

## Walking with Gianluca Di Bella during the development of clinical cardiac imaging

Gianluca Di Bella

Gianluca Di Bella, Clinical and Experimental Department of Medicine and Pharmacology, Faculty of Medicine, University of Messina, CAP 98100, Messina, Italy

Author contributions: Di Bella G solely contributed to this manuscript.

Supported by University of Messina

Correspondence to: Gianluca Di Bella, MD, PhD, Clinical and Experimental Department of Medicine and Pharmacology, Faculty of Medicine, University of Messina, via Consolare Valeria N 1, CAP 98100, Messina, Italy. [gianluca.dibella@tiscali.it](mailto:gianluca.dibella@tiscali.it)

Telephone: +39-90-2213531 Fax: +39-90-2213531

Received: August 11, 2010 Revised: October 28, 2010

Accepted: November 4, 2010

Published online: November 26, 2010



Figure 1 Gianluca Di Bella, MD, PhD, Clinical and Experimental Department of Medicine and Pharmacology, Faculty of Medicine, University of Messina, via Consolare Valeria N 1, CAP 98100, Messina, Italy.

### Abstract

Cardiac magnetic resonance imaging (MRI) for the diagnosis and management of many cardiac diseases has been established in clinical practice. It provides anatomic and functional information and is the most precise technique for quantification of ventricular volume, function and mass. Among cardiac MRI sequences used in clinical practice, delayed contrast enhancement is an accurate and reliable method used in the diagnosis of ischemic and nonischemic cardiomyopathies. In addition, new technology applied in echocardiographic imaging has permitted quantification of myocardial deformations with 2-dimensional strain imaging (longitudinal, circumferential and radial strain). Cardiac MRI and echocardiography therefore both play a crucial role in the diagnosis and management of cardiovascular disease. Dr. Di Bella and colleagues have defined the roles of cardiac MRI and echocardiography in many clinical and experimental settings.

© 2010 Baishideng. All rights reserved.

**Key words:** Cardiac magnetic resonance imaging; Strain echocardiography; Myocarditis; Myocardial infarction; Cardiomyopathy; Heart failure

**Peer reviewer:** Jonathan D Dodd, MB, MSc, MRCPI, FFR, Consultant Radiologist, St. Vincent's University Hospital, Senior Clinical Lecturer, University College Dublin, Dublin 4, Ireland

Di Bella G. Walking with Gianluca Di Bella during the development of clinical cardiac imaging. *World J Cardiol* 2010; 2(11): 399-402 Available from: URL: <http://www.wjgnet.com/1949-8462/full/v2/i11/399.htm> DOI: <http://dx.doi.org/10.4330/wjc.v2.i11.399>

### INTRODUCTION AND EDUCATIONAL EXPERIENCE

Dr. Gianluca Di Bella (Figure 1) is a Professor of Cardiology and researcher in the Faculty of Medicine and Surgery at the University of Messina, Italy. He received his first class degree in the Faculty of Medicine and Surgery at the University of Messina in 2001. He was certified as a specialist in cardiovascular disease at the University of Messina in 2005. He pursued graduate work on the application of cardiac magnetic resonance in the magnetic resonance imaging (MRI) laboratory at the Clinical Physiology Institute (CNR), Pisa, Italy under Dr. Lombardi M in 2004-2005. He received training in the application of cardiac magnetic

resonance and computed tomography in the Radiological Department of the University Hospital of Leuven (Belgium) under Prof. Dr. Bogaert J in 2007. He received PhD qualification in “methodologies and techniques of cardiovascular imaging” at the University of Messina, Italy in 2009. His research has been supported by research grant and fellowship awards from the Italian Society of Cardiology since 2004. As an independent investigator, he received the young researcher award from the Italian Society of Cardiology in 2006 and 2008. He is a reviewer for international journals and plays a key role in the Italian Society of Cardiology (e.g. vice-chairman of the cardiac MRI working group) and Italian Society of Echocardiography (e.g. member of the task force on integrated cardiac imaging).

## RESEARCH FOCUS AND STRATEGIES

Over recent years, Dr. Di Bella's research group has investigated cardiovascular diseases using cardiac MRI and strain echocardiography. An integrated approach with MRI and echocardiography provides an excellent and useful tool that permits identification of the pathophysiology of cardiovascular diseases. Dr. Di Bella's research has permitted identification of the relationship between myocardial damage and deformation in acute myocarditis<sup>[1-6]</sup>. Furthermore, Dr. Di Bella's research has included the study of clinical signs of heart failure, systolic function and cardiomyopathies<sup>[7-17]</sup>.

