

# World Journal of *Cardiology*

*World J Cardiol* 2017 May 26; 9(5): 396-469



### REVIEW

- 396 Sleep, health behaviors, and behavioral interventions: Reducing the risk of cardiovascular disease in adults  
*Kaar JL, Luberto CM, Campbell KA, Huffman JC*

### MINIREVIEWS

- 407 Heart failure after myocardial infarction in the era of primary percutaneous coronary intervention: Mechanisms, incidence and identification of patients at risk  
*Cahill TJ, Kharbanda RK*
- 416 Transcervical access, reversal of flow and mesh-covered stents: New options in the armamentarium of carotid artery stenting  
*Paraskevas KI, Veith FJ*
- 422 Empirical anticoagulation for patients in sinus rhythm at high risk of ischaemic stroke: A review of current literature  
*Battipaglia I, O'Neill J, Hogarth AJ, Tayebjee MH*
- 429 Antitachycardia pacing programming in implantable cardioverter defibrillator: A systematic review  
*De Maria E, Giacomelli D, Borghi A, Modonesi L, Cappelli S*

### ORIGINAL ARTICLE

#### Retrospective Cohort Study

- 437 Clinical characteristics and outcomes of octogenarians presenting with ST elevation myocardial infarction in the Australian population  
*Sim WL, Mutha V, Ul-Haq MA, Sasongko V, Van-Gaal W*

#### Retrospective Study

- 442 Jailing polymer jacketed guide-wires during bifurcation coronary interventions is associated with procedural myocardial infarction  
*Chatterjee A, White JS, Hashim T, Leesar MA*

#### Observational Study

- 448 Markers of inflammation and cardiovascular disease in recently diagnosed celiac disease patients  
*Tetzlaff WF, Meroño T, Menafra M, Martin M, Botta E, Matoso MD, Sorroche P, De Paula JA, Boero LE, Brites F*

**Prospective Study**

- 457 Combined assessment of myocardial damage and electrical disturbance in chronic heart failure  
*Kadowaki S, Watanabe T, Otaki Y, Narumi T, Honda Y, Takahashi H, Arimoto T, Shishido T, Miyamoto T, Kubota I*

**CASE REPORT**

- 466 Cough induced syncope: A hint to cardiac tamponade diagnosis  
*Ramirez R, Lasam G*

**ABOUT COVER**

Editorial Board Member of *World Journal of Cardiology*, Gergely Feher, MD, PhD, Assistant Professor, Department of Neurology, Medical School, University of Pecs, Pecs, Baranya 7623, Hungary

**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:** *Fang-Fang Ji*  
**Proofing Editorial Office Director:** *Xiu-Xia Song*

**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**  
 May 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>

Retrospective Study

## Jailing polymer jacketed guide-wires during bifurcation coronary interventions is associated with procedural myocardial infarction

Arka Chatterjee, Jeremy S White, Taimoor Hashim, Massoud A Leesar

Arka Chatterjee, Taimoor Hashim, Massoud A Leesar, Division of Cardiovascular Disease, University of Alabama at Birmingham, Birmingham, AL 35294, United States

Jeremy S White, Department of Internal Medicine, University of Alabama at Birmingham, Birmingham, AL 35294, United States

**Author contributions:** Chatterjee A formulated the research question, designed the study, performed statistical analyses and wrote the manuscript; White JS and Hashim T were involved in individual chart reviews to extract data and verify accuracy; Leesar MA supervised the study as senior investigator.

**Institutional review board statement:** The Institutional Review Board of the University of Alabama at Birmingham approved the study.

**Informed consent statement:** The institutional Review Board of the University of Alabama at Birmingham waived the need for informed consent since this was a retrospective study using de-identified data only.

**Conflict-of-interest statement:** None of the authors have any disclosures/conflicts of interest pertaining to this manuscript.

**Data sharing statement:** No additional data are available.

**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:** Massoud A Leesar, MD, Division of Cardiovascular Disease, University of Alabama at Birmingham,

1520 3<sup>rd</sup> Ave S FOT 907, Birmingham, AL 35294, United States. [mleesar@uabmc.edu](mailto:mleesar@uabmc.edu)  
Telephone: +1-205-9347898  
Fax: +1-205-9340973

Received: October 28, 2016

Peer-review started: November 2, 2016

First decision: January 14, 2017

Revised: February 1, 2017

Accepted: March 12, 2017

Article in press: March 13, 2017

Published online: May 26, 2017

### Abstract

#### AIM

To study the relationship of jailed polymer jacketed guide wires (PGW) with procedural myocardial infarction (PMI) after bifurcation coronary interventions.

