Case Based Review

Anti-Aging Eastern Europe

CARDIAC STENTING IN DEXTROCARDIA- AN APPROACH TO A RARE HEART ANOMALY: A CASE-BASED REVIEW

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Abstract
Dextrocardia with situs inversus, often called mirror dextrocardia, is an uncommon congenital heart defect where the heart's apex points to the right side.
The success of percutaneous coronary intervention (PCI) may contribute to its impact on individual anatomical features. Rare congenital anomalies, such as dextrocardia, create difficulties when performing interventional procedures.
We report the case of a 67-year-old man with dextrocardia who was diagnosed with coronary artery disease (CAD), grade III angina pectoris, double-vascular coronary artery disease, NYHA functional class III heart failure (HF), who was successfully treated with primary percutaneous stent implantation.
Successful cardiac stenting in dextrocardia demonstrates the possibilities of modern cardiac surgery and interventional cardiology in treating rare abnormalities. This clinical case highlights the importance of an individual approach and careful planning to achieve optimal results in treating complex patients.

Key words: congenital heart disease, dextrocardia, situs inversus, coronary heart disease, PCI, case report.

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Key Messages for Research and Practice

- Thorough evaluation, precise diagnosis, and the utilization of advanced technology are essential for achieving a successful result in dextrocardia
- Collaborative planning and cooperation among medical professionals significantly increase the chances of achieving a positive result
- This clinical case underscores the significance of a personalized approach and meticulous planning to attain the best outcomes when treating complicated patients

Introduction

Dextrocardia with situs inversus, often called mirror dextrocardia, is an uncommon congenital heart defect where the heart's apex points to the right side. Dextrocardia with organ transposition is scarce, occurring in about 0.01% of cases [1,2].

Hieronymus Fabricius provided the earliest account of situs inversus in 1606, and in 1643, Marco Aurelio Severino, an Italian surgeon and anatomist, detailed the condition known as dextrocardia [3]. The first presentation of individuals with dextrocardia can pose difficulties for clinicians who are not prepared. The lack of heart sounds during auscultation may indicate a likely diagnosis of dextrocardia to the clinician. Chest and abdominal X-rays and CT scans can verify the existence of dextrocardia and consider situs classification [4].

The initial cardiac catheterization for patients with dextrocardia was documented in 1973, followed by, after 7 years, the first coronary artery bypass surgery. The first percutaneous intervention for dextrocardia took place in 1987. Since then, several reports have been made regarding percutaneous treatment for coronary stenoses in patients with dextrocardia [5,6,7]. Percutaneous coronary intervention on patients with dextrocardia introduces multiple difficulties for the interventional cardiologist. These challenges involve choosing suitable diagnostic and interventional catheters, obtaining modified interventional views, and, in certain instances, viewing mirror images through image reversal software [8].

Individuals with dextrocardia typically have a life expectancy comparable to that of the general population, except when accompanied by other structural heart conditions. It is believed that the occurrence of atherosclerotic CAD in these individuals is similar to that of the overall population [9,10].

The success of PCI may contribute to its impact on individual anatomical features. Rare congenital anomalies, such as dextrocardia, create difficulties when performing interventional procedures.

Dextrocardia is one of the rare congenital anomalies with a frequency of occurrence of 1 in 5-30 thousand, mainly due to the adoption of the heart position closer to the right side of the chest [11].

This anatomy complicates the catheter's insertion and further manipulations. It also makes it difficult to inform and prevents the accumulation of clinical experience to develop treatment protocols [12].

Dextrocardia contributes to the complications of the diagnostic and intervention processes due to the heart's reverse anatomical location. To avoid misclassification, an accurate echocardiography assessment is necessary since the right-sided axis of the heart shows real dextrocardia. In contrast, other right-sided heart positions indicate mechanical displacement and not genuine dextrocardia.

Other additional malformations are often observed in patients with dextrocardia, which complicate the clinical picture. Although early diagnosis can reduce the risk of serious concomitant diseases, systematic examination, assessment of atrioventricular relationships, and planning appropriate interventions play an important role in identifying structural abnormalities [13].

Only 10% of patients with dextrocardia have no significant cardiac issues, while nearly 100% have congenital heart defects. Key diagnostic tools for confirming dextrocardia include palpation, percussion, X-ray, CT, echocardiography, and MRI [14].