Another focus of Dr. Di Bella's research has been on cardiac imaging in patients with myocardial infarction<sup>[18-32]</sup>, heart valve disease<sup>[33,34]</sup>, atrial septal defect<sup>[35]</sup> and congenital anomalies<sup>[36-38]</sup>. He has authored papers on the correlation between percutaneous transluminal coronary angioplasty (PTCA) time and acute myocardial damage during ST elevation myocardial infarction<sup>[18]</sup>, the relation between Q waves and scar tissue<sup>[20]</sup>, the evidence that obese patients have less scar tissue than patients without obesity (obesity paradox)<sup>[22]</sup> and the correlation between scar tissue and non-sustained ventricular tachycardia<sup>[23]</sup>. Recently, he identified early MRI signs in patients with cardiac amyloidosis<sup>[39]</sup>.

## RESEARCH ACHIEVEMENTS

The following highlight Dr. Di Bella's contributions in the field of cardiac imaging, diagnosis and pathophysiology of cardiac diseases.

### **Role of cardiac MRI and echocardiography in the diagnosis and pathophysiology of acute myocarditis**

Di Bella *et al*<sup>[1]</sup> demonstrated the role of cardiac MRI in the diagnosis of focal myocarditis, even with the lack of wall motion abnormalities. Furthermore, Di Bella *et al*<sup>[2,3,6]</sup> identified the role of endocardium and epicardium in left ventricular deformation. They showed that both longitudinal and circumferential myocardial deformations were impaired in patients with acute myocarditis with preserved wall motion and evidence of subepicardial damage<sup>[3]</sup>. Particularly, longitudinal strain was reduced in all myocardial

walls independently from the presence or absence of subepicardial damage, although segments with subepicardial damage had greater impairment of longitudinal strain than those without damage. This suggests that subepicardium contributes together with subendocardium to longitudinal strain.

### **New advances of echocardiography and cardiac MRI in cardiac function**

Cardiac function and its pathophysiology were studied by Dr. Di Bella and colleagues in different clinical and experimental settings. Di Bella *et al*<sup>[7]</sup> studied cardiac function during hypoxemia induced by prolonged breath holding (in air) in healthy diving athletes. Results showed that, during breath holding, the stroke volume and cardiac output increased due to recruitment of left ventricle preload reserve, which counterbalanced the reduction in systolic function.

Others studies investigated the role of symptoms and signs in identifying left ventricular dilatation and/or systolic dysfunction<sup>[7,8]</sup>. Recently, Di Bella *et al*<sup>[10]</sup> showed that strain echocardiography allows an accurate, rapid, easy and reliable semiautomatic quantification of the left ventricular ejection fraction.

### **Scar tissue and myocardial infarction: new observations using cardiac MRI**

Dr. Di Bella and colleagues published studies on the role of scar tissue in patients with acute and chronic myocardial infarction. The most interesting results have demonstrated the following: (1) the impact of no reflow and scar tissue in patients with ST elevation myocardial infarction and the relation with PTCA time<sup>[18]</sup>; (2) the capability of cardiac MRI in simultaneous visualization of myocardial scar, no-reflow phenomenon and ventricular and atrial thrombi<sup>[19]</sup>; (3) the relationship between regional function and scar tissue<sup>[20]</sup>; (4) the predictive role of Q waves to identify localization and extension of scar tissue<sup>[21]</sup>; (5) the relationship between body mass index and scar tissue<sup>[22]</sup>; and finally; and (6) the combined role of regional function and scar tissue in the genesis of non-sustained ventricular tachycardia<sup>[23]</sup>. In this latter study, entitled “Different substrates of non-sustained ventricular tachycardia in post-infarction patients with and without left ventricular dilatation,” Dr Di Bella showed that necrotic and viable myocardium coexistence within the same wall segments predicts occurrence of non-sustained ventricular tachycardia in patients without left ventricular dilatation, whereas left ventricular mass and end-systolic volume are predictors of non-sustained ventricular tachycardia in those with left ventricular dilatation.

### **Early identification of cardiac amyloidosis by cardiac MRI**

The diagnosis of early stage cardiac amyloidosis is very difficult, however, studies have shown that cardiac MRI is a helpful tool for identification of amyloidotic deposition in patients with heart failure due to amyloidosis. Di Bella *et al*<sup>[39]</sup> showed that cardiac MRI is a suitable technique to identify cardiac amyloidosis in asymptomatic patients.

