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Pattern of dominancy in coronary artery among Saudi population; coronary angiography study

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ABSTRACT

Most common causes of death and morbidity worldwide, particularly in developed countries, are coronary heart diseases. This study used coronary angiography to identify the dominant coronary artery in the Saudi population and assess the arterial supply to the atrioventricular node and bundle in relation to the degree of coronary artery stenosis. Retrospective research was done on patients who visited the King Fahad Cardiac Center, Riyadh between January, 2022 and December, 2022. The records of 310 patients, aged 18 years or older, of both sexes, whose coronary artery angiography revealed disease in coronary arteries, were included as a sample in the study. The results revealed that the right coronary artery predominated in both male and female Saudi patients (56.1%) and that both the right coronary artery and anterior descending artery were equally susceptible to stenosis. There was no connection between sex and the stenosis site. The results also revealed a weak relationship between the dominant coronary artery and the degree of right coronary artery stenosis and anterior descending artery stenosis reduction.

Keywords: Coronary, Angiography, cardiovascular disease, dominant artery, Stenosis, Saudi.

1. INTRODUCTION

Coronary artery disease causes one or more coronary arteries to become narrowed or blocked, typically as a result of atherosclerosis. This leads to myocardial ischemia, which can result in myocardial infarction and angina pectoris. One of the leading causes of disease and mortality worldwide, particularly in poorer nations, is atherosclerosis (Malakar et al., 2019). Understanding the pathophysiology of coronary artery disease is made easier

by having a solid understanding of the normal architecture of the coronary arteries (Cao et al., 2021).

The right and left coronary arteries supply the heart with blood. The anterior descending artery and circumflex artery are secondary divisions of the left coronary artery. The anterior and left sides of the heart are supplied with blood by left anterior descending artery, sometimes called the anterior interventricular artery. The left and back of the heart are supplied by the circumflex artery. Acute marginal and posterior descending arteries are divisions of the right coronary artery, also referred to as the posterior interventricular artery. The right coronary artery supplies right ventricle, the right atrium, sinoatrial node, atrioventricular node and a portion of the left ventricle (Engele et al., 2021).

When the right coronary artery or circumflex artery produces the posterior descending and posterolateral branches, it is referred to as having "dominance" in reference to the coronary arteries. The left dominance, which affects 7% to 8% of the population, is frequently referred to as several of normal anatomy. The non-dominant right coronary artery only provides the right ventricle and the atria in populations with left dominance, whereas the left coronary artery supplies the complete left ventricle.

About 85% of people have a dominant right coronary artery, compared to 15% who do not. There is clinical importance to the varied dominating vascular pattern. Understanding the variations and pathologies of the coronary arteries is essential for interpreting the results of cardiac illnesses and choosing and organizing the right course of treatment. For the precise surgical operations, knowledge of the precise coronary arteries aberrant and their aortic origin is also necessary (Felmeden et al., 2000). According to a previous study, the right coronary artery extends its branches in less than 10% of cases, supplying blood not only to right ventricle but also to around half of the left ventricle (Nerantzis and Koutsaftis, 1998).

One of the most significant branches of the heart is the sinoatrial nodal artery, that supplies SA node, which is responsible for starting each heartbeat (Sañudo et al., 1998). In about 60% of people the sinoatrial nodal artery originates from the right coronary artery and in the remaining 40% of cases it arises from left circumflex coronary artery (Pejković et al., 2008). The current study examined the structural variations of the coronary artery patterns that supply the heart and examines their importance in the management of arrhythmias and other cardiac conditions.

2. MATERIALS AND METHODS

It was a retrospective study based on archived data conducted on 310 patients. Using an appropriate sample technique, all patients of both genders over the age of 18 who visited the King Fahad Cardiac Center in Riyadh for various indications were included. The research contains an excluded criterion represented in patients with congenital heart diseases patients were enrolled patients who visited the King Fahad Cardiac Center in Riyadh between January 2022 and December 2022 from the cardiovascular medicine department. The Prince Sattam Bin Abdulaziz University's ethical committee at the Faculty of Medicine gave its approval to the ethical issues (PSAU-2022 ANT 59 /44PI). Inclusion criteria for the study included Saudi and non-Saudi patients who presented to the King Fahad Cardiac Center, were admitted to the Cardiac Center for any reason, indicated and completed a coronary angiogram and had at least one documented coronary artery lesion on said coronary angiogram. Patients had to be of both sexes, male and female, over the age of 18, residents of KSA and be of any gender based on coronary angiography showing at least one identifiable coronary lesion.

