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# Assessing the effect of hypertension on the severity of coronary artery lesions in young female with acute coronary syndrome

Ruifang Liu[1], Fangxing Xu[1], Tongku Liu[2], Yujie Zhou[1] and Xiaofan Wu[1*]

## Abstract

**Background** The fact that hypertension is associated with atherosclerotic cardiovascular disease in the elderly has been confirmed. However, very little is known about its impact on the severity of coronary artery lesions in young people, especially in young women.

**Objective** To evaluate the effect of essential hypertension (EH) on the severity of coronary artery lesions in young women with acute coronary syndrome (ACS), and to provide a reference for clinical prevention and treatment.

**Methods** From January 2003 to January 2022, 5220 young women (aged ≤ 44 years) who underwent coronary angiography (CAG) due to chest pain symptoms were retrospectively analyzed, of whom 2684 were diagnosed with ACS. After patients with diabetes, hypercholesterolemia, and smoking were excluded, 1772 patients were enrolled. According to whether the patient has EH or not, they were divided into EH combined with ACS group (EH-ASC group; $n=824$) and non-hypertension ACS group (control group; $n=948$). The severity of coronary artery lesions and the follow-up results after percutaneous coronary intervention (PCI) were compared between the groups.

**Results** There was no significant difference in the type of ACS and the number of lesion vessels between the two groups ($P>0.05$). The proportion of type B2 (17.11%) and type C (31.55%) lesions in the EH-ACS group was significantly higher than that (11.39% and 20.68%) in the control group ($P<0.05$). The number of stents implanted ($1.55\pm0.95$) and the length of stents ($23.99\pm6.77$ mm) in the EH-ACS group were significantly greater than those ($1.36\pm0.75$ and $22.34\pm6.91$ mm) the in control group ($P<0.05$). During a follow-up period of 11–138 months, the cumulative rate of major adverse cardiac events (MACE) and target vessel revascularization (TVR) in the EH-ACS group (22.09% and 20.26%) was significantly higher than that (9.28% and 8.65%) in the control group ($P<0.05$).

**Conclusion** Hypertension exacerbates the severity of coronary artery lesions in young women with ACS. It is suggested that attention should be paid to the prevention and treatment of hypertension in young women, a special population, to reduce the prevalence of ACS, and a focus on improving hypertension awareness and management among young women could be beneficial in reducing the risk and severity of ACS.

**Keywords** Young female, Hypertension, Acute coronary syndrome, Coronary artery lesion

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## Introduction

Acute coronary syndrome (ACS) is a major disease that threatens the health and safety of women today. Young women (aged < 45 years) are a special group with a low risk of suffering from coronary heart disease (CHD) [1, 2]. However, since the 1980s, the annual mortality rate of young women with CHD has increased by an average of 1.3% [3]. Hypertension has been widely recognized as a risk factor for CHD in the elderly [4, 5]. Nevertheless, the impact of hypertension on coronary arteries vessels in young women is barely reported. Hypertension in young people is often insidious. Because it is often no obvious symptoms in the early stage and is more often found during physical examinations or occasional measurements. Some patients have insufficient awareness of the dangers of hypertension and believe that asymptomatic treatment is unnecessary. Even patients taking medication often cannot adhere to long-term due to excessive concerns about adverse drug reactions. The above phenomenon results in a low rate of awareness, treatment, and control of hypertension. The management of hypertension and cardiovascular risk in the elderly has been given sufficient attention, while the cardiovascular risk of young hypertensive patients has not been well controlled and systematically managed. It will help to avoid and reduce the occurrence of atherosclerotic cardiovascular diseases such as ACS to effectively control hypertension in young people. There are few research reports on whether hypertension has the same harm to young women as male patients, especially its impact on the severity of coronary artery lesions. In this study the difference in the severity of coronary artery lesions between young women (age ≤ 44 years old) with hypertension ACS and non-hypertension ACS patients was retrospectively analyzed, and the harm of hypertension for coronary artery vessels was evaluated to provide a reference for the management of hypertension and the prevention in young women.

