



# Incidence and in-hospital mortality of acute aortic dissection in China: analysis of China Health Insurance Research (CHIRA) Data 2011

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## Abstract

**Objective** Acute aortic dissection (AAD) is a catastrophic event with high early mortality rate, but to date, no data on the incidence of AAD in Mainland China is available. This study aimed to estimate the incidence of AAD in China and characterize the clinical profile, management and in-hospital outcomes of this vascular event. **Methods** We used the China Health Insurance Research Data (the CHIRA Data) 2011 which comprises all inpatient hospital records (300,886) during the period of Jan. 1st 2011 to Dec. 31 2011 of 3,335,000 randomly sampled beneficiaries (1,718,500 men and 1,616,500 women) from 25 cities and counties in different economic-geographic regions of Mainland China. Patients with acute aortic dissection were identified according to International Classification of Disease 10<sup>th</sup> Revision (ICD-10) of I71.0. The estimated incidence of AAD was calculated using the equation: estimated incidence =  $2.0 \times (40\% \times \text{hospital admission rate}) + 60\% \times \text{hospital admission rate}$ . **Results** The hospital admission rate was 2.0/100,000 (65/3,325,000, 95% CI: 1.2–2.8). The estimated annual incidence of AAD was 2.8/100,000 (95% CI: 1.9–3.6) and was higher in male than in female (3.7 vs. 1.5,  $P < 0.001$ ). The mean age was  $58.9 \pm 13.4$  years. During the mean hospital stay of  $23 \pm 6$  days, the overall in-hospital mortality was 13.9% (9/65). **Conclusions** Our study showed relatively lower but not negligible incidence and in-hospital mortality of AAD in the mainland of China. The mean age of patients with AAD in Chinese was younger than that reported by researches from west countries, while the male to female incidence ratio is similar to those reported by other studies.

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**Keywords:** Acute aortic dissection; China health insurance research; Incidence rate

## 1 Introduction

Acute aortic dissection (AAD) is a catastrophic event with high early mortality rate.<sup>[1]</sup> Previous estimations of annual incidence of AAD ranged 5 to 30 per million,<sup>[2]</sup> while several more recent studies indicated higher incidence in the era of widespread use of modern diagnostic technology such as computed tomographic angiography.<sup>[3–5]</sup> These studies, however, were all conducted in American and European countries. Limited information on the incidence of AAD in Asian population is available to date. During the past decade, a few studies have reported the clinical profiles

and outcomes of AAD in China, based on data from single medical center,<sup>[6,7]</sup> or designated, high emergency volume hospitals,<sup>[8]</sup> rather than from nationally representative samples.

This study used the China Health Insurance Research Data (CHIRA Data) 2011 to estimate the incidence of AAD in China and characterize the clinical profile, management and in-hospital outcomes of this vascular event.

## 2 Methods

### 2.1 The CHIRA Data

The CHIRA Data is an administrative database initiated in 2007 and managed by the China Health Insurance Research Association. This database collected sampled hospital inpatient records across the mainland of China, of those patients covered by the mainstream health insurance, including the Urban Employee Basic Health Insurance, the Urban Resident Basic Medical Insurance, the Government

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Insurance Scheme, and the New Cooperative Medical Scheme.<sup>[9]</sup> In 2011, about 92% of the population was covered by these insurance programs.<sup>[9]</sup> The CHIRA Data used a two-stage sampling design to collect data. In the first stage, convenience sampling was used to include four municipalities directly under the Central Government (Beijing, Shanghai, Tianjin, and Chongqing), most provincial capital cities and other cities and counties of which the Medical Insurance Bureau were able and willing to provide electronic hospital record data. In the second stage, a systematic random sampling was used to extract 2% of the beneficiaries from those of the municipalities, 5% from those of provincial capital cities, and 10% from those of other participating cities and counties.

The CHIRA Data contains detailed inpatient hospital record information, including patient's age, sex, diagnoses, medications, surgical and other interventional procedures, imaging and laboratory examinations, total hospitalization cost and in-hospital outcomes of patient (cured, improved, worsened, death and others). The data files from the participating cities and counties are de-identified by scrambling the identification codes of both patients and medical facilities and send to the Chinese Society of Health Insurance Researchers to form the original files of CHIRA Data.

