Data Article

Morphometric and hemodynamic parameter dataset for coronary artery aneurysms caused by atherosclerosis

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ABSTRACT

In comparison with intracranial aneurysm, there are relatively few investigations of coronary artery aneurysms (CAA). Coronary atherosclerosis is the first cause of CAA; therefore, it is necessary to providing as many details of clinical CAA caused by atherosclerosis as possible. The aim of the data is to provide morphometric and hemodynamic parameters of CAAs caused by atherosclerosis, as well as the demographics of patients with CAAs. Various morphometric parameters were obtained from the reconstructed epicardial coronary arterial trees of 61 patients while multiple hemodynamic parameters were determined from their computed flow fields. The data classified the CAAs into 4 types. All subjects in each group are listed in this data article. This data set support the main findings presented in the research article (Fan et al., 2019). © 2019 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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The dataset presented in this article describes morphometric and hemodynamic parameters in epicardial coronary arteries of patients with CAAs caused by atherosclerosis. And it also provides the demographics of the CAA study population. There are 61 patients with 80 CAAs, which includes 10 CAAs of type I, 18 CAAs of type II, 29 CAAs of type III and 23 CAAs of type IV.

Table 1 and Table 2 list the demographics (e.g., age, myocardial ischemia, diabetes mellitus) of 61 patients. Table 3 and Table 4 list the morphometric parameters (i.e., \( L/W \), \( L_{\text{chord}} / L_{\text{arc}} \), \( D_{\text{fit}} \) of aneurysm) for type I-IV CAAs. Table 5 and Table 6 list hemodynamic parameters (i.e., SAR-OSI and SAR-TAWSS) for type I-IV CAAs.

### 2. Experimental design, materials and methods

#### 2.1. Materials

The experiment shows the demographic data for 61 patients (patient numbers, P1–P61) with CAAs, who underwent coronary CT angiography (CTA) of the coronary arteries at the Beijing Anzhen Hospital, Beijing, China. A total of 80 coronary artery aneurysms (CAA number, C1–C80) were identified among these 61 specific patients. Multiple morphometric parameters are also defined. The study was approved by the Institutional Review Board (IRB) for the Beijing Anzhen Hospital, which conforms with the declaration of Helsinki.
Table 1
Demographics of the type I and II CAA study population with CAAs (type IP1–P7 type II, P8–P18).

| N. | Age (year) | Gender | MI | Hypertension | Hyperlipidemia | DM | Smoking | Systolic blood pressure (mmHg) | Systolic blood pressure (mmHg) | Fasting glucose (mmol/L) | TG (mmol/L) | LDL (mmol/L) | HDL (mmol/L) | TC (mmol/L) | BMI (kg/m²) |
|----|------------|--------|----|--------------|----------------|----|---------|--------------------------------|--------------------------------|-----------------|-------------|-------------|-------------|-------------|-------------|
| P1 | 69         | M      | Y  | Y            | Y              | Y  | N       | 139                            | 96                             | 5.6             | 2.00        | 3.01        | 1.01        | 5.09        | 32          |
| P2 | 39         | M      | Y  | Y            | Y              | Y  | N       | 135                            | 86                             | 4.8             | 1.91        | 1.23        | 0.94        | 3.97        | 28.2        |
| P3 | 62         | M      | N  | Y            | N              | Y  | N       | 135                            | 95                             | 4.2             | 1.05        | 2.3         | 0.96        | 3.32        | 26.5        |
| P4 | 64         | M      | Y  | N            | Y              | N  | Y       | 116                            | 70                             | 5.6             | 1.02        | 1.36        | 1.02        | 3.277427    | 25.2        |
| P5 | 40         | M      | N  | N            | Y              | N  | Y       | 110                            | 68                             | 5.3             | 2.31        | 2.46        | 1.04        | 3.171111    | 28.6        |
| P6 | 63         | M      | Y  | N            | N              | N  | Y       | 110                            | 60                             | 5.8             | 1.02        | 1.72        | 0.95        | 2.63        | 26.0        |
| P7 | 54         | M      | Y  | N            | N              | N  | Y       | 109                            | 65                             | 5.9             | 1.28        | 2.53        | 0.89        | 3.49        | 24.0        |
| P8 | 73         | M      | Y  | Y            | N              | N  | Y       | 150                            | 78                             | 6.22            | 1.53        | 2.76        | 1.39        | 4.7         | 28.8        |
| P9 | 73         | M      | Y  | N            | Y              | N  | Y       | 140                            | 75                             | 4.63            | 2.85        | 2.23        | 1.76        | 3.86        | 29.2        |
| P10| 70         | M      | N  | N            | Y              | N  | Y       | 115                            | 78                             | 5.41            | 2.75        | 2.72        | 1.42        | 3.84        | 27.1        |
| P11| 44         | M      | Y  | Y            | Y              | N  | Y       | 145                            | 73                             | 6.67            | 2.98        | 1.32        | 1.03        | 4.42        | 25.6        |
| P12| 52         | M      | N  | Y            | N              | N  | Y       | 136                            | 74                             | 6.37            | 1.64        | 1.56        | 0.82        | 3.82        | 29.8        |
| P13| 52         | M      | F  | Y            | Y              | N  | N       | 141                            | 77                             | 4.92            | 1.65        | 2.15        | 1.46        | 3.83        | 29.8        |
| P14| 52         | F      | N  | Y            | Y              | N  | N       | 132                            | 75                             | 5.01            | 2.01        | 1.93        | 1.6         | 4.15        | 24.5        |
| P15| 61         | M      | Y  | N            | N              | N  | N       | 120                            | 73                             | 4.77            | 1.65        | 2.27        | 0.97        | 3.78        | 24.9        |
| P16| 59         | ##     | Y  | N            | N              | N  | N       | 132                            | 77                             | 6.97            | 1.55        | 1.84        | 1.94        | 4.4         | 25.5        |
| P17| 42         | M      | N  | Y            | N              | Y  | N       | 115                            | 74                             | 5.92            | 1.55        | 1.42        | 0.51        | 4.90        | 23.2        |
| P18| 43         | ##     | Y  | Y            | Y              | N  | N       | 132                            | 78                             | 7.53            | 2.45        | 2.49        | 1.01        | 4.85        | 20.3        |
Table 2: Demographics of the type III and IV CAA study population (type III, P19–P41; type IV, P42–P461).

