

Myocardial bridging in the era of a drug epidemic: a case report addressing the need to revisit donor organ assessment

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Background

Myocardial bridging (MB), though typically a benign finding, may occasionally lead to syncope, myocardial infarction, arrhythmia, or sudden death. Surgical denervation of transplanted hearts complicates the management of such incidentally detected post-transplant coronary anomalies due to the lack of classic ischaemic symptoms.

Case summary

A middle-aged female underwent an uncomplicated cardiac transplantation from a healthy male donor in his early 20s who had suffered a cardiac arrest while using cocaine. Given the young donor age, a pre-transplant coronary angiogram (CAG) was deferred. However, 6-week post-transplant, routine CAG, and intravascular ultrasound revealed an extensive MB spanning a significant portion of the left anterior descending coronary artery with substantial myocardium at risk. A stress test with myocardial perfusion imaging performed to evaluate the functional significance of the bridge did not reveal any perfusion abnormalities in the myocardium at risk.

Discussion

In current practice, younger donors often do not undergo pre-transplantation CAG routinely performed in older donors given the lower prevalence of significant coronary disease. However, post-operatively this young donor was found to have passed on a potentially life-threatening MB to a denervated recipient, who cannot manifest typical anginal symptoms during ischaemia, thereby challenging providers to choose among strategies of watchful waiting, risk stratification, or pre-emptive intervention. In retrospect, the donor's mode of death may have signalled an underlying structural abnormality that warranted further pre-transplant characterization. In order to ensure optimal quality of transplanted hearts, young donors may warrant pre-transplant CAG despite their age, particularly those with a history of drug use or suspicious mode of death.

Keywords

Case report • Cardiac transplant • Donor screening • Myocardial bridging • Drug overdose • Transplant guidelines • Outcomes

Learning points

- Pre-transplant cardiac evaluation is warranted for young and lower-risk donors with unexpected sudden cardiac death.
- The clinical presentation of myocardial bridging, a congenital anomaly, varies from lack of symptoms to sudden cardiac death. It may pose concern in a denervated cardiac transplant recipient due to the recipient's inability to manifest ischaemic symptoms that might otherwise appear in an innervated patient and raise concern.
- An increase in the incidence of drug overdose as the cause of death among cardiac donors necessitates a more extensive pre-transplant cardiac evaluation.

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Introduction

Pre-operative evaluation of donor hearts is a vital step in ensuring the highest quality of allografts to minimize the morbidity and mortality of transplant recipients. In donors with cardiac disease manifesting as abnormal electrocardiogram (EKG), transthoracic echocardiogram (TTE), or invasive haemodynamics when available, guidelines for pre-transplant evaluation are clear.¹ However, traditional recommendations fall short in other scenarios, such as screening of donors under the age of 50 years or those with a history of drug abuse. As a result, this creates the potential for undetected transmission of clinically silent structural anomalies that may ultimately harm the transplant recipient. Herein, we present a case of a young donor, who suffered a cardiac arrest likely due to cocaine-induced vasospasm. Subsequent post-transplant testing revealed a large myocardial bridge spanning the mid-left anterior descending coronary artery (LAD), which may in hindsight have been implicated in his death. Myocardial bridging (MB) is a congenital structural anomaly wherein a band of myocardium overlies and compresses a coronary artery during systole.² Prevalent in as many as 23–26% of patients at autopsy,³ MB compresses coronary arteries during ventricular contraction, leading to downstream tissue injury as well as accelerated atherosclerosis from altered shear stress in adjacent vessel segments.² The case that follows highlights some challenges that may arise when suboptimal cardiac evaluation is performed for young donors, particularly those who experience unexplained or suspicious cardiac deaths.

Timeline

Initial presentation: A middle-aged woman with a longstanding history of non-ischaemic cardiomyopathy, presented to the hospital in cardiogenic shock after several months of progressive dyspnoea. She was stabilized with an intra-aortic balloon pump and listed for heart transplantation. Due to the long-anticipated waitlist time, she received a left ventricular assist device as a bridge to transplant.

