

SA nodal artery – its origin in relation to the dominance of coronary arteries

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Abstract

Eighty hearts were dissected and the right and left coronary arteries, posterior interventricular branch and the sinuatrial nodal artery were identified. 'Dominancy' of the coronary arteries was determined according to the origin of the posterior interventricular branch. The origin of the sinuatrial nodal artery was analysed in relation to the 'dominancy' of the coronary arteries.

Key Words: Right coronary artery (RCA), Left coronary artery (LCA), Posterior interventricular artery (PIVA), SA nodal artery.

Introduction

The right and left coronary arteries arise from the coronary ostia in the aortic sinuses and enter the groove between the atria and the ventricles. The left coronary artery gives off the left anterior descending branch and continues as the left circumflex artery (1). The right coronary artery passes towards the right margin of the heart and continues in the posterior part of the atrioventricular groove (1, 2).

Dominancy has been attributed to the coronary arteries based on the reciprocal lengths of the right coronary artery and the circumflex branch of the left coronary artery in the posterior interventricular groove (3, 4). If the right coronary artery crosses the crux (the area in the posterior surface of the heart where the coronary sulcus meet the posterior interventricular sulcus) right coronary artery is considered as the dominant artery. If the circumflex branch of the left coronary artery crosses the crux left coronary artery is considered as the dominant artery.

As the posterior interventricular artery is given off from the coronary artery which crosses the crux it is considered that the PIVA is given off from the dominant coronary artery. Even though a 'dominant' coronary artery has been described a greater volume of the heart is supplied by the left coronary artery (1, 2).

The sinuatrial (SA) nodal artery is the largest atrial branch which supplies the area adjacent to the superior vena cava and the SA node. It may arise from the RCA or from the circumflex branch of the LCA (5). A knowledge of the blood supply to the atrial portion of the conducting system is important as impaired circulation may influence the function of the SA node thereby causing arrhythmias (6).

Although the origin of the SA nodal artery from the right coronary artery (RCA) and left coronary artery (LCA) has been described the relationship of the origin of the SA nodal artery to the 'dominancy' of the coronary arteries has not been analysed.

The objective of this study is to compare the percentages of dominance of the RCA and LCA with the findings of previous workers and to analyse the origin of the SA nodal artery in relation to the 'dominancy' of the coronary arteries.

Materials and Methods

Eighty hearts were obtained from the Medicolegal Department of the General Hospital Colombo. Specimens were removed within 48 hrs after death from patients who died of non-cardiac conditions.

The coronary arteries were flushed with 5% 'formalin' followed by pure water through a cannula introduced into the coronary ostia via the aortic sinuses. The aorta was cut short to facilitate the introduction of the cannula. A gelatin solution coloured with Giemsa stain was injected as far as the coronary sinus using the same cannula (7).

In all specimens coronary arteries were dissected to identify the origin of the PIVA and the SA nodal artery.

Coronary arteries were grouped as 'dominant' or 'non-dominant' depending on the origin of the PIVA. The frequency of origin of the SA nodal artery in relation to the 'dominancy' of the coronary arteries was statistically analysed.

Results

The artery which gives rise to the posterior interventricular branch is considered as the 'dominant' coronary artery (Fig. 1a & 1b). In the present study RCA was 'dominant' in 62 (77.5%) and LCA in 14 (17.5%) of the specimens (Table 1). In 4 (5.0%) specimens the PIVA originated from both coronary arteries (balanced pattern) and was running in or on either side of the interventricular groove (Fig. 2).

Table 1 Classification of coronary arteries based on the origin of the posterior interventricular branch. (n = 80)

Artery	'dominancy'	number	%
RCA	dominant	62	77.5
LCA	dominant	14	17.5
RCA and LCA	balanced pattern	04	05.0

RCA right coronary artery
LCA left coronary artery

Table 2 shows the origin of the SA nodal artery in 76 specimens in relation to the 'dominancy' of the coronary arteries. Four specimens where a balanced pattern was seen were not included. The SA nodal artery was arising from the

'dominant' coronary artery in 48 (63.15%) specimens and from the 'non-dominant' coronary artery in 28 (36.8%) specimens.

Table 2 Origin of the SA nodal artery in relation to the 'dominancy' of the coronary arteries (n = 76)

	number	%
'dominant' artery	48	63.2
'non-dominant' artery	28	36.8

The difference in the percentages were statistically analysed using the standard error of the differences in percentages (8) and was not found to be significant ($p > 0.05$).

Discussion

In standard descriptions of the coronary arteries, PIVA is usually described as arising from the RCA and runs in the posterior interventricular groove (1, 2). It supplies the posterior part of the interventricular septum and the adjacent left ventricle (9). PIVA usually arises as a single artery but in about 30% it may be accompanied by two branches that arise from the RCA (1). PIVA may also originate from the circumflex branch of the LCA and enter the interventricular groove (2).

