

# World Journal of *Cardiology*

*World J Cardiol* 2017 July 26; 9(7): 562-639



**REVIEW**

- 562 Sudden cardiac death in patients with rheumatoid arthritis

*Masoud S, Lim PB, Kitas GD, Panoulas V*

**MINIREVIEWS**

- 574 Vascular complications of transcatheter aortic valve replacement: A concise literature review  
*Chaudhry MA, Sardar MR*
- 583 Peripheral interventions and antiplatelet therapy: Role in current practice  
*Singh P, Harper Y, Oliphant CS, Morsy M, Skelton M, Askari R, Khouzam RN*
- 594 Is Entresto good for the brain?  
*Patel N, Gluck J*
- 600 Cardiac and pericardial tumors: A potential application of positron emission tomography-magnetic resonance imaging  
*Fathala A, Abouzied M, AlSugair AA*

**SYSTEMATIC REVIEWS**

- 609 Hand dysfunction after transradial artery catheterization for coronary procedures  
*Ul Haq MA, Rashid M, Kwok CS, Wong CW, Nolan J, Mamas MA*
- 620 Infective endocarditis and thoracic aortic disease: A review on forgotten psychological aspects  
*Suárez Bagnasco M, Núñez-Gil IJ*

**CASE REPORT**

- 629 Endovascular treatment of paravisceral mycotic aneurysm: Chimmeny endovascular sealing the end of de road  
*Rabellino M, Moltini PN, Di Caro VG, Chas JG, Marechchino R, Garcia-Monaco RD*
- 634 Percutaneous closure of congenital Gerbode defect using Nit-Occlud® Lê VSD coil  
*Phan QT, Kim SW, Nguyen HL*

**ABOUT COVER**

Editorial Board Member of *World Journal of Cardiology*, Hiroki Teragawa, FACC, FAHA, MD, PhD, Director, Doctor, Department of Cardiovascular Medicine, JR Hiroshima Hospital, Hiroshima 732-0057, Japan

**AIM AND SCOPE**

*World Journal of Cardiology* (*World J Cardiol*, *WJC*, online ISSN 1949-8462, DOI: 10.4330) is a peer-reviewed open access journal that aims to guide clinical practice and improve diagnostic and therapeutic skills of clinicians.

*WJC* covers topics concerning arrhythmia, heart failure, vascular disease, stroke, hypertension, prevention and epidemiology, dyslipidemia and metabolic disorders, cardiac imaging, pediatrics, nursing, and health promotion. Priority publication will be given to articles concerning diagnosis and treatment of cardiology diseases. The following aspects are covered: Clinical diagnosis, laboratory diagnosis, differential diagnosis, imaging tests, pathological diagnosis, molecular biological diagnosis, immunological diagnosis, genetic diagnosis, functional diagnostics, and physical diagnosis; and comprehensive therapy, drug therapy, surgical therapy, interventional treatment, minimally invasive therapy, and robot-assisted therapy.

We encourage authors to submit their manuscripts to *WJC*. We will give priority to manuscripts that are supported by major national and international foundations and those that are of great basic and clinical significance.

**INDEXING/ABSTRACTING**

*World Journal of Cardiology* is now indexed in Emerging Sources Citation Index (Web of Science), PubMed, and PubMed Central.

**FLYLEAF**

I-IV Editorial Board

**EDITORS FOR THIS ISSUE**

**Responsible Assistant Editor:** *Xiang Li*  
**Responsible Electronic Editor:** *Huan-Liang Wu*  
**Proofing Editor-in-Chief:** *Lian-Sheng Ma*

**Responsible Science Editor:** *Jin-Xin Kong*  
**Proofing Editorial Office Director:** *Jin-Lei Wang*

**NAME OF JOURNAL**  
*World Journal of Cardiology*

**ISSN**  
ISSN 1949-8462 (online)

**LAUNCH DATE**  
December 31, 2009

**FREQUENCY**  
Monthly

**EDITORS-IN-CHIEF**  
**Jian-Jun Li, MD, PhD, Professor**, Center for Coronary Artery Disease, Fu Wai Cardiovascular Hospital, Chinese Academy of Medical Science, Beijing 100037, China

**Giuseppe De Luca, PhD**, Assistant Professor, Department of Cardiology, Piedmont University, Novara 28100, Italy

**Nathan D Wong, FACC, FAHA, PhD, Director, Professor**, Heart Disease Prevention Program, Division of Cardiology, Department of Medicine, University of California, Irvine, CA 92629, United States

sity of California, Irvine, CA 92629, United States

**EDITORIAL BOARD MEMBERS**  
All editorial board members resources online at <http://www.wjgnet.com/1949-8462/editorialboard.htm>

**EDITORIAL OFFICE**  
Xiu-Xia Song, Director  
*World Journal of Cardiology*  
Baishideng Publishing Group Inc  
7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA  
Telephone: +1-925-2238242  
Fax: +1-925-2238243  
E-mail: [editorialoffice@wjgnet.com](mailto:editorialoffice@wjgnet.com)  
Help Desk: <http://www.f6publishing.com/helpdesk>  
<http://www.wjgnet.com>

**PUBLISHER**  
Baishideng Publishing Group Inc  
7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA  
Telephone: +1-925-2238242  
Fax: +1-925-2238243  
E-mail: [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)  
Help Desk: <http://www.f6publishing.com/helpdesk>  
<http://www.wjgnet.com>

**PUBLICATION DATE**  
July 26, 2017

**COPYRIGHT**  
© 2017 Baishideng Publishing Group Inc. Articles published by this Open-Access journal are distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited, the use is non commercial and is otherwise in compliance with the license.

**SPECIAL STATEMENT**  
All articles published in journals owned by the Baishideng Publishing Group (BPG) represent the views and opinions of their authors, and not the views, opinions or policies of the BPG, except where otherwise explicitly indicated.

**INSTRUCTIONS TO AUTHORS**  
<http://www.wjgnet.com/bpg/gerinfo/204>

**ONLINE SUBMISSION**  
<http://www.f6publishing.com>

## Infective endocarditis and thoracic aortic disease: A review on forgotten psychological aspects

Mariana Suárez Bagnasco, Iván J Núñez-Gil

Mariana Suárez Bagnasco, Universidad Católica del Uruguay, CP 11600, Montevideo, Uruguay

Iván J Núñez-Gil, Servicio de Cardiología, Hospital Clínico Universitario San Carlos, 28040 Madrid, Spain

**Author contributions:** Suárez Bagnasco M and Núñez-Gil IJ designed the research, analyzed the data and wrote the paper; Suárez Bagnasco M performed the research.