#### METHODS

Consecutive bifurcation interventions performed from January 2010 to October 2014 were included in the study. Chart review was performed to obtain demographic, clinical and procedural data. PMI was defined as Creatine Kinase MB > 3 × upper reference limit of normal. Multivariate logistic regression was used to ascertain relationship of PGW use with PMI.

#### RESULTS

Two hundred and ninety-three patients (age 63.5 ± 12.3 years; 33.8% diabetic) were included in the study. Eighty point two percent ( $n = 235$ ) were true bifurcation lesions use of PGW was associated with PMI on univariate analysis (OR = 4.1;  $P = 0.002$ ). This association remained significant after adjusting for other possible risk factors (OR = 3.5;  $P = 0.02$ ).

## CONCLUSION

Our results suggest that PGW use for side branch protection may be associated with PMI. Randomized studies are needed to validate these findings.

**Key words:** Coronary bifurcation lesions; Percutaneous coronary intervention; Procedural myocardial infarction; Jailed guidewire; Polymer shearing

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

**Core tip:** This is a retrospective study aiming to investigate the relationship of jailed polymer jacketed guide wires (PGW) with procedural myocardial infarction (PMI) after a bifurcation coronary intervention. There is concern that this causes polymer shearing and distal micro-embolization. Our data suggests that jailed PGW are strongly associated with PMI, even after adjusting for pertinent risk factors. Thus caution should be exercised in routinely jailing PGW until further definitive data are available.

Chatterjee A, White JS, Hashim T, Leesar MA. Jailing polymer jacketed guide-wires during bifurcation coronary interventions is associated with procedural myocardial infarction. *World J Cardiol* 2017; 9(5): 442-447 Available from: URL: <http://www.wjgnet.com/1949-8462/full/v9/i5/442.htm> DOI: <http://dx.doi.org/10.4330/wjc.v9.i5.442>

## INTRODUCTION

Coronary bifurcation lesions (CBL) are a challenging subset of day to day coronary interventions with a higher adverse event profile as compared to non-bifurcation lesions<sup>[1]</sup>. In the past decade, multiple studies have investigated the optimum approach to bifurcation lesions *vis-à-vis* simple (provisional side branch stenting only) vs complex (mandatory main and side branch stenting) approaches<sup>[2-4]</sup>. These have led to a widespread consensus that the simple approach should be preferred in majority of CBLs as the complex strategy showed higher incidence of adverse cardiac events, mainly myocardial infarction<sup>[5]</sup>.

In the simple approach, a coronary guidewire is frequently inserted into the side-branch (SB) as a strategy to prevent occlusion. This is considered to be an important step as side branch compromise is associated with higher incidence of myocardial infarction and death<sup>[6,7]</sup>. Stent deployment in the main vessel (MV) "jails" this guidewire which then has to be pulled from underneath the stent struts. Polymer jacketed guidewires (PGW) have the advantage of maximum lubricity which allows them to be easily withdrawn from a jailed position. However there are concerns over wire damage and shearing of the polymer jacket<sup>[8]</sup> and hence these are not universally recommended for

jailing<sup>[9]</sup>. In addition, studies of pathological specimens have revealed evidence of embolized polymer in the myocardium<sup>[10,11]</sup>. Guidewires with no or minimal polymer coatings are felt to be safer but run a risk of wire fracture during attempts at withdrawal<sup>[12]</sup>. In a pilot study using scanning electron microscopy (SEM) at our institution, it was established that polymer shearing is a real phenomenon and that the amount of polymer sheared is weakly correlated with biomarker release post procedure<sup>[13]</sup>. These studies have posed a question regarding an incremental risk of myonecrosis and possibly procedural myocardial infarction (PMI) with jailing of PGW and polymer shearing.

To try and answer this question, we performed a retrospective analysis of consecutive CBL interventions at our institution to determine if there is any association between type of guidewire jailed and PMI.

## MATERIALS AND METHODS

All coronary interventions performed between January 2010 and October 2014 at our institution were reviewed to identify CBL interventions. Inclusion criteria were: CBL requiring percutaneous coronary intervention (PCI), MV diameter  $\geq$  2.5 mm and side branch diameter  $\geq$  2 mm. Criteria for exclusion were PCI for chronic total occlusions, cases where dual antiplatelet therapy was started after PCI and unavailability of biomarker levels at least 12 h after PCI. The Institutional Review Board of the University of Alabama at Birmingham approved the study. Chart review was performed to extract demographic and clinical parameters. Patients were divided into two groups based on occurrence of PMI as defined below.