'Dominancy' has been attributed to the coronary arteries based on the length of the coronary arteries (3, 4). The artery which crosses the crux is considered as the dominant coronary artery and the PIVA is given off from that artery.

In standard description of the coronary arteries the PIVA is described as arising from the RCA in 80-90% and in the remainder from the circumflex branch of the LCA (1, 2). In the balanced pattern (10) each coronary artery gives rise to a branch which runs on either side of the posterior interventricular groove (Fig 2).

Studies done previously (7, 9, 10) have shown that the RCA is more frequently considered as 'dominant' compared with the LCA (Table 3). In the present study, RCA is 'dominant' in 62

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(77.5%) and LCA in 14 (17.5%). With regard to the balanced pattern, previous studies show a frequency varying between 12%-40% (10, 11, 12, 13) (Table 3). In the present study the incidence was only 5%.

Table 3 Reported frequencies of coronary arterial dominance patterns

Source	n	pattern of dominance %		
		RCA	LCA	bal
Kurjia <i>et al.</i> (11)	119	46	14	40
Chaudhry (13)	103	75	13	12
Schlesinger (10)	225	48	18	34
Velican (12)	566	58	15	27
Current study	80	77.5	17.5	05

n – sample size

RCA – right coronary artery

LCA – left coronary artery

bal – balanced pattern

SA nodal artery is the largest artery to the human cardiac atria and it supplies the SA node and the area near the superior vena cava (6). This artery usually arises as a direct branch of the RCA in about 65% and in the remainder from the circumflex branch of the LCA (1, 2, 6, 14). In the present study the SA nodal artery arose from the RCA in 64 (80%) and from the LCA in 16 (20%).

This study as well as those of previous workers has shown that in most instances the RCA is the dominant coronary artery and that the SA nodal artery more frequently arose from the RCA. This however does not necessarily imply that the SA nodal artery more frequently arose from the dominant coronary artery.

Analysis of the origin of the SA nodal artery in relation to dominance revealed that in 48 (63.15%) specimens the SA nodal artery was seen to arise from the 'dominant' coronary artery and in 28 (36.8%) it was a branch of the 'non-dominant' coronary artery (Table 2) (Figs. 3a & b and 4a & b).

As the difference between the percentages was not statistically significant ($p > 0.05$) it was concluded that the origin of the SA nodal artery is not related to the 'dominance' of the coronary arteries.

In conclusion this study shows that even though the RCA is more frequently dominant than the LCA and the SA nodal artery more frequently arises from the RCA, the origin of the SA nodal artery is not related to the dominance of the coronary arteries. Thus the dominance of the coronary arteries is a misleading terminology even when considering the blood supply to the arterial portion of the conducting system.

Conclusions

The present study shows that

1. The RCA is more frequently 'dominant' than the LCA.
2. The SA nodal artery arises from the RCA more frequently than from the LCA.
3. The origin of the SA nodal artery is not related to the 'dominance' of the coronary arteries.

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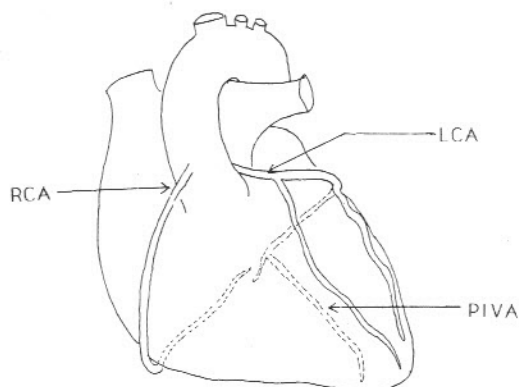


Fig. 1 (a)

Dominancy of the left coronary artery

RCA – Right coronary artery

LCA – Left coronary artery

PIVA – Posterior interventricular artery

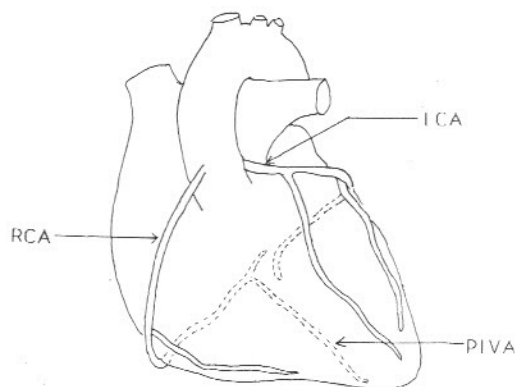


Fig. 1 (b)