Individuals who met additional coronary artery imaging indications and patients whose coronary angiograms showed no coronary artery lesions are among the exclusion criteria. Patients with biased registrations as a result of incomplete registration were also rejected and removed, as were patients with incomplete or missing data points in their electronic medical records.

Data were gathered from patients' electronic health records. A data collecting sheet containing the patient's BMI, age, gender, findings of an echocardiography, an assessment of the coronary arteries' stenosis and the location of the stenosis. A check list was used to gather the information from patient records. Associating coronary artery stenosis with position and coronary artery dominance, pattern of coronary artery dominance based on posterior descending artery and posterolateral ventricular artery origin from either the left or right coronary or both and Study groups will be assigned to subjects.

The degree and location of coronary involvement, as well as coronary dominancy, were identified. Transthoracic echocardiography was used to determine left ventricular ejection fraction. Coronary Artery Disease was defined as more than 50% diameter stenosis in one or more of the three major coronary arteries or their major branches. Chi square and the t-test were used to evaluate the data in order to identify any significant associations between the variables.

3. RESULTS

A total of 310 patients who visited the cardiology department participated in the study. According to the results, 174 patients (56.1%) had right dominant coronary arteries, consisting of 127 (40.9%) males and 36 (11.6%) females, 47 (15.1%) had left dominant

coronary arteries, consisting of 90 (29%), 64 (20.6%) males and 26 (8.3%) females and 46 (14.8%) co-dominant arteries, consisting of 39 (12.5%) males and 7 (2.25%) females (Table 1, 2) (Figure 1).

38 (12.2%) of the patients had stenosis at the normal site, 71 (22.9%) had stenosis at the right dominant site, 48 (15.4%) men and 23 (7.4%) females. Approximately 64 (20.6%) males, about 45 (14.5%) females and about 19 (6.1%) had left anterior descending artery stenosis. Additionally, 137 people (44.1%) out of 108 people (34.83%) of males and 29 people (9.3%) of females had some degree of stenosis in both arteries. Age and the presence of lesions in left principal coronary artery or left anterior descending artery were not statistically significantly associated. Additionally, there was no statistically significant link between age and the quantity of damaged vessels. A statistically insignificant connection between the dominant coronary artery and gender was not also found (Table 3) (Figure 2).

The data was also examined for stenosis severity and distributed using a novel grade analysis method. It revealed that 29.93% of the patients had no RCA stenosis and 33.67% had normal LADs and that 22.43% of the RCAs and 19.27% of the LADs had diameter reductions of less than 50% in each. According to the statistics, there were 37 cases of LAD stenosis and 48 cases of RCA stenosis between 49% and 69% diameter decrease. A total of 47 (15.16%) RCA and 71 (22.9%) LAD patients had diameter reductions of greater than 69% but less than 90% and 9 (2.9%) RCA patients and 16 (5.1%) LAP patients had full blockage (Figure 3, 4, 5).

The results also demonstrated a relationship between the dominant coronary artery and the degree of RCA and LAD stenosis reduction. The dominant coronary artery and the degree of decrease have a weak link, according to the results of the Cramer's V test for association used to examine this correlation.

Table 1 Demographic information and lesions from coronary artery disease

Parameter		Number	Percentage
Nationality	Saudi	285	91.9%
	Non-Saudi	25	8.06%
Gender	Male	230	74.19%
	Female	80	25.8%
Age	Less than 29	9	2.9%
	between 29 to 39	19	6.1%
	between 39 to 49	63	20.3%
	between 49 to 59	78	25.1%
	More than 59	141	45.4%

Table 2 Demonstrates the prevalence of coronary artery stenosis in Saudi society

Gender	Coronary Artery Dominance			
	Right Coronary	Left Coronary	Co-dominant	Total
Male	127	64	39	230
Female	47	26	7	80
Total	174	90	46	310

Table 3 Demonstrates the location of coronary artery stenosis in Saudi men and women