## Materials and methods

### Study objects and grouping

5220 young female patients (≤ 44 years old) underwent coronary angiography (CAG) due to chest pain or discomfort in Beijing Anzhen Hospital and Affiliated Hospital of Beihua University from January 2003 to January 2022. Of them, 2684 (51.42%) were diagnosed with ACS. After patients with diabetes, high cholesterol, and smoking were excluded, 1772 patients with ACS were selected as study objects. According to whether the patient suffered from essential hypertension (EH), they were divided into EH combined with ACS group (EH-ASC group; $n = 824$) and non-hypertension ACS group (control group; $n = 948$) (See Fig. 1). The severity of coronary artery lesions and follow-up results were compared between the two groups.

### Inclusion and exclusion criteria

#### *Inclusion criteria and diagnostic criteria*

(1) Young women, age ≤ 44 years old. (2) Those who had received a CAG examination and were diagnosed as ACS or had undergone percutaneous coronary intervention

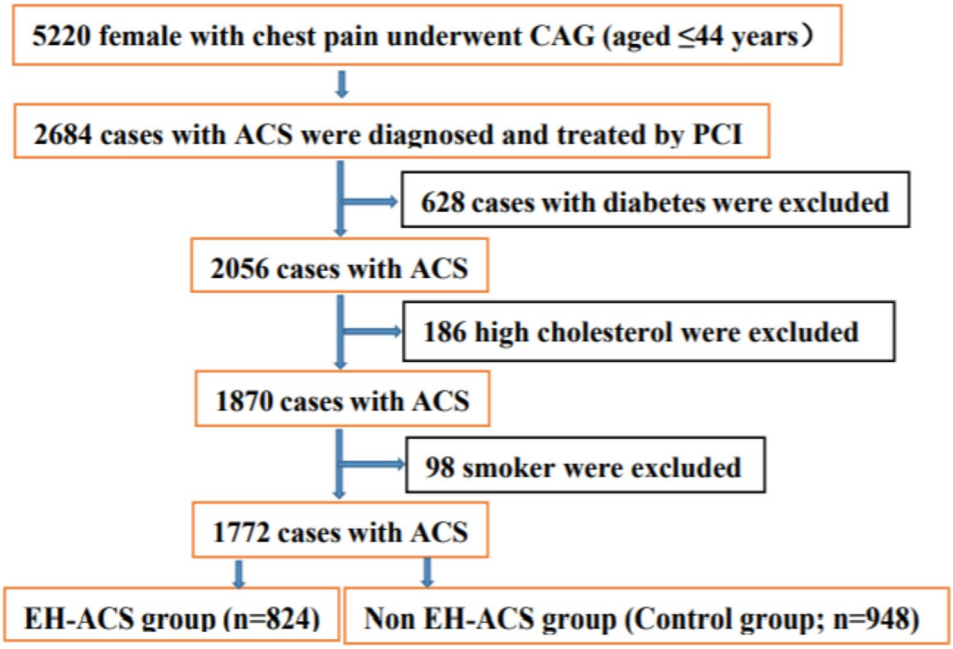


**Fig. 1** Flow chart of selected patients Note: ACS: Acute coronary syndrome; CAG: Coronary angiography; EH: Essential hypertension; PCI: Prcutaneous coronary intervention

(PCI). The diagnosis of EH met with the diagnostic criteria proposed in ACC/AHA on hypertension guidelines [6]. The diagnosis of ACS complied with the diagnostic criteria specified in the diagnostic and treatment guidelines of the ACC/AHA and ESC [7], and had at least one coronary artery diameter stenosis with ≥75% confirmed by CAG. According to the number of vessels involved (left main trunk, left anterior descending branch, left circumflex branch, and right coronary artery), the coronary artery involvement was divided into single-branch, double-branch, and triple-branch lesions. Any two or more branches involvement of left main coronary artery (LM), left anterior descending branch (LAD), left circumflex branch (LCX), and right coronary artery (RCA) was defined as a multi-vessel lesion.