| No. | Age (year) | Gender | MI | Hypertension | Hyperlipidemia | DM | Smoking | Systolic blood pressure (mmHg) | Systolic blood pressure (mmHg) | Fasting glucose (mmol/L) | TG (mmol/L) | LDL (mmol/L) | HDL (mmol/L) | TC (mmol/L) | BMI (kg/m²) |
|-----|------------|--------|----|--------------|----------------|----|---------|--------------------------------|--------------------------------|------------------------|-------------|-------------|-------------|------------|-------------|
| P19 89 | 89 | M | Y | Y | N | N | Y | 130 | 80 | 5.76 | 0.63 | 1.86 | 1.05 | 3.2 | 34.3 |
| P20 77 | 77 | M | Y | Y | N | N | Y | 135 | 86 | 4.23 | 0.95 | 1.91 | 0.95 | 3.17 | 31.2 |
| P21 75 | 75 | F | N | Y | N | N | N | 144 | 88 | 5.51 | 1 | 2.32 | 0.85 | 3.61 | 32.5 |
| P22 63 | 63 | M | Y | Y | N | N | Y | 135 | 86 | 4.63 | 0.95 | 1.91 | 0.95 | 3.17 | 31.5 |
| P23 57 | 57 | F | Y | Y | Y | N | N | 125 | 85 | 4.86 | 2.97 | 2.64 | 0.79 | 4.4 | 31.0 |
| P24 82 | 82 | M | Y | Y | N | N | Y | 161 | 100 | 4.39 | 8.12 | 2.1 | 1.34 | 4.38 | 27.9 |
| P25 53 | 53 | M | N | N | Y | N | Y | 150 | 92 | 4.7 | 3.01 | 2.53 | 0.89 | 4.63 | 19.0 |
| P26 44 | 44 | M | Y | Y | Y | N | Y | 166 | 73 | 6.67 | 5.42 | 1.63 | 1.03 | 4.42 | 25.9 |
| P27 31 | 31 | M | N | N | N | N | Y | 144 | 92 | 5.13 | 5.57 | 3.71 | 1.76 | 6.22 | 27.5 |
| P28 41 | 41 | M | Y | N | N | N | N | 137 | 79 | 4.77 | 0.71 | 2.27 | 0.97 | 3.6 | 25.6 |
| P29 32 | 32 | M | Y | N | N | N | N | 83 | 53 | 5.84 | 0.44 | 2.15 | 1.29 | 3.64 | 17.0 |
| P30 33 | 33 | M | N | Y | Y | N | Y | 148 | 87 | 5.3 | 2.44 | 2.84 | 1.04 | 5.03 | 28.7 |
| P31 50 | 50 | M | N | Y | Y | N | N | 124 | 79 | 6.37 | 2.39 | 3.75 | 1.07 | 7.07 | 22.4 |
| P32 32 | 32 | M | N | Y | Y | N | N | 122 | 83 | 5.08 | 2.52 | 1.68 | 0.88 | 3.87 | 10.2 |
| P33 61 | 61 | M | Y | N | N | N | N | 137 | 79 | 5.77 | 0.71 | 2.27 | 0.97 | 3.6 | 25.5 |
| P34 35 | 35 | M | N | Y | Y | N | N | 120 | 80 | 4.68 | 3.32 | 1.91 | 0.73 | 3.51 | 20.7 |
| P35 33 | 33 | M | Y | N | N | N | N | 83 | 53 | 5.84 | 0.44 | 2.15 | 1.29 | 3.64 | 19.4 |
| P36 64 | 64 | F | N | Y | N | N | N | 119 | 70 | 5.4 | 0.79 | 1.67 | 0.94 | 3.2 | 26.3 |
| P37 52 | 52 | F | N | Y | N | N | N | 118 | 73 | 6.36 | 0.93 | 1.86 | 0.85 | 4.6 | 32.6 |
| P38 48 | 48 | F | N | N | N | N | N | 115 | 58 | 4.97 | 0.66 | 1.73 | 1.01 | 3.25 | 24.7 |
| P39 46 | 46 | F | N | N | N | N | N | 105 | 79 | 4.86 | 0.16 | 1.9 | 1.24 | 3.65 | 16.3 |
| P40 31 | 31 | F | N | N | N | N | N | 104 | 58 | 5.57 | 1.68 | 1.75 | 1.03 | 3.48 | 20.5 |
| P41 50 | 50 | F | N | N | N | N | N | 88 | 72 | 5.86 | 1.67 | 1.8 | 0.99 | 3.67 | 21.6 |

