

## Original Research Article

# Study on prevalence of Frank's sign in cardiac patients in a tertiary care centre, Kanyakumari district

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### ABSTRACT

**Background:** Despite its identification over 40 years ago, very few dermatologists are aware of the relevance of Frank's sign as a cutaneous indicator of coronary artery disease. Aim was to find out the prevalence of Frank's sign among cardiac patients attending a tertiary care centre in Kanyakumari district.

**Methods:** This was a cross-sectional case-control study involving 270 patients, out of which 200 patients with proven CAD (by angiography) and 70 patients without evidence of CAD of more than 40 years of age, in cardiac ward as well as patients attending Cardiology and dermatology OPD in Sree Mookambika Institute of Medical Sciences, kanyakumari during a period of 5 months from August 2020 to December 2020. The data compiled included age, gender, presence of CAD, presence of DELC, grade of DELC, and laterality.

**Results:** DELC was present in 109 cases (40.3%) out of which 92 cases (34 %) had CAD and in 17 cases (6.3%) were without CAD, which was statistically significant ( $p < 0.05$ ).

**Conclusions:** There have been very few studies evaluating the frequency of DELC in South Indian patients with CAD. According to results of the present study, DELC was significantly associated with CAD. DELC was an important dermatological indicator of CAD with a moderately high specificity (75%) and positive predictive value (84%), but had a low sensitivity (46%) and negative predictive value (33%).

**Keywords:** Frank's sign, Coronary artery disease, Diagonal earlobe crease

### INTRODUCTION

Frank's sign is a diagonal earlobe crease (DELC) which is a wrinkle that extends  $45^\circ$  backward from the tragus to the auricle; it is hypothesized to be a predictor of atherosclerotic disease. This sign has been positively correlated with coronary artery disease (CAD) and was classified as an independent variable for CAD.<sup>1-4</sup> The etiology is unclear; some studies suggested a parallel process of age-related and microvascular disease associated weakening of elastic fibers of earlobes and in coronary arteries.<sup>5</sup>

According to a report of World Health Organization (WHO) in 2005, cardiovascular disease (CVD) caused 17.5 million (30%) of the 58 million deaths that occurred worldwide.<sup>6</sup> It is highly critical to explore the usefulness of various simple and reliable signs of atherosclerosis with respect to identification of the participants at risk for CAD to decrease the liability inflicted by the disease.

The diagonal ear lobe crease (DELC) or "frank's sign" has long been recognized as a potential marker of CAD. Despite its identification over 40 years ago, very few

dermatologists are aware of the relevance of Frank’s sign as a cutaneous indicator of coronary atherosclerosis.<sup>7</sup>

There are few published reports on the prevalence of Frank's sign in cardiac patients in South India. Hence we performed a study to know the prevalence and significance of Frank's sign in cardiac patients attending a tertiary care centre in South India.

**METHODS**

This was a prospective cross-sectional study. It was conducted among 270 patients, out of which 200 patients with proven CAD (by angiography) and 70 patients without evidence of CHD, admitted in cardiac ward as well as patients attending Cardiology and dermatology OPD in Sree Mookambika Institute of Medical Sciences, kanyakumari during a period of 5 months from August 2020 to December 2020. Inclusion criteria: Angiography-proven CAD patients above 40 years of age and patients of both sexes were included as cases and patients attending dermatology OPD above 40 years of age and of both genders without any systemic comorbidity were included as controls. The study was approved by the Institutional Ethics Committee.

The data compiled included age, gender, presence of DELC, grade of DELC, and laterality.

CAD patients include those with acute coronary syndrome (ST elevation myocardial infarction, non-ST elevation myocardial infarction/unstable angina) or stable ischemic heart disease. Patients having large earrings and those with excessive generalized wrinkling were excluded from the study.

The presence of DELC was checked in both ears in sitting position. If present, it was graded as follows: grade 1: A small amount of wrinkling on the earlobe, grade 2a: creased more than halfway across the earlobe, grade 2b: A superficial crease across the earlobe, and grade 3: A deep crease across the whole of the earlobe. Data obtained thus were compiled and analyzed using SPSS 22.0 software with the Chi-square test. A P<0.05 was set for the statistical significance.