#### *Exclusion criteria*

(1) ACS caused by coronary artery bypass graft vascular lesions; (2) Coronary artery aneurysm with acute myocardial infarction (AMI); (3) Patients with uncontrolled local or systemic infectious diseases; (4) Patients with advanced malignant tumors; (5) Patients with hematological diseases, such as hemophilia, thrombocytopenia, or moderate or severe anemia (hemoglobin ≤ 80 g/L); (6) Patients who refuse a CAG examination. (7) Patients with diabetes, hypercholesterolemia and smoking were excluded.

### Record indicators and judgment standards

#### *Recording indicators*

Age, body mass, personal history, medical history, physical and laboratory examination results, data related to CAG and PCI, and major adverse cardiac events (MACE) were recorded. MACE was defined as all-cause death, recurrent non-fatal myocardial infarction, and target vessel revascularization.

#### *Evaluation indicators for severity of coronary artery lesions*

According to AHA/ACC classification criteria coronary artery lesions were divided into types A, B1, B2, and C lesions [8]. Types A to C indicated the progression of the lesion from mild to severe. The number of vascular branches involvement and the number and length of stent implantation were recorded. The larger the value, the more severe the lesion.

#### *Judgment criteria for risk factors*

(1) Smoking: referred to continuous or cumulative smoking time ≥ 6 months; (2) Type 2 diabetes met with the diagnostic criteria of diabetes mellitus described by the American Diabetes Association [9]; (3) Family history of early-onset CHD referred to the patient's close relatives whose age was less than 50 years old were diagnosed with CHD, or died of CHD or unknown causes; (4) Overweight was body mass index ≥ 24 kg/m$^2$, and Obesity was defined as BMI ≥ 30 [10, 11]; (5) Menopause was no menstruation for ≥ 3 months; (6) Obstetrical and gynecological diseases referred to the patient who has been suffering from obstetrical and gynecological diseases before admission and are currently taking medication or are still not cured; (7) Hypothyroidism referred to the patient who had suffered from hypothyroidism in the past, or was taking thyroid hormone treatment or the plasma thyroxine levels at this admission was lower than the low limit of the normal reference value and accompanied by the rise of thyrotropin level; (8) Autoimmune disease referred to the patient who had an autoimmune disease in the past or was taking relevant drugs; (9) Anxiety or depression were the patient had been diagnosed with depression or anxiety in the past and was taking antidepressant drugs; (10) Hypercholesterolemia: total cholesterol in serum > 6.0 mmol/L [12]; (11) Hihg low-density lipoprotein cholesterol (LDL-C) was defineted as LDL-C ≥ 4.1mmol/L [13]; (12) Hyperuricemia: referred to uric acid value > 375 μmol/L; (13) Hyperhomocysteinemia: homocysteine > 15 umol/L.

### The PCI methods

PCI was performed with the conventional PCI method. All patients underwent right radial artery or left radial artery approach or right brachial artery approach for PCI. During the procedure, heparin sodium 100u/kg was used to maintain the value of 350–500 s of activated clotting time of whole blood. For each hour of operation, 1000 u of heparin sodium was added. After the PCI procedure all patients received the maintenance doses of aspirin 100 mg/d and clopidogrel 75 mg/d or ticagrelor 90 mg/twice a day (oral administration for at least one year). Angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, β-receptor blockers, calcium channel blockers, nitrates, and statins were administered according to the specific condition of the patient. The specific treatment plan for a patient was determined by his or her physician on a case-by-case basis.

### Method and endpoint of follow-up

The follow-up was performed by outpatient, inpatient or telephone. The end point of follow-up was MACE. The follow-up ended on January 31, 2023.