	Location of Stenosis				
Gender	Normal	RCA	LAD	RCA & LAD	Total
Male	29	48	45	108	230
Female	9	23	19	29	80
Total	38	71	64	137	310

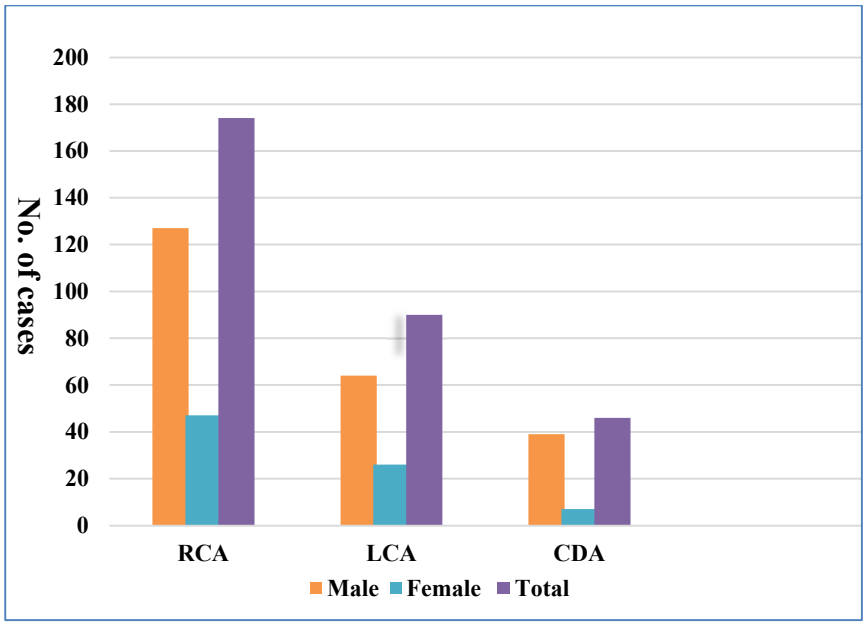

Figure 1 A clustered bar indicates how prevalent coronary arteries are among the participants. RCA (Right Coronary artery), LCA (Left Coronary artery), CDA (Co-dominant artery)

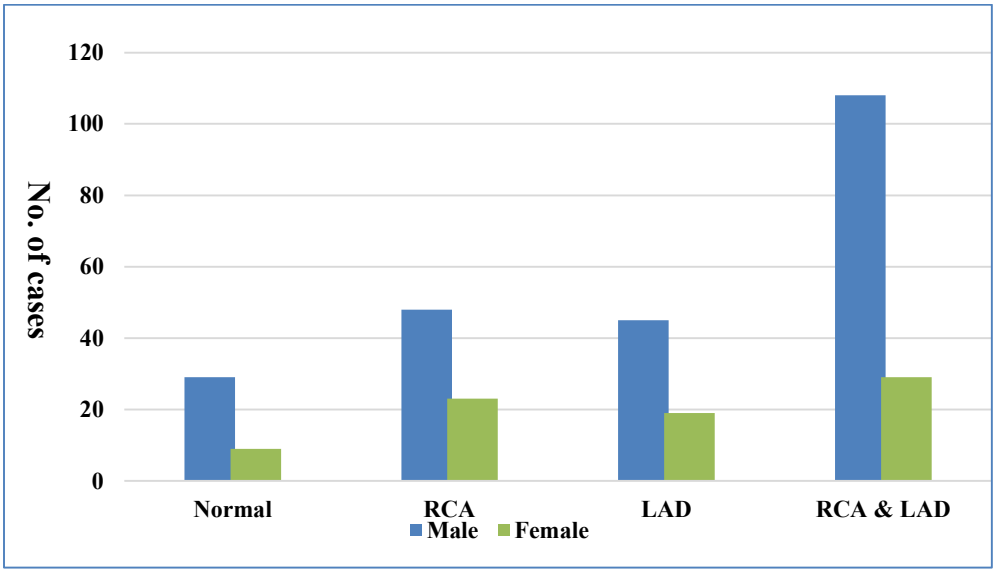

Figure 2 Male and female patients' coronary artery stenosis locations are displayed as clustered bars