Acute myocardial infarction in individuals with dextrocardia can pose various difficulties in both electrocardiographic assessment and coronary interventions, owing to the atypical positioning of the heart, mirrored arrangements of the aorta and its branches, as well as unusual coronary origins and orientations. Furthermore, the role of dextrocardia as a risk factor for coronary artery disease is not as thoroughly recognized [15].

This case-based review discusses a patient diagnosed with coronary artery disease who has dextrocardia and was successfully treated through percutaneous stent implantation. We will also outline additional cases of stenting involving the rare condition of dextrocardia with primary percutaneous stent placement, providing a comprehensive understanding of this unique condition.

Case Description

67 years old man was admitted to the Shymkent Heart Center on a planned basis with a diagnosis of coronary artery disease (CHD), class III angina pectoris (CCS), double-vascular coronary lesion, heart failure (HF) of functional class III according to NYHA.

Upon admission, he complained of pressing discomfort behind the sternum in the right half of his chest, which occurs with moderate physical exertion. It is accompanied by shortness of breath and a lack of air. It lasts 5-10 minutes with irradiation into the right scapular region; symptoms are relieved independently at rest.

It is known from the anamnesis that he notes the appearance of pressing pains behind the sternum during physical exertion throughout the year. He was treated by a cardiologist at his place of residence. In the last 2 months, there has been a progression of angina pectoris and a decrease in exercise tolerance. In November 2023, coronary angiography was performed on an outpatient basis, where a two-vessel lesion of the coronary bed was revealed.

According to the patient, dextrocardia was detected at an early age during a chest X-ray. There were no cases of congenital anomalies among close relatives.

Upon objective examination, the condition is satisfactory. There are no visual changes in the heart area. The apical shock is localized in the V intercostal space 1 cm inside the right mid-clavicular line. The boundaries of the heart are not expanded. The heart rate is correct, with a heart rate of 84 per minute. Blood pressure on the right is 125/80 mmHg, and blood pressure on the left is 120/80 mmHg.

Exams

Coagulogram. INR (International Normalized Ratio) 1.12, Prothrombin time (PT) 12.5 sec., Prothrombin index 89.29 %, Fibrinogen 6.20 g/l.

Blood electrolytes. Calcium (total) 2.33 mmol/L, Sodium 148.6 mmol/L, Potassium 4.6 mmol/l.

Biochemical blood analysis. Glucose 5.9 mmol/l, Urea 5.16 mmol/l, Creatinine 85.30 mmol/l, GFR according to the CKD-EPI formula 81 ml/min/1.73 m2, Creatinine clearance according to the Cockcroft-Gault formula 83 ml/min, ALT 23.50 Units/l, AST 22.90 Units/l, Bilirubin (total) 10.30 mmol/l, C-reactive protein 21.80 mg/l, Cholesterol 3.62 mmol/l, HDL cholesterol 0.80 mmol/l, Atherogenicity coefficient 3.5, LDL cholesterol 2.14 mmol/l, Triglycerides 1.14 mmol/l.

Complete blood count (CBC). Hemoglobin (Hb) 122 g/l, Red blood cells 4.17 = 10-12/l, Color indicator 0.88, Hematocrit 38.9 %, Average red blood cell volume 93.3 fl, Average content of Hb in the erythrocyte 29.3 pg, Average concentration of Hb in erythrocyte 314 g/l, Red blood cell volume distribution 13.2%, Platelets 235 × 10^9/l, Platelets 0.250 %, Average platelet volume 10.5 fl, White blood cells 7.48 × 10^9/l, Neutrophils 49.2% (abs. quantity: 3.68 × 10^9/l), Eosinophils 2.7% (abs. quantity 0.20 × 10^9/L), Basophils 0.80% (abs. quantity: 0.06 × 10^9/l), Monocytes 8.8% (abs. quantity 0.66 × 10^9/l), Lymphocytes 38.5% (abs. quantity 2.88 × 10^9/l), ESR (according to Panchenkov) 34 mm/hour, ESR (according to Westergren) 41 mm/hour.

Blood type and Rh factor. Blood type: B (III), Rh factor positive, Markers of viral hepatitis B and C negative.

