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Evaluation of increased high-sensitivity cardiac troponin in patients with radiofrequency ablation

Radyofrekans ablasyon uygulanmış hastalarda artmış yüksek-duyarlıklı kardiyak troponin seviyesinin değerlendirilmesi

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Abstract

Aim: In our study; we explored which ablation parameter is mostly associated with the increased high-sensitivity troponin tests (hs-cTnT) in patients undergone radiofrequency ablation (RFA).

Methods: We included patients who underwent RFA within the previous year, and later admitted to emergency service with chest pain to our study. ECG and echocardiographic examination were performed before the electrophysiological study (EPS) for all patients. After RFA, information regarding the total duration, energy and mean temperature was recorded. Blood samples were collected via venous route from patients who underwent RFA, and later admitted to emergency service with chest pain to study hs-cTnT.

Results: There were 119 patients [38 males, median age 51years (IQR:29)] included in our study. 6 of them (80.7%) were detected to have atrioventricular nodal re-entrant tachycardia (AVNRT), 14(11.8%) Wolff Parkinson White Syndrome (WPW), and 9 (7.5%) Right Ventricular Outflow Tract (RVOT) Tachycardia. Hs-cTnT and total RFA duration (r=0.683,p<0.001), total energy (r=0.423, p<0.001) and mean temperature (r=0.371, p<0.001) were correlated. In linear regression analysis; total RFA duration (OR:0.842, 95% CI: 0.685-0.999, p<0.001) and mean temperature (OR:10.738, 95% CI: 6.420-15.055, p<0.001) were detected to be independent predictors for hs-cTnT.

Conclusion: This study has shown us that it should be noted that patients who underwent RFA for a prolonged duration and at high temperature may admit to the emergency service with chest pain, therefore, their troponin levels may increase, and also in these patients no further work-up or treatment would be required.

Keywords: High-sensitivity troponin, Radiofrequency ablation, Emergency service

Öz

Amaç: Çalışmamızda; radyofrekans ablasyon (RFA) uygulanan hastalarda ablasyon parametreleri ile yüksek duyarlıklı troponin testi (hs-cTnT) düzeyinin ilişkisini araştırdık.

Yöntemler: Bir yıl önce RFA yapılan ve daha sonra göğüs ağrısı ile acil servise başvuran hastaları çalışmamıza dahil ettik. EKG ve ekokardiyografik inceleme tüm hastalar için elektrofizyolojik çalışma (EPS) öncesinde yapıldı. RFA'dan sonra toplam süre, enerji ve ortalama sıcaklık ile ilgili bilgiler kaydedildi. Acil servise göğüs ağrısı ile başvuran RFA uygulanmış hastalardan kan örnekleri venöz yolla alındı

Bulgular: Çalışmamıza 119 hasta [38 erkek, medyan 51 yaş (IQR: 29)] alındı. Bunların 6'sında (%80,7) atriyoventriküler nodal re-entran taşikardi (AVNRT), 14'ü (%11,8) Wolff Parkinson White Sendromu (WPW) ve 9'u (%7,5) Sağ Ventrikül Çıkıntı Yolu (RVOT) Taşikardisi tespit edildi. Hs-cTnT ve toplam RFA süresi (r=0,683, p<0.001), toplam enerji (r=0,423, p<0,001) ve ortalama sıcaklık (r=0,371, p<0,001) korele bulundu. Doğrusal regresyon analizinde; toplam RFA süresi (OR: 0,842, %95 GA: 0,685-0,999, p<0.001) ve ortalama sıcaklık (OR: 10,738, %95 GA: 6,420-15,055, p<0,001), hs-cTnT için bağımsız ön gördürücü olarak saptandı.

Sonuç: Bu çalışma bize, RFA uygulanan uzun süreli ve yüksek sıcaklıktaki hastaların göğüs ağrısı ile acil servise başvurabileceğini, bu nedenle troponin düzeylerinin artabileceğini ve bu hastalarda daha ileri tedavi veya takip gerekmeyeceğini göstermiştir.