### Angiographic definitions

Angiograms were reviewed and quantitative measurements made using the CAAS system. A CBL was defined as a lesion located at a major coronary bifurcation point. Lesions were classified according to the Medina classification with a score of "1" or "0" being given to the proximal MV, distal MV and the SB components if they had  $\geq$  50% diameter stenosis. Lesions were also classified as true bifurcation lesions (Medina type 1,1,1; 1,0,1 or 0,1,1) vs non-true bifurcation lesions (Medina type 1,0,0; 0,1,0 or 0,0,1).

### Definition of procedural myocardial infarction

PMI was defined as creatine kinase (CK) MB  $> 3 \times 99^{\text{th}}$  percentile of upper limit of normal post procedure if the pre-procedure levels were normal or a  $> 20\%$  increase if pre-procedure levels were abnormal but stable or down-trending. If there were any unrelated cause for biomarker elevation, *e.g.*, acute stent thrombosis, no reflow, SB occlusion,  $<$  TIMI 3 flow in MV or SB, shock or hypotension in the immediate 24 h post PCI, acute kidney injury, stroke, bleeding requiring transfusion, pulmonary embolism, access complication causing limb

**Table 1** Demographic and clinical characteristics of the study population

	No PMI (n = 270)	PMI (n = 23)	P value
Age (yr)	63.6 ± 12.1	62.9 ± 14.4	0.80
Male sex	68.1%	60.9%	0.49
Smoking	55.6%	52.2%	0.86
Diabetes mellitus	33.0%	43.5%	0.36
Hypertension	78.1%	65.2%	0.33
Hyperlipidemia	73.7%	78.3%	0.87
Acute coronary syndrome	45.6%	52.2%	0.66

PMI: Procedural myocardial infarction.

ischemia or sustained arrhythmia these cases were classified as not having PMI. This was done to focus only on cases without a clear explanation for cause of PMI.

### Statistical analysis

Continuous variables are represented as mean ± SD and compared using the Welch's *t* test as the sample sizes are unequal. Categorical variables were compared using the Fisher's exact test. Statistical analyses were carried out using SPSS v 22.0 (SPSS, Chicago, Illinois). Multivariate logistic regression was used to ascertain relationship of the following variables with PMI: Age, Diabetes Mellitus, severe lesion calcification, true bifurcation lesion, use of newer antiplatelet agent (Ticagrelor and Prasugrel), Bivalirudin use, upstream Glycoprotein IIb/IIIa use, use of preplanned two stent technique, SB protection with any guidewire and SB protection with PGW.

## RESULTS

A total of 293 consecutive patients undergoing CBL interventions were included in the study. Seven point eight percent ( $n = 23$ ) patients were classified as having had a PMI. Demographic and clinical characteristics of the patients broken down into two groups depending on whether or not PMI occurs are shown in Table 1. There were no statistically significant differences between the two groups. Table 2 shows the angiographic and procedural characteristics of patients with and without PMI. The most common bifurcation lesions included were left anterior descending/diagonal and left circumflex/marginal branch respectively. Proportion of true bifurcation lesions was higher and Bivalirudin use lower in the PMI group but these differences did not reach statistical significance. Seventy-four point four percent of total patients had a wire placed in the side branch and jailed with no difference amongst the two groups. However a jailed PGW was much more common in the PMI group (43.4% vs 15.9%,  $P = 0.003$ ). There were no instances of wire entrapment or wire rupture in either group. The most common PGW jailed was a Hi Torque Whisper (Abbot Vascular, Abbott Park, IL, United States) while non PGW jailed were Runthrough NS

**Table 2** Angiographic and procedural characteristics

	No PMI (n = 270)	PMI (n = 23)	P value
Vessels involved			0.68
LM bifurcation	15.9%	21.7%	
LAD/Diagonal	40.0%	47.8%	
LCX/OM	34.8%	21.7%	
RPDA/RPLA	8.8%	4.3%	
RCA/RV marginal	0.003%	0%	
Severe calcification	57.4%	65.2%	0.52
True bifurcation (Medina 1,1,1; 1,0,1; 0,1,1)	79.3%	91.3%	0.27
Main vessel diameter (mm)	3.3 ± 0.5	3.3 ± 0.4	0.4
Side branch diameter (mm)	2.6 ± 0.5	2.6 ± 0.4	0.94
Antiplatelet therapy			0.97
Plavix	73.7%	69.6%	
Prasugrel	7.0%	8.7%	
Ticagrelor	19.3%	21.7%	
Anticoagulant			0.08
Heparin	45.2%	65.2%	
Bivalirudin	54.8%	34.8%	
Upstream GpIIb/IIIa use	11.5%	13.0%	0.74
Planned 2 stent approach	28.1%	39.1%	0.34
Final kissing balloon angioplasty	45.9%	56.5%	0.39
SB protected	73.3%	87%	0.21
PGW jailed	15.9%	43.4%	0.003

PMI: Procedural myocardial infarction; PGW: Polymer jacketed guide wires.