**Conflict-of-interest statement:** No conflict of interests regarding this article.

**Data sharing statement:** Since this manuscript is a review of published studies and it did not involve the participation of subjects, therefore the obtaining of informed consent is waived. Data set available from the corresponding author at email: [mariansb@gmail.com](mailto:mariansb@gmail.com).

**Open-Access:** This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Manuscript source:** Invited manuscript

**Correspondence to:** Mariana Suárez Bagnasco, PhD, Universidad Católica del Uruguay, Av. 8 de Octubre 2738, CP 11600, Montevideo, Uruguay. [mariansb@gmail.com](mailto:mariansb@gmail.com)  
Telephone: +598-24872717

**Received:** November 28, 2016

**Peer-review started:** December 1, 2016

**First decision:** March 8, 2017

**Revised:** April 10, 2017

**Accepted:** April 18, 2017

**Article in press:** April 19, 2017

**Published online:** July 26, 2017

### Abstract

#### AIM

To summarize the current evidence on psychological issues in thoracic aortic disease (TAD) and infective endocarditis (IE) setting.

#### METHODS

We performed a narrative review about psychological issues in adults with IE and TAD. Through the electronic databases, PubMed and PsycINFO, we searched full manuscripts in English and published until September 1, 2014.

#### RESULTS

We found sixteen studies exploring psychological issues in patients with IE (six studies) and in TAD (ten papers). Psychological issues assessed were quality of life, depression, anxiety and posttraumatic stress disorder. Quality of life was explored in IE (four papers) and in TAD (eight papers). Depression and anxiety were analyzed in TAD only (five papers). Post-traumatic stress disorder was assessed in IE (one study). Quality of life was found impaired in three of four studies about IE and in three of eight studies about TAD. Posttraumatic stress disorder was present in 11% and was associated with lower levels of quality of life in IE patients. In TAD patients, anxiety and depression levels after different invasive interventions did not differ.

#### CONCLUSION

Sixteen studies report about psychological issues in IE and TAD. Most of them explore quality of life and to a less extent anxiety and depression.

**Key words:** Infective endocarditis; Thoracic aortic disease; Psychology; Depression; Anxiety; Quality of life; Posttraumatic stress disorder

© The Author(s) 2017. Published by Baishideng Publishing Group Inc. All rights reserved.



**Core tip:** Some papers and guidelines have recently reported that psychosocial factors such as depression, anxiety and other mental disorders like personality disorders and post-traumatic stress disorder are related to morbidity and mortality due to cardiovascular diseases. Chronic heart failure, arrhythmias, and acute myocardial infarction are one of the most studied pathologies. However, other cardiovascular diseases are poorly or not yet studied from a psychological point of view, including infective endocarditis and thoracic aortic disease. The study of psychological issues in these severe diseases could bring us information about specific needs to cover with psychological interventions and to design specialized care training and practice.

Suárez Bagnasco M, Núñez-Gil JJ. Infective endocarditis and thoracic aortic disease: A review on forgotten psychological aspects. *World J Cardiol* 2017; 9(7): 620-628 Available from: URL: <http://www.wjgnet.com/1949-8462/full/v9/i7/620.htm> DOI: <http://dx.doi.org/10.4330/wjc.v9.i7.620>

## INTRODUCTION

Infective endocarditis (IE) is an inflammatory disease of the heart, an infection of the endocardium that usually involves valves and adjacent structures. The incidence of IE ranges from one country to another within 3-10 episodes/100000 person-years. It is higher in patients with underlying valvular heart diseases, prosthesis and those with intravenous drug abuse. IE with positive blood cultures represents 85% of all IE. Causative microorganisms are most often staphylococci, streptococci, and enterococci<sup>[1-7]</sup>. This disorder presents in a variety of clinical forms according to the initial clinical manifestation, underlying cardiac disease, microorganism involved, prosthesis presence, and development of complications. It may present as an acute and rapidly progressive infection or as sub-acute with low-grade fever and non-specific symptoms. With a modern combination of antimicrobial therapy and heart valve surgery, the in-hospital mortality rate of patients with or chronic disease IE varies from 9.6 to more than 26% (1-8)<sup>[1-8]</sup>. Psychological factors such as depression, anxiety and some personality traits could negative influence IE development and prognosis.

On the other hand, thoracic aortic diseases (TAD) include a wide spectrum of degenerative, structural, acquired, genetic-based, and traumatic disease states and presentations. The overall global death rate from aortic aneurysms and aortic dissection increased from 2.49 per 100000, to 2.79 per 100000 inhabitants between 1990 and 2010. TAD may be diagnosed after a long period of subclinical development or after an acute presentation such as acute aortic syndromes. Acute aortic syndromes are often the first sign of the disease, requiring rapid diagnosis and decision-making to improve prognosis. Medical therapy aims to reduce

shear stress on the diseased segment of the aorta by reducing blood pressure and cardiac contractibility. Further management options include endovascular therapy and surgery<sup>[9,10]</sup>. Psychological factors such as anxiety, depression and personality, could promote subclinical development and could negatively influence medical outcome after surgery and endovascular therapy, as well.

The aim of this review is to summarize the current evidence on psychological issues in TAD and IE setting. Thus, we performed a narrative review about psychological issues in adults with both TAD and IE.

## MATERIALS AND METHODS

Through the electronic databases PubMed and PsycINFO we searched all full manuscripts published in English until September 1, 2014.

The main data search terms were: Infective endocarditis + psychology, infective endocarditis + psychiatry, infective endocarditis + depression, infective endocarditis + anxiety, infective endocarditis + quality of life, infective endocarditis + personality, infective endocarditis + illness perception, infective endocarditis + therapeutic adherence, infective endocarditis + coping, thoracic aortic disease + psychology, thoracic aortic disease + psychiatry, thoracic aortic disease + depression, thoracic aortic disease + anxiety, thoracic aortic disease + personality, thoracic aortic disease + quality of life, thoracic aortic disease + therapeutic adherence, thoracic aortic disease + illness perception, thoracic aortic disease + coping.

## RESULTS

We found sixteen studies exploring psychological issues in patients with IE and TAD: Six about IE and ten about TAD. Main results are summarized in Tables 1 (IE) and 2 (TAD). Psychological issues assessed were mainly quality of life, depression, anxiety and post-traumatic stress disorder.