Electrocardiogram (ECG). Rhythm- sinus, heart rate 68 beats/min, Electrical axis of the heart-deflected to the left, Pathological changes- Q wave in leads I, aVL, V1-V5, Incomplete right bundle branch block (RBBB) (fig.1).

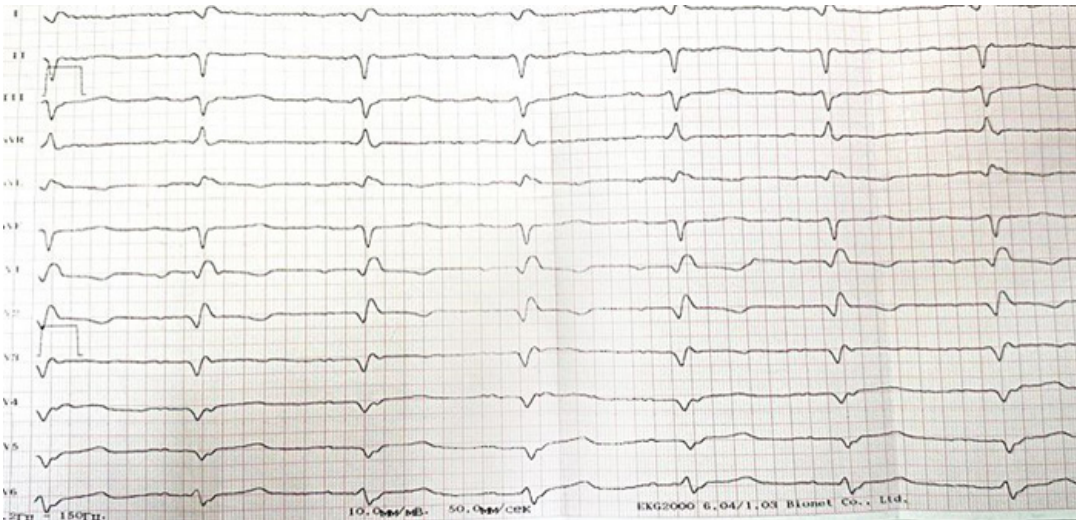

Figure 1. Electrocardiogram of the patient with dextrocardia

Echocardiography. Dextrocardia. Right-sided, right-formed heart. Sealing of the root and ascending aorta. Grade I mitral regurgitation, grade III tricuspid regurgitation. Dilation of the left atrium and left ventricle- hypokinesis of the left ventricle's middle, apical anterior and anteroposterior segments. The ejection fraction is 43%. Grade I diastolic dysfunction of the left ventricle. The pericardium is without features.

Chest X-ray. Radiological signs of fibrous changes in the lower lobe of the lung on both sides, chronic bronchitis. The internal organs of the chest are arranged in a mirror arrangement (fig. 2). Chest X-ray. Radiological signs of fibrous changes in the lower lobe of the lung on both sides, chronic bronchitis. The internal organs of the chest are arranged in a mirror arrangement (fig. 2).

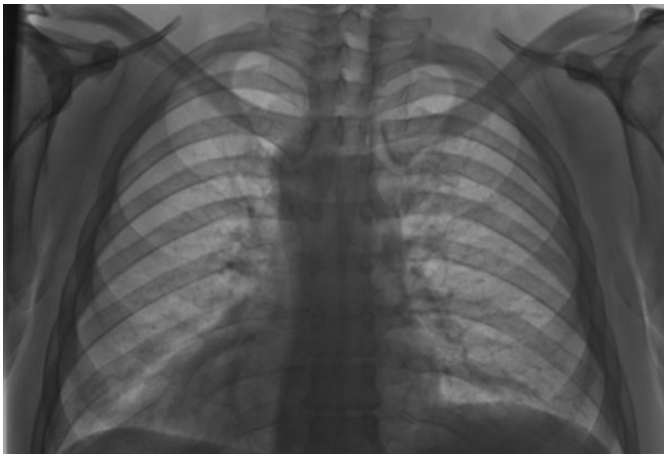

Figure 2. X-ray of the patient with dextrocardia

Fiberoptic gastroduodenoscopy (FGDS). Catarrhal esophagitis. Superficial gastritis. Scarring of the duodenal bulb. Bulbit.

