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Antithrombotic Therapy and Direct Medical Costs in Patients with Acute Coronary Syndrome in Shanghai, China

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ABSTRACT

Background: Acute coronary syndrome (ACS) is a leading cause of morbidity and mortality worldwide. **Objectives:** To describe patient profile, treatment patterns, and disease burden for patients with ACS. **Methods:** A retrospective descriptive cohort study was conducted. Data were obtained from electronic medical records from seven Shanghai medical centers. Patients with at least one primary diagnosis of ACS from 2006 to 2012 were included. Patient ACS-related antithrombotic medication use, laboratory tests, key comorbidities, health care utilization, and direct medical costs were examined. Log-linear regression was conducted to explore factors associated with total direct medical costs. **Results:** The mean age for the 6601 patients included was 69.7 ± 12.5 years, and most of the patients (73%) were men. Comorbidities included diabetes (18.2%), hypertension (21.2%), and hyperlipidemia (8.6%). Out of these, 6466 (98%) patients had been hospitalized for ACS with an average length of stay of 14.0 ± 16.4 days per hospitalization. A total of 914 (13.8%) patients had emergency room visits. Of these, 93.5% received any antithrombotic therapy,

including antiplatelet agents (92.7%) and anticoagulants (20.8%). ACS-related direct medical costs (in yuan renminbi (¥)) were $\text{¥}18,421 \pm \text{¥}24,741$ per hospitalization, including costs for medications ($\text{¥}6,776$) and laboratory tests ($\text{¥}1,355$), and $\text{¥}2,894 \pm \text{¥}7,060$ per outpatient visit, including costs for medications ($\text{¥}620$) and laboratory tests ($\text{¥}464$). The higher direct medical cost was associated significantly ($P < 0.05$) with age, being male, antiplatelet and anticoagulant use, and several comorbid disease states (diabetes, hyperlipidemia, hypertension, and chronic kidney disease). **Conclusions:** Antithrombotic therapeutic treatments were commonly used among patients with ACS in Shanghai, China. Higher treatment costs for patients with ACS in Shanghai, China, involved their antithrombotic medication use and key comorbidities. **Keywords:** acute coronary syndrome, antithrombotic therapy, medical cost.

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Introduction

Acute coronary syndrome (ACS) is a severe and life-threatening disease, which is a common manifestation of coronary artery disease (CAD) or coronary heart disease (CHD) that encompasses acute myocardial infarction (AMI) and unstable angina [1–5]. AMI includes both ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI) [2–5]. Patients who are more likely to develop ACS often have certain risk factors, which include smoking, hypertension, diabetes, hypercholesterolemia, family history of CAD, overweight body habitus, or obesity [2,6–9].

ACS is a major cause of mortality and morbidity in patients with cardiovascular disease (CVD), accounting for 50% of all CVD deaths [10]. In addition, ACS is associated with more than 2.5 million hospitalizations worldwide each year [11,12]. According to the Heart Disease and Stroke Statistics 2014 Update from the American Heart Association, there were more than 625,000 hospital discharges of ACS, and this number increased to 1,141,000 when adding secondary hospital discharges of ACS in 2010 [13].

According to the Report on Cardiovascular Diseases in China (2013), the prevalence of CVD is increasing and an estimated 290

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million patients had a diagnosis of CVD in 2012 [14]. The prevalence of CHD was 4.6 per 1000 residents of all ages. There is a higher prevalence in urban population than in rural population [15]. At present, CVD is the major health concern in China and nearly 3.5 million patients die annually [14]. The increasing prevalence of CVD in the Chinese urban population may be partially driven by some major risk factors, such as the increasing prevalence of hypertension and overweight/obesity, the high proportion of smokers in this population, and the low proportion of adults indulging in sufficient physical activity [14].

The economic burden associated with ACS medical treatment is substantial, even when indirect costs such as loss of productivity are not included. A recent Chinese report has shown that in 2012 the average medical spending for AMI per hospitalization was ¥16,892 (¥, yuan renminbi; US \$1 = ¥6.0) in China regardless of urban or rural area and the average days of hospitalization were 9.9 days [16]. Pharmacotherapy is important in AMI treatment, which accounted for 28.6% of the total medical spending [16].

A universal health care insurance policy was implemented around 2010 in China. The exact nature of the coverage, which services are included and what proportion of the total cost is covered, is still evolving and varies across provinces and cities. There are four major health insurance schemes in China: 1) Employment-based medical insurance for urban workers: The scheme consists of a pooled fund for inpatient stays and individual medical savings accounts for outpatient visits. It is funded by payroll taxes from both employers and employees. 2) Urban-resident scheme targeted for those urban residents who are not covered by other schemes: It is funded by both urban residents and the local government. 3) Rural cooperative medical system for the rural population: It is funded by individual rural participants as well as by local and central governments. 4) Medical assistance program for low-income families: It is jointly funded by central and provincial governments.