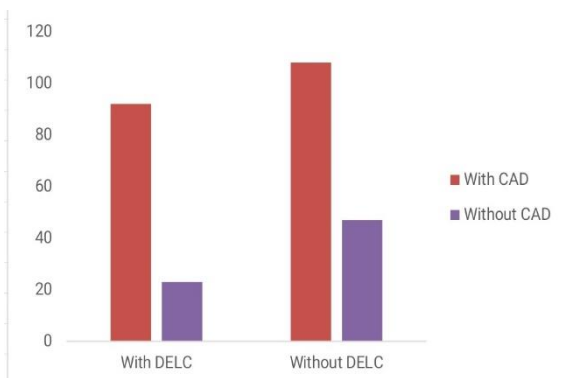
**RESULTS**

Total participants interviewed during survey were 270, out of which 100 were females and 170 were males. Mean age of participants with DELC was 53.43 years and without DELC was 43.52 years.

**Table 1: Distribution of DELC in cases and controls.**

	With DELC (%)	Without DELC (%)	Total (%)	X2	P value
<b>With CAD</b>	92 (34)	108 (40)	200 (74)	10.15	<0.05
<b>Without CAD</b>	17 (6.3)	53 (19.6)	70 (26)		
<b>Total</b>	109 (40.3)	161 (59.6)	270 (100)		

DELC was present in 109 cases (40.3%) out of which 92 cases (34 %) had CAD and in 17 cases (6.3%) were without CAD. The prevalence of DELC was 34% in cases and 6.3% in controls which was statistically significant (p<0.05).



**Figure 1: Distribution of DELC in cases and controls.**

The observed sensitivity, specificity, positive predictive value and negative predictive value of the DELC for the diagnosis of CAD were in the following order: 46.0, 75.7, 84.4 and 32.9%.

**Age**

Total participants (cases and controls) were classified into four age groups (40–50, 51–60, 61–70, and >70 years). Mean age of participants without DELC was 43.52 years with SD±13.42. In contrast, mean age of persons with DELC was 53.43 years with SD±13.47 (z=9.71, P=0.00). The prevalence of DELC was significantly high in the 61-70 years age group (12.9%,  $\chi^2=5.04$ , P<0.05).

**Table 2: Age wise distribution**

Age (in years)	Cases with DELC	Cases without DELC	$\chi^2$	P value
<b>40-50</b>	12 (4.4%)	28 (10.4%)	5.04	<0.05
<b>51-60</b>	24 (8.9%)	32 (11.8%)		
<b>61-70</b>	35 (12.9%)	28 (10.4%)		
<b>&gt;70</b>	21 (7.8%)	30 (11.1%)		

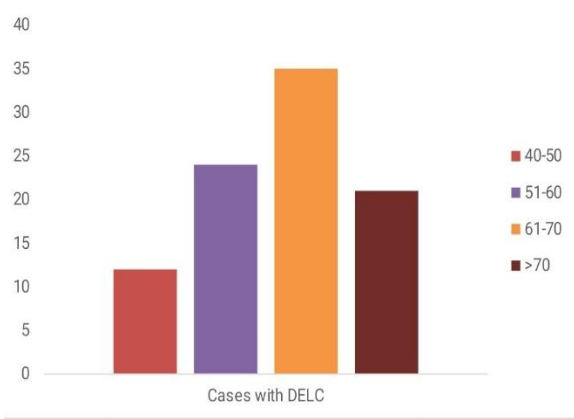


Figure 2: Age wise distribution of cases.

**Gender**

It was seen that DELC among cases was more common among male patients (70.7%), when compared to female patients (29.3%) which was statistically significant ( $\chi^2=4.28$ ,  $p<0.05$ ).

Table 3: Gender wise distribution.

Gender	With DELC (%)	Without DELC (%)	$\chi^2$	P value
Male	65 (70.7)	61 (56.5)	4.28	<0.05
Female	27 (29.3)	47 (43.5)		

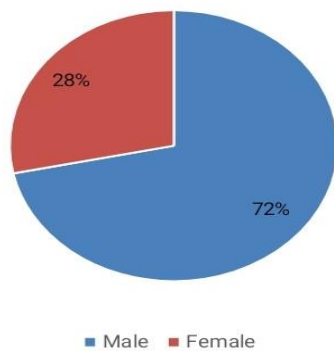


Figure 3: Gender wise distribution.

**Grade**

Grade-wise distribution of DELC was as follows: grade 1: 32 (27.8%), grade 2:48 (41.7%) and grade 3:35 (30.5%).

Table 4: Grade wise distribution.