The CHIRA Data 2011 comprises 300,886 randomly sampled inpatient hospital records from 3,335,000 beneficiaries (1,718,500 men and 1,616,500 women) of 25 cities and counties in different economic-geographic regions of

Mainland China, during the period of January 1, 2011 to December 31, 2011 (Figure.1)

This study was approved by the Ethics Committee of the Chinese PLA General Hospital, Beijing, China. Patient records/information was anonymized and de-identified prior to analysis.

## 2.2 Identification of AAD patient and determination of patient outcome

Patients with AAD were identified according to International Classification of Disease 10<sup>th</sup> Revision (ICD-10) of 171.0. Currently, the CHIRA Data is de-identified and not linked to other registration database, so we were not able to determine the accuracy of the diagnosis, the type of dissection (type A or type B). We were also not able to identify whether it was a first-ever or a recurrent event. Existing literature showed that recurrent AAD is relatively rare.<sup>[3,4]</sup>

We defined both "death" and "treatment withdrawal" as died in hospital, to calculate the in-hospital mortality. Treatment withdrawal is common in China when the treating physician expresses to the family that there is little hope of the patient's survival because many Chinese are reluctant to die in hospital.<sup>[10]</sup>

## 2.3 Statistical analysis

Student's *t*-test was used for continuous data. The chi-squared test or Fisher's exact test, as appropriate, was used for categorical data. The statistical analysis was con-

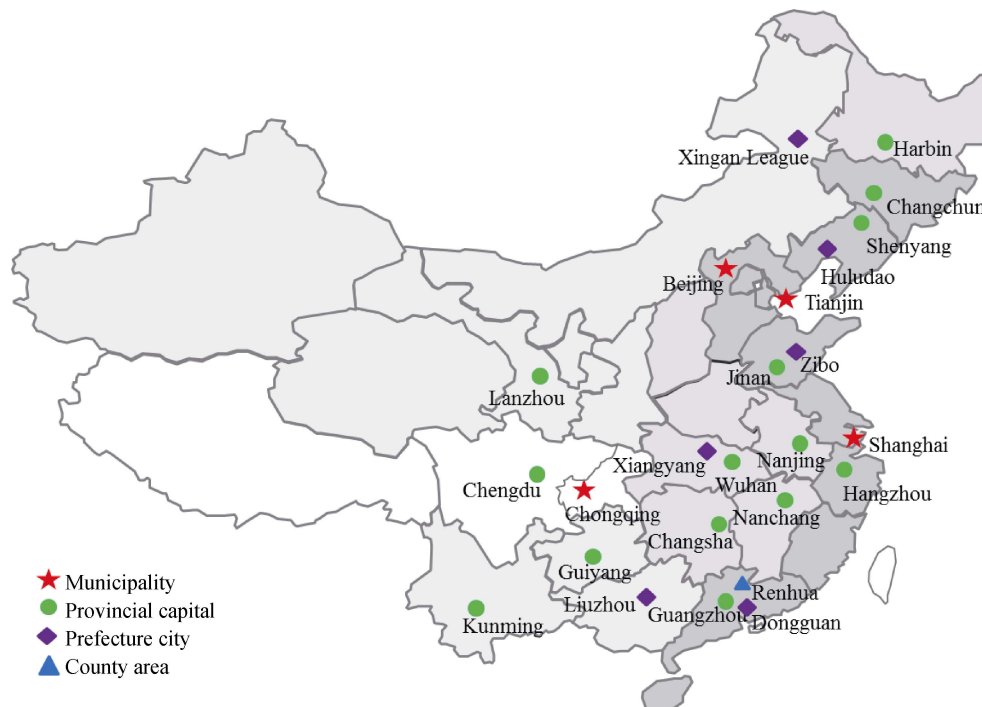


Figure 1. Map of China with participating areas in the China Health Insurance Research Data (CHIRA Data) 2011.