### Statistical analysis

All data were analyzed by using the statistical software SPSS(Statistical Product Service Solutions)SPSS 25.0 (IBM SPSS Statistics V25.0, Armonk, New York). Normality tests were performed on all measurement data. Data conforming to the normal distribution were expressed as mean ± standard deviation ($\bar{x} \pm S$). The comparison between the two groups used the "t" test. Count

**Table 1** Comparison of age in two groups

| Age (years-old) | *n* | 19 ~ 29 | 30 ~ 39 | 40 ~ 44 |
|---|---|---|---|---|
| EH-ACS group, n(%) | 824 | 27(3.28) | 249(30.22) | 548(66.50) |
| Control group, n(%) | 948 | 37(3.90) | 238(25.11) | 673(70.99) |

Note: Comparison of different age in two groups was $X^2 = 5.960$, $P = 0.051$

**Table 2** Comparison of cardiovascular risk factors between two groups [ N (%) ]

| | EH-ACS group (*n* = 824) | Control group (*n* = 948) | $X^2$ | *P* |
|---|---|---|---|---|
| Overweight and obesity | 491(59.59) | 547(57.70) | 0.647 | 0.421 |
| Obesity | 98(11.89) | 86(9.07) | 3.771 | 0.061 |
| Early-onset CHD | 111(13.47) | 129(13.61) | 0.007 | 0.933 |
| Menopause | 31(3.76) | 33(3.48) | 1.000 | 0.752 |
| Hypothyroidism | 75(9.10) | 84(8.86) | 0.355 | 0.551 |
| Autoimmunity | 39(4.73) | 54(5.70) | 1.702 | 0.427 |
| Depression or anxiety | 117(14.20) | 137(14.45) | 0.023 | 0.880 |
| Gynaecopathia | 135(16.38) | 150(15.82) | 0.130 | 0.749 |
| High LDL-C | 33(4.00) | 30(3.16) | 0.908 | 0.369 |
| Hyperuricemia | 105(12.74) | 102(10.76) | 1.681 | 0.195 |
| High Hcy | 107(12.99) | 102(10.76) | 2.100 | 0.147 |

Note: early-onset CHD: early-onset coronary heart disease family history; High Hcy: High homocysteinemia; LDL-C: low-density lipoprotein cholesterol. Hihg LDL-C was defineted as LDL-C ≥ 4.0mmol/L

data expressed as a percentage (%). The comparison between groups used the $\chi^2$ test. Kaplan Meier survival analysis and risk analysis were used and functional curves were plotted. Log-rank test was used to compare the differences between the two curves. The difference was statistically significant when the *P* value was less than 0.05.

## Results

### Comparison of age between the two groups and the duration of EH and CHD

The age distribution range of patients in the EH-ACS group ($n = 824$) and control group ($n = 948$) is 19 ~ 44 years old (See Table 1), which conforms to the age standard of youth of the World Health Organization (https://www.who.int/data/#highlights).

The exposure duration and treatment of EH and CHD were based on patients' own reports. The shortest and longest history of EH was 57 months and 198 months, with an average of 143.91 ± 36.58 months. Among 824 patients with EH, 91 (11.04%) would take medicine as instructed by a doctor, and 733 (88.96%) did not take drugs when there were no symptoms. It is unclear whether the blood pressure values of patients treated with antihypertensive drugs met the standard level of SBP < 140 mmHg and DBP < 90 mmHg. The duration of CHD was roughly estimated to be 1–38 months reported by patients themselves. For patients without CHD history and acute myocardial infarction, the duration of CHD was defined to be 1 month. There was no significant difference ($P > 0.05$) in the duration of CHD compared EH-ACS group (10.30 ± 8.38 months) with the control group (10.57 ± 8.35 months) ($t = 0.679$, $P = 0.497$). CHD and EH are often asymptomatic in the early stage. Therefore, the actual duration of the disease was greater than the estimated value. According to the specific conditions of patients with CHD and EH, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, β-receptor blockers, calcium channel blockers, nitrates, and statins were administrated.

### Comparison of cardiovascular risk factors between EH-ACS group and control group

The recognized risk factors of CHD are diabetes, high cholesterol, and smoking. Patients with the three risk factors were excluded. There was no significant difference between groups in other risk factors ($P > 0.05$), as shown in Table 2.