Quality of life was reviewed in 4 papers for IE and for TAD in 8 papers using Short Form 36 Health Survey questionnaire (SF-36) or EuroQol five dimensions questionnaire (EQ-5D).

Post-traumatic stress disorder was assessed in IE (one study) using the Post-traumatic stress disorder questionnaire. Depression and anxiety were analyzed in TAD (five papers) using Hospital Anxiety and Depression Scale (HADS).

## IE

We included six manuscripts about psychological issues in IE, all published in the last 5 years. Two papers used a qualitative method and four studies used a quantitative prospective design.

**Quantitative studies:** Quantitative studies assessed quality of life using standardized questionnaires.

**Table 1** Scheme of main findings about infective endocarditis

Ref.	Methods and materials	Main results
Verhagen <i>et al</i> <sup>[11]</sup> , 2009	Prospective, 67 treated for left-sided native valve endocarditis complete Short Form 36 Health Survey questionnaire and Posttraumatic Stress Disorder questionnaire	Quality of life was significantly impaired in IE patients, compared with an age- and sex-matched population. Posttraumatic stress disorder 11%
Perrotta <i>et al</i> <sup>[12]</sup> , 2010	Prospective, 40 infective prosthetic valve endocarditis or native endocarditis with abscess operated with homograft replacement. Short Form 36 Health Survey questionnaire	Statistically significant differences in quality of life were found between IE patients and an age-matched and gender-matched general population
Berg <i>et al</i> <sup>[15]</sup> , 2010	Qualitative, 10 patients. Semi-structured interview	Patients explain that a sudden unexpected physical change occurred that is difficult to understand and interpret. During the hospital admission, time is spent thinking about choices and lost possibilities before admission. They talk about investing their energy and attention on getting well
Yeates <i>et al</i> <sup>[13]</sup> , 2010	Prospective, 9 active native left sided valve endocarditis and cerebrovascular complications. EuroQol five dimensions questionnaire	6 reported some problems with mobility, 5 reported some problems with usual activities and 5 pain or discomfort
Nayak <i>et al</i> <sup>[14]</sup> , 2011	Prospective, 85 active endocarditis, native valve endocarditis or prosthetic valve endocarditis. EuroQol five dimensions questionnaire	Quality of life was not impaired
Rasmussen <i>et al</i> <sup>[16]</sup> , 2014	Qualitative, 11 patients. Semi-structured interview	Patients felt physically weak and mentally imbalanced to a varying degree. Uncertainty of recovery trajectory and future capacity was considered stressful

Three of four studies reported quality of life impaired in IE patients. One study reported the presence of a posttraumatic stress disorder in 11% of the cases.

In 2009, a prospective and multicenter follow-up study was performed aiming to assess quality of life and posttraumatic stress disorder of adults treated because a left-sided native valve endocarditis. Twelve months after the end of the antimicrobial treatment 67 adults completed both the SF-36 and the Post-traumatic stress disorder questionnaires. The quality of life was significantly impaired in IE patients, compared with an age- and sex-matched population. A posttraumatic stress disorder was present in 11% of the cases. The type of infecting microorganism, the length of hospitalization, type of cardiac surgery, and infective complications did not affect the result of the quality of life scores<sup>[11]</sup>.

In 2010, another study reported the outcomes and quality of life after homograft replacement for IE. After a mean follow-up of 37 ± 11 mo, the quality of life was assessed using a SF-36 form. Forty five patients completed a specific questionnaire.

Statistically significant differences between patients operated with homograft and an age-matched and gender-matched general population were depicted in four subscales: Role-physical, general health, vitality, mental health<sup>[12]</sup>.

In the same year, Yeates *et al*<sup>[13]</sup> assessed the quality of life of IE patients who suffered cerebrovascular complications using the EQ-5D questionnaire. After a mean follow-up of 37.2 mo, 9 adults responded EQ-5D questionnaire by telephone: 7 reported no problems with self-care, 6 reported some problems with mobility, 5 reported some problems with usual

activities and 5 pain or discomfort.

In 2011, another study evaluated the early and mid-term outcomes, mortality and morbidity and quality of life of patients operated for IE. After a mean follow-up time of 37.2 mo, 85 patients answered a EQ-5D questionnaire. In that study, the patient's quality of life was not impaired<sup>[14]</sup>.

**Qualitative studies:** Qualitative studies review patient's experiences after IE diagnoses. Berg *et al*<sup>[15]</sup> described in 2010 IE experiences before and during hospital admission, including experience of physical symptoms and expectations for future health. Ten patients were included just before or after discharge, after a mean of 51.5 d of hospital admission. IE was perceived as an "intermezzo in life": Presage and appearance of IE, reaction to IE, living through IE, the little life with IE, body change and loved ones at distance.

The patients explained that perceived a sudden unexpected physical change, difficult to understand and interpret. This happens after a very long hospital admission, far different from one's normal way of life. During the hospital admission, they spent some time thinking about choices and lost possibilities before admission. They mentioned the idea of investing their energy and attention on getting well. Patients felt like not being able to interpret their body's signals, or that they did not receive clear signals whatsoever from the body that there is something wrong. Symptoms of IE are similar to and are often misinterpreted as a common infection or virus, such as a lung infection or influenza. Another important idea reported was that the disease does not only affect the patients, but can