(Terumo Interventional Systems, Somerset, NJ, United States), Cougar LS (Medtronic, Minneapolis, MN, United States) and HT Balance Middle Weight (BMW, Abbot Vascular, Abbott Park, IL, United States).

Univariate logistic regression analysis did not reveal any significant association of PMI with age, Diabetes, lesion calcification, use of newer antiplatelet agents, use of Bivalirudin, upstream use of Gp IIb/IIIa use, SB protection, pre-planned use of complex 2 stent strategy or Medina classification as true bifurcation lesion. The use of jailed PGW was strongly associated with PMI with an odds ratio of 4.1 (95%CI: 1.7-9.9;  $P = 0.002$ ). Performing multivariate logistic regression to adjust for all the aforementioned factors still showed a strong association between jailing of PGW and PMI (Figure 1, Odds ratio 3.5; 95%CI: 1.2-9.9;  $P = 0.02$ ).

## DISCUSSION

SB protection is of considerable importance during CBL interventions. Occlusion of a SB > 1.0 mm has been associated with a 14% risk of MI<sup>[6]</sup>. In a large series of 2227 CBL interventions, Hahn *et al*<sup>[7]</sup> reported a SB occlusion rate of 8.4% and this increased the rate of major adverse cardiovascular events. The only protective factor found to prevent SB occlusion was the presence of a jailed guide-wire. Similar findings were reported in the Nordic study illustrating the importance of the jailed SB wire<sup>[14]</sup>. The jailed guide wire provides a physical impediment to closure of the SB ostium and also facilitates re-wiring of the vessel by making the angle between the MV and the SB wider<sup>[15]</sup>. Thus jailing

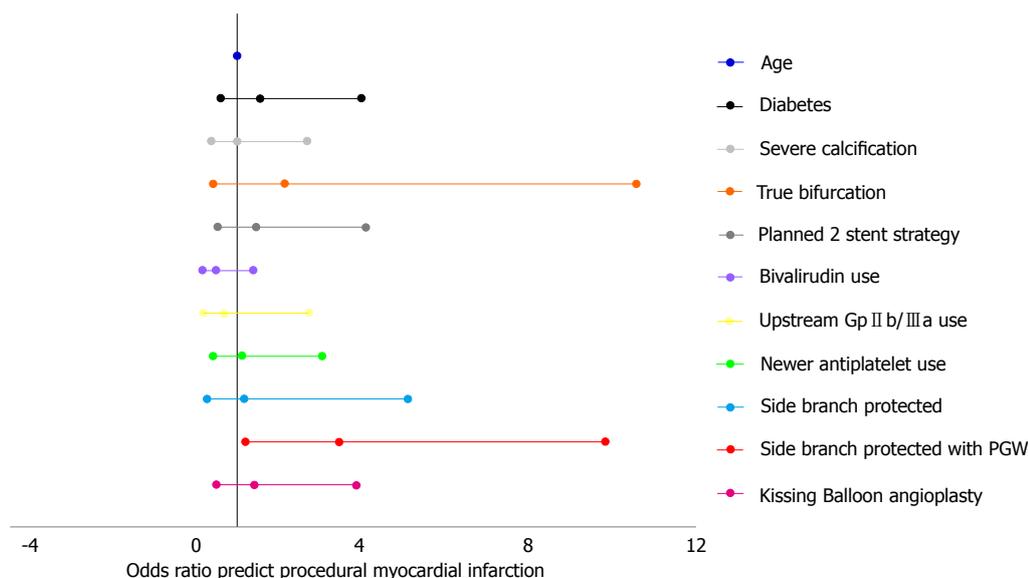


Figure 1 Multi-variate Odds ratios for various factors in predicting procedural myocardial infarction. PGW: Polymer jacketed guide wires.

a wire in the SB during MV stenting is a widely accepted practice for CBL interventions. However there is less consensus on the type of guide-wire to jail.

All coronary guide-wires have some degree of polymer coating on them with varying degrees of polymer cover or jacket. Based on the latter, guide-wires are broadly classified into three categories: (1) Wires with no polymer jacket - minimum lubricity, *e.g.*, HT BMW, Prowater and HT Floppy II; (2) Wires with intermediate polymer jacket - lack polymer jacket at the very distal end only; medium lubricity, *e.g.*, HT BMW Universal, Runthrough NS, Cougar LS; and (3) Wires with full polymer jacket - polymer jacket throughout the length of the wire; maximum lubricity; *e.g.*, HT Whisper, HT Pilot, HT Fielder XT.