Anahtar kelimeler: Yüksek duyarlıklı troponin, Radyofrekans ablasyon, Acil servis

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Introduction

Radiofrequency ablation (RFA) is an invasive interventional method used for the treatment of arrhythmias with high rate of acute success and very low rate of recurrence [1]. For this reason, current guidelines recommend RFA as first line indication therapy [2]. Sometimes, patients admit to emergency service with chest pain after RFA, and their troponin levels are found to be increased [3]. This increase in troponin levels may very well be related to myocardial injury during RFA, but also to some other reasons [4]. An increase can be detected even in very small myocardial injuries with the new generation high-sensitivity troponin tests (hs-cTnT) [5]. The information regarding the extent of increase in troponin and whether the troponin increase is mostly associated with the amount of energy given, total RFA duration or mean temperature is not clearly reported in the literature. In our study; we explored which ablation parameter out of mean temperature, total energy or total RFA duration is mostly associated with the increased hs-cTnT in patients undergone RFA.

Materials and methods

We included patients who underwent RFA within the previous year, and later admitted to emergency service with chest pain to our study. We excluded patients who had diseases causing hs-cTnT elevation such as heart failure, coronary artery disease, renal dysfunction, and also patients with impaired liver functions, who had permanent pacemaker and metabolic disease. Patients' demographic data and height-weight indices were calculated. ECG (Nihon Kohden 1150k) and pulse were recorded for all patients before the electrophysiological study (EPS). Left atrial volume (LAV), left atrium diameter (LAD) and ejection fraction were calculated in echocardiographic examination (Vivid-7, GE Wingmed sound Horten, Norway). Electrophysiological study was performed using EP Tracer device (Medtronic, Inc., USA) by inserting catheters via femoral region in all patient. Quadrupole diagnostic catheter (6Fr, 110 cm, Marinr® SC Series, Medtronic, Minneapolis, MN, USA) was inserted into right atrial appendix, quadrupole RF ablation catheter (7Fr, 110 cm, RF Mariner® MC, Medtronic, USA) into right ventricular region on which his record was taken, ten-pole coronary sinus catheter (7Fr, 110 cm, RF Mariner® MC, Medtronic, USA) into coronary sinus. In atrioventricular nodal re-entrant tachycardia (AVNRT) patients, tachycardia was induced using scheduled atrial and ventricular stimulation or jump and echo beats were determined. In Wolff Parkinson White (WPW) syndrome patients, localization of accessory tract was detected by guidance of coronary sinus catheter. In right ventricular outflow tract tachycardia (RVOT) patients; earliest V record was determined at right ventricular outflow tract. Ablation was performed by adjusting electrical power to upper limit of 50 watts, target temperature to upper limit of 70oC using RFA 500 khz generator device (Medtronic Attakr II, Medtronic Inc., MN, USA). The absence of tachycardia induction after junction rhythm or disappearance of jump and echo beats in AVNRT patients, disappearance of delta wave in superficial ECG or shifting of eccentric distribution to concentric distribution on coronary sinus catheter in WPW patients, and disappearance of clinical V waves in VES patients were accepted as endpoints. Later, hs-cTnT assessment was performed using electroimmunoassay method (Roche Diagnostics, Mannheim, Germany) with blood samples obtained via venous route from patients admitted to emergency service with chest pain. All patients gave informed consent. Local ethics committee gave the necessary legal permissions for the study.

Statistical Analysis

We divided the variables as continuous and categorical. We tested the normality of continuous data using the Kolmogorov-Smirnov test. As not all of our data normally distributed, we showed interquartile range (IQR) values in addition to median value. We performed a correlation analysis between hs-cTnT and ablation parameters. As distributions were normal, we used Spearman's correlation coefficient. We performed linear regression analysis with variables detected to be significantly correlated. P value of <0.05 was regarded as significant. All statistical analyses were performed with SPSS statistics software (Ver. 20.0, SPSS Inc., Chicago, IL, USA).