Eight months after presentation: Patient underwent uncomplicated orthotopic heart transplant from a healthy male donor in his early 20s.

Six weeks after transplant: Routine right and left heart catheterizations with endomyocardial biopsy were performed. A significant myocardial bridge spanning the mid-portion of the left anterior descending coronary artery with near-complete systolic obliteration was discovered on coronary angiogram and confirmed by intravascular ultrasound.

Ten weeks after transplant: Treadmill-based exercise SPECT nuclear stress testing revealed no evidence of perfusion abnormalities in the anterior wall.

Six months after transplant: Patient remained symptom-free and enrolled in a cardiac rehabilitation program.

Case presentation

A middle-aged woman with a history of non-ischaemic cardiomyopathy, presumed secondary to viral myocarditis, presented to the hospital with several months of progressive dyspnoea on exertion. On arrival, physical exam findings of cold and wet profile as well as laboratory abnormalities were consistent with cardiogenic shock, necessitating an intra-aortic balloon pump. An LVAD was implanted as a bridge to cardiac transplant given her relatively unfavourable blood group and long-anticipated wait time for transplantation. Eight months later, she underwent uncomplicated orthotopic heart transplantation from a healthy male donor with no significant past medical history in his early 20s. Of note, the donor had suffered a sudden cardiac arrest in the setting of cocaine use. Given the donor's young age and lack of echocardiographic abnormalities, no angiographic evaluation was performed. The post-operative course was uncomplicated, and the patient was discharged home.

Routine coronary angiogram (CAG) and intravascular ultrasound (IVUS) (Figures 1 and 2) performed 6 weeks after transplant revealed a large myocardial bridge with near systolic occlusion spanning the length of the mid-LAD segment. Given concern for the bridge's clinical significance coupled with the inability to rely on traditional anginal symptoms due to surgical denervation of the transplanted heart, the patient was advised to undergo treadmill-based exercise SPECT nuclear stress testing, which showed no perfusion abnormalities at peak exercise. In addition, her heart rate, blood pressure, and EKG responses to exercise were normal without evidence of ST-segment changes or arrhythmia. As a result of the reassuring testing, the patient was enrolled in cardiac rehabilitation and is clinically progressing as expected. No further testing is planned beyond routine angiography to monitor for allograft vasculopathy.

Discussion

Myocardial bridging is a congenital anatomic variant wherein part of the myocardium overlies and inadvertently compresses a coronary artery during myocardial contraction. Its clinical presentation can vary from incidental finding to clinically significant systolic compression resulting in angina, myocardial ischaemia, arrhythmia, or sudden cardiac death.² The incidence of MB has been reported with considerable variation, ranging from 0.5% to 16% on angiography⁴ to 23% to 26% on autopsy.³ Among cardiac transplant patients, its incidence is thought to be higher than previously reported in the literature, likely due to increased myocardial stiffness and ventricular hypertrophy in the transplanted heart.⁵ Due to uncertainty regarding the true incidence and clinical significance of such lesions among transplant patients, there are no guidelines to direct screening and management of MB in this patient population.

At a time of ever-rising transplant demands and stagnating donor organ availability, optimal donor selection and screening assume paramount importance. Criteria for donor selection follow institutional standards to meet national mortality and graft survival outcomes.¹ Traditional cardiac donor assessment criteria include age, cardiac history and haemodynamics, EKG, TTE, and CAG when appropriate. The need for CAG is determined by donor age and

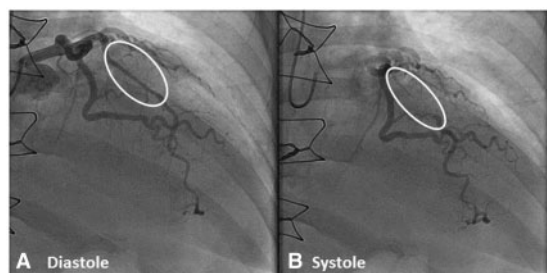


Figure 1 Coronary angiogram imaging illustrating mid-left anterior descending coronary artery myocardial bridge during (A) diastole and (B) systole.