In this paper, Di Bella and colleagues showed an unusual localization of myocardial damage (hyperenhancement) in mid-basal segments of inferior and inferolateral walls. Furthermore, they observed an enhancement of the atria and/or tricuspid valve and/or right ventricle in all patients affected by cardiac deposition of amyloidosis.

### Outcome in patients with suspected arrhythmogenic right ventricular dysplasia

Aquaro *et al*<sup>[40]</sup> studied the role of right ventricular (RV) abnormalities detected by cardiac MRI to predict adverse outcome in patients with suspected arrhythmogenic right ventricular dysplasia (ARVD). They showed that RV abnormalities are also associated with worse outcomes in patients without a definite diagnosis of ARVD.

## CONCLUSION

Cardiac imaging has greatly modified the diagnostic process with noninvasive, rapid and accurate diagnosis of cardiac diseases. Echocardiography is the first step of cardiac imaging while an appropriate use of cardiac MRI is mandatory for identification of the substrate of many diseases. Overall, Dr. Di Bella's research has contributed to a better understanding of the role of strain echocardiography and cardiac MRI in clinical practice.

## ACKNOWLEDGMENTS

I am grateful to my colleagues and the past and present heads of the University of Messina for their contributions to our studies. I also wish to express my gratitude to several investigators from the CNR Pisa, Italy for their support and cooperation in our studies.