### Comparison of the characteristics of coronary artery lesions between two groups

There was no significant difference in the type of ACS and the number of diseased vessels between the two groups ($P > 0.05$). Type A and B1 lesions in the EH-ACS (32.04% and 18.93%) were significantly less than that (43.57% and 24.68%) in the control group ($P < 0.05$). However, the proportion of type B2 (18.8%) and type C (30.7%) lesions in the EH-ACS group was significantly higher than that (11.39% and 20.68%) in the control group ($p < 0.05$). The number of stents implanted (1.55 ± 0.95) and the length of stents implanted (23.99 ± 6.77 mm) in the EH-ACS group were significantly higher than those (1.36 ± 0.75 and 22.34 ± 6.91 mm, respectively) in the control group ($P < 0.05$). The result shows that hypertension aggravates the degree of coronary artery lesions (see Tables 3 and 4).

### Results of follow-up

The duration of follow-up was 11–138 months. The mean follow-up duration in the EH-ACS group and the control group was 65.49 ± 29.18 and 65.97 ± 30.58 months respectively. There was no significant difference between the two groups ($t = 0.335$, $P = 0.738$). The rate of MACE and TVR during follow-up showed a significant difference ($P < 0.05$) (see Table 5).

### Kaplan Meier analysis of event-free survival and risk in two groups of patients

The event-free rate and risk of occurrence during follow-up are shown in Figs. 2 and 3. For the overall comparison of event occurrence rates and risk ratios at different times, the statistic of the Log Rank (Mantel-Cox) test is 50.493, $P < 0.001$, which indicates that the difference between the two curves is very significant.

**Table 3** Comparison of coronary artery lesions between two groups [n (%)]

| | EH-ACS (*n* = 824) | Control (*n* = 948) | $X^2$ | *P* |
|---|---|---|---|---|
| UA | 618(75.00) | 739(77.95) | 2.144 | 0.143 |
| Non-STEMI | 54(6.55) | 49(5.17) | 1.544 | 0.214 |
| Anterior wall AMI | 116(14.08) | 121(12.76) | 0.657 | 0.418 |
| Inferior wall AMI | 36(4.37) | 39(4.11) | 0.071 | 0.790 |
| LM | 42(5.10) | 65(6.86) | 2.405 | 0.121 |
| LAD | 651(79.00) | 729(76.90) | 1.135 | 0.287 |
| LCX | 113(13.71) | 153(16.14) | 2.033 | 0.154 |
| RCA | 158 (19.17) | 138(14.56) | 6.756 | 0.009 |
| Single branch | 688(83.50) | 767(80.91) | 2.010 | 0.156 |
| Double branch | 110(13.35) | 151(15.93) | 2.334 | 0.127 |
| Three branches | 27(3.28) | 29(3.06) | 0.068 | 0.794 |
| Type A | 264(32.04) | 413(43.57) | 24.808 | < 0.001 |
| Type B1 | 156(18.93) | 234(24.68) | 8.496 | 0.004 |
| Type B2 | 141(17.11) | 108(11.39) | 11.939 | 0.001 |
| Type C | 260(31.55) | 196(20.68) | 27.296 | < 0.001 |

Note: AMI: acute myocardial infarction; Double branch: Double branch lesions; LAD: left anterior descending branch; LCX: left circumflex branch; LM: left coronary artery trunk; Non-STEMI: non-ST segment elevation myocardial infarction; RCA: right coronary artery; Single branch: Single branch lesions; Three branches: three branches lesions; Type A: Type A lesions; Type B1:Type B2 lesions; Type C: Type C lesions; UA: unstable angiona pectori

**Table 4** Comparison of the number of coronary lesion branches and the number and length of stents implantation

| | EH-ACS (*n* = 824) | Control (*n* = 948) | t | *P* |
|---|---|---|---|---|
| No.of lesion branches | 1.18 ± 0.45 | 1.23 ± 0.51 | 1.851 | 0.064 |
| No.of stents | 1.55 ± 0.95 | 1.36 ± 0.75 | 4.495 | < 0.001 |
| Length of stents (mm) | 23.99 ± 6.77 | 22.34 ± 6.91 | 5.029 | < 0.001 |