**Table 1. Estimated age-and sex-specific incidence rates of acute aortic dissection per hundred thousand population**

Age (yrs)	Men (n = 1718500)		Women (n = 1616500)		Total (n = 3,328,600)	
	Case	Rate/100,000 (95% CI)	Case	Rate/100,000 (95% CI)	Case	Rate/100,000 (95% CI)
<20	0	–	0		0	
20–29	0	–	1	0 (0–1)	1	0 (0–1)
30–39	1	0 (0–1)	0	–	1	0 (0–1)
40–49	15	7.0 (5.2–8.6)	1	0 (0–1)	16	3.9 (2.3–4.8)
50–59	12	8.1 (5.4–10.6)	6	3.8 (2.1–5.7)	18	6.3 (2.8–9.2)
60–69	8	8.6 (5.3–13.2)	5	5.0 (2.2–7.6)	13	7.4 (3.1–10.2)
70–79	8	15.8 (8.4–21.2)	5	8.5 (3.8–16.4)	13	12.8 (7.2–15.4)
≥80	3	18.6 (2.6–37.4)	0	–	3	8.1 (1.9–25.8)
Total	47	3.7 (2.4–6.2)	18	1.5 (0.7–2.7)	65	2.8 (1.9–3.6)

ducted using the Statistical Package for the Social Sciences version 12.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was defined as  $P < 0.05$ . Data are presented as mean  $\pm$  SD unless otherwise stated.

A recent prospective, population-based study showed that about 50% (48.6%) of patients with type A AAD died before hospital admission,<sup>[4]</sup> and a retrospective analysis of multiple medical centers with the largest sample size showed that in China, about 40% of AAD (726/1812) was type A,<sup>[8]</sup> therefore, we calculated the estimated incidence of AAD in China using the following equation: Estimated incidence =  $2.0 \times (40\% \times \text{hospital admission rate}) + 60\% \times \text{hospital admission rate}$ .

### 3 Results

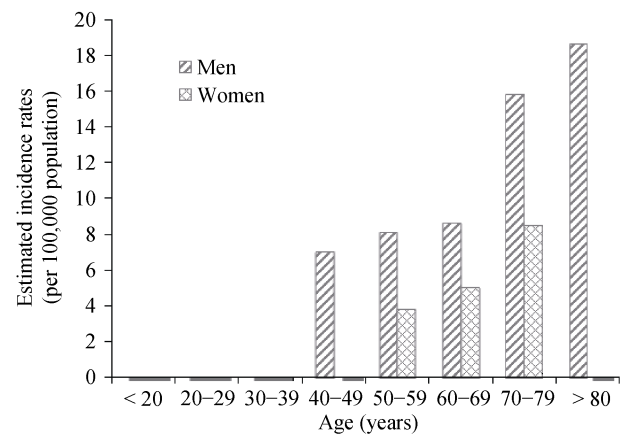
#### 3.1 Estimated incidence of AAD

Sixty-five patients were identified with principle diagnosis of AAD, the hospital admission rate was 2.0/100,000 (65/3,335,000, 95% CI: 1.2–2.8). The estimated annual incidence of AAD was 2.8/100,000 (95% CI: 1.9–3.6) and was higher in male than in female (3.7 vs. 1.5,  $P < 0.001$ ). The age-and sex-specific incidence rates per hundred thousand population was showed in Table 1. For both men and women, the incidence rate of AAD increased with increasing age (Figure 2).

#### 3.2 Patient characteristics and in-hospital mortality

Of the sixty-five patients, 47 were male and 18 were female, with a male/female ratio of 2.6: 1. The mean age was  $58.9 \pm 13.4$  years. There was no significant difference between the mean age of the male ( $58.1 \pm 11.6$  years) and that of the female ( $60.8 \pm 14.2$  years) patients ( $P = 0.43$ ).

Surgery was performed in 11 (17%) patients and 13 patients (20%) underwent endovascular treatments. Of these 24 patients, one received hybrid procedures (surgical great



**Figure 2. Estimated incidence rate of acute aortic dissection according to age and sex.**

vessel bypass with endovascular stent graft implantation). Most (41/65, 63%) patients received only medical treatment.