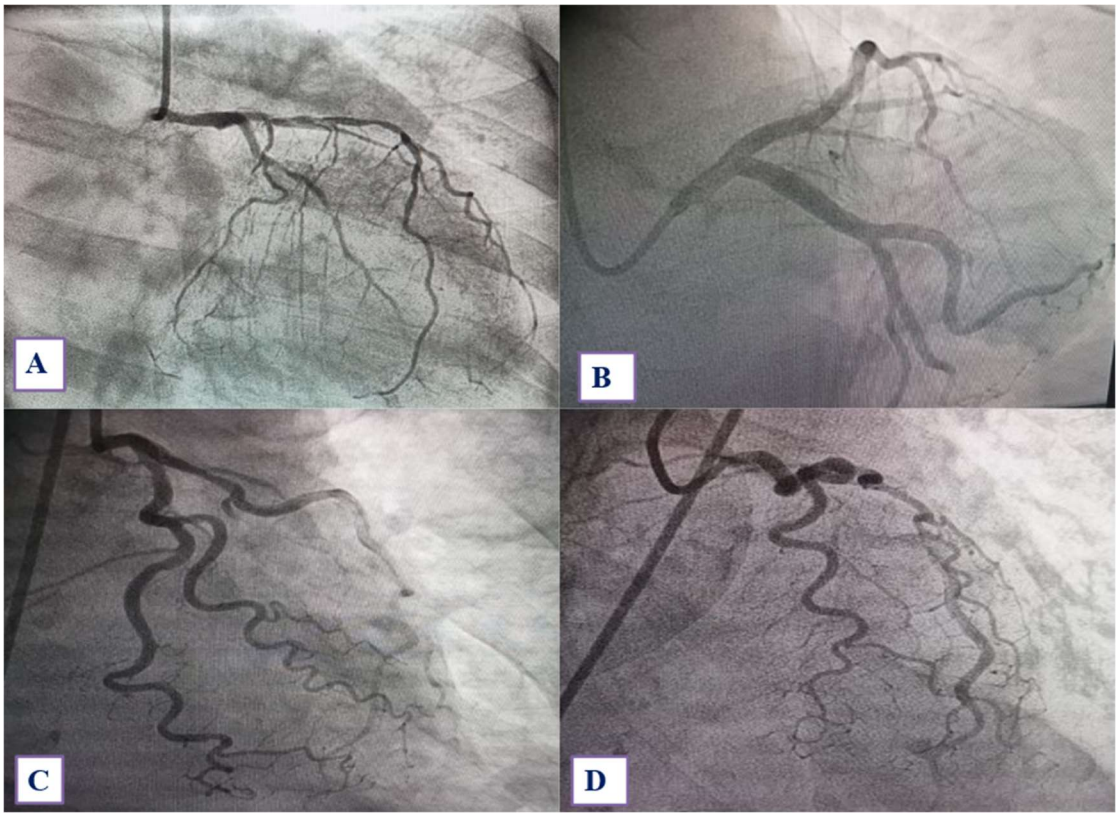

Figure 3 A) Coronary angiography with multiple plaques in left coronary system. B) Normal left circumflex coronary artery. C& D) Tortuous left coronary system