Note: ACS: acute coronary syndrome; No. of lesion branches: number of culprit coronary arteries causing ACS; No. of stents: average number of stents implantation in each patient; Length of stents: the average length of the stent implantation at the culprit lesion of each coronary artery

**Table 5** MACE rate of during follow-up

| | EH-ACS (*n* = 824) | Control (*n* = 948) | $X^2$ | *P* |
|---|---|---|---|---|
| MACE, n(%) | 182(22.09) | 88(9.28) | 55.963 | < 0.001 |
| Deaths, n(%) | 15(1.82) | 6(0.63) | 5.308 | 0.021 |
| Non-f MI, n(%) | 24(2.91) | 6(0.63) | 13.765 | < 0.001 |
| TVR, n(%) | 167(20.26) | 82(8.65) | 49.261 | < 0.001 |

Note: MACE: major adverse cardiac events; Deaths: all-cause death; Non-f MI: recurrent non-fatal myocardial infarction; TVR: target vessel revascularization

## Discussion

EH in young people is characterized by insidious onset and low awareness of the disease. Most patients with EH have no symptoms at the initial stage of the disease, and often their blood pressure is found to be elevated during a physical examination. Therefore, the duration of hypertension in patients is longer than the recorded medical history. The treatment rate is low because there are no symptoms. Even if some patients take antihypertensive drugs, they are driven by symptoms, and they stop taking drugs when there are no symptoms. Therefore, the rate