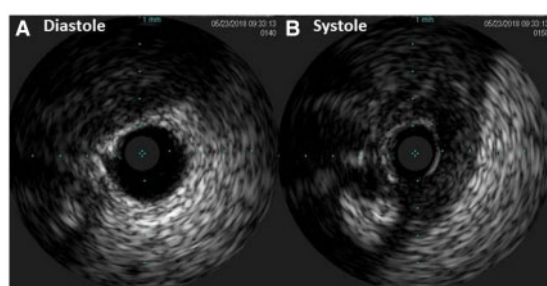


Figure 2 Intravascular ultrasound imaging illustrating myocardial bridge during (A) diastole and (B) systole.

comorbidities. Institutional standards typically mandate age cut-offs around 50 years given the worse perioperative mortality and increased incidence of allograft vasculopathy among older donors.⁶ Complete echocardiographic assessment remains the single most important tool for examination of donor cardiac function.¹ Screening by CAG is performed per institutional norms for donors >40 years and for those with risk factors such as diabetes mellitus, hypertension, hyperlipidaemia, family history of coronary artery disease, tobacco use, or concerning findings on TTE.¹ High-risk behaviour and history of drug abuse do not currently constitute national risk factors necessitating pre-selection CAG, though some institutions likely take this into consideration. Nevertheless, these non-traditional risk factors are increasingly relevant given the rise in cardiac allografts from donors suffering drug-related death, which jumped from 1.5% of cardiac transplant donors in 1999 to 17.6% in 2017.⁷

In the case reported above, a healthy male donor in his early 20s, with a history of cocaine use passed on a potentially life-threatening myocardial bridge—one that may have been related to his own demise—to a denervated transplant recipient unable to manifest typical angina during ischaemia. Due to the donor's young age, a screening CAG had not been performed prior to the cardiac transplant, so the bridge was only discovered incidentally during a routine 6-week follow-up CAG. Pre-transplant detection and consideration for possible unroofing of the bridge at the time of transplant could have

prevented passage of the possibly harmful myocardial bridge to an unsuspecting recipient. Therefore, performing routine CAG among young patients with suspicious cardiac deaths would potentially allow for this anomaly to be addressed intra-operatively.

Cocaine use has been implicated in coronary vasospasm, enhanced vasoconstriction at sites of stenosis and accelerated coronary atherosclerosis.⁸ Nevertheless, a study of the United Network for Organ Sharing (UNOS) database showed donor cocaine use did not adversely affect recipient mortality up to 5 years after transplantation.⁹ The long-term impact of cocaine use on allograft function, however, remains unknown. Given the mechanism of donor death and worrisome angiographic finding coupled with an inability to rely on symptoms in the recipient, the care team chose to risk-stratify this patient with non-invasive testing and ultimately followed by observation. However, the sequence of events did raise the question as to whether better screening guidelines are necessary.

Patient perspective

This case raises the question of whether to expand pre-transplantation coronary artery evaluation to include younger, lower-risk donors, particularly those who suffer unexplained sudden cardiac death, as it may signal the presence of an underlying structural abnormality that would change peri-transplant decision-making and/or post-transplant surveillance.

Conclusion

Given the rising demand for organs and a stagnant donor pool, the importance of optimizing the quality of transplanted organs is greater than ever. At the same time, the drug abuse epidemic has changed the risk profile of the typical transplant donor. Therefore, international guidelines must also evolve their pre-transplant screening recommendations to ensure optimal allograft selection and, in turn, maximal patient survival.

Lead author biography



Garima Dahiya, MD, is a second-year internal medicine resident at Allegheny General Hospital, Pittsburgh, PA. She holds a special interest in electrophysiology and cardiac critical care.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: Consent has not obtained from the patient for publication of this case report due to issues surrounding the confidentiality of organ transplant. This case was considered by the institutional transplant committee who agreed that a consent exemption was appropriate. The editors have been made aware of this and agree with the publication of this case report without consent in this instance.

Conflict of interest: none declared.

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