## REFERENCES

- 1 Di Bella G, de Gregorio C, Minutoli F, Pingitore A, Coglitore S, Arrigo F, Carerj S. Early diagnosis of focal myocarditis by cardiac magnetic resonance. *Int J Cardiol* 2007; **117**: 280-281
- 2 Di Bella G, Carerj S, Coglitore S. Acute myocarditis with normal systolic wall thickening: inside physiopathological mechanisms and diagnostic imaging techniques. *Int J Cardiol* 2008; **127**: 393-394; author reply 395
- 3 Di Bella G, Gaeta M, Pingitore A, Oreto G, Zito C, Minutoli F, Anfuso C, Dattilo G, Lamari A, Coglitore S, Carerj S. Myocardial deformation in acute myocarditis with normal left ventricular wall motion—a cardiac magnetic resonance and 2-dimensional strain echocardiographic study. *Circ J* 2010; **74**: 1205-1213
- 4 Di Bella G, Donato R, Anfuso C, Zito C, Patanè S, Carerj S, Arrigo F, Scribano E, Coglitore S. Simultaneous recognition of myocardial, pleural and pulmonary parenchyma inflammation by cardiac magnetic resonance. *Int J Cardiol* 2009; **136**: e31-e32
- 5 Di Bella G, Zito C, Minutoli F, Anfuso C, Dattilo G, Donato R, Coglitore S, Arrigo F, Carerj S. [Role of non invasive cardiac imaging in myocarditis] *Recenti Prog Med* 2008; **99**: 149-154
- 6 Di Bella G, Coglitore S, Zimbalatti C, Minutoli F, Zito C, Patanè S, Carerj S. Strain Doppler echocardiography can identify longitudinal myocardial dysfunction derived from edema in acute myocarditis. *Int J Cardiol* 2008; **126**: 279-280
- 7 Rovai D, Morales MA, Di Bella G, De Nes M, Pingitore A, Lombardi M, Rossi G. Clinical diagnosis of left ventricular dilatation and dysfunction in the age of technology. *Eur J Heart Fail* 2007; **9**: 723-729
- 8 Rovai D, Morales MA, Di Bella G, Prediletto R, De Nes M, Pingitore A, Rossi G. Echocardiography and the clinical diagnosis of left ventricular dysfunction. *Acta Cardiol* 2008; **63**: 507-513
- 9 Pingitore A, Gemignani A, Menicucci D, Di Bella G, De Marchi D, Passera M, Bedini R, Ghelarducci B, L'Abbate A. Cardiovascular response to acute hypoxemia induced by prolonged breath holding in air. *Am J Physiol Heart Circ Physiol* 2008; **294**: H449-H455
- 10 Di Bella G, Zito C, Gaeta M, Cusmà Piccione M, Minutoli F, Donato R, Recupero A, Madaffari A, Coglitore S, Carerj S. Semiautomatic quantification of left ventricular function by two-dimensional feature tracking imaging echocardiography. A comparison study with cardiac magnetic resonance imaging. *Echocardiography* 2010; **27**: 791-797
- 11 Di Bella G, Carerj S, Coglitore S. Left dominant arrhythmogenic cardiomyopathy a new clinical entity without a typical substrate of myocardial damage. *J Am Coll Cardiol* 2009; **53**: 1570-1571; author reply 1571-1572
- 12 Pugliatti P, Di Bella G, Recupero A, Patanè S, Coglitore S. Non compaction cardiomyopathy and Antiphospholipid syndrome: a catastrophic thromboembolic association. *Int J Cardiol* 2008; **128**: 126-128
- 13 Di Bella G, Bramanti O, Russo MS, Migliorato A, Anfuso C, Minutoli F, Arrigo F, Coglitore S. Hypertrophic cardiomyopathy mimicking acute myocardial infarction: diagnostic role of cardiac magnetic resonance. *Int J Cardiol* 2008; **125**: e34-e36
- 14 de Gregorio C, Cento D, Di Bella G, Coglitore S. Minor stroke in a Takotsubo-like syndrome: a rare clinical presentation due to transient left ventricular thrombus. *Int J Cardiol* 2008; **130**: e78-e80
- 15 de Gregorio C, Di Bella G, Curtò L, Cannavò S, Coglitore S. Atrial parasystole in left ventricular noncompaction: a morphofunctional study by echocardiography and magnetic resonance imaging. *J Cardiovasc Med (Hagerstown)* 2008; **9**: 285-288
- 16 Aquaro GD, Positano V, Pingitore A, Strata E, Di Bella G, Formisano F, Spirito P, Lombardi M. Quantitative analysis of late gadolinium enhancement in hypertrophic cardiomyopathy. *J Cardiovasc Magn Reson* 2010; **12**: 21
- 17 Di Bella G, Coglitore S, Recupero A, Pugliatti P, Minutoli F, Patanè S, Bottari A, de Gregorio C. Comprehensive recognition of double-site dynamic obstruction in hypertrophic cardiomyopathy by cardiac magnetic resonance and Doppler echocardiography. *Int J Cardiol* 2007; **121**: e9-e11
- 18 Aquaro GD, Pingitore A, Strata E, Di Bella G, Palmieri C, Rovai D, Petronio AS, L'Abbate A, Lombardi M. Relation of pain-to-balloon time and myocardial infarct size in patients transferred for primary percutaneous coronary intervention. *Am J Cardiol* 2007; **100**: 28-34
- 19 Di Bella G, Aquaro GD, Strata E, Deiana M, De Marchi D, Lombardi M, Pingitore A. Simultaneous visualization of myocardial scar, no-reflow phenomenon, ventricular and atrial thrombi by cardiac magnetic resonance. *Int J Cardiol* 2007; **115**: e10-e11
- 20 Pingitore A, Rovai D, Positano V, Di Bella G, Strata E, De Marchi D, Passera M, Aquaro GD, Lombardi M. Do mechanical markers of myocardial ischaemia predict the transmural extent of myocardial infarction in man? *J Cardiovasc Med (Hagerstown)* 2006; **7**: 400-405
- 21 Rovai D, Di Bella G, Rossi G, Lombardi M, Aquaro GD, L'Abbate A, Pingitore A. Q-wave prediction of myocardial infarct location, size and transmural extent at magnetic resonance imaging. *Coron Artery Dis* 2007; **18**: 381-389
- 22 Pingitore A, Di Bella G, Lombardi M, Iervasi G, Strata E, Aquaro GD, Positano V, De Marchi D, Rossi G, L'Abbate A,

