

## Research Article

# Vascular corrosion casting of human heart

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## ABSTRACT

Variation in the morphological pattern of coronary arteries and their major branches is an important factor in the assessment and treatment of coronary heart disease. Detailed knowledge of the blood supply of the heart is necessary today because of the wider practice of cardiac surgery, and also for better understanding of the anomalous branches, anastomosis and dominance pattern in circulation caused by coronary vasculature. We utilized 80 human heart specimens and found right dominance in 69 specimens, left dominance in 9 specimens and balanced type of circulation in 2 specimens. We observed anastomosis between the major arteries in arteriogram but in vascular corrosion method we did not found because cast substance interpretation to minor vessels is too difficult. The present study acknowledges about Coronary vascular pattern, circulatory dominance of the arteries and by using the vascular corrosion method.

**Keywords:** Coronary arteries, Corrosion, Casting

## INTRODUCTION

Blood supply of the heart is by two coronary arteries originating from the ascending aorta. The left coronary artery divides into left anterior descending artery and circumflex artery, supplies blood to the front of the left side of the heart, lateral side and back of the heart.<sup>1</sup> The right coronary artery divides into the posterior descending artery and acute marginal arteries, supplies blood to the right ventricle, right atrium, Sino Atrial node, Atrio ventricular node and variable portion of the left ventricle.<sup>2</sup> Hettler stated the left coronary artery dominance, right coronary artery dominance and co-dominant are the three types of coronary circulation.<sup>3</sup> Anomalous origin and distribution of the coronary arteries were shown to be a cause of sudden death in young and adult patients, often in association with physical exertion. Coronary artery anomalies when occur pose difficulty with coronary visualisation, identification and present unique problems for surgical treatment. Our

study through corrosion casts may throw some additional light on the blood supply to human heart and serve to promote further work in this exciting field of medicine.

## METHODS

A total (n=80) heart specimens were collected with a portion of ascending aorta from relatively fresh bodies that came for post-mortem at the Forensic Department, S.V. Medical College, Tirupati. Each specimen thoroughly washed to free it from the blood clots then polythene catheters were introduced in to both the coronary arteries through the coronary Ostia and ligature is applied. The solution of 6% polyvinyl acetate resin in acetone is injected at constant pressure with a 20 ml syringe and then the heart is suspended in cold water bath and it is allowed to hang freely in water bath which intend prevents the collapse of blood vessels due to its own weight and the resin can enter the terminal branches of coronary vessels. The injection is continued as the

canula is withdrawn to fill up the proximal stems of coronary vessels. At the end, little resin solution is put into the aorta to maintain the continuity of the arteries. The heart specimens are immersed in ice cold water for 6 to 8 hours and then immersed in the acid bath containing 9 parts of concentrated Hydrochloric acid and 1 part of concentrated Nitric acid till the tissue is completely macerated. This process takes usually 4 - 8 days then the cast is washed under running tap water, dried and photographed to study.

## RESULTS

In our study 80 human heart specimens were dissected and observed for the coronary arteries from their origin to termination by using vascular corrosion technique to study the branching pattern and circulation. Out of 80 specimens 69 (male-48, female-21) of right predominance, 9 specimens (male-8, female-1) of left predominance and 2 specimens (male-1, female-1) of balanced or co-dominance type of coronary circulation was observed [Table-1]. We also observed the anastomosis between the left circumflex and right coronary arteries, the anastomosis between the anterior and posterior descending arteries. The casting technique reveals the vascular pattern [Figure 1] and dominance pattern along with anomalous communication between the arteries [Figure 2]. The data were analyzed through descriptive statistics to calculate percentages. Qualitative statistics were used to analyze Casting techniques. This study is under clearance with Human ethical committee, S.V.Medical College, Tirupathi.

**Table 1: Type of Dominance pattern in Human Heart specimens.**

Sex	Right dominance Circulation	Left Dominance Circulation	Balanced Circulation
Male	48	8	1
Female	21	1	1
Total	69	9	2



**Figure 1: Vascular cast of human heart with right coronary artery and left coronary artery & branches**

**showing right dominance (RCA: right coronary artery, LCA: left coronary artery, LAD: left anterior descending branch; RMA: right marginal arteries; SN: sinoartial node artery).**



**Figure 2: Vascular cast of human heart with right coronary artery and left coronary artery & branches showing left dominance (RCA: right coronary artery, LCA: left coronary artery, LAD: left anterior descending branch, LCX: left circumflex branch; RMA&LMA: right & left marginal arteries; C: conus artery; D: diagonal artery; SN: sinoartial node artery).**

The incidence of the coronary dominance is (69)86.25% of right coronary, 11.25% (9) of left coronary and (2) 2.5% of balanced type of circulation among 80 heart specimens were recorded.

## DISCUSSION

Vascular anatomy can be achieved using different methods: simple dissection, dissection associated with filling of the vessels using latex resin, filling of the vessels with a polymerizing substance (vinylite, acrylic etc) with subsequent corrosion of the organ tissue using acidic solutions and angiographies.<sup>4</sup> Tsikaras et al. believe that acrylic resins together with corrosion techniques are ideal for the production of anatomic molds because of the low cost, availability of materials, ease of manipulating the polymer and resin, fast setting (3 to 9 hours), the resistance of the molds, solubility of the dyes and the good visualization of small-calibre branches.<sup>4</sup> In our study we observed abnormality of the root of the coronary arteries was found in 1 case in 80 specimens, it is in agreement with the work by Angelini, who observed three cases in 125 hearts.<sup>5</sup> The present study shows 86.25% of right coronary predominance, 11.25% left predominance and 2.5% of balanced type of coronary circulation were observed. Most of the literatures stated the right predominance is seen in 70% of hearts left dominance in 20% of hearts and 10% of balanced type of coronary circulation.<sup>1,6</sup> Balanced type of circulation is more common in females.<sup>4</sup> According to James 1961, the left coronary artery predominance is seen in males.<sup>11</sup> The incidence of right predominance in 90% of hearts, left

predominance in 10% and balanced type in few hearts.<sup>6</sup> In a study revealed on the basis of 6000 selective arteriogram, the right coronary predominance was present in 60% of persons.<sup>7</sup> Most common form of coronary circulation was found to be the right dominant.<sup>8</sup> Ahmed et al found 73.4% of anastomoses, most commonly associated to right dominance.<sup>9</sup> Benter et al found seven communications in 125 samples.<sup>10</sup> No anastomoses linking the two coronary systems were observed in any of the specimens using this method<sup>12</sup>, but in the same specimens arteriogram technique we found some anastomosis branches.

## CONCLUSION

Our vascular corrosion casting technique is to analyze the dominance patterns of the circulation of the human heart, the number of branches from the right coronary artery to the left ventricle, the number of branches from the left coronary artery to the right ventricle and the frequency and location of inter coronary anastomosis. We acknowledge this study gives prompt information to the anatomists and to clinicians to understand the branching pattern and variations in circulation of the heart.

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