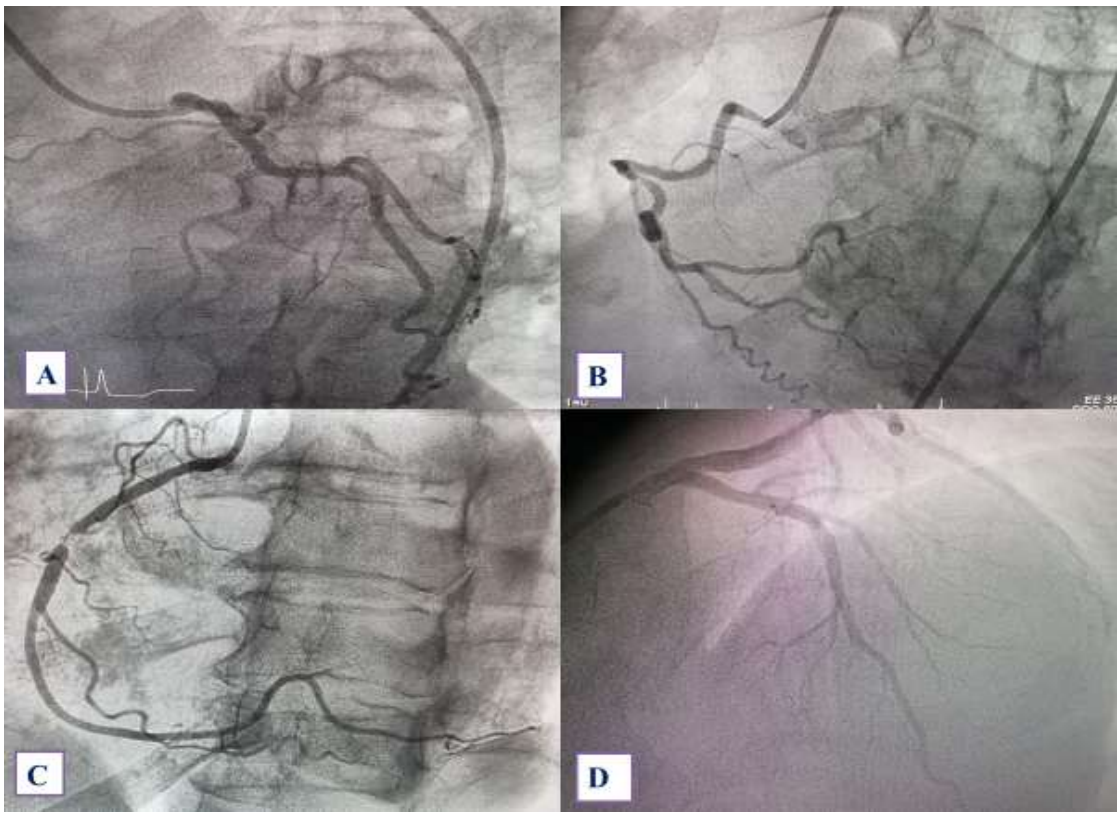

Figure 4 A) Selective LCX injection. B) Tortuous RCA. C) Mid RCA significant lesion. D) Mild left coronary artery system disease