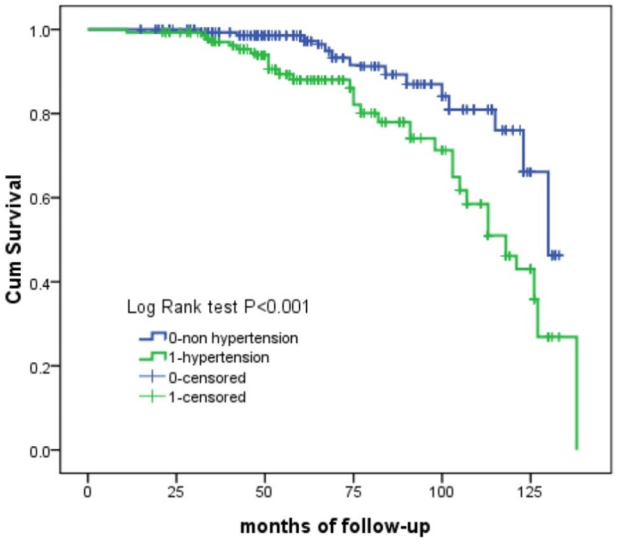


**Fig. 2** Comparison of survival function curves

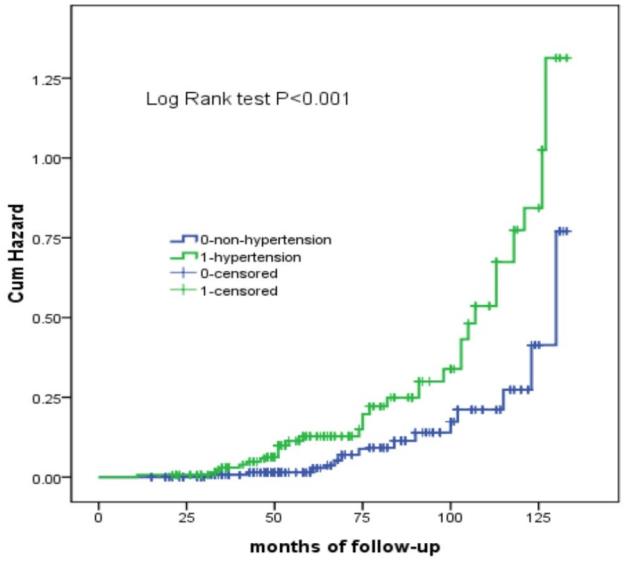


**Fig. 3** Comparison of risk function curves

of reaching the standard for antihypertensive treatment is low. The blood pressure level of most patients is not controlled within the target of < 140/90mmHg. The study results of Yoon YH, et al. [14, 15] showed that elevated blood pressure is independently associated with coronary atherosclerosis. A total of 4,666 patients who underwent coronary artery computer tomography angiography examination were divided into the elevated blood pressure group (SBP 130–139 mm Hg or DBP 80–89 mm Hg; *n* = 1,139), and hypertension group (SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg; *n* = 665). The results showed that compared with the normal blood pressure group (SBP < 120 mm Hg and DBP < 80 mm Hg; *n* = 2,395), the incidence of coronary artery plaque in the elevated blood

pressure group was 37% higher, and progressively higher blood pressure values have a linear relation with the presence of coronary artery plaque. Among young adults, those with elevated blood pressure had significantly higher risk for subsequent cardiovascular disease events compared with those with normal blood pressure before the age of 40 years [16]. The impact of EH on the severity of coronary artery disease in young women remains unclear until now. Previous studies have shown that the prevalence of ACS in women is lower. Among young women under 45 years of age, the prevalence of ACS is increasing year by year, and the proportion of hospitalization and mortality has also significantly increased [17]. In this study, 5520 young female patients (≤ 44 years old) received a CAG examination. 2684 of them (51.42%) suffered from ACS. ACS is a coronary event that may endanger the life of patients. Study results have shown that premenopausal women have the protective effect of estrogen on cardiovascular system [18–22], which reduces the probability of suffering from ACS in this special population. Estrogen acts on the estrogen receptor of vascular smooth muscle cells, increases the gene expression of nitric oxide synthase in endothelial cells, promotes the production of nitric oxide, and expands coronary arteries and peripheral blood vessels. The estrogen loss may result in chronic activation of the renin-angiotensin-aldosterone system [23].Therefore the incidence of coronary microvascular dysfunction significantly rises in postmenopausal women [24]. The estrogen inhibits the oxidation of LDL-C and very low-density lipoprotein cholesterol and the formation of atherosclerotic plaque, so it has a protective effect on the cardiovascular system of women, and the risk of CHD is significantly lower than that of men of the same age [25, 26]. However, the effect of estrogen lowering on the early onset of ACS is still unclear. Research results have shown that in premenopausal women, elevated blood pressure is accompanied by vascular wall thickening, and has a high risk of cardiovascular disease for young women [27].The results of this study indicate that hypertension exacerbates the severity of coronary artery lesions in young women with ACS. In this study, the proportion of type B2 (17.11%) and type C (31.55%) coronary artery lesions in the EH-ACS group was significantly higher than those (11.39% and 20.68%) in the control group ($P < 0.05$). In the EH-ACS group, the number of stents implantation in each patient (1.36 ± 0.75) and the length of stents (24.51 ± 6.71) were significantly higher than those (1.54 ± 0.95 and 22.34 ± 6.91) in the control group ($P < 0.05$). The cumulative rate (22.09% and 20.26%) of MACE and TVR in the EH-ACS group during 11–138 months of follow-up was significantly higher than those (9.28% and 8.65%) in the control group ($P < 0.05$). The results showed that hypertension aggravated the severity of coronary artery lesions in young women with ACS. The studied results have shown that the coronary artery lesions in young women are mostly single coronary artery lesions, and the anterior descending artery is the most vulnerable, and the rate of MACE in follow-up five years after PCI is high [28]. This study's results showed that there was no significant difference in the proportion of patients with unstable angina, non-ST segment elevation AMI and anterior wall AMI between groups ($P > 0.05$). There was also no significant difference in the number of coronary artery lesion branches between groups ($P > 0.05$). There was no significant difference in the proportion of lesions of LM, LAD, and LCX between groups ($P > 0.05$). However, the proportion (19.17%) of RCA involvement in the EH-ACS group was significantly higher than that (14.56%) in the control group ($P < 0.05$). The reason for the elevated proportion of RCA involvement is unclear.