Coronary Artery Angiography (CAG). The type of coronary blood flow is right. LAD: chronic dissection from the mouth to the middle third with 80% stenosis in the proximal third, satisfactory blood flow (TIMI III) (fig. A1). No obstructive lesions, adequate blood flow (Thrombolysis in Myocardial Infarction III (TIMI III)). Right coronary artery (RCA): stenosis in the distal third is 95%, and blood flow is satisfactory (Thrombolysis in Myocardial Infarction III (TIMI III)) (fig. B2).

The patient was treated with beta-blockers (5 mg/day), antiplatelet agents (100 mg/day), anticoagulants (75 mg/day), potassium-sparing diuretics (50 mg/day), ACE inhibitors (4 mg/day), type 2 sodium-dependent glucose transporter inhibitors (10 mg/day), statins (40 mg/day).

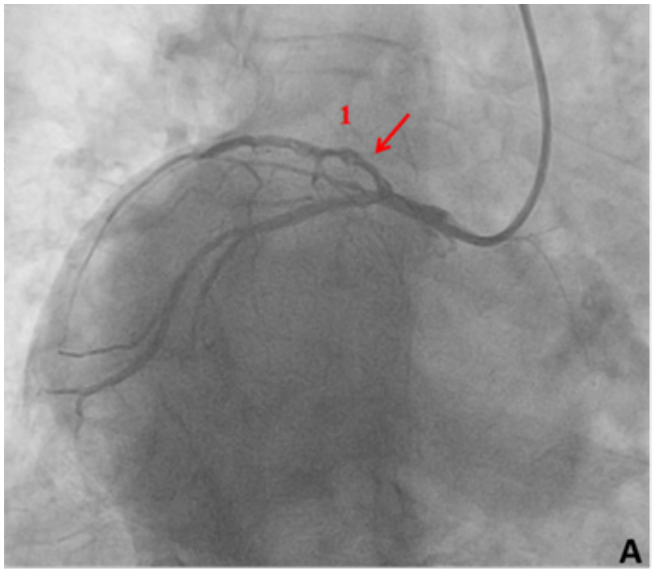

Figure A1. Coronary Artery Angiography (CAG). Without obstructive lesions, blood flow is satisfactory (Thrombolysis in Myocardial Infarction III (TIMI III))

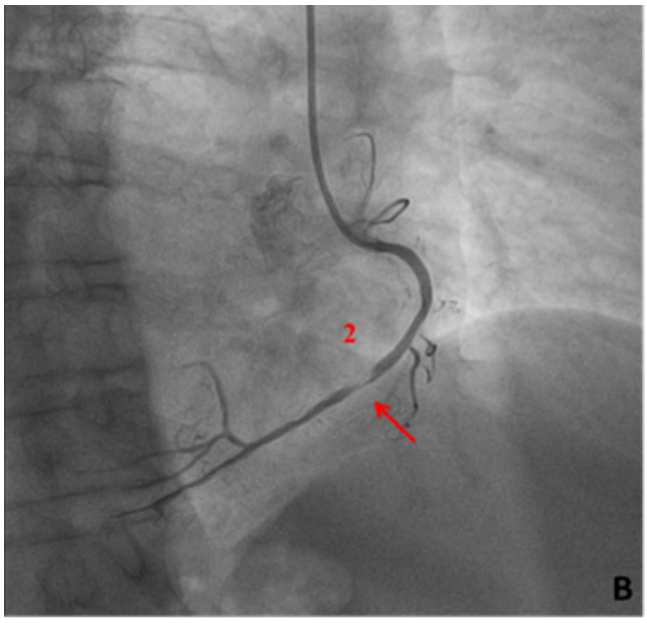

Figure B2. Coronary Artery Angiography (CAG). RCA: stenosis in the distal third is 95%, and blood flow is satisfactory (Thrombolysis in Myocardial Infarction III (TIMI III)).

The protocol of the surgery (dated 02.28.2024).

After three times treatments of the surgical field with iodine-povidone and under local anaesthesia with Lidocaine 1% solution (1.5 ml), the anterior-inferior artery (AIA) was punctured and catheterized according to Seldinger, and a Balton 6F introducer was installed. The obtained images revealed chronic dissection from the mouth of the anterior descending artery (ADA) to the middle third with stenosis up to 80%, stenosis in the distal third of the right coronary artery (RCA) 95%, TIMI – III. It was decided that percutaneous intervention (PCI) AIA and RCA should be performed.