**Table 2** Scheme of main findings about thoracic aortic disease

Ref.	Methods and materials	Main results
Immer <i>et al</i> <sup>[22]</sup> , 2004	Prospective, 363 patients. 176 acute type A dissections, 187 aortic aneurysms. Antegrade cerebral perfusion 41 cases. Short Form 36 Health Survey questionnaire	Averaged quality life score was higher with the use of antegrade cerebral perfusion, independently of the duration of deep hypothermic circulatory arrest
Stalder <i>et al</i> <sup>[23]</sup> , 2007	Prospective, 244 patients. 76 isolated replacement of the ascending aorta, 42 separate aortic valve replacement and supracoronary replacement of the ascending aorta, 86 mechanical composite graft, 40 biologic composite graft. Short Form 36 Health Survey questionnaire	No difference in quality of life between groups was found
Dick <i>et al</i> <sup>[17]</sup> , 2008	Post hoc analysis, 122 patients. 52 thoracic endovascular aortic repair, 70 open aortic repair. Short Form 36 Health Survey questionnaire and Hospital Anxiety and Depression Scale	Anxiety and depression scores were not significantly different between group No statistical differences in quality life scores
Immer <i>et al</i> <sup>[26]</sup> , 2008	Prospective, 567 patients. 387 deep hypothermic circulatory arrest with pharmacologic protection with pentothal only, 91 selective antegrade cerebral perfusion and pentothal, 89 continuous cerebral perfusion through the right subclavian artery and pentothal. Short Form 36 Health Survey questionnaire	Average quality of life after an arrest time between 30 and 50 min with continuous cerebral perfusion through the right subclavian artery was significantly better than selective antegrade cerebral perfusion
Krähenbühl <i>et al</i> <sup>[24]</sup> , 2008	Prospective, 907 patients. 219 acute aortic dissection type A, 617 aortic aneurysm. Transient neurological dysfunction 89 cases. Short Form 36 Health Survey questionnaire	Patients with transient neurological dysfunction showed a significantly impaired quality of life
Dick <i>et al</i> <sup>[18]</sup> , 2009	Post hoc analysis, 52 patients. 27 treated electively, 25 emergency indications. Short Form 36 Health Survey questionnaire and Hospital Anxiety and Depression Scale	Anxiety and depression scores were in normal range and not increased after emergency situations No statistical differences between groups in quality of life were found
Lohse <i>et al</i> <sup>[25]</sup> , 2009	Prospective, 124 patients. 45 supracoronary replacement of the ascending aorta, 59 Wheat procedure, 15 David procedure, 12 Bentall-De Bono procedure, 3 Cabrol procedure. Short Form 36 Health Survey questionnaire	Different surgical techniques had no statistically significant influence on postoperative quality of life
Aicher <i>et al</i> <sup>[19]</sup> , 2011	Prospective, 166 patients. 86 aortic valve repair, 41 valve replacement with mechanical prosthesis, 39 valve replacement with pulmonary autograft. Short Form 36 Health Survey questionnaire and Hospital Anxiety and Depression Scale	No differences were found in anxiety or depression scores between groups Patients after aortic valve repair <i>vs</i> replacement with pulmonary autograft revealed similar quality of life scores
Lehr <i>et al</i> <sup>[20]</sup> , 2011	Prospective, 144 patients. 51 mechanical conduit, 93 biological valve conduit. Hospital Anxiety and Depression Scale	No significant differences were found between groups for either anxiety and depression
Okamoto <i>et al</i> <sup>[21]</sup> , 2013	Prospective, 128 patients. 49 aortic surgery, 79 coronary artery bypass. Hospital Anxiety and Depression Scale	No statistical differences were found in depression or anxiety scores

also have a great impact on the life of their families<sup>[15]</sup>.

In 2014, a qualitative study described patient experiences during recovery after IE. Eleven patients were interviewed 3 to 6 mo after discharge. Patients talked of IE as an unpredictable disease. They described a phase of adaptation to a new life situation, which some perceived as manageable and temporary, whereas others found it extremely distressing and prolonged. Most of them experienced a persisting weakness and felt frustrated about the prolonged recovery phase. Patients felt physically weak and mentally imbalanced to a varying degree. They described a time of emotional instability and different psychological reactions, ranging from mild mood swings to severe anxiety. Uncertainty of recovery trajectory and future capacity was considered stressful. They worried about sources of infections; open wounds and they recognized that even a hemorrhoid could become a cause for concern. Most of them described how significant the support from family and friends had been during hospital admission and recovery. Some also described feeling concerned and guilty; being the cause of the stress and strain their loved ones had been through<sup>[16]</sup>.

## TAD

We found ten suitable manuscripts that studied psychological issues using standardized questionnaires in TAD patients, after surgery or endovascular therapy and a variable follow up period.

**Depression and anxiety:** Five papers studied depression and anxiety in patients treated with surgery or endovascular therapy. No statistical differences were found in anxiety and depression scores after aortic valve repair using mechanical replacement *vs* after aortic valve repair using pulmonary autograft; after underwent thoracic aortic surgery *vs* after coronary artery bypass grafting; after thoracic endovascular aortic repair *vs* after open aortic repair or after thoracic endovascular aortic repair which indication was done electively *vs* emergency.

In 2008, a study assessed anxiety and depression on diseases of descending thoracic aorta, in patients treated either by thoracic endovascular aortic repair or open aortic repair. After mean follow-up of  $34 \pm 18$  mo, 75 adults fulfilled a HADS form. Although depression and anxiety scores tended to be more elevated in patients that underwent thoracic endovascular aortic

repair than in patients that underwent open aortic repair patients, statistical significances were not found<sup>[17]</sup>.

In 2009, Dick *et al.*<sup>[18]</sup> studied the impact of urgency procedures on quality of life in patients with descending thoracic aorta disease. Twenty seven patients completed the HADS after mean follow-up of  $29 \pm 16$  mo. Anxiety and depression scores were in normal range and did not increase after emergency situations.

In 2011, a study was conducted to assess and compare anxiety and depression after aortic valve repair using two replacement alternatives: Mechanical valve and pulmonary autograft. After a follow up interval that ranged between 3 and 7 years, 166 subjects responded the HADS questionnaire. No differences were found regarding anxiety or depression scores between groups<sup>[19]</sup>.

In the same year, anxiety and depression over a group of patients who underwent aortic root replacement with mechanical and biological conduits were assessed and compared by Lehr *et al.*<sup>[20]</sup>. Seventy four patients completed a HADS form after a median follow-up of 40 mo. Anxiety and depression scores were not significantly different between groups.

In 2013, other study compared anxiety and depression in patients undergoing thoracic aortic surgery with another cohort of patients undergoing coronary artery bypass grafting. Hospital anxiety and depression scale was complete at 1-5 years postoperatively by 98 patients. Twenty-eight percent of thoracic aortic surgery patients had depression and 14% anxiety. Twenty percent of coronary bypass patients had depression and 16% anxiety. No statistical differences were found in depression or anxiety scores either in this study<sup>[21]</sup>.

**Quality of life:** Over ten, eight studies analyzed the impact of different surgical procedures and endovascular therapy on the quality of life of patients with diseases of aortic root and aortic valve, ascending aorta, aortic arch, and descending aorta.