**L/W ≥ 2 and CAA in one vessel**

| No. | Age (year) | Gender | MI | Hypertension | Hyperlipidemia | DM | Smoking | Systolic blood pressure (mmHg) | Systolic blood pressure (mmHg) | Fasting glucose (mmol/L) | TG (mmol/L) | LDL (mmol/L) | HDL (mmol/L) | TC (mmol/L) | BMI (kg/m²) |
|-----|------------|--------|----|--------------|----------------|----|---------|--------------------------------|--------------------------------|------------------------|-------------|-------------|-------------|------------|-------------|
| P19 89 | 89 | M | Y | Y | N | Y | N | 125 | 75 | 6.22 | 1.31 | 2.76 | 1.39 | 4.7 | 31.4 |
| P20 77 | 77 | M | Y | Y | N | N | N | 120 | 73 | 15.02 | 13.58 | 2.28 | 0.89 | 7.41 | 19.1 |
| P21 75 | 75 | F | Y | Y | Y | Y | Y | 135 | 100 | 14.29 | 13.37 | 3.39 | 1.06 | 6.38 | 28.4 |
| P22 63 | 63 | M | Y | N | N | N | N | 148 | 95 | 6.37 | 2.39 | 3.86 | 1.07 | 7.07 | 28.2 |
| P23 57 | 57 | M | N | Y | Y | N | N | 80 | 30 | 5.76 | 0.63 | 1.86 | 1.05 | 3.2 | 28.1 |
| P24 82 | 82 | M | N | Y | Y | N | N | 128 | 74 | 5.3 | 2.06 | 3.62 | 1.01 | 5.36 | 27.9 |
| P25 53 | 53 | M | N | N | Y | N | N | 135 | 75 | 5.01 | 0.66 | 1.93 | 1.6 | 3.9 | 27.1 |
| P26 44 | 44 | M | Y | N | N | N | N | 138 | 95 | 6.65 | 1.28 | 2.39 | 1.17 | 3.92 | 26.8 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P53 82 | F | Y | Y | Y | N | N | 133 | 85 | 8.31 | 1.53 | 3.10 | 1.16 | 3.12 | 25.9 |
| P54 52 | M | N | N | N | Y | N | N | 101 | 59 | 5.41 | 2.56 | 3.37 | 0.90 | 5.74 | 25.8 |
| P55 69 | F | N | Y | N | N | N | N | 101 | 67 | 5.47 | 2.87 | 2.37 | 1.06 | 4.32 | 25.1 |
| P56 61 | F | Y | Y | Y | N | Y | 108 | 75 | 3.54 | 3.67 | 2.85 | 1.04 | 4.41 | 24.8 |
| P57 52 | M | Y | Y | N | N | Y | 143 | 82 | 5.56 | 0.58 | 1.62 | 0.45 | 5.30 | 24.3 |
| P58 61 | M | N | N | Y | N | Y | 116 | 68 | 5.23 | 2.34 | 2.36 | 1.13 | 4.42 | 24.0 |
| P59 58 | F | N | N | Y | N | N | 129 | 73 | 7.19 | 0.66 | 2.02 | 1.23 | 5.33 | 22.8 |
| P60 53 | F | N | N | N | ## | N | 120 | 55 | 3.24 | 0.45 | 2.67 | 1.27 | 3.83 | 22.6 |
| P61 40 | F | N | N | N | ## | N | 119 | 55 | 3.74 | 0.36 | 2.19 | 1.11 | 2.52 | 22.5 |
2.2. Methods

