International Journal of Cardiology xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Use of cardiovascular prevention treatments after acute coronary syndrome in China and associated factors

Emily R. Atkins [a,b,*,1,2,3], Xin Du [c,3], Yangfeng Wu [c,d,e,3], Runlin Gao [f,3], Anushka Patel [a,b,g,3], Clara K. Chow [a,b,h,3]

[a] The George Institute for Global Health, University of Sydney, Sydney, Australia
[b] Sydney Medical School, University of Sydney, Sydney, Australia
[c] The George Institute for Global Health, Beijing, China
[d] Department of Epidemiology and Biostatistics, Peking University School of Public Health, China
[e] China International Center for Chronic Disease Prevention, China
[f] Cardiovascular Institute and Fu Wai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, China
[g] Royal Prince Alfred Hospital, Australia
[h] Westmead Hospital, Australia

ARTICLE INFO

Article history:
Received 27 September 2016
Received in revised form 28 February 2017
Accepted 13 March 2017
Available online xxxx

Keywords:
Cardiovascular prevention treatment
Risk factors
Women
Acute coronary syndromes
Adherence

ABSTRACT

Background: Prevention of repeat cardiovascular events is an important means of addressing the increasing burden of coronary heart disease in China, however there is minimal information about the use of cardiovascular prevention treatment following acute coronary syndrome (ACS) in China.
Methods: We analysed data from baseline and 6, 12, 18, and 24-month follow-up surveys of 15,140 consecutive ACS patients recruited in 70 hospitals from 17 provinces of China. We describe the use of indicated cardiovascular prevention medicines, risk factor control, change over time and factors associated with continued prevention.
Results: 12,094 patients had follow-up data up to 12 months. At discharge, 86.1% were on a combination of antiplatelet, statin and blood pressure (BP) lowering drugs. Use of this combination fell to 68.0% at 12 months and 59.7% in patients followed to 24 months. Patients admitted to tertiary hospitals were more likely to be on the combination compared to secondary hospitals (at discharge 90.1% vs. 79.5%, $p < 0.0001$; at 12 months 71% vs. 64%, $p < 0.001$ respectively). At 12 months 25.2% achieved control in ≥four of five guideline levels of risk factors and this was similar by hospital level. Prescription of BP-lowering drugs and statins at discharge was the strongest predictor of use at 12 months follow-up. Lower income was associated with less use of both.
Conclusions: Use of cardiovascular prevention treatment declines steadily over time following an ACS. The largest proportional decline is in the first six months. Ensuring patients are discharged on these therapies and addressing barriers for low-income earners may help address this gap.

1. Introduction

Cardiovascular disease (CVD) is the leading global cause of mortality and morbidity internationally [1]. Preventing secondary events is an effective means of reducing CVD burden and is a current priority of the World Heart Federation [2]. This includes the use of pharmacotherapy (blood pressure-lowering, cholesterol-lowing with statins, and antiplatelet medications), and lifestyle modification to achieve risk factor targets [3].

Use of effective pharmacotherapy in patients after acute coronary syndromes (ACS) has been found to be sub-optimal globally and very poor in studies of selected populations from lower income countries [4–6]. However there is less information about the rate at which medication use declines after an ACS event, the factors that influence use of prevention medications. Such information is particularly lacking in emerging economies such as China, where the CVD burden is rising.

The aims of this study were to 1) examine the use of indicated cardiovascular prevention medications and the extent of risk factor control up to 24 months after an ACS event in China; 2) examine whether variation exists by age, sex, hospital location; and 3) explore the factors related to less use of prevention medications at 12 months post ACS.

2. Methods

We conducted a cohort analysis using serial surveys collected as part of a cluster randomised control trial. The data used in this study are drawn from the baseline and 6, 12, 18, and 24-month survey data of patients with ACS from 70 hospitals in 17 provinces

* Corresponding author at: The George Institute for Global Health, University of Sydney, Australia.
E-mail address: eatkins@georgeinstitute.org.au (E.R. Atkins).
[1] Street address: Level 10, King George V Building, 83-117 Missenden Rd, Camperdown NSW 2050 Australia.
[2] Postal Address: PO Box M201, Missenden Rd, NSW 2050 Australia.
[3] This author takes responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

http://dx.doi.org/10.1016/j.ijcard.2017.03.057
0167-5273/

or municipalities in urban and rural China between October 2007 and August 2010. The trial design is described elsewhere [7]. Hospitals were randomised to early introduction or later introduction of the intervention. The intervention was a series of three clinical pathways for in hospital risk stratification at initial presentation, management of ST- elevation myocardial infarction (STEMI), and management of non-STEMI and unstable angina pectoris (UAP). The clinical algorithms were associated with an increase in the percentage of patients discharged on cardiovascular prevention medications [7].