- Rovai D. The obesity paradox and myocardial infarct size. *J Cardiovasc Med* (Hagerstown) 2007; **8**: 713-717
- 23 **Di Bella G**, Passino C, Aquaro GD, Rovai D, Strata E, Arrigo F, Emdin M, Lombardi M, Pingitore A. Different substrates of non-sustained ventricular tachycardia in post-infarction patients with and without left ventricular dilatation. *J Card Fail* 2010; **16**: 61-68
- 24 **Di Bella G**, Gaeta M, Anfuso C, Zito C, Patanè S, Carerj S, Arrigo F, Coglitore S. Lipomatous metaplasia in ischemic cardiomyopathy. *J Cardiovasc Med* (Hagerstown) 2009; **10**: 568-569
- 25 **Patanè S**, Marte F, Di Bella G, Chiribiri A. Acute myocardial infarction with diminutive right coronary artery and obstructive hypertrophic cardiomyopathy without significant coronary stenoses. *Int J Cardiol* 2009; **135**: e73-e75
- 26 **Patanè S**, Marte F, Di Bella G, Turiano G. Acute myocardial infarction and subclinical hyperthyroidism without significant coronary stenoses. *Int J Cardiol* 2009; **134**: e135-e137
- 27 **Patanè S**, Marte F, Di Bella G, Chiofalo S, Currò A, Coglitore S. Acute myocardial infarction and Kounis syndrome. *Int J Cardiol* 2009; **134**: e45-e46
- 28 **Patanè S**, Marte F, Di Bella G. Changing axis deviation with changing bundle branch block and new-onset of atrial fibrillation during acute myocardial infarction. *Int J Cardiol* 2009; **132**: e128-e130
- 29 **Patanè S**, Marte F, Patanè F, Di Bella G, Chiofalo S, Cinnirella G, Evola R. Acute myocardial infarction in a young patient with myocardial bridge and elevated levels of free triiodothyronine. *Int J Cardiol* 2009; **132**: 140-142
- 30 **Patanè S**, Marte F, Di Bella G. Catastrophic early drug eluting stents thrombosis and aspirin hypersensitivity. *Int J Cardiol* 2008; **131**: e25-e27
- 31 **Patanè S**, Marte F, Di Bella G, Chiribiri A. Acute myocardial infarction after consumption of aspirin in a chronic methadone user patient. *Int J Cardiol* 2007; **120**: e32-e33
- 32 **Coglitore S**, Di Bella G, de Gregorio C, Andò G, Recupero A, Grimaldi P, Arrigo F. A double acute coronary syndrome and early left ventricular thrombus formation associated to C-reactive protein elevation at admission. *Int J Cardiol* 2008; **124**: e28-e30
- 33 **Di Bella G**, Masci PG, Ganame J, Dymarkowski S, Bogaert J. Images in cardiovascular medicine. Liquefaction necrosis of mitral annulus calcification: detection and characterization with cardiac magnetic resonance imaging. *Circulation* 2008; **117**: e292-e294
- 34 **Di Bella G**, Carerj S, Andò G, Minutoli F, Celona A, Coglitore S, Arrigo F. Cardiac imaging in the evaluation of mitral annulus caseous calcification. *Int J Cardiol* 2006; **113**: E30-E31
- 35 **Zito C**, Dattilo G, Oreto G, Di Bella G, Lamari A, Iudicello R, Trio O, Caracciolo G, Coglitore S, Arrigo F, Carerj S. Patent foramen ovale: comparison among diagnostic strategies in cryptogenic stroke and migraine. *Echocardiography* 2009; **26**: 495-503
- 36 **Recupero A**, Pugliatti P, Rizzo F, Carerj S, Cavalli G, de Gregorio C, Di Bella G, Minutoli F, Arrigo F, Oreto G, Coglitore S. Persistent left-sided superior vena cava: integrated noninvasive diagnosis. *Echocardiography* 2007; **24**: 982-986
- 37 **Melluso C**, Raffa S, Di Bella G, Tripodo E, Zito C, Coglitore S, Carerj S, Bramanti O, Arrigo F. Double superior and inferior vena cava: unusual venous anomaly. *J Cardiovasc Med* (Hagerstown) 2008; **9**: 289-292
- 38 **Aquaro GD**, Di Bella G, Strata E, Deiana M, De Marchi D, Pingitore A, Lombardi M. Cardiac magnetic resonance findings in isolated congenital left ventricular diverticuli. *Int J Cardiovasc Imaging* 2007; **23**: 43-47
- 39 **Di Bella G**, Minutoli F, Mazzeo A, Vita G, Oreto G, Carerj S, Anfuso C, Russo M, Gaeta M. MRI of cardiac involvement in transthyretin familial amyloid polyneuropathy. *AJR Am J Roentgenol* 2010; **195**: W394-W399
- 40 **Aquaro GD**, Pingitore A, Strata E, Di Bella G, Molinaro S, Lombardi M. Cardiac magnetic resonance predicts outcome in patients with premature ventricular complexes of left bundle branch block morphology. *J Am Coll Cardiol* 2010; **56**: 1235-1243

S- Editor Cheng JX L- Editor Lutze M E- Editor Zheng XM