One study assessed the quality of life after aortic valve replacement comparing two replacement alternatives: Mechanical and pulmonary autograft. Over a follow-up interval between 3 and 7 years, 166 subjects completed a SF-36 questionnaire. Patients who had undergone aortic valve repair and replacement with pulmonary autograft depicted similar quality of life scores, but this matter was better in patients after replacement with mechanical prosthesis regarding physical functioning, general health, and mental health<sup>[19]</sup>.

**Ascending aorta:** Four papers studied the quality of life of patients with diseases of ascending aorta.

In 2004 a study analyzed the impact of the duration of the deep hypothermic circulatory arrest and the potential effects of antegrade cerebral perfusion

on quality of life in patients undergoing surgery of the thoracic aorta. Two hundred and ninety adults completed the SF-36 questionnaire after mean follow up of  $2.4 \pm 1.2$  years. Averaged quality life score was significantly better with the use of antegrade cerebral perfusion, independently of the duration of deep hypothermic circulatory arrest<sup>[22]</sup>.

In 2007 another manuscript analyzed the impact of different surgical procedures on quality of life in patients with ascending aorta diseases. Patients were divided according to the operative procedure: Isolated replacement of the ascending aorta, separate aortic valve replacement and supracoronary replacement of the ascending aorta, mechanical composite graft, and biologic composite graft. After mean follow-up of  $26.6 \pm 8.8$  mo, 176 patients completed a SF-36 questionnaire. No difference in quality of life between groups was found<sup>[23]</sup>.

Krähenbühl *et al.*<sup>[24]</sup>, in 2008, assessed the influence of transient neurological dysfunction (defined as a Glasgow coma scale value  $< 13$ ) on the quality of life of patients undergoing surgery of ascending aorta and proximal aortic arch. Over a mean follow-up interval of  $27 \pm 14$  mo, 79 subjects completed a SF-36 questionnaire. Patients with transient neurological dysfunction showed a significantly impaired quality of life except for bodily pain.

In 2009, a study assessed the quality of life among patients who underwent replacement of a dilated ascending aorta. Patients were divided according to the operative procedure. Operative procedures consisted of supracoronary replacement of the ascending aorta, the Wheat procedure, the David procedure, the Bentall-De Bono procedure, and the Cabrol procedure. One hundred and twenty two patients completed a SF-36 questionnaire after mean follow-up of  $36.4 \pm 15.5$  mo. Different surgical techniques had no statistically significant influence on postoperative quality of life. However, many subscales of SF-36 were below the norm when compared with a standard population, in particular physical pain and physical function<sup>[25]</sup>.

**Aortic arch:** Two studies assessed quality of life of patients with diseases of aortic arch.

Immer *et al.*<sup>[26]</sup> published (2008) a study assessing the impact of continuous cerebral perfusion through the right subclavian artery on quality of life. With a mean follow-up of  $2.4 \pm 1.2$  years, 453 adults respond SF-36 questionnaire. Interestingly, the average quality of life after an arrest time between 30 and 50 min with continuous cerebral perfusion through the right subclavian artery was significantly better than when selective antegrade cerebral perfusion was used.

As we mentioned previously, in 2008, Krähenbühl *et al.*<sup>[24]</sup> assessed the influence of transient neurological dysfunction on quality of life of patients undergoing surgery of proximal aortic arch and ascending aorta, showing that patients with transient neurological



dysfunction showed a significantly impaired quality of life later.

**Descending aorta:** Two studies explored quality of life of patients with diseases of descending aorta. Dick *et al.*<sup>[17]</sup>, in 2008 analyzed quality of life in patients treated either by thoracic endovascular aortic repair or by open aortic repair for diseases of the descending thoracic aorta. Seventy-five adults completed the SF-36 questionnaire after a mean follow-up of  $34 \pm 18$  mo. Quality of life scores of open aortic repair in the patients included in this study ranged from 63 to 110; the median was 93. Quality of life scores of thoracic endovascular aortic repair ranged from 60 to 112, with a median of 83. Thus, the authors concluded that after thoracic aortic repair the quality of life was reduced.

One year later, Dick *et al.*<sup>[18]</sup>, published another paper regarding the impact of urgency procedures on quality of life in patients with descending thoracic aorta disease. After a mean follow-up of  $29 \pm 16$  mo, 27 adults responded the SF-36 questionnaire. Quality of life scores after emergency range between 58 and 124, with a median of 72. Quality of life scores after elective endovascular aortic repair range between 61 and 105, median: 85. No statistical differences between groups in quality of life were found.

## DISCUSSION

We summarize the results of a small number of studies dealing with psychological issues in IE and TAD. Despite the high impact that psychological conditions might cause in these severe diseases, we could verify that there is not much information available on these matters. Thus, we aimed to review the available evidence on this context.

Some papers<sup>[27-29]</sup> and guidelines<sup>[30-33]</sup> previously reported that psychosocial factors such as depression, anxiety and other mental disorders such as personality disorders and post-traumatic stress disorders are related to morbidity and mortality due to cardiovascular diseases. Chronic heart failure, arrhythmias, and acute myocardial infarction are one of the most studied pathologies in that setting. Otherwise, other cardiovascular diseases are poorly or not studied from a psychological point of view, such as IE and TAD. We found four studies comparing anxiety and depression scores in patients with TAD after treatment and only one paper assessing post-traumatic stress disorder after IE treatment.

When specialists choose a specific type of invasive intervention, psychological aspects are usually ignored. The identification of interventions that increase anxiety and/or depression could be of interest from a medical point of view because anxiety and/or depression might negatively influence patient recuperation after the intervention. In TAD patients, anxiety and depression levels after different invasive interventions did not differ. No statistical differences were found in anxiety

and depression scores: After aortic valve repair using mechanical replacement vs after aortic valve repair using pulmonary autograft; after underwent thoracic aortic surgery vs after coronary artery bypass grafting; after thoracic endovascular aortic repair vs after open aortic repair, after thoracic endovascular aortic repair which indication was done electively vs emergency. Moreover, baseline anxiety and depression scores had not been reported. Depression or/and anxiety before invasive intervention, might negatively influence coping and recuperation after intervention.

A posttraumatic stress disorder was present in 11% and was associated with lower levels of quality of life in IE patients. IE patients with posttraumatic stress disorder reported feeling nervousness and depressive, having problems with work or other daily activities and having frequent interference with social activities due to physical or emotional problems. Although the percentage of posttraumatic stress disorder in IE might be considered low, IE patients with posttraumatic stress disorder need specialized mental health care and interventions to improve their quality of life.