The evaluation surveys were conducted in 15,140 consecutive ACS patients who were recruited in waves, and were followed-up every six months after discharge with either a clinic visit or telephone call. At each hospital, data from fifty consecutive ACS patients were collected, and every six months thereafter 50 new patients were enrolled with ongoing follow-up of all patients. For patients followed-up by telephone, the blood pressure was home measured and patient reported, and cholesterol was measured at a local hospital and the results were reported by the patients. Secondary hospitals are broadly defined as regional hospitals providing services to a few communities, whilst tertiary hospitals provide high level specialist services to several regions. For the current analyses, we have combined patients from the hospitals into three groups classified according to the length of follow-up of patients (at least 12 months, at least 18 months and at least 24 months; Appendix Fig. A).

All patients provided written informed consent, and ethics approval was obtained from the University of Sydney (09-2007/10276), the Chinese Academy of Medicine and Peking Union Medical College, and the Cardiovascular Institute and Fuwai Hospital Human Research Ethics Committees.

2.1. Outcomes and definitions

The cardiovascular prevention medication classes examined were: aspirin, other antiplatelet agents, statins, angiotensin converting enzyme inhibitors (ACEI), angiotensin II receptor blockers (ARB), beta blockers (BB), and calcium channel antagonists. We defined the three drug combination of interest as aspirin or other antiplatelet together with a statin and any blood-pressure lowering drug. The five risk factor control targets were BP below 140/90 mm Hg, total cholesterol below 4.5 mmol/L, body mass index (BMI) below 25 kg/m^2, not a current smoker, and reporting moderate or vigorous physical activity for at least 30 min five or more times a week, based on guidelines at that time [8,9].

2.2. Statistical analysis

Use of cardiac medications and achievement of risk factor control were reported as proportions and compared by sex, age group (<60 years versus ≥60 years), and hospital type (secondary versus tertiary). Chi-square tests were used for comparison of proportions for categorical variables. Poisson regression with log link was used to model the adjusted relative risk of receiving statin, any blood pressure (BP) lowering drug or achieving at least four (of five) risk factor control targets at 12 months follow-up. The determinants of aspirin use were not modelled as there was minimal decline in aspirin use at 12 months. The independent variables included in the prediction models were history of myocardial infarction (MI), smoking status (current smoker or not), BP > 140/90 mm Hg at admission, and receipt of statin or any BP lowering drug at discharge from the index admission, age, gender, diagnosis (STEMI, NSTEMI, UAP), hospital level, family income, history of stroke, history of diabetes, and history of dyslipidaemia, and included all those variables which were significant at the 10% level in univariate models. Poisson regression was chosen as the outcomes were not rare. Socioeconomic status is known to impact cardiovascular risk-factors and cardiovascular prevention treatment after ACS, therefore we have included family income in all models. No imputation of missing variables. Statistical analysis was conducted using SAS Enterprise Guide version 5.1.

3. Results

Of the 15,140 patients included in the study, 12,094 (79.9%) had follow-up data at 12 months. Of the 11,129 patients who should have completed 18-month visits by study end, data were available for 8593 (77.2%). Of the 7429 patients who should have completed 24-months follow-up by study end, data were available for 5612 (75.5%). Baseline characteristics were similar across groups defined by period of follow-up, indicating that the smaller follow-up subsets were similar to the entire cohort (Appendix Table A). The final diagnosis was STEMI/NSTEMI in 53% (n = 8046) and UAP in 47% (n = 7094) in the overall cohort. Overall 2603 (17.2%) had at least one all-cause readmission in 12 months. Of those with UAP, 64% had a history of vascular disease (MI, angina pectoris, heart failure, coronary artery disease, stroke or transient ischaemic attack).