PGW (3<sup>rd</sup> category) offer the attractive quality of lubricity and are easily withdrawn from underneath stent struts. However the interventional community has been wary of these as the initial reports of wire rupture were consistently with hydrophilic PGW<sup>[8]</sup>. Since then multiple reports of non hydrophilic wires being entrapped have been published as well<sup>[16-19]</sup>. With the lesser degree of lubricity of a non PGW, greater force may be required to extract the wire and hence risk deep intubation of the guide catheter and injury to the vessel as well.

Some reports have also raised the possibility of shearing of the polymer jacket during extraction of the jailed PGW<sup>[20]</sup>. Grundeken *et al*<sup>[11]</sup> examined the possibility of distal polymer embolization in two ways - they examined the aspirate from patients undergoing aspiration thrombectomy and reported that 45% samples had polymer material in them. Also, examination of autopsy specimens from patients who had undergone PCI showed intramyocardial polymer in 10% subjects. The amount of polymer detected increased as the polymer jacket increased with the maximum embolization noted in cases using HT Whisper

wires. This study is especially concerning because polymer embolization occurred even without jailing the guide-wire. It is notable that distal embolization of athero-emboli is considered an important contributor in the etiology of PMI<sup>[21]</sup> - hence embolization of non-degradable polymer is a plausible hypothetical cause for PMI as well.

To try and quantify the extent of polymer shearing and embolization, we have previously performed a small study examining jailed HT Whisper and Runthrough NS wires with SEM<sup>[13]</sup>. This revealed polymer shearing in both types of wires but up to 5 fold higher in the HT Whisper, a PGW. Amount of polymer shearing was also weakly correlated with the level of CK MB post procedure. Pan *et al*<sup>[22]</sup> randomized 235 patients who underwent CBL interventions with the jailed wire technique to use of PGW or non PGW and examined the jailed wires using an optical microscope. They reported more structural damage to non PGW although no wire fracture was noted. It should be noted though that the study used magnification up to 6.3X only, which is insufficient to detect shearing of polymer and also used wires with no polymer cover as the comparison group, the use of which has gone down in comparison to wires with intermediate polymer cover. Also, the rate of PMI was not different in the two groups.

In this respect, our study is the second study to investigate the relationship of type of wire jailed to PMI. Our results show a strong association of jailed PGW to PMI which are contrary to the results of Pan *et al*<sup>[22]</sup>. One reason may be that there are varied reasons why patient have elevated cardiac biomarkers post PCI. Some of these may be no reflow phenomenon, distal athero-embolization, occlusion of SB, coronary perforation, development of cardiogenic (or other types of) shock, access complications causing limb ischemia, arrhythmias, bleeding causing hemodynamic instability,

*etc.* These, at least by our current knowledge of PMI are more likely to be contributors than polymer embolization from jailed PGW. Hence we meticulously excluded all cases which may have had any confounding factor causing a biomarker elevation and categorized these cases as having no PMI. This further strengthens our belief in the credibility of our results.

### Limitations

Our study has all the limitations of a retrospective analysis and the inherent biases. However we have attempted to correct these biases by careful data acquisition, exclusion of cases with potential confounding factors and a multivariate logistic regression analysis. We also note that the definition of PMI used is inconsistent with the 3<sup>rd</sup> universal definition of MI consensus document<sup>[23]</sup> which defines PMI as  $> 5 \times$  ULN of cardiac Troponin (cTn) along with symptoms, electrocardiographic, imaging or angiographic evidence of ischemia. Multiple studies have been done that question the relevance of the  $5 \times$  ULN of cTn criterion as a  $> 3 \times$  ULN of CK-MB cut-off is better correlated with mortality<sup>[24]</sup> and evidence of new myocardial injury as detected by cardiac MRI<sup>[25]</sup>. In fact, a cut off of  $3 \times$  ULN of CK-MB is equivalent to a cut-offs of  $20 \times$  cTn for mortality and  $40 \times$  cTn for MRI proven new myocardial injury. Hence while the updated definition is valid in conjunction with clinical evidence of ischemia, CK MB may be a better choice for isolated biomarker analyses.

In conclusion, our study shows that jailed PGW may be associated with a threefold higher risk of PMI. Given the retrospective design, this finding should be treated as hypothesis generating and hopefully will trigger prospective analysis to confirm or refute this association. The etiology for this risk is believed to be polymer shearing and micro-embolization which has been proven by multiple small but rigorously conducted studies<sup>[11,13]</sup>. We believe that much has to be learned about the potential role of polymer shearing and embolization in myonecrosis post CBL intervention. There is also a need to determine if the wires with intermediate polymer cover may be the best middle path compromise in the argument of lubricity vs fracture and polymer shearing.