Study results have shown that hypertension impairs blood vessels of the target organ through three approaches. (1) The pressure acts on the blood vessel wall for a long time, which causes the rupture of elastic fibers in the blood vessel wall. (2) Vascular wall stress activates mitotic protein kinase through the signal transduction system of smooth muscle cells, which promotes smooth muscle cell proliferation and protein synthesis. (3) Oxidative stress. Oxidative stress mainly occurs in the vascular endothelium, impairs the function of vascular endothelium [29–31], triggers the formation of atherosclerotic plaques in arteries, accumulates foam cells in plaques, and thins the fibrous cap on the surface of plaques to form unstable plaques (vulnerable plaques), which break or erode plaques, thus triggering AMI.

#### Limitations of this study

The study was a retrospective analysis, and found the impact of hypertension on coronary artery lesions in young females with ACS. There are some limitations to this study. The duration and treatment of EH and CHD were recorded based on patient self-reports, which might introduce reporting bias. The study does not utilize advanced imaging techniques like intravenous ultrasound or optical coherence tomography for more precise quantification of plaque burden and severity. It is not clear whether the patient's blood pressure reached the target of ≤ 140/90 mmHg during antihypertensive drug treatment or not. Future studies should incorporate prospective designs and advanced imaging modalities for more detailed and quantitative analysis of the burden of lesions and the stability of atherosclerotic plaques in coronary artery, explore the underlying mechanisms linking hypertension to increased coronary lesion severity in young females, which would further enrich the findings and aid in targeted interventions.

## Conclusion

The proportion of type B2 and type C lesions in the EH-ACS group was significantly higher than that in the control group ($P<0.05$), and the number and length of stents implantation in the EH-ACS group were significantly greater than those in the control group ($P<0.05$). The results showed hypertension exacerbates the severity of coronary artery lesions in young women with ACS. It is suggested that attention should be paid to the prevention and treatment of hypertension in young women, a special population, to reduce the prevalence of ACS, and a focus on improving hypertension awareness and management among young women could be beneficial in reducing the risk and severity of ACS.

### Features and opinions of this Article

In this study, coronary angiography was used for the first time to assess the damage of hypertension to coronary arteries. The objects of the study are a special group of young women. The results showed that hypertension had an impact on the severity of coronary artery lesions and aggravated coronary artery lesions in young women with ACS. The results suggest that attention should be paid to the prevention and treatment of hypertension in the young women population to reduce the prevalence of ACS.

#### Abbreviations

| | |
|---|---|
| ACS | Acute coronary syndrome |
| AMI | Acute myocardial infarction |
| CAG | Coronary angiography |
| CHD | Coronary heart disease |
| EH | Essential hypertension |
| EH-ASC | EH combined with ACS |
| LAD | left anterior descending branch |
| LCX | Left circumflex branch |
| LDL-C | Low-density lipoprotein cholestero |
| LM | Left coronary artery trunk |
| MACE | Major adverse cardiac events |
| Non-f MI | Recurrent non-fatal myocardial infarction |
| Non-STEMI | Non-ST segment elevation myocardial infarction |
| PCI | Prcutaneous coronary intervention |
| RCA | Right coronary artery |
| TVR | Target vessel revascularization |

#### Author contributions

1) conceived and designed the experiments; Ruifang Liu, Fangxing Xu, Tongku Liu, Xiaofan Wu2) performed the experiments; Ruifang Liu, Fangxing Xu, Tongku Liu3) analyzed and interpreted the data; Ruifang Liu, Yujie Zhou, Tongku Liu, Xiaofan Wu,4) contributed reagents, materials, analysis tools or data; Ruifang Liu, Yujie Zhou, Tongku Liu, Xiaofan Wu5) wrote the paperRuifang Liu, Fangxing Xu, Tongku Liu, Xiaofan Wu.

#### Funding

No.

#### Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Declarations

#### Ethical statements and informed consent

This retrospective study was approved by the Ethics Committee of Beijing Anzhen Hospital (Approved ID: 2021016X, on June 18, 2021). All patients signed the informed consent form of interventional examination and treatment before coronary angiography.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no competing interests.

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