Dominancy of the right coronary artery

RCA – Right coronary artery

LCA – Left coronary artery

PIVA – Posterior interventricular artery

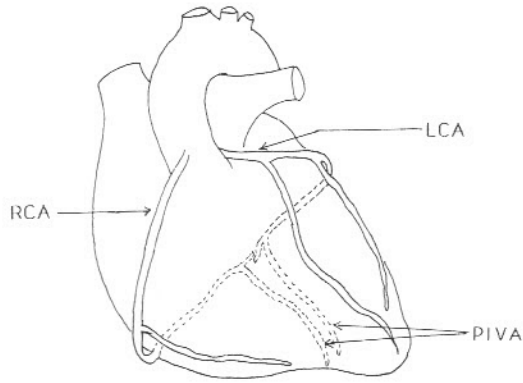


Fig. 2
Balanced pattern

RCA – Right coronary artery
LCA – Left coronary artery
PIVA – Posterior interventricular artery

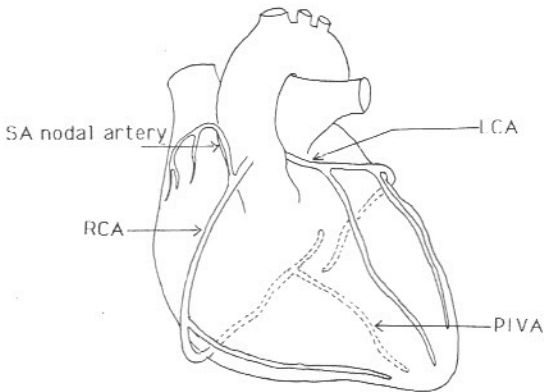


Fig. 3 (a)

SA nodal artery arising from dominant right coronary artery

RCA – Right coronary artery
LCA – Left coronary artery
PIVA – Posterior interventricular artery

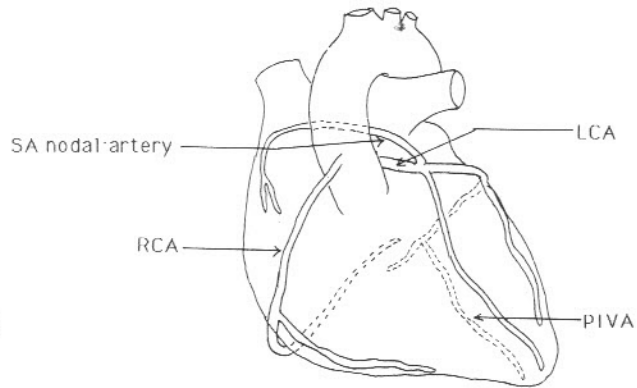


Fig. 3 (b)

SA nodal artery arising from dominant left coronary artery

RCA – Right coronary artery
LCA – Left coronary artery
PIVA – Posterior interventricular artery

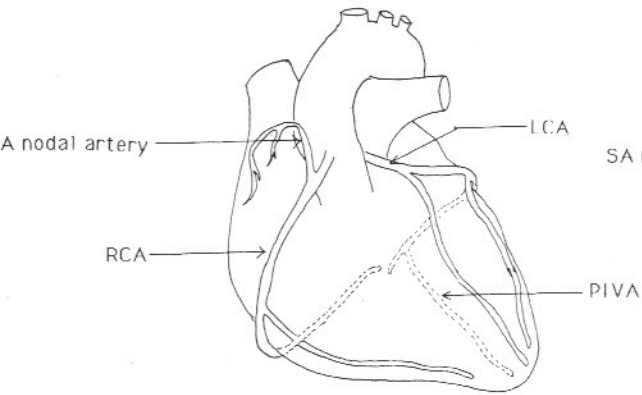


Fig. 4 (a)
**SA nodal artery arising from non-dominant
 right coronary artery**

RCA – Right coronary artery
 LCA – Left coronary artery
 PIVA – Posterior interventricular artery

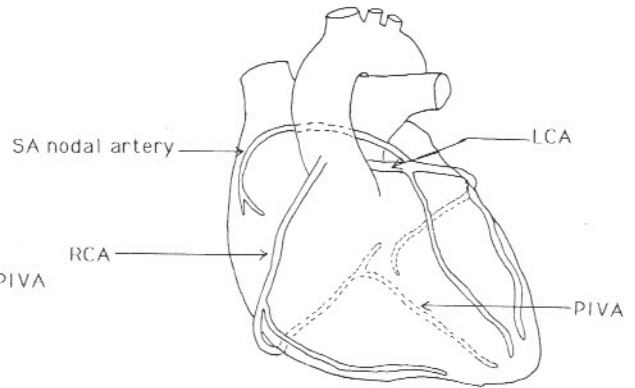


Fig. 4 (b)
**SA nodal artery arising from non-dominant
 left coronary artery**

RCA – Right coronary artery
 LCA – Left coronary artery
 PIVA – Posterior interventricular artery