Cannulation of the trunk of the left coronary artery (LCA) with the Climber AL 1 6F guide catheter was not stable, so it was replaced with Launcher EBU 3.0 6F. The Asahi Sion coronary conductor was inserted into the distal third of the common coronary artery (CCA), and the second Asahi Fielder XT-A conductor was inserted into the distal third of the ADA. An angioplasty of the ADA was performed with a Pantera Pro 2.0×25 mm balloon at a pressure of 12 atm, and an Abluminus DES+ 3.0×36 mm stent was implanted at 12 atm (fig. A3). The stent was post-dilated with a Mozes NC 3.0=18 mm balloon at a pressure of 18 atm.

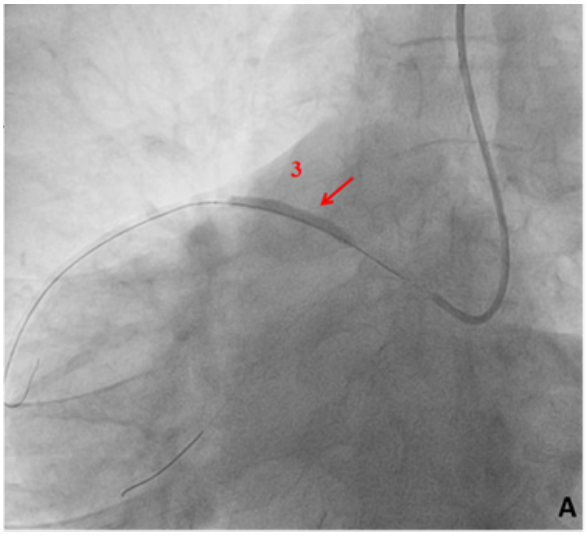

Figure A3. Angioplasty of the anterior descending artery with a Pantera Pro 2.0×25 mm balloon at a pressure of 12 atm and an Abluminus DES+ 3.0×36 mm stent implanted at a pressure of 12 atm.

Cannulation of Hyde's RCA with a Launcher catheter of 3.5 6A. The Asahi Sion blue coronary conduit is inserted into the distal third of the RCA. RCA angioplasty was performed with a Pantera Pro 2.0×15 mm balloon at a pressure of 10 atm, and an Abluminus DES+ 3.0×36 mm stent was implanted at 12 atm (fig. B4). The stent was post-dilated with a Mozes NC 3.0=18 mm balloon at a pressure of 16 atm.

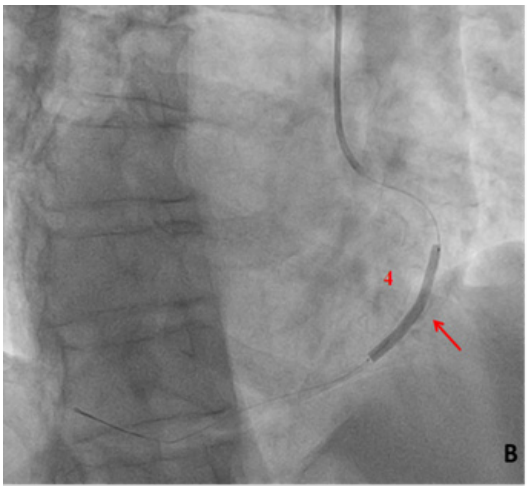

Figure B4. Angioplasty of the right coronary artery with a Pantera Pro 2.0×15 mm balloon at a pressure of 10 atm and an Abluminus DES+ 3.0×36 mm stent implanted at a pressure of 12 atm.

On the control coronary angiography, residual stenosis and dissection are not determined, and blood flow in the anterior inferior artery and the RCA is TIMI-III (fig. A5, B6). The angiographic result of the intervention is reasonable. There are no complications. Contrast consumption is 150.0.