Most of the studies assessed IE and TAD quality of life after treatment. Quality of life was reported to be impaired in three of four studies about infectious endocarditis and in three of eight studies about TAD. However, recent clinical guidelines about infectious endocarditis did not mention quality of life and recent guidelines about TAD did not make the slightest reference to quality of life either.

Most of quantitative studies about IE reported that after 12 or 37 mo after IE diagnosis, quality of life was clearly impaired. Only one study explored the possible influence of the causal microorganism, length of hospitalization, type of cardiac surgery, and infective complications in quality of life scores. The authors concluded that those issues did not clearly affect quality of life scores. In two studies, the patients evaluated their personal health as poor mentioning that it was likely to get worse. In one study, patients reported feeling tired, worn out all, nervousness and depressive. Since depression was not assessed, we can not know if those IE patients had depression, although this is a possibility. Moreover, elevated pro-inflammatory cytokines in IE could promote psychological alterations such as depression, especially in vulnerable patients, and this might compromise prognosis and the ability to cope the disease.

The cerebral perfusion technique used in invasive intervention of TAD patients might have neurological consequences and could influence the perceived quality of life as well. After a surgery of thoracic aorta, patients might postoperatively develop confusion, agitation and delirium, also named "temporary neurological dysfunction". Although resolution of these symptoms usually occur before hospital discharge, patients with temporary neurological dysfunction had lower scores in quality of life than patients without temporary neurological dysfunction. Patients with temporary

neurological dysfunction evaluate their personal health as poor and believe that it is likely to get worse. This way, they reported feeling nervousness, depressive, and having problems with work or other daily activities. The incidence of neurological complications might be decreased using selective antegrade cerebral perfusion. A study reported that the average quality of life after an arrest time between 30 and 50 min with continuous cerebral perfusion through the right subclavian artery was significantly better than selective antegrade cerebral perfusion. One important limitation was that all the studies revised did not include assessment before treatment or a proper control group. In addition, detailed medical records about patients that answered these mentioned questionnaires used to assess psychological issues are frequently not available.

Sixteen studies have been published about psychological issues in IE and TAD. Most of them explored quality of life and to a less extent anxiety and depression. Papers reviewed were heterogeneous in patients and procedures; they included few participants, they did not include control groups and they did not evaluate patients before treatment. Thus, we feel that more studies are needed, especially with a prospective design. The study of psychological issues is relevant and could bring us information about specific needs to be covered by psychological interventions and to design specialized care training and practice.

## COMMENTS

### Background

Some papers and guidelines reported that psychosocial factors such as depression, anxiety and other mental disorders such as personality disorders and post-traumatic stress disorder are related to morbidity and mortality due to cardiovascular diseases. Chronic heart failure, arrhythmias, and acute myocardial infarction are one of the most studied pathologies. Otherwise, other cardiovascular diseases are poorly or not yet studied from a psychological point of view, such as infective endocarditis (IE) and thoracic aortic disease (TAD). The study of psychological issues in these severe diseases could bring people valuable information about specific needs to cover with psychological interventions and to design specialized care training and practice. The aim of this review is to summarize the current evidence on psychological issues in TAD and IE setting. The authors performed a narrative review about psychological issues in adults with both TAD and IE.

### Research frontiers

From the health-psychology standpoint, both IE and TAD are almost forgotten research subjects. Patients with medical disorders usually require specialized medical attention and psychological care. It might be expected that patients with severe cardiovascular diseases will not be the exception, especially in the cases of IE and TAD, which generally require several invasive interventions. This area of interest is pretty new. All the papers revised in this research were published in the present century. Nevertheless, precise data on the psychological disorders that could be associated with IE and TAD is still lacking.

### Innovations and breakthroughs

Sixteen studies have been published about psychological issues in IE (six studies) and TAD (ten papers). Psychological issues assessed were quality of life, depression, anxiety and posttraumatic stress disorder. Quality of life was reported impaired in three of four studies about infectious endocarditis and in three of eight studies about TAD. However, recent clinical guidelines about infectious endocarditis did not mention quality of life and recent guidelines

about TAD made slightest reference to quality of life. Depression and anxiety were analyzed in TAD only (five papers). Anxiety and depression levels after different invasive interventions did not differ. No statistical differences were found in anxiety and depression scores: After aortic valve repair using mechanical replacement vs after aortic valve repair using pulmonary autograft; after underwent thoracic aortic surgery vs after coronary artery bypass grafting; after thoracic endovascular aortic repair vs after open aortic repair, after thoracic endovascular aortic repair which indication was done electively vs emergency. Moreover, baseline anxiety and depression scores had not been reported. Depression or/and anxiety before invasive intervention, might negatively influence patient recuperation after intervention. Regarding to IE, since depression was not properly assessed in the published manuscripts we do not have precise data. However, elevated pro-inflammatory cytokines in IE could promote psychological alterations such as depression, especially, in vulnerable patients, and this might compromise prognosis and coping disease. Post-traumatic stress disorder was assessed in IE (one study). It was present in 11% and was associated with lower levels of quality of life in IE patients. Although percentage of posttraumatic stress disorder in IE might be considered low, IE patients with posttraumatic stress disorder need specialized mental health care and interventions to improve quality of life.

### Applications

Despite the high impact that psychological conditions might cause in these severe diseases, the authors could verify that there is not much information available. It would be desirable that future studies used prospective designs, included control group and completed psychological assessment before and after treatments/interventions.

### Terminology

Psychological aspects revised in this paper include depression, anxiety, personality, coping, therapeutic adherence, illness perception and quality of life.

### Peer-review

The focus on IE is very timely and important, and the author presents the data in a very meaningful and useful manner.