Here, CAAs caused by atherosclerosis are divided into four groups in this data set. As the presence of a coronary artery bifurcation is the main major risk factor for CAAs followed by high aneurysm shape index \((L/W, \text{ where } L \text{ and } W \text{ refer to the aneurysm length and maximum diameter, respectively})\); the characteristics of CAAs are grouped into type I \((L/W \geq 2 \text{ and CAA covering a bifurcation})\), type II \((L/W < 2 \text{ and CAA covering a bifurcation})\), type III \((L/W \geq 2 \text{ and CAA in one vessel})\), and type IV \((L/W < 2 \text{ and CAA in one vessel})\).

2.2.1. Demographic data

General medical examinations, including medical history collection, blood pressure measurement, blood sampling, and urine analysis were performed. ST segment elevations as well as hyperacuity T waves were used for determination of myocardial ischemia. (Hf-800b semi-automatic blood biochemical analyzer, HLIFE kangyu medical, Ji nan, China). Demographics of the study population, including age, sex, myocardial ischemia, hypertension, hyperlipidemia, diabetes mellitus, smoking, blood pressure, fasting blood glucose, triglycerides, cholesterol concentrations, and body mass index are listed in Tables 1 and 2.

Table 3
Morphometric parameters for type I and II CAAs (type I, C1–C10 and type II, C11–C28).

| Aneurysm No. | Aneurysm shape index (L/W) | \(\frac{L_{\text{chord}}}{L_{\text{arc}}}\) | Mean \(D_{\text{mean}}\) of aneurysm (mm) | Aneurysm sphericity (\(\phi\)) |
|-------------|---------------------------|-----------------|---------------------------------|-----------------|
| L/W ≥ 2 and CAA's covering a bifurcation |
| C1          | 3.1                       | 0.9             | 4.6                             | 0.8             |
| C2          | 3.0                       | 0.8             | 7.2                             | 0.9             |
| C3          | 3.0                       | 0.8             | 7.9                             | 0.8             |
| C4          | 2.8                       | 0.8             | 8.7                             | 0.8             |
| C5          | 2.7                       | 0.7             | 5.4                             | 0.8             |
| C6          | 2.7                       | 0.9             | 6.5                             | 0.8             |
| C7          | 2.5                       | 0.8             | 7.3                             | 0.9             |
| C8          | 2.5                       | 0.8             | 7.2                             | 1.0             |
| C9          | 2.4                       | 0.9             | 7.0                             | 0.9             |
| C10         | 2.3                       | 0.8             | 7.1                             | 0.9             |
| L/W < 2 and CAA's covering a bifurcation |
| C11         | 1.8                       | 0.9             | 6.7                             | 0.9             |
| C12         | 1.7                       | 0.9             | 6.8                             | 0.7             |
| C13         | 1.6                       | 0.9             | 4.2                             | 1.1             |
| C14         | 1.5                       | 0.9             | 7.3                             | 0.9             |
| C15         | 1.4                       | 0.8             | 7.4                             | 1.2             |
| C16         | 1.3                       | 0.9             | 3.3                             | 1.0             |
| C17         | 1.3                       | 0.8             | 3.4                             | 0.9             |
| C18         | 1.3                       | 0.7             | 9.5                             | 1.0             |
| C19         | 1.3                       | 0.9             | 6.2                             | 1.0             |
| C20         | 1.2                       | 0.8             | 3.4                             | 1.2             |
| C21         | 1.2                       | 0.9             | 4.0                             | 1.3             |
| C22         | 1.2                       | 0.7             | 4.0                             | 1.0             |
| C23         | 1.1                       | 0.8             | 2.7                             | 0.4             |
| C24         | 1.1                       | 0.7             | 9.5                             | 1.0             |
| C25         | 1.1                       | 0.7             | 3.2                             | 1.0             |
| C26         | 1.1                       | 0.7             | 6.2                             | 0.9             |
| C27         | 1.1                       | 0.7             | 0.8                             | 0.1             |
| C28         | 1.0                       | 0.8             | 6.2                             | 1.0             |