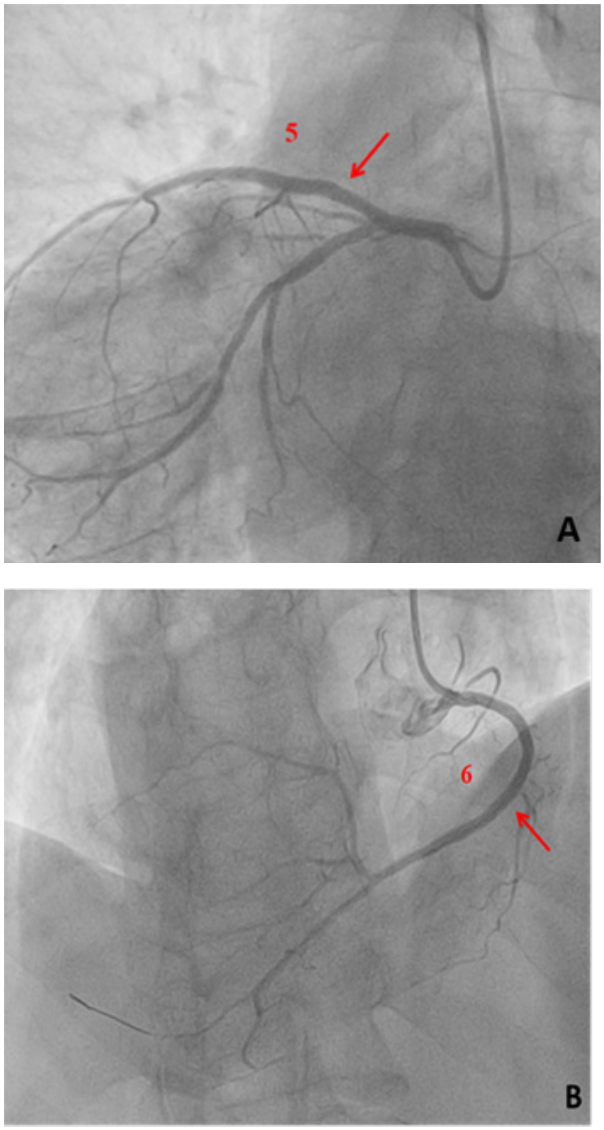

Figure A5-B6. Residual stenosis and dissections are not detected, and blood flow in the anterior descending artery and the right coronary artery TIMI-III.

Search strategy and case selection

Articles describing cases of dextrocardia were searched through Medline/ PubMed, Scopus, and the Directory of Open Access Journals (DOAJ). The following keywords were used: Congenital heart disease, dextrocardia, situs inversus, coronary heart disease, and PCI. Only articles in English were analyzed. Patients over the age of 18 were included in the study. Cases without a complete clinical description were excluded.

The manuscript was written following CAse-BAsed REview sTandards (CABARET) [16].

Discussion

Cardiac stenting in dextrocardia is a complex and rare procedure that requires highly qualified medical personnel and careful planning. In the presented clinical case, a stenting procedure was successfully performed, which confirms the possibility of effective treatment of patients with this heart anomaly.

To achieve outstanding clinical results, healthcare providers should understand the underlying causes of a patient's dextrocardia and utilize perioperative imaging techniques like X-ray examination, CT scan, MRI, and echocardiography to verify the diagnosis and categorize its specific type [4].

In this case-based review, we described a case of cardiac stenting in dextrocardia using instrumental diagnostic methods such as electrocardiography, echocardiography, chest X-ray, and coronary angiography. Mirror images are necessary to produce left-sided views from the right while keeping cranial and caudal angles unchanged. Researchers in China used equivalent right-sided views to create standard left-sided images, with cameras in the left anterior oblique (LAO) cranial stance generating a mirror image of the right anterior oblique (RAO) cranial view [17,18].

In addition to standard general guidelines, specific technical considerations should be considered during percutaneous coronary angioplasty for these patients, such as catheter manipulation in the opposite direction. Furthermore, regarding coronary imaging, it is typically necessary to obtain mirror images, meaning that equivalent views from the right side are required to generate the standard left-sided images and vice versa while maintaining the same cranial or caudal angles [19].

Conducting coronary angiography and PCI in individuals with dextrocardia presents various technical complications. Specific modifications are required, such as utilizing mirror-image angiographic angles, selecting the right catheter, and manoeuvring the catheter for precise access to the coronary arteries [20].

The literature describes several cases of percutaneous interventions in patients with congenital malformations such as dextrocardia.