Primary prevention for ACS focuses on smoking cessation, healthy eating, and exercise along with optimizing control of key risk factors such as hypertension, diabetes, and dyslipidemia [2,3,17]. Treatment for ACS varies depending on several factors, such as the type of patient presentation, the services or procedures the hospital can provide, and economic concern. Common treatments of ACS include pharmacotherapy (such as aspirin, thrombolytics, nitroglycerin, β -blockers, statins, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers) and coronary revascularization such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) [1,2].

The Antiplatelet Treatment Consensus from Relative Experts for ACS Patients Managed without Revascularization in 2009 was published by the Chinese Experts Group of ACS Patients Managed without Revascularization [18]. In this guideline, the following antiplatelet agents are recommended: aspirin, clopidogrel, and glycoprotein IIb/IIIa inhibitors [18]. In 2012, the Chinese Society of Cardiology published an updated clinical guideline for patients with non-ST-segment elevation ACS [19]. In this clinical guideline, the following treatments are recommended: post-myocardial infarction therapy (including beta receptor blockers, nitrates, calcium channel blockers, angiotensin-converting enzyme, and nicorandil), antiplatelet therapy, anticoagulant therapy, statins, and revascularization (including PCI and CABG) [19].

According to the China Patient-Centered Evaluative Assessment of Cardiac Events (China PEACE)-Retrospective Acute Myocardial Infarction Study [20], the percentage of patients with STEMI who underwent revascularization procedures is increasing dramatically; for example, patients with STEMI who underwent PCI increased from 10.2% in 2001 to 27.6% in 2011. Pharmacotherapy still plays a very important role in the treatment of STEMI in China, possibly because patients who live in rural areas or small cities may have to receive pharmacotherapy only because the hospitals may not have

the ability (such as lacking a skilled provider or facility) to perform the revascularization surgery. In 2011, the percentages of patients with STEMI who received aspirin, clopidogrel, and beta blockers within 24 hours were 91.2%, 80.7%, and 57.7%, respectively [20].

Objective and Significance

Despite the high prevalence of CHD in China, there is very limited health technology assessment on ACS. The objective of this study was to describe the patient profile, treatment patterns, and disease burden for patients with ACS in China.

To our knowledge, no available study has been published to date on characterizing ACS in China from a health technology assessment perspective. Information on health care utilization, treatment patterns, and factors influencing the treatment cost of ACS can be disseminated to the medical community so that treatment or management of ACS can be enhanced in China.

Methods

Primary Data Source

Given the higher prevalence of ACS in the urban areas of China, we decided to use the Shanghai electronic medical record (EMR) databases that were developed by the Shanghai Food and Drug Administration Adverse Drug Reaction Center from multiple urban medical centers (hospitals) in Shanghai city. Shanghai is one of the most populated cities in China, with a population of 23.0 million (as per the 2010 China Population Census) [21].

The Shanghai EMR data include both inpatient and outpatient records from seven medical centers. There are four major data files: 1) patients' demographic file: hospital ID, age, sex, date of birth, marriage status, and so on; 2) diagnosis file: date of hospital admission, date of discharge, diagnosis before discharge, and so on; 3) medication use file: drug name, dosage, date of medication use, cost of unit dose, and so on; and 4) the laboratory test and procedure file: procedure name, laboratory test name, laboratory test value, and so on. All data records are documented in Chinese.

Cohort Definition and Selection Procedures

A retrospective cohort design was selected for this study. Patients with at least one primary diagnosis of ACS, CAD, or CHD were selected on the basis of the discharge diagnosis in the medical record documented in outpatient and inpatient files between January 2006 and July 2012. The *International Classification of Diseases, Ninth Revision* and/or *International Classification of Diseases, Tenth Revision* codes were not available in the discharge diagnosis file. All diagnoses were documented in Chinese medical terms. According to medical practitioners in China, patients with ACS are commonly diagnosed using several possible terms related to CAD or CHD. We included all diagnosis terms in Chinese to identify and select the final study patients. We included both new and existing patients with ACS for the study cohort.

Study Medications, Treatment Cost, and Health Outcomes

Medication use pattern involves antiplatelet drug use, anticoagulant drug use, thrombolytic use, and some traditional Chinese medicine (TCM) or herbal medicines. The follow-up time was calculated from the first index date of ACS to the end of the study period or death date, whichever came first.

Health care resource utilization was measured, such as days of hospital stay, number of emergency room visits, total hospital cost, including that for laboratory test, Western medicine, TCM, herbal medicine, and hospital and physician fees. The direct medical cost was calculated as the sum of hospitalization cost,

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