1. LDL: low density lipoprotein
2. HDL: high density lipoprotein
3. BMI: body mass index
4. ##: unknown information
5. TC: total cholesterol
Table 4
Morphometric parameters for type III and IV CAAs (type III, C29–C57 and type IV, C58–C80).

| Aneurysm No. | Aneurysm shape index (L/W) | Mean D_{sca} of aneurysm (mm) | Aneurysm sphericity (\phi) |
|--------------|----------------------------|--------------------------------|---------------------------|
| L/W ≥ 2 and CAAs in one vessel |
| C29          | 5.2                        | 10.2                           | 0.6                       |
| C30          | 5.1                        | 6.9                            | 1.0                       |
| C31          | 5.1                        | 7.9                            | 0.7                       |
| C32          | 4.7                        | 5.4                            | 0.8                       |
| C33          | 4.7                        | 6.6                            | 0.7                       |
| C34          | 4.7                        | 5.8                            | 0.9                       |
| C35          | 4.3                        | 6.4                            | 0.8                       |
| C36          | 4.1                        | 3.1                            | 0.8                       |
| C37          | 4.0                        | 6.8                            | 0.8                       |
| C38          | 3.0                        | 5.1                            | 1.0                       |
| C39          | 2.9                        | 4.0                            | 0.9                       |
| C40          | 2.9                        | 6.8                            | 0.9                       |
| C41          | 2.9                        | 4.5                            | 0.9                       |
| C42          | 2.8                        | 6.2                            | 0.9                       |
| C43          | 2.8                        | 4.4                            | 0.9                       |
| C44          | 2.7                        | 7.9                            | 1.0                       |
| C45          | 2.7                        | 5.0                            | 0.8                       |
| C46          | 2.6                        | 4.0                            | 0.9                       |
| C47          | 2.6                        | 3.2                            | 0.9                       |
| C48          | 2.5                        | 7.9                            | 0.7                       |
| C49          | 2.5                        | 3.3                            | 1.0                       |
| C50          | 2.4                        | 4.2                            | 0.9                       |
| C51          | 2.4                        | 5.6                            | 0.8                       |
| C52          | 2.4                        | 2.5                            | 0.9                       |
| C53          | 2.3                        | 7.9                            | 0.8                       |
| C54          | 2.2                        | 10.4                           | 1.0                       |
| C55          | 2.2                        | 4.3                            | 0.8                       |
| C56          | 2.1                        | 6.2                            | 0.9                       |
| C57          | 2.0                        | 7.1                            | 0.7                       |
| L/W < 2 and CAAs in one vessel |
| C58          | 1.9                        | 6.8                            | 1.2                       |
| C59          | 1.9                        | 3.3                            | 0.8                       |
| C60          | 1.9                        | 4.9                            | 1.1                       |
| C61          | 1.8                        | 6.1                            | 1.2                       |
| C62          | 1.8                        | 6.4                            | 1.0                       |
| C63          | 1.7                        | 4.5                            | 0.8                       |
| C64          | 1.6                        | 4.7                            | 1.0                       |
| C65          | 1.6                        | 2.7                            | 0.9                       |
| C66          | 1.6                        | 7.9                            | 0.9                       |
| C67          | 1.6                        | 10.2                           | 0.9                       |
| C68          | 1.6                        | 4.5                            | 1.0                       |
| C69          | 1.6                        | 3.8                            | 1.0                       |
| C70          | 1.5                        | 3.7                            | 1.1                       |
| C71          | 1.5                        | 2.0                            | 1.2                       |
| C72          | 1.4                        | 5.0                            | 0.8                       |
| C73          | 1.4                        | 5.5                            | 1.0                       |
| C74          | 1.3                        | 2.2                            | 1.1                       |
| C75          | 1.3                        | 2.7                            | 1.0                       |
| C76          | 1.3                        | 4.9                            | 0.9                       |
| C77          | 1.2                        | 4.7                            | 1.3                       |
| C78          | 1.2                        | 7.5                            | 1.0                       |
| C79          | 1.1                        | 3.8                            | 1.0                       |
| C80          | 1.1                        | 3.8                            | 1.0                       |