3.1. Cardiovascular prevention medication use

At discharge, among participants with 12 months follow-up, 95.3% were prescribed aspirin, 77.2% BB, 76.4% ACEI or ARB, 92.0% statins and 86% were on at least the three drug combination of aspirin or other antiplatelet, statin and any BP lowering (Table 1). This fell at six months to: aspirin 92%, BB 72%, ACEI/ARB 66%, statin 80% and 70% on at least three drugs, and continued to decline at 12, 18 and 24 months (Fig. 1). Among patients with a history of previous MI (n = 1833; Appendix Table B), reported use of medications at the time of hospital admission was 65% for aspirin, 36% another antiplatelet, 39% BB, 31% ACEI/ARB, 35% statins, 54.6% on any BP lowering treatment, and 28% reported the 3-drug combination.

While fewer women than men were discharged on appropriate medications (84.9% vs. 86.5% on 3 drugs, p = 0.02), the decline in medication use over time was similar for women and men (Table 1). A substantially higher proportion of patients admitted to tertiary hospitals were discharged on at least 3 drugs, compared with those treated in secondary hospitals (90.1% vs. 79.5%, p < 0.0001). These proportions declined to 71% in tertiary and 64% at secondary hospitals at 12 months. (Appendix Fig. B).

There was a small but significant difference in use of the 3 drug combination at discharge based on ACS type (87.5% for NSTEMI/STEMI vs. 84.6% for UAP; p < 0.0001). At 12 months, the corresponding figures were 70.5% vs. 66.6% (p < 0.0001).

3.2. Risk factor control at 12 months

At 12 months following discharge, 78.2% patients had BP < 140/90 mm Hg, 22.0% had LDL < 2 mmol/L, 61.3% had a BMI < 25 kg/m^2, while 85.5% were not currently smoking and 62.7% reported adequate physical activity – with 25.2% achieving control in four or more of these five guideline levels of risk factors. There was no difference in overall risk factor control between women and men (24.8% vs. 25.4%, p = 0.55; Table 2). A larger proportion of older people had better control of total cholesterol, LDL cholesterol, BMI, and non-smoking status, compared with those under 60 years of age. The converse was true for BP control and exercise levels (Appendix Table C). There was a small but significant difference in achieving at least 4 of 5 risk factor control targets between older and younger people (26.5% vs. 23.1%, p < 0.0001).

The proportions achieving BP, HDL, and LDL goals were similar between tertiary and secondary hospital patients (Appendix Table C). A slightly higher proportion of tertiary hospital patients achieved total cholesterol goal (54.5% vs. 52.4%; p = 0.031).

3.3. Factors related to use of therapies at 12 months

Use of BP lowering medication at discharge was the strongest predictor (relative risk 1.80; 95% CI 1.67–1.94) of 12 month BP lowering drug use. Those in the lowest income bracket were less likely to be using BP lowering drugs compared with those in the highest (RR 0.95; 95% CI 0.92–0.98). Current smoking, high BP at baseline, revascularization, and hospital level were significantly associated with receiving BP lowering at 12 months (Table 3).

Similarly, statin use at discharge was the strongest predictor of statin use at 12 months (RR 2.02; 95% CI 1.84–2.21; Table 3). Again, those in the lowest income bracket compared with the highest were less likely to be using statins at 12 months (RR 0.86; 95% CI 0.81–0.90). Diagnosis, hospital level, revascularization, history of diabetes or dyslipidaemia were also associated with use of statins at 12 months.

Being female (RR 0.81; 95% CI 0.75–0.87), attending a secondary hospital (RR 0.90; 95% CI 0.82–0.99), having high BP at admission (RR 0.65; 95% CI 0.58–0.74), being a current smoker at admission (RR 0.63; 95% CI 0.58), and having a history of dyslipidaemia (RR 0.78; 95% CI 0.70–0.87) were associated with not achieving at least four out of five of the risk factor targets at 12 months (Table 3).

Please cite this article as: E.R. Atkins, et al., Use of cardiovascular prevention treatments after acute coronary syndrome in China and associated factors, Int J Cardiol (2017), http://dx.doi.org/10.1016/j.ijcard.2017.03.057