## COMMENTS

### Background

Polymer jacketed guide wires (PGW) are frequently used for side branch protection during bifurcation coronary interventions. Their lubricity is an attractive property for this use as it makes them easy to retract from underneath stent struts. However, microscopic shearing of polymer from jailed guide wires has been reported and may be a potential cause of procedural myocardial infarction (PMI) as this may cause distal micro-embolization. Hence, the authors performed a retrospective analysis of bifurcation interventions at this institution to ascertain relationship of PGW use with PMI.

### Research frontiers

PMI has important prognostic implications in patients undergoing percutaneous coronary intervention. Thus it is important to understand if any procedural factors such as use of PGW have any effect on PMI.

### Innovations and breakthroughs

This is only the second study to ascertain if there is a relationship between use of jailed PGW and PMI. In their data there is a strong association of these which translates to a three fold higher risk of PMI if a PGW is jailed.

### Applications

These results should caution interventional cardiologists from adopting PGW as their go to wire for jailing until prospective data comparing different types of wires are available. Randomized studies are needed to compare newer generation non polymer jacketed, intermediate polymer jacketed and full polymer jacketed coronary guide wires.

### Terminology

PGW: Polymer jacketed guide wires; PMI: Procedural myocardial infarction.

### Peer-review

This is an interesting manuscript about the relation of jailing PGW to PMI. The authors demonstrated that jailed PGW might be associated with PMI. This manuscript is nicely structured and well written.

## REFERENCES

- 1 **Lefèvre T**, Louvard Y, Morice MC, Dumas P, Loubeyre C, Benslimane A, Premchand RK, Guillard N, Piéchaud JF. Stenting of bifurcation lesions: classification, treatments, and results. *Catheter Cardiovasc Interv* 2000; **49**: 274-283 [PMID: 10700058 DOI: 10.1002/(SICI)1522-726X(200003)49:3<274::AID-CCD11>3.0.CO;2-N]
- 2 **Colombo A**, Bramucci E, Saccà S, Violini R, Lettieri C, Zanini R, Sheiban I, Paloscia L, Grube E, Schofer J, Bolognese L, Orlandi M, Niccoli G, Latib A, Airolidi F. Randomized study of the crush technique versus provisional side-branch stenting in true coronary bifurcations: the CACTUS (Coronary Bifurcations: Application of the Crushing Technique Using Sirolimus-Eluting Stents) Study. *Circulation* 2009; **119**: 71-78 [PMID: 19103990 DOI: 10.1161/CIRCULATIONAHA.108.808402]
- 3 **Hildick-Smith D**, de Belder AJ, Cooter N, Curzen NP, Clayton TC, Oldroyd KG, Bennett L, Holmberg S, Cotton JM, Glennon PE, Thomas MR, Maccarthy PA, Baumbach A, Mulvihill NT, Henderson RA, Redwood SR, Starkey IR, Stables RH. Randomized trial of simple versus complex drug-eluting stenting for bifurcation lesions: the British Bifurcation Coronary Study: old, new, and evolving strategies. *Circulation* 2010; **121**: 1235-1243 [PMID: 20194880 DOI: 10.1161/CIRCULATIONAHA.109.888297]
- 4 **Maeng M**, Holm NR, Erglis A, Kumsars I, Niemelä M, Kervinen K, Jensen JS, Galløe A, Steigen TK, Wiseth R, Narbute I, Gunnes P, Mannsverk J, Meyerdierks O, Rotevatn S, Nikus K, Vikman S, Ravkilde J, James S, Aarøe J, Ylitalo A, Helqvist S, Sjögren I, Thayssen P, Virtanen K, Puhakka M, Airaksinen J, Christiansen EH, Lassen JF, Thuesen L. Long-term results after simple versus complex stenting of coronary artery bifurcation lesions: Nordic Bifurcation Study 5-year follow-up results. *J Am Coll Cardiol* 2013; **62**: 30-34 [PMID: 23644088 DOI: 10.1016/j.jacc.2013.04.015]
- 5 **Katritsis DG**, Siontis GC, Ioannidis JP. Double versus single stenting for coronary bifurcation lesions: a meta-analysis. *Circ Cardiovasc Interv* 2009; **2**: 409-415 [PMID: 20031750 DOI: 10.1161/CIRCINTERVENTIONS.109.868091]
- 6 **Aroora RR**, Raymond RE, Dimas AP, Bhadwar K, Simpfendorfer C. Side branch occlusion during coronary angioplasty: incidence, angiographic characteristics, and outcome. *Cathet Cardiovasc Diagn* 1989; **18**: 210-212 [PMID: 2605622]
- 7 **Hahn JY**, Chun WJ, Kim JH, Song YB, Oh JH, Koo BK, Rha SW, Yu CW, Park JS, Jeong JO, Choi SH, Choi JH, Jeong MH, Yoon JH, Jang Y, Tahk SJ, Kim HS, Gwon HC. Predictors and outcomes of side branch occlusion after main vessel stenting in coronary bifurcation lesions: results from the COBIS II Registry (COronary Bifurcation Stenting). *J Am Coll Cardiol* 2013; **62**: 1654-1659