The mean hospital stay was  $23 \pm 6$  days. The overall in-hospital mortality was 13.9% (9/65). The in-hospital mortality was 36.4% (4/11) for those received surgery, 7.7% (1/13) for those received endovascular treatments, and 9.8% (4/41) for those received only medical treatment.

### 4 Discussion

To our knowledge, this is the first population-based study addressing the epidemiology of acute aortic dissection in the Mainland China. There are three main findings in our present study. First, we found that in the Mainland of China, the hospital admission rate of AAD, irrespective of age, was about 2.0/100,000, and we estimated the overall incidence was approximately 2.8/100,000 per year in the Mainland China. Although the age and sex distribution of the study population might not be comparable, our result is lower than

that reported by Yu, *et al.*<sup>[11]</sup> in people from China Taiwan (4.3/100,000), that by Pacini, *et al.*<sup>[3]</sup> in Italian (4.7/100,000), and that by Howard, *et al.*<sup>[4]</sup> in the UK (6/100,000). Missed diagnosis and misdiagnosis might account for the lower incidence rate. AAD is a relatively uncommon disease with a wide range of manifestations, and classic findings are often absent,<sup>[2]</sup> making it difficult to diagnosis. China lacks an adequate primary care system to refer patients to specialist,<sup>[12]</sup> and emergency medicine in China remains underdeveloped.<sup>[13]</sup> Second, in consistent with other recent reports of AAD in China, our study also found that the mean age of patients with AAD (58.9 ± 13.4 years) was younger than that reported by researches from American and European countries,<sup>[2-5]</sup> China Taiwan,<sup>[11]</sup> and Japan.<sup>[14]</sup> The “early onset” may be simply a feature of Chinese AAD patients,<sup>[8]</sup> however, it is possible that misdiagnosis and pre-hospital death are more common in the elderly patients with AAD, because of typical symptoms (abrupt onset of chest or back pain) and signs (aortic regurgitation murmur or pulse deficits) of dissection were less common among the elderly.<sup>[15]</sup>

Third, the overall in-hospital mortality was about 14%, which is lower than that reported in most previous studies.<sup>[2-6]</sup> This result should be interpreted with caution. In contrast to a retrospective analysis of patients with AAD in 19 large hospitals in Mainland China,<sup>[8]</sup> which reported that surgery was used in 75.3% of patients with type A AAD and endovascular treatment was performed in 76.1% of patients with type B AAD, the majority (63%) of patients in our present study received only medical treatment, implying that a higher proportion of patients in our study was relatively “stable”, while many “unstable” or more severe patients were either transferred to hospitals with expertise to manage AAD, or died in the emergency department before admitted as inpatient.

In recent decades, health care utilization databases are increasingly used for epidemiologic research,<sup>[16,17]</sup> including investigations of incidence and prevalence of common,<sup>[18]</sup> and rare diseases. The strengths and limitations of this kind of study have been extensively discussed.<sup>[16,17]</sup> Health care utilization databases have the advantages of large size, representativeness of routine clinical care and availability at relatively low cost, making it particularly for the study of rare events such as the incidence of AAD. Studies of hospital discharge coding in the UK showed satisfactory accuracy of primary diagnoses, suggesting that routinely collected data are sufficiently robust to support their use for research.<sup>[19]</sup>

The present study has several limitations. The CHIRA Data included only inpatient information, which might lead to underestimation of the incidence of AAD, although it is

reasonable to presume that most patients with AAD would be admitted. The convenience sampling design of CHIRA Data making it contains higher proportion of patients from urban areas and lower proportion of patients from rural areas. The sensitivity and specificity of the AAD diagnosis had not been evaluated and information on the type of dissection (type A or type B) was not available, therefore the results of this study were only estimations.

In conclusion, our study showed relatively lower but not negligible incidence and in-hospital mortality of AAD in the mainland of China. Our study also further confirmed that the mean age of patients with AAD in Chinese was younger than that reported by researches from west countries, while the male to female incidence ratio is similar to those reported by other studies.

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