Results

We included 119 patients [38 males, median age 51 (IQR:29)] into our study. 96 of them (80.7%) had AVNRT, 14 (11.8%) had WPW, and 9 (7.5%) had RVOT. Median value of total RFA duration was 97 (IQR:106) seconds, median value of total amount of energy was 53.5 (IQR:15) watt, median value of mean temperature was 51 (IQR:7) °C, and median value of hs-cTnT measured at admittance to emergency service was 103 (IQR:157.5) pg/dL (Table 1). In the correlation analysis performed between hs-cTnT and electrophysiological parameters, significant correlation was found with total RFA duration (r=0.683, p<0.001, figure 1), total energy (r=0.423, p<0.001, figure 2), mean temperature (r=0.371, p<0.001, figure 3). A linear regression analysis was performed between hs-cTnT and ablation parameters. Total RFA duration (OR:0.842, 95% CI: 0.685-0.999, p<0.001) and mean temperature (OR: 10.738, 95% CI: 6.420-15.055, p<0.001) were detected to be independent predictors for hs-cTnT (Table 2).

Table 1: Demographic, laboratory and electrophysiological findings of patients

Patients, n	119
Age, years	51 (IQR:29)
Male gender, (%)	38 (31.9)
Diagnosis AVNRT (%)	96 (80.7)
Diagnosis WPW (%)	14 (11.8)
Diagnosis RVOT (%)	9 (7.5)
BMI, kg/m^2	25.9 (IQR:6.64)
Pulse, beat/minute	75 (IQR:13)
EF,%	60 (IQR:4)
LAD, mm	35 (IQR:4)
LAV, mm	48 (IQR:2)
Total time, second	97 (IQR:106)
Total energy, watt	53.5 (IQR:15)
Mean Temperature, °C	51 (IQR:7)
Hs-cTnT, ng/l	103 (IQR:157.5)

AVNRT: atrioventricular reentrant tachycardia, BMI: body mass index, Hs-cTnT: high sensitive cardiac troponin T, LAD: left atrial diameter, LAV: left atrial volume, EF: ejection fraction, RVOT: right ventricle outflow tract, WPW: wolf Parkinson white, IQR: inter quartile range.

Table 2: Linear regression analyses for elevated Hs-cTnT

	Odds ratio	95 % CI	p
Total time	0.842	0.685-0.999	<0.001
Total energy	0.486	(-1.459)-2.431	0.621
Mean Temperature	10.738	6.420-15.055	<0.001

Hs-cTnT: high sensitive cardiac troponin T

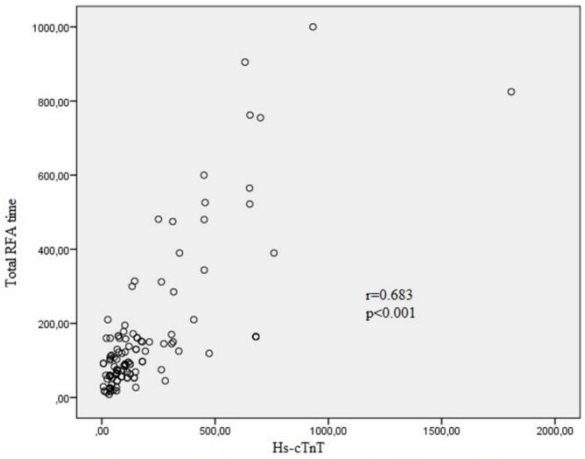

Figure 1: Simple scatter graph showing correlation between hs-cTnT and total RF time.

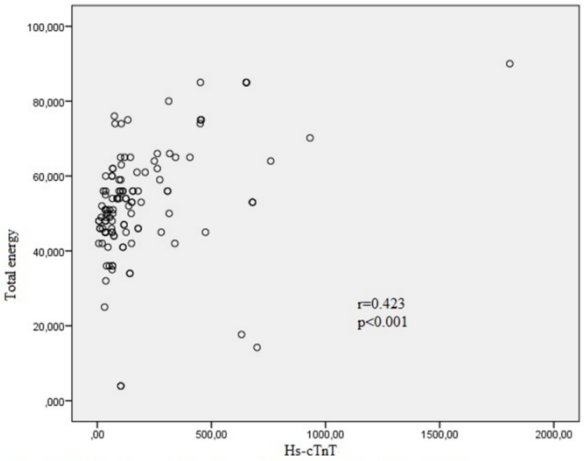

Figure 2: Simple scatter graph showing correlation between hs-cTnT and total energy

