery, endovascular, or a conservative approach, considering the mortality risk between operative, minimally invasive, and conservative management. Abolla and Saputra reported a patient with chronic type A dissection accompanied by an aortic root aneurysm and Marfan syndrome was chosen to undergo a conservative approach with adequate medical therapy compared to endovascular or operative intervention because the patient's condition did not support such invasive procedures (Abolla & Saputra, 2023). Operative procedures that can be considered include TEVAR (thoracic endovascular aortic repair), open surgery, or a combination of the Endo-Bentall procedure, but there is still not much literature discussing the effectiveness of these procedure. (Ghoreishi et al., 2023; Pandhika et al., 2019).

4. CONCLUSION

This case is quite rare and difficult to identify, especially in areas with limited cardiac examination modalities, as patients are often unstable and difficult to perform a proper examination. This case illustrates the importance of screening and early diagnosis of Marfan syndrome in patients with clinical heart failure and aortic aneurysm. Initial conservative therapy, such as beta-blockers or ARBs, can reduce the risk of rupture and rapid aortic dilation. Diagnosis and patient management must be comprehensive, rapid, and precise. Given these limitations, cardiologists are required to suspect every aortic dilation as an aortic aneurysm requiring immediate intervention, thereby avoiding delays in patient referral for further examination and treatment. Survival rates will also increase in patients with minimal complications who have undergone surgery.

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