6. TG: triglycerides
7. MI: myocardial ischemia
8. DM: diabetes mellitus
2.2.2. Morphometric data

Similar to previous studies [2,3], the Coronary CTA was performed through three CT scanners (i.e., 256-row detector CT scanner [Revolution CT, GE Healthcare, Milwaukee, USA], 320-detector row [Aquilion One; Toshiba, Otawara, Japan], or dual-source [Somatom Definition Flash; Siemens, Forchheim, Germany] CT). All studies were of diagnostic image quality with optimal contrast enhancement and no substantial motion artifacts. All digitized data were imported into the MIMICS Innovation Suite platform (Materialise Company, Belgium) for 3D geometry reconstruction. Morphometric data of the epicardial coronary arteries with the CAA, i.e., L/W, Lchord/ Larc, \( \phi \) and Mean Dfit of aneurysm were extracted based on the coronary CTA in each aneurysm (detailed definitions as follows).

1. L/W: aneurysm shape index, where \( W \) is maximum aneurysm diameter, \( L \) is aneurysm length.
2. \( \phi \): sphericity index = \( \frac{\pi^{1/3}\sqrt[3]{6V}}{A} \), where \( V \) is the aneurysm volume and \( A \) is the surface area.
3. Mean Dfit of aneurysm (mm): the best fit diameter of the aneurysm, \( D_{fit} \), is calculated as twice the average radius between the point on the centerline and the contour of the 3D aneurysm vessel.
4. \( L_{chord} / L_{arc} \): \( L_{chord} \) (mm) is the straight length from inlet to outlet of coronary artery and \( L_{arc} \) (mm) is the accumulative length along the centerline of coronary artery.

| Aneurysm No. | L/W ≥ 2 and CAAs covering a bifurcation | L/W < 2 and CAAs covering a bifurcation |
|-------------|------------------------------------------|------------------------------------------|
|             | SAR-OSI (%)                              | SAR-TAWSS (%)                            |
| C1          | 13.6                                     | 47.5                                     |
| C2          | 14.0                                     | 68.6                                     |
| C3          | 11.8                                     | 29.0                                     |
| C4          | 8.2                                      | 74.0                                     |
| C5          | 6.0                                      | 39.8                                     |
| C6          | 4.6                                      | 48.2                                     |
| C7          | 0.9                                      | 36.3                                     |
| C8          | 0.9                                      | 31.7                                     |
| C9          | 7.0                                      | 40.6                                     |
| C10         | 0.3                                      | 42.5                                     |
| C11         | 0.4                                      | 18.8                                     |
| C12         | 0.6                                      | 22.9                                     |
| C13         | 0.5                                      | 22.1                                     |
| C14         | 0.2                                      | 19.6                                     |
| C15         | 0.6                                      | 27.1                                     |
| C16         | 0.6                                      | 24.6                                     |
| C17         | 0.3                                      | 20.8                                     |
| C18         | 0.3                                      | 33.0                                     |
| C19         | 0.1                                      | 31.9                                     |
| C20         | 0.3                                      | 30.5                                     |
| C21         | 0.6                                      | 27.5                                     |
| C22         | 0.1                                      | 25.7                                     |
| C23         | 0.1                                      | 16.5                                     |
| C24         | 0.2                                      | 29.1                                     |
| C25         | 0.3                                      | 25.4                                     |
| C26         | 0.0                                      | 18.7                                     |
| C27         | 0.1                                      | 17.0                                     |
| C28         | 0.1                                      | 17.0                                     |

9. DM: diabetes mellitus
10. Y: yes
11. N: no
12. M: male
13. F: female
The morphometric parameters for type I and II CAAs, which includes 10 type I CAAs and 18 type II CAAs, are listed in Table 3. The morphometric parameters for Type III and IV CAAs, which includes 29 type III CAAs and 23 type IV CAAs, are listed in Table 4.