## REFERENCES

- 1 **Habib G**, Hoen B, Tornos P, Thuny F, Prendergast B, Vilacosta I, Moreillon P, de Jesus Antunes M, Thilen U, Lekakis J, Lengyel M, Müller L, Naber CK, Nihoyannopoulos P, Moritz A, Zamorano JL. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC) for Infection and Cancer. *Eur Heart J* 2009; **30**: 2369-2413 [PMID: 19713420 DOI: 10.1093/eurheartj/ehp285]
- 2 **Wilson W**, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, Bolger A, Cabell CH, Takahashi M, Baltimore RS, Newburger JW, Strom BL, Tani LY, Gerber M, Bonow RO, Pallasch T, Shulman ST, Rowley AH, Burns JC, Ferrieri P, Gardner T, Goff D, Durack DT. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation* 2007; **116**: 1736-1754 [PMID: 17446442 DOI: 10.14219/jada.archive.2008.0346]
- 3 **Baddour LM**, Wilson WR, Bayer AS, Fowler VG, Bolger AF, Levison ME, Ferrieri P, Gerber MA, Tani LY, Gewitz MH, Tong DC, Steckelberg JM, Baltimore RS, Shulman ST, Burns JC, Falace DA, Newburger JW, Pallasch TJ, Takahashi M, Taubert KA. Infective endocarditis: diagnosis, antimicrobial therapy, and management of complications: a statement for healthcare professionals from the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease,

- Council on Cardiovascular Disease in the Young, and the Councils on Clinical Cardiology, Stroke, and Cardiovascular Surgery and Anesthesia, American Heart Association: endorsed by the Infectious Diseases Society of America. *Circulation* 2005; **111**: e394-e434 [PMID: 15956145 DOI: 10.1161/CIRCULATIONAHA.105.165564]
- 4 **Tleyjeh IM**, Abdel-Latif A, Rahbi H, Scott CG, Bailey KR, Steckelberg JM, Wilson WR, Baddour LM. A systematic review of population-based studies of infective endocarditis. *Chest* 2007; **132**: 1025-1035 [PMID: 17873196 DOI: 10.1378/chest.06-2048]
  - 5 **Keynan Y**, Rubinstein E. Pathophysiology of infective endocarditis. *Curr Infect Dis Rep* 2013; **15**: 342-346 [PMID: 23737237 DOI: 10.1007/s11908-013-0346-0]
  - 6 **Fernández-Hidalgo N**, Almirante B. [Infective endocarditis in the XXI century: epidemiological, therapeutic, and prognosis changes]. *Enferm Infecc Microbiol Clin* 2012; **30**: 394-406 [PMID: 22222058 DOI: 10.1016/j.eimc.2011.11.005]
  - 7 **Que YA**, Moreillon P. Infective endocarditis. *Nat Rev Cardiol* 2011; **8**: 322-336 [PMID: 21487430 DOI: 10.1038/nrcardio.2011.43]
  - 8 **Moreillon P**, Que YA. Infective endocarditis. *Lancet* 2004; **363**: 139-149 [PMID: 14726169 DOI: 10.1016/S0140-6736(03)15266-X]
  - 9 **Hiratzka LF**, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE, Eagle KA, Hermann LK, Isselbacher EM, Kazerooni EA, Kouchoukos NT, Lytle BW, Milewicz DM, Reich DL, Sen S, Shinn JA, Svensson LG, Williams DM. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the diagnosis and management of patients with thoracic aortic disease. A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. *J Am Coll Cardiol* 2010; **55**: e27-e129 [PMID: 20359588 DOI: 10.1016/j.jacc.2010.02.015]
  - 10 **Erbel R**, Aboyans V, Boileau C, Bossone E, Bartolomeo RD, Eggebrecht H, Evangelista A, Falk V, Frank H, Gaemperli O, Grabenwöger M, Haverich A, Iung B, Manolis AJ, Meijboom F, Nienaber CA, Roffi M, Rousseau H, Sechtem U, Sirnes PA, Allmen RS, Vrints CJ. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). *Eur Heart J* 2014; **35**: 2873-2926 [PMID: 25173340 DOI: 10.1093/eurheartj/ehu281]
  - 11 **Verhagen DW**, Hermanides J, Korevaar JC, Bossuyt PM, van den Brink RB, Speelman P, van der Meer JT. Health-related quality of life and posttraumatic stress disorder among survivors of left-sided native valve endocarditis. *Clin Infect Dis* 2009; **48**: 1559-1565 [PMID: 19392637 DOI: 10.1086/598930]
  - 12 **Perrotta S**, Aljassim O, Jeppsson A, Bech-Hanssen O, Svensson G. Survival and quality of life after aortic root replacement with homografts in acute endocarditis. *Ann Thorac Surg* 2010; **90**: 1862-1867 [PMID: 21095327 DOI: 10.1016/j.athoracsur.2010.06.100]
  - 13 **Yeates A**, Mundy J, Griffin R, Marshall L, Wood A, Peters P, Shah P. Early and mid-term outcomes following surgical management of infective endocarditis with associated cerebral complications: a single centre experience. *Heart Lung Circ* 2010; **19**: 523-527 [PMID: 20435516 DOI: 10.1016/j.hlc.2010.03.004]
  - 14 **Nayak A**, Mundy J, Wood A, Griffin R, Pinto N, Peters P, Shah P. Surgical management and mid-term outcomes of 108 patients with infective endocarditis. *Heart Lung Circ* 2011; **20**: 532-537 [PMID: 21550303 DOI: 10.1016/j.hlc.2011.03.013]
  - 15 **Berg SK**, Preisler P, Pedersen BD. Patients perspective on endocarditis--an intermezzo in life. *Eur J Cardiovasc Nurs* 2010; **9**: 126-131 [PMID: 20015692 DOI: 10.1016/j.ejcnurse.2009.11.007]
  - 16 **Rasmussen TB**, Zwissler AD, Moons P, Berg SK. Insufficient living: experiences of recovery after infective endocarditis. *J Cardiovasc Nurs* 2014; **30**: E11-E19 [PMID: 24704921 DOI: 10.1097/JCN.0000000000000144]
  - 17 **Dick F**, Hinder D, Immer FF, Hirzel C, Do DD, Carrel TP, Schmidli J. Outcome and quality of life after surgical and endovascular treatment of descending aortic lesions. *Ann Thorac Surg* 2008; **85**: 1605-1612 [PMID: 18442547 DOI: 10.1016/j.athoracsur.2008.01.027]
  - 18 **Dick F**, Hinder D, Immer FF, Savolainen H, Do DD, Carrel TP, Schmidli J. Thoracic endovascular aortic repair: impact of urgency on outcome and quality of life. *Eur J Cardiothorac Surg* 2009; **35**: 96-103 [PMID: 18829340 DOI: 10.1016/j.ejcts.2008.08.019]
  - 19 **Aicher D**, Holz A, Feldner S, Köllner V, Schäfers HJ. Quality of life after aortic valve surgery: replacement versus reconstruction. *J Thorac Cardiovasc Surg* 2011; **142**: e19-e24 [PMID: 21450311 DOI: 10.1016/j.jtcvs.2011.02.006]
  - 20 **Lehr EJ**, Wang PZ, Oreopoulos A, Kanji H, Norris C, Macarthur R. Midterm outcomes and quality of life of aortic root replacement: mechanical vs biological conduits. *Can J Cardiol* 2011; **27**: 262. e15-262. e20 [PMID: 21459276 DOI: 10.1016/j.cjca.2010.12.034]
  - 21 **Okamoto Y**, Motomura N, Murashima S, Takamoto S. Anxiety and depression after thoracic aortic surgery or coronary artery bypass. *Asian Cardiovasc Thorac Ann* 2013; **21**: 22-30 [PMID: 23430416 DOI: 10.1177/0218492312444283]
  - 22 **Immer FF**, Lippeck C, Barmettler H, Berdat PA, Eckstein FS, Kipfer B, Saner H, Schmidli J, Carrel TP. Improvement of quality of life after surgery on the thoracic aorta: effect of antegrade cerebral perfusion and short duration of deep hypothermic circulatory arrest. *Circulation* 2004; **110**: II250-II255 [PMID: 15364871 DOI: 10.1161/01.CIR.0000138387.61103.a0]
  - 23 **Stalder M**, Staffelbach S, Immer FF, Englberger L, Berdat PA, Eckstein FS, Carrel TP. Aortic root replacement does not affect outcome and quality of life. *Ann Thorac Surg* 2007; **84**: 775-80; discussion 780-1 [PMID: 17720374 DOI: 10.1016/j.athoracsur.2007.04.099]
  - 24 **Krähenbühl ES**, Immer FF, Stalder M, Englberger L, Eckstein FS, Carrel TP. Temporary neurological dysfunction after surgery of the thoracic aorta: a predictor of poor outcome and impaired quality of life. *Eur J Cardiothorac Surg* 2008; **33**: 1025-1029 [PMID: 18343679 DOI: 10.1016/j.ejcts.2008.01.058]
  - 25 **Lohse F**, Lang N, Schiller W, Roell W, Dewald O, Preusse CJ, Welz A, Schmitz C. Quality of life after replacement of the ascending aorta in patients with true aneurysms. *Tex Heart Inst J* 2009; **36**: 104-110 [PMID: 19436802]
  - 26 **Immer FF**, Moser B, Krähenbühl ES, Englberger L, Stalder M, Eckstein FS, Carrel T. Arterial access through the right subclavian artery in surgery of the aortic arch improves neurologic outcome and mid-term quality of life. *Ann Thorac Surg* 2008; **85**: 1614-1618; discussion 1618 [PMID: 18442549 DOI: 10.1016/j.athoracsur.2007.11.027]
  - 27 **Rozanski A**, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation* 1999; **99**: 2192-2217 [PMID: 10217662 DOI: 10.1161/01.CIR.99.16.2192]
  - 28 **Smith PJ**, Blumenthal JA. [Psychiatric and behavioral aspects of cardiovascular disease: epidemiology, mechanisms, and treatment]. *Rev Esp Cardiol* 2011; **64**: 924-933 [PMID: 21889253 DOI: 10.1016/j.rec.2011.06.003]
  - 29 **Everson-Rose SA**, Lewis TT. Psychosocial factors and cardiovascular diseases. *Annu Rev Public Health* 2005; **26**: 469-500 [PMID: 15760298 DOI: 10.1146/annurev.publhealth.26.021304.144542]
  - 30 **Perk J**, De Backer G, Gohlke H, Graham I, Reiner Z, Verschuren M, Albus C, Benlian P, Boysen G, Cifkova R, Deaton C, Ebrahim S, Fisher M, Germano G, Hobbs R, Hoes A, Karadeniz S, Mezzani A, Prescott E, Ryden L, Scherer M, Syväne M, Scholte op Reimer WJ, Vrints C, Wood D, Zamorano JL, Zannad F. European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts). *Eur Heart J* 2012; **33**: 1635-1701 [PMID: 22555213 DOI: 10.1093/eurheartj/ehs092]
  - 31 **Smith SC**, Benjamin EJ, Bonow RO, Braun LT, Creager MA, Franklin BA, Gibbons RJ, Grundy SM, Hiratzka LF, Jones DW, Lloyd-Jones DM, Minissian M, Mosca L, Peterson ED, Sacco RL, Spertus J, Stein JH, Taubert KA. AHA/ACC Secondary Prevention