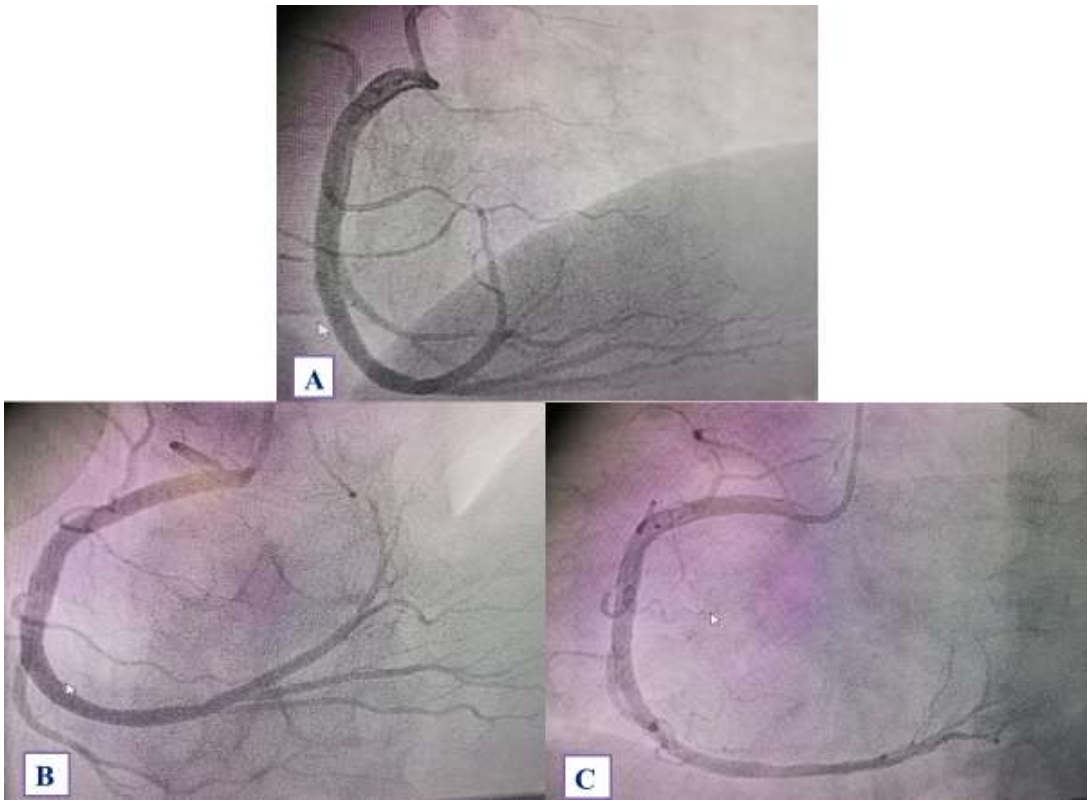

Figure 5 A & B) Dominant RCA. C) Codominant RCA

4. DISCUSSION

Our research revealed that the majority of Saudi patients, both male and female, were RCA dominant and that both the RCA and LAD were equally susceptible to stenosis. There was no relationship between sex and the stenosis site. Based only on severity, the majority of patients are unlikely to have hemodynamic and clinical relevance, according to the grading study. Additionally, a sizable number of individuals with a high degree of severity were found in the findings, which has been deemed a threshold for clinical importance. The majority of the individuals had RCA and LAD stenosis. The numbers must be compared to the other clinical findings (Vural et al., 2010).

The location and severity of stenosis among the patients did not significantly correlate. However, the results revealed a relationship between the DCA and the extent of RCA and LAD stenosis reduction, however this relationship was weak when examined using Cramer's V test for association in RCA stenosis and LAD stenosis. The results of the current study differ in this regard from the majority of earlier investigations, when it was stated that other coronary arterial lesions, such as left anterior descending artery, were more frequently implicated. Another study looked at 189 coronary angiograms of patients who had ST segment elevation myocardial infarction and had less than 50% arterial narrowing. It found that the LAD was the most common coronary arterial lesion among STEMI patients, with 36% to 38% of cases, followed by RCA and LCX lesions (27 to 29%) (Ghanim et al., 2017). Similar to this, Wang et al., (2017) investigated 5288 individuals with CHD in China and used coronary angiography to evaluate the lesions. They noted that the LAD, RCA and LCX had the most lesions, supporting the idea that arterial lesions in the Saudi population differ from those in other parts of the world. However, this discrepancy can be explained by the age difference of 40 years, various cultural traditions or global social conventions.

In Saudi Arabia, elderly adults have a considerably greater rate of coronary arterial lesions than younger ones do. In contrast, Tsai et al., (2017) did research in Taiwan with 245 patients under the age of 40 who had occlusive CAD with acute coronary syndrome. The LAD was the area with the most lesions, followed by the LCX and the RCA. Once more, the arterial lesions in CAD were different in this study from Taiwan.

Future studies should investigate the diameter of coronary arteries using various radiological techniques, such as 64 slice MSCT scans, to determine the vessel's shape or taper from its origin to its termination. They should also identify the dominant artery in relation to various ethnic groups both inside and outside the Kingdom of Saudi Arabia to reach a clear conclusion.

5. CONCLUSION

The prevalence of coronary artery lesions in coronary artery disease among the Saudi population is reported in this study, which is the first detailed investigation on coronary artery lesions from Saudi Arabia. When compared to other populations, the Saudi population's pattern of coronary artery lesions is different.

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Authors' Contributions

All authors contributed to the research and/or preparation of the manuscript. Ali Hassan A Ali, Fayez E A Elshaer and Abdulmajeed Mazroua Almazroua participated in the study design and wrote the first draft of the manuscript. Salem Abdulhadi Aldosari, Mubarak Hussain Aldossari and Abdullah Mohammed Alqahtani collected and processed the samples. Meshari Khalid Alhumaydani, Faris Abdullah Alselmi, Ziad Awadh Almutairi and Abdulrahman Abdullah Aldaghfag participated in the study design and performed the statistical analyses. All of the authors read and approved the final manuscript.

Ethics Approval

All series of steps that were implemented in this study that included animal models were in compliance with Ethics Committee of Prince Sattam bin Abdulaziz University Institutional Review Board (PSAU-2022 ANT 59 /44PI).

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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