- [PMID: 23954335 DOI: 10.1016/j.jacc.2013.07.041]
- 8 **Louvard Y**, Lefèvre T, Morice MC. Percutaneous coronary intervention for bifurcation coronary disease. *Heart* 2004; **90**: 713-722 [PMID: 15145893 DOI: 10.1136/hrt.2002.007682]
  - 9 **Latib A**, Colombo A. Bifurcation disease: what do we know, what should we do? *JACC Cardiovasc Interv* 2008; **1**: 218-226 [PMID: 19463303 DOI: 10.1016/j.jcin.2007.12.008]
  - 10 **Schipper ME**, Stella PR, de Jonge N, Virmani R, de Weger RA, Vink A. Embolization of hydrophilic coating material to small intracardial arteries after multiple percutaneous transluminal angioplasty procedures. *Int J Cardiol* 2012; **155**: e45-e46 [PMID: 21851997 DOI: 10.1016/j.ijcard.2011.07.055]
  - 11 **Grundeken MJ**, Li X, Kurpershoek CE, Kramer MC, Vink A, Piek JJ, Tijssen JG, Koch KT, Wykrzykowska JJ, de Winter RJ, van der Wal AC. Distal embolization of hydrophilic-coating material from coronary guidewires after percutaneous coronary interventions. *Circ Cardiovasc Interv* 2015; **8**: e001816 [PMID: 25582439 DOI: 10.1161/CIRCINTERVENTIONS.114.001816]
  - 12 **Owens CG**, Spence MS. How should I treat a patient to remove a fractured jailed side branch wire? *EuroIntervention* 2011; **7**: 520-527 [PMID: 21764672 DOI: 10.4244/EIJV7I4A83]
  - 13 **Chatterjee A**, Brott BC, Foley R, Alli O, Sasse M, Ahmed M, Al Solaiman F, Reddy G, Ather S, Leesar MA. Safety of hydrophilic guidewires used for side-branch protection during stenting and proximal optimization technique in coronary bifurcation lesions. *Cardiovasc Revasc Med* 2016; **17**: 456-462 [PMID: 27210866 DOI: 10.1016/j.carrev.2016.04.006]
  - 14 **Steigen TK**, Maeng M, Wiseth R, Erglis A, Kumsars I, Narbute I, Gunnes P, Mannsverk J, Meyerdierks O, Rotevatn S, Niemelä M, Kervinen K, Jensen JS, Galløe A, Nikus K, Vikman S, Ravkilde J, James S, Aarøe J, Ylitalo A, Helqvist S, Sjögren I, Thaysen P, Virtanen K, Puhakka M, Airaksinen J, Lassen JF, Thuesen L. Randomized study on simple versus complex stenting of coronary artery bifurcation lesions: the Nordic bifurcation study. *Circulation* 2006; **114**: 1955-1961 [PMID: 17060387 DOI: 10.1161/CIRCULATIONAHA.106.664920]
  - 15 **Weinstein JS**, Baim DS, Sipperly ME, McCabe CH, Lorell BH. Salvage of branch vessels during bifurcation lesion angioplasty: acute and long-term follow-up. *Cathet Cardiovasc Diagn* 1991; **22**: 1-6 [PMID: 1995167]
  - 16 **Ojeda Delgado JL**, Jiménez Mena M, Barrios Alonso V, Pena Tizón J, Fernández Sánchez-Villarán E, Hernández Madrid A, Marín Huerta E, Pey Illera J. [Guide-wire rupture as a complication of coronary angioplasty. Apropos 2 cases and a review of the literature]. *Rev Esp Cardiol* 1992; **45**: 141-144 [PMID: 1561468]
  - 17 **Sezgin AT**, Gullu H, Ermis N. Guidewire entrapment during jailed wire technique. *J Invasive Cardiol* 2006; **18**: 391-392 [PMID: 16877789]
  - 18 **Bonvini RF**, Werner KD, Buettner HJ, Buergelin KH, Zeller T. Retrieval of lost coronary guidewires during challenging percutaneous coronary interventions. *Cardiovasc Revasc Med* 2010; **11**: 262. e7-262.10 [PMID: 20934661 DOI: 10.1016/j.carrev.2009.04.109]