- and Risk Reduction Therapy for Patients with Coronary and other Atherosclerotic Vascular Disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation. *Circulation* 2011; **124**: 2458-2473 [PMID: 22052934 DOI: 10.1161/CIR.0b013e318235eb4d]
- 32 **Pearson TA**, Blair SN, Daniels SR, Eckel RH, Fair JM, Fortmann SP, Franklin BA, Goldstein LB, Greenland P, Grundy SM, Hong Y, Miller NH, Lauer RM, Ockene IS, Sacco RL, Sallis JF, Smith SC, Stone NJ, Taubert KA. AHA Guidelines for Primary Prevention of Cardiovascular Disease and Stroke: 2002 Update: Consensus Panel Guide to Comprehensive Risk Reduction for Adult Patients Without Coronary or Other Atherosclerotic Vascular Diseases. American Heart Association Science Advisory and Coordinating Committee. *Circulation* 2002; **106**: 388-391 [PMID: 12119259 DOI: 10.1161/01.CIR.0000020190.45892.75]
- 33 **Piepoli MF**, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, Cooney MT, Corrà U, Cosyns B, Deaton C, Graham I, Hall MS, Hobbs FD, Løchen ML, Löllgen H, Marques-Vidal P, Perk J, Prescott E, Redon J, Richter DJ, Sattar N, Smulders Y, Tiberi M, van der Worp HB, van Dis I, Verschuren WM. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur Heart J* 2016; **37**: 2315-2381 [PMID: 27222591 DOI: 10.1093/eurheartj/ehw106]

**P- Reviewer:** Firstenberg MS, Lai S **S- Editor:** Song XX

**L- Editor:** A **E- Editor:** Wu HL







Published by **Baishideng Publishing Group Inc**  
7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA  
Telephone: +1-925-223-8242  
Fax: +1-925-223-8243  
E-mail: [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)  
Help Desk: <http://www.f6publishing.com/helpdesk>  
<http://www.wjgnet.com>