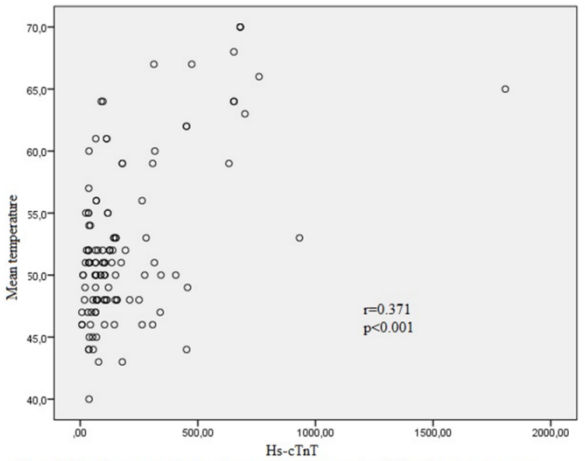

Figure 3: Simple scatter graph showing correlation between hs-cTnT and mean temperature.

Discussion

In our study, we explored the extent of correlation of hs-cTnT with ablation parameters and which one of them is the independent predictor. Significant correlation was detected between all ablation parameters and hs-cTnT. In linear regression analysis; while RFA duration and mean temperature were detected as independent predictors, total energy was not found to be an independent predictor.

In a meta-analysis of studies performed with cardiac troponin I (c-TnI) assessments, it was stated that RFA increases troponin level, and in the presence of coronary artery disease, interpretation might be difficult [6]. As we excluded CAD patients in our study, contrary to previous studies troponin increases made difficult to interpret non-cardiac causes. In another study performed with C-TnI, temperature and duration were demonstrated to be significantly correlated with troponin elevation [7]. In other two studies performed with c-TnI, a strong correlation was mentioned between RFA duration and total energy [8,9]. In another study evaluating hs-cTnT and hs-TnI together in patients with ventricular tachycardia and atrial fibrillation, both were detected to be significantly correlated with the amount of energy given [10]. In a study by Vasatova et al., a correlation between RFA duration and hs-cTnT was mentioned [11]. Hs-cTnT is elevated in many RFA patients, and also may be elevated in supraventricular arrhythmias without RFA is performed. Hs-cTnT elevation was reported in AVNRT patients admitted to the emergency service without coronary artery disease [12]. In another study, patients who admitted to emergency service and had increased hs-cTnT levels were selected and followed-up for a period of time. No significant finding was detected for cardiovascular event [13]. In another study, a significant correlation was found between high heart rate and troponin level [14]. In a study performed in patients with atrial fibrillation, c-TnT levels were demonstrated to be increased in all patients undergone ablation [15]. Again, in patients with atrial fibrillation, cryoablation and RF ablation was compared, and troponin level was detected to be increased in both groups [16]. In a study comparing linear ablation, and RF ablation performed with the guidance of complex fractionated electrogram, less troponin elevation was detected in linear ablation group than the other group [17]. Apart from all these studies, it was stated that c-TnT may increase in patients with atrial fibrillation only due to tachycardia [18]. An overall correlation was mentioned in all these previous studies, but no comparison was performed. The significant ablation parameters in the correlation analysis were not evaluated in regression analysis. Therefore, it was not mentioned which ablation parameter would be the independent predictor.

Our study has some limitations. We did not include patient groups with longer period, more amount of energy and more temperature (e.g., atrial fibrillation, atrial flutter) into our study. As we did not collect routine troponin data from the patients before and after RFA, we did not have information regarding basal troponin values, we did not follow-up the patients with hs-cTnT level of more than expected in the hospital due to possible complications.

In conclusion, we detected that RFA duration and temperature are independent predictors for hs-cTnT increase, and the total amount of energy is not an independent predictor. This study has shown us once more that it should be noted that patients who underwent RFA for a prolonged duration and at high temperature may admit to the emergency service with chest pain, therefore, their troponin may increase, and also in these patients no further work-up or treatment would be required.

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