| Aneurysm No. | SAR-OSI (%) | SAR-TAWSS (%) |
|--------------|-------------|---------------|
| L/W ≥ 2 and CAAs in one vessel | | |
| C29          | 18.4        | 49.0          |
| C30          | 18.6        | 43.5          |
| C31          | 15.0        | 39.3          |
| C32          | 11.8        | 40.4          |
| C33          | 17.2        | 44.8          |
| C34          | 13.9        | 38.5          |
| C35          | 9.0         | 20.3          |
| C36          | 10.2        | 21.4          |
| C37          | 8.8         | 35.8          |
| C38          | 8.4         | 37.2          |
| C39          | 7.1         | 13.5          |
| C40          | 6.3         | 24.9          |
| C41          | 4.2         | 35.2          |
| C42          | 8.5         | 32.1          |
| C43          | 4.0         | 27.4          |
| C44          | 4.9         | 27.9          |
| C45          | 3.5         | 32.0          |
| C46          | 4.1         | 28.5          |
| C47          | 4.5         | 32.7          |
| C48          | 3.9         | 32.0          |
| C49          | 1.1         | 26.0          |
| C50          | 1.8         | 29.0          |
| C51          | 1.4         | 20.3          |
| C52          | 1.2         | 22.2          |
| C53          | 2.7         | 22.7          |
| C54          | 0.8         | 38.3          |
| C55          | 1.1         | 18.2          |
| C56          | 0.7         | 36.6          |
| C57          | 1.6         | 21.0          |
| L/W < 2 and CAAs in one vessel | | |
| C58          | 1.1         | 14.1          |
| C59          | 0.9         | 9.7           |
| C60          | 0.5         | 14.3          |
| C61          | 0.6         | 8.2           |
| C62          | 0.3         | 19.4          |
| C63          | 0.1         | 12.6          |
| C64          | 0.4         | 9.5           |
| C65          | 0.3         | 21.8          |
| C66          | 0.1         | 6.4           |
| C67          | 0.2         | 24.0          |
| C68          | 0.1         | 20.4          |
| C69          | 0.0         | 5.4           |
| C70          | 0.1         | 27.8          |
| C71          | 0.1         | 20.6          |
| C72          | 0.0         | 16.1          |
| C73          | 0.0         | 12.8          |
| C74          | 0.1         | 1.5           |
| C75          | 0.0         | 0.0           |
| C76          | 0.1         | 4.9           |
| C77          | 0.0         | 10.0          |
| C78          | 0.1         | 0.4           |
| C79          | 0.0         | 1.0           |
| C80          | 0.1         | 2.0           |
2.2.3. Hemodynamic data

Based on morphometric data, geometrical models were meshed using the ANSYS ICEM software (ANSYS Inc., Canonsburg, USA). The Navier-Stokes and continuity equations were solved using a finite volume solver, FLUENT (ANSYS Inc., Canonsburg, USA), as in previous studies [2,3]. Three cardiac cycles were required to achieve convergence for the transient analysis. A constant time step was employed, where $\Delta t = 0.01$ s with 84 total time steps per cardiac cycle. The aortic pulsatile pressure wave was applied to the inlet of epicardial coronary arterial tree [2]. The resistance boundary condition was assigned to each outlet [2].

The time-averaged wall shear stress (TAWSS) and the oscillatory shear index (OSI) were obtained from the computed flow fields. From the data, we also computed SAR-TAWSS [4,5] and SAR-OSI [6,7] within the CAA region (detailed definitions as follows).

1. SAR-TAWSS within the CAA region: surface area ratio of low TAWSS ($<4$ dyn/cm$^2$) within the CAA region. Surface area of TAWSS $\leq 4$ dyn/cm$^2$ indicates the disease-prone site [4,5].

2. SAR-OSI within the CAA region: surface area ratio of high OSI ($\geq 0.15$) within the CAA region. Surface area of OSI $\geq 0.15$ indicates the disease-prone site [6,7].

The hemodynamic parameters for type I and II CAAs, which includes 10 type I CAAs and 18 type II, are listed in Table 5. The hemodynamic parameters for type III and IV CAAs, which includes 29 type III CAAs and 23 type IV CAAs, are listed in Table 6.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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