Grade	Persons with DELC (%)
Grade 1	32 (27.8)
Grade 2	48 (41.7)
Grade 3	35 (30.5)

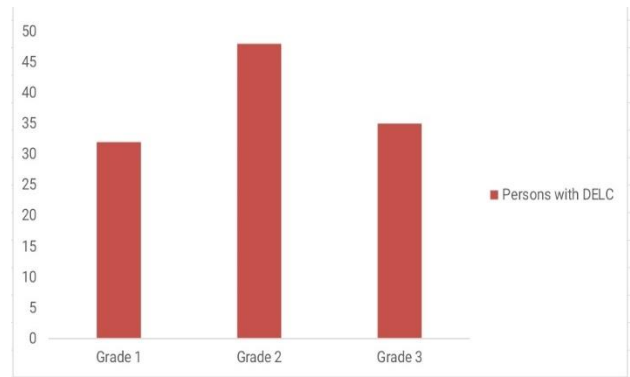


Figure 4: Grade wise distribution.

**Laterality**

It was seen that majority of the cases of ischemic CAD had bilateral Frank’s sign positivity (94.9%), and this result was statistically significant with  $P<0.001$ .

Table 5: Laterality wise distribution.

Laterality	Persons with DELC (%)
Bilateral	106 (97.2)
Unilateral	3 (2.8)

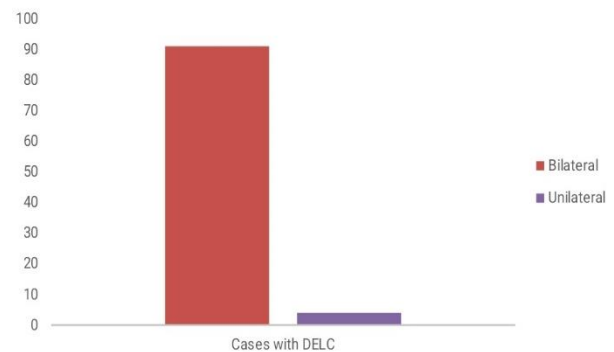


Figure 5: Laterality wise distribution.

**DISCUSSION**

Our study showed that the prevalence of DELC was high in patients with CAD (34%), which was statistically significant ( $p<0.05$ ) and a similar positive association was found in other studies such as those by Kumar et al (41%) Evrengul et al (51%), Ramdurg et al (63%) and Blodgett et al (75%) respectively.<sup>1,7-9</sup> The observed sensitivity, specificity, positive predictive value and negative predictive value of the DELC for the diagnosis of CAD were in the following order: 46.0, 75.7, 84.4 and 32.9%. Similar values were observed in a study by Evrengul et al in 2004.<sup>1</sup>

It can thus be said that while DELC was quite prevalent among patients with ischemic heart disease, its prevalence was not as significant as to deem it pathognomonic for the same, through our study.

The mean age of persons with DELC was 53.43 years and the prevalence of DELC was significantly high in the 61-70 years age group (12.9%,  $p < 0.05$ ). The increase in prevalence of DELC with increasing age was also found in studies by Kadam et al (mean age 43.5), Kumar et al (61.2), Ramdurg et al (61.25), and Evrengül et al (59%).<sup>1,7,8,10</sup> This supports the hypothesis that age-related weakening of elastic fibers of earlobes may play a role in the pathogenesis of DELC and further studies are needed to prove the same.

In our study, DELC was more commonly seen among male patients (70.7%), which was statistically significant ( $p < 0.05$ ). This was consistent with the findings of previous studies like those by Ramdurg et al (64%), Sousa et al in (70%), and Kadam et al (83%).<sup>8,10,11</sup> This implies that male gender is another risk factor for DELC.

Grade 2 DELC was the most common grade (41%) of DELC in our study. A similar finding was obtained in a recent study by Kadam et al in 2018 (36%).<sup>11</sup> Thus most cases may have only wrinkling of the earlobe and we should inspect the ears closely with a hand lens to visualise the crease.

Majority of the cases of CAD in our study had bilateral Frank's sign positivity (97%), and this result was statistically significant with  $p < 0.05$ . This was a consistent finding in previous studies.<sup>1,11</sup>

### Limitations

Limitations of the present study are that the DELC prevalence in normal population was not calculated, it would have helped compare the findings among two groups. As it was the single center study, the result may not be generalized. Also, there is a lack of underlying pathophysiological mechanism for above-mentioned results.

### CONCLUSION

There have been very few studies evaluating the frequency of DELC in South Indian patients with CAD. According to results of the present study, DELC was significantly associated with CAD. DELC was an important dermatological indicator of CAD with a moderately high specificity (75%) and positive predictive value (84%), but had a low sensitivity (46%) and negative predictive value (33%).

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*Ethical approval: The study was approved by the institutional ethics committee*

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