overweight or obese (p=0.663). In the cases: 19 (40.4%), 19 (40.4%) and 9 (19.1%) had frontal, mild to moderate vertex and severe vertex and androgenetic alopecia, respectively.

The Intima Media Thickness (IMT) in the case (androgenetic alopecia) and control groups were: 0.56 ± 0.15 and 0.55 ± 0.14 mm respectively (p=0.674) (Figure 1). Among <40 years individuals, the IMT in the cases and controls were 0.51 ± 0.11 and 0.50 ± 0.10 mm respectively (p=0.840). Also in overweight or obese individuls, the IMT in the case and control groups were 0.58 ± 0.15 and 0.57 ± 0.12 mm respectively (p=0.887).

Figure1: Comparison of intima-media thickness (IMT) between the case (androgenetic alopecia) and control groups (p=0.674).

In the androgenetic alopecia (the case group), the IMT in the frontal, mild to moderate vertex and severe vortex alopecia were 0.50 ± 0.14, 0.60 ± 0.12 and 0.64 ± 0.14 mm, respectively. Comparison of IMT between "frontal" and "vertex" type androgenetic alopecia in the case group, revealed significant difference: 0.61 ± 0.14 mm in vertex versus 0.5 ± 0.14 mm in frontal alopecia. (p=0.08) (Figure 2).

Discussion

This case-control study is one of the first studies surveying the relationship between androgenetic alopecia and carotid intima-media thickness in the country .Androgenic activity in the body (and androgenetic alopecia as an manifestation of such condition), has been surveyed as a probable risk factor/associated feature of atherosclerosis since recent years, and some evidences heve been presented in this issue, as the studies of Ajayi et al and Herman et al which showed the effects of androgen on stimulation of platelet function and endothelial damage [20-21].

So surveying the relationship between androgenetic alopecia and cardiovascular diseases or subclinical atherosclerosis (intima-media thickness) has been considered in many researches.

Figure 2: Comparison of Intima-Media Thickness (IMT) between the two types of androgenetic alopecia (p=0.018).

Comparison of IMT between the cases with moderate to severe vertex alopecia with the controls revealed higher measures of IMT in the vertex alopecia, but nonsignificant difference (p=0.108).

In this study, the case (androgenetic alopecia) and control groups were matched regarding age and BMI, also known cardiovascular outcomes or risk factors were excluded from the both groups. This marching is an important feature of our study which has been not considered in some similar studies.

Based on our findings, although measures of IMT were higher in the case group than the control, but the difference between the groups was not statistically significant. Similar non-significant differences were showed in comparison of IMT between the case and control groups among <40 years or obese individuals. In the case group, measures of IMT in vertex type androgenetic alopecia were significantly higher than frontal type: 0.61 ± 0.14 mm versus 0.5 ± 0.14 mm. (p=0.018)

Although the IMT was higher in vertex type androgenetic alopecia than the controls, but the difference was not significant. Comparison of IMT between the case and control groups, among obese or elder than 40 years individual showed similar non-significant results.

It should be considered that means of IMT in the both groups (alopecia and the controls) were in the normal range.

Review the similar studies regarding relationship between androgenetic alopecia and atherosclerosis revealed that in the most studies in which, like our study, individuals with cardiovascular risk factors or outcomes were excluded from the study, then the relationship was surveyed in such situation, the results were similar to our study, as there was not significant relationship between androgenetic alopecia and subclinical atherosclerosis (IMT) or cardiovascular diseases.

Like the study of Shahar et al in which surveying 5056 males in the age of 52-72 years, after excluding the cases with cardiovascular disease or risk factors, showed nonsignificant difference in IMT and MI between the males with and without androgenetic alopecia.16 In the study of Cook et al, 748 admitted males after excluding diabetes mellitus were studied. The results showed weak relationship between androgenetic alopecia and cardiovascular diseases [22].

In the study of Ben Halim et al, 65 males admitted because of myocardial infarction and the controls were studied. Exclusion criteria were diabetes mellitus and hypertension. The results, like our study, din not revealed significant relationship between androgenetic alopecia and MI [23]. Herrera and Lynch with surveying the data of a prospective 22 years study, showed that androgenetic alopecia is not associated with increased risk of coronary artery disease [24]. Also Herrera in a prospective 34 years study on 2017 males showed that after adjusting age and cardiovascular risk factors, there is not significant relationship between androgenetic alopecia and cardiovascular outcomes [25]. Ellis et al showed that male pattern baldness in not a cardiovascular risk factor in general population [18,26].

Comparison of our findings with above studies revealed that matching of cases and controls, also excluding cardiovascular risk factors/ diseases in our study indicates more distinct surveying the relationship between androgenetic alopecia and IMT without the effect of confounding factors.

In some studies like the study of Lotufo et al also Schnohr et al, a weak relationship (odds ratio: 1.2-1.4) was detected between androgenetic alopecia and coronary artery disease [11,27].

Some studies had different results; Lesko et al compared 665 post MI males with controls without excluding cardiovascular risk factors. The results showed that androgenetic alopecia, especially vertex type, is a risk factor for MI [5]. Also, Trieu and Eslick in a meta-analysis, surveyed 31 studies regarding the relationship between androgenetic alopecia and cardiovascular diseases, without focusing on exclusion of risk factors and matching of androgenetic alopecia group with the controls. The authors concluded that androgenetic alopecia is a risk factor with does response relation for cardiovascular diseases [12]. The studies of Miric et al and Robora et al showed similar results as Trieu and Eslick [9,10].

In the study of Dogramaci et al, like our study, the alopecia group and controls were matched and risk factors were excluded. The results were different from our findings; they showed higher IMT in androgenetic alopecia than the controls, while both IMT measures were in the normal range [13]. These different results may be related to genetic factors.

So, based on the findings of this study and comparison with similar studies, it seems that, although androgenic stimulation and androgenetic alopecia, can increase carotid intima-media thickness, but in the absence of other known cardiovascular risk factors, have not significant effect on subclinical atherosclerosis or cardiovascular disease.

Considering the important role of genetic factors in atherosclerosis, also different results of our study in comparison to some other studies, surveying of relationship between androgenetic alopecia and atherosclerosis/ cardiovascular diseases in the country was recommended.

Limitation of our study was relatively small size of cases.

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