Elbasheer et al. reported on a male patient who experienced an acute inferior myocardial infarction along with tricavascular coronary artery disease and who was successfully managed with emergency primary angioplasty followed by elective multivessel stenting. This case represents the first instance of combined primary and subsequent multivessel stenting in a patient with dextrocardia and situs inversus [21].

Vijayvergiya et al. described a case involving a 48-year-old pre-menopausal woman with hypertension who had dextrocardia and experienced an acute myocardial infarction. This condition was effectively managed with emergency coronary angioplasty and stenting of a blocked proximal right coronary artery (RCA) [20].

A man of the same age underwent percutaneous coronary intervention using trans-radial access, which was successfully performed despite dextrocardia and transposition of internal organs, even without changing the angiographic image on the monitor. Angiography and angioplasty were performed through access to the right radial artery without turning over the image on the screen. The patient tolerated the procedure well, and his hospital stay passed without complications [22].

Chinese researchers described a case of a 56-year-old man with coronary artery disease who also presented with dextrocardia. He underwent a percutaneous coronary intervention to treat stenosis in the right coronary artery, where a drug-coated stent was successfully inserted. This case demonstrated that the interventional treatment of patients with dextrocardia adheres to the same general guidelines as those without dextrocardia. However, certain technical aspects, such as the mirrored orientation, different catheter manipulations, and selection of projection angles, need to be taken into account to achieve the best possible outcomes for the patient [18].

According to a report by Robinson et al., stenting has been effectively utilized to address coronary stenosis in individuals with dextrocardia. Due to the patient's unstable condition and ongoing chest pain, he underwent angioplasty and stenting the following day. The Judkins 5 left guide catheter was utilized to catheterize the left coronary system on the right side. The critical area was visualized using an oblique view from the right and a caudal view from the left. The stenting procedure proceeded smoothly without complications by employing Judkins catheters, standard image acquisition techniques, and counter-rotation of the catheters [23].

This case-based review has described several cases of percutaneous intervention in patients with dextrocardia. However, due to the rarity of this condition, there is insufficient published literature in publicly available databases.

In general, the approach to interventional management for patients with dextrocardia is similar to that for those without it; however, certain technical aspects, including the mirrored anatomy, unique catheter manipulation, and specific choices for projection positioning, must be considered to ensure the best outcomes for the patient.

Although our case report is limited because it includes only one patient, it still demonstrates that each member of the medical team is responsible for patient safety. Our case also demonstrates how important careful preparation was to ensure a successful surgical outcome.

Conclusion

Comprehensive examination and accurate diagnosis, including the use of modern equipment, are key factors for a successful outcome. Pre-planning and interdisciplinary collaboration of medical specialists significantly increase the chances of success. Stenting in dextrocardia requires special attention to the patient's anatomical features. Using specialized tools and techniques adapted to rare anatomy minimizes risks and complications. Postoperative management of patients with dextrocardia requires enhanced monitoring for timely detection and correction of possible complications. Considering the unique aspects of the postoperative period in such patients is essential.

In conclusion, successful cardiac stenting in dextrocardia demonstrates the possibilities of modern cardiac surgery and interventional cardiology in treating rare abnormalities. This clinical case highlights the importance of an individual approach and careful planning to achieve optimal results in treating complex patients.

INFORMED CONSENT

Informed consent was obtained in writing from the patient to publish this case report and any associated images.

AUTHOR CONTRIBUTION

Study design and conceptualization: A. Auanassova, D. Suigenbayev.
Data acquisition and review of the literature: I. Kerimkulov, Z. Orazaly.
Making interpretations: I. Kerimkulov, G. Assanova.
Drafting the manuscript: A. Auanassova, D. Suigenbayev.
Critically reviewing the manuscript: All authors.
Final approval: All authors.

All authors fulfilled the authorship requirements set by the International Committee of Medical Journal Editors (ICMJE) and take full responsibility for the integrity of all aspects of the work.

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CONFLICT OF INTEREST

All authors declare that there is no potential conflict of interest that requires disclosure in this article.