  - 19 **Balbi M**, Bezante GP, Brunelli C, Rollando D. Guide wire fracture during percutaneous transluminal coronary angioplasty: possible causes and management. *Interact Cardiovasc Thorac Surg* 2010; **10**: 992-994 [PMID: 20351016 DOI: 10.1510/icvts.2009.227678]
  - 20 **Pawlowski K**, Dorniak W, Klaudel J. Percutaneous evacuation of detached hydrophilic coating of jailed guidewire. *J Invasive Cardiol* 2010; **22**: E193-E195 [PMID: 21041863]
  - 21 **Babu GG**, Walker JM, Yellon DM, Hausenloy DJ. Peri-procedural myocardial injury during percutaneous coronary intervention: an important target for cardioprotection. *Eur Heart J* 2011; **32**: 23-31 [PMID: 21037252 DOI: 10.1093/eurheartj/ehq393]
  - 22 **Pan M**, Ojeda S, Villanueva E, Chavarria J, Romero M, Suarez de Lezo J, Mazuelos F, Segura J, Carrasco F, Hidalgo F, Lopez-Aguilera J, Rodriguez S, Puente M, Suarez de Lezo J. Structural Damage of Jailed Guidewire During the Treatment of Coronary Bifurcation Lesions: A Microscopic Randomized Trial. *JACC Cardiovasc Interv* 2016; **9**: 1917-1924 [PMID: 27659568 DOI: 10.1016/j.jcin.2016.06.030]
  - 23 **Thygesen K**, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD, Thygesen K, Alpert JS, White HD, Jaffe AS, Katus HA, Apple FS, Lindahl B, Morrow DA, Chaitman BR, Clemmensen PM, Johanson P, Hod H, Underwood R, Bax JJ, Bonow JJ, Pinto F, Gibbons RJ, Fox KA, Atar D, Newby LK, Galvani M, Hamm CW, Uretsky BF, Steg PG, Wijns W, Bassand JP, Menasche P, Ravkilde J, Ohman EM, Antman EM, Wallentin LC, Armstrong PW, Simoons ML, Januzzi JL, Nieminen MS, Gheorghiade M, Filippatos G, Luepker RV, Fortmann SP, Rosamond WD, Levy D, Wood D, Smith SC, Hu D, Lopez-Sendon JL, Robertson RM, Weaver D, Tendera M, Bove AA, Parkhomenko AN, Vasilieva EJ, Mendis S, Bax JJ, Baumgartner H, Ceconi C, Dean V, Deaton C, Fagard R, Funck-Brentano C, Hasdai D, Hoes A, Kirchhof P, Knutti J, Kolh P, McDonagh T, Moulin C, Popescu BA, Reiner Z, Sechtem U, Sirnes PA, Tendera M, Torbicki A, Vahanian A, Windecker S, Morais J, Aguiar C, Almahmeed W, Arnar DO, Barili F, Bloch KD, Bolger AF, Botker HE, Bozkurt B, Bugiardini R, Cannon C, de Lemos J, Eberli FR, Escobar E, Hlatky M, James S, Kern KB, Moliterno DJ, Mueller C, Neskovic AN, Pieske BM, Schulman SP, Storey RF, Taubert KA, Vranckx P, Wagner DR. Third universal definition of myocardial infarction. *J Am Coll Cardiol* 2012; **60**: 1581-1598 [PMID: 22958960 DOI: 10.1016/j.jacc.2012.08.001]
  - 24 **Novack V**, Pencina M, Cohen DJ, Kleiman NS, Yen CH, Saucedo JF, Berger PB, Cutlip DE. Troponin criteria for myocardial infarction after percutaneous coronary intervention. *Arch Intern Med* 2012; **172**: 502-508 [PMID: 22371874 DOI: 10.1001/archinternmed.2011.2275]
  - 25 **Lim CC**, van Gaal WJ, Testa L, Cuculi F, Arnold JR, Karamitsos T, Francis JM, Petersen SE, Digby JE, Westaby S, Antoniadou C, Kharbanda RK, Burrell LM, Neubauer S, Banning AP. With the "universal definition," measurement of creatine kinase-myocardial band rather than troponin allows more accurate diagnosis of periprocedural necrosis and infarction after coronary intervention. *J Am Coll Cardiol* 2011; **57**: 653-661 [PMID: 21292125 DOI: 10.1016/j.jacc.2010.07.058]

**P- Reviewer:** Nunez-Gil IJ, Schoenhagen P, Ueda H  
**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>