REFERENCES

1.Rosenberg HN, Rosenberg IN. Simultaneous association of situs inversus, coronary heart disease and hiatus hernia; report of a case and review of literature. Ann Intern Med. 1949;30(4):851-9

2.Bohun CM, Potts JE, Casey BM, Sandor GG. A population-based study of cardiac malformations and outcomes associated with dextrocardia. Am J Cardiol. 2007;100(2):305-9

3.Cleveland M. Situs inversus viscerum: an anatomic study. Arch Surg. 1926;13(3):343-368

4.Fox CJ 3rd, Keflemariam Y, Cornett EM, Urman RD, Rapoport Y, Shah B, Mancini MC, Kaye AD. Structural Heart Issues in Dextrocardia: Situs Type Matters. Ochsner J. 2021; 21(1):111-114

5.Ettinger PO, Brancato R, Penn D. Dextrocardia, anteroseptal infarction, and fascicular block. Chest. 1975; 68(2):229-30

6.Irvin RG, Ballenger JF. Coronary artery bypass surgery in a patient with situs inversus. Chest. 1982;81(3): 380-1

7.Moreyra AE, Saviano GJ, Kostis JB. Percutaneous transluminal coronary angioplasty in situs inversus. Cathet Cardiovasc Diagn. 1987; 13(2):114-6

8.Tushar Raina, Ever D Grech, David Cumberland Percutaneous coronary intervention in dextrocardia Br J Cardiol. 2008; 15:111–2

9.Vijayvergiya R, Gawalkar AA, Kasinadhuni G, Kaushal S, Batta A, Kumar B. Percutaneous coronary intervention in dextrocardia patients with situs inversus. AsiaIntervention. 2022; 8(2):132-135

10.Toselli M, Solinas E, Vignali L. Percutaneous coronary intervention in dextrocardia: a case report and a brief review of the literature. J Cardiovasc Med (Hagerstown). 2020; 21(8):613-615

11.Nair R, Muthukuru SR. Dextrocardia. 2022; In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024

12.Ziguras, Christopher & McBurnie, Grant. Governing Cross-Border Higher Education. 1st edition. 2015

13.Evans WN, Acherman RJ, Collazos JC, Castillo WJ, Rollins RC, Kip KT, Restrepo H. Dextrocardia: practical clinical points and comments on terminology. Pediatr Cardiol. 2010; 31(1):1-6

14.Rapoport Y, Fox CJ, Khade P, Fox ME, Urman RD, Kaye AD. Perioperative implications and management of dextrocardia. J Anesth. 2015; 29(5):769-85

15.Rathore A, Gowda Somashekar CM, Sadananda KS, Manjunath CN. Acute myocardial infarction in dextrocardia - A diagnostic and therapeutic challenge. Can dextrocardia be a risk factor? J Cardiol Cases. 2017; 17(2):48-51

16.Benlidayi IC, Gupta L. CAse-BAsed REview sTandards (CABARET): Considerations for Authors, Reviewers, and Editors. J Korean Med Sci. 2024;39(30):e225

17.Yabe Y, Tsukahara R. Percutaneous transluminal coronary angioplasty for culprit lesions in patients with post myocardial infarction angina based on dextrocardia and anomalous coronary arteries. Case reports and methods. Angiology. 1995; 46(5):431-40

18.Long W, He Z, Wang X, Wu H, Chen Y, Yang Z. Successful Drug-eluting Stent Implantation in a Male Patient with Dextrocardia: A Case Report. Open Med (Wars). 2017; 12:481-484

19.Macdonald JE, Gardiner R, Chauhan A. Coronary angioplasty via the radial approach in an individual with dextrocardia. Int J Cardiol. 2008;131(1):e10-1

20.Vijayvergiya R, Grover A. Percutaneous coronary intervention for acute myocardial infarction in a patient with dextrocardia. World J Cardiol. 2010;2(4):104-6

21.Elbasheer E, Habib A, Salam A. Primary angioplasty and later elective multivessel stenting in a patient with dextrocardia: a case report and literature review. J Invasive Cardiol. 2010;22(7): E125-8

22.Sinha RP, Agarwal D, Sarang AM, Thakkar AS. Successful transradial percutaneous coronary intervention in a patient with dextrocardia and situs inversus. J Clin Diagn Res. 2015; 9(1):OD04-6

23.Robinson N, Golledge P, Timmis A. Coronary stent deployment in situs inversus. Heart. 2001; 86(5):E15