

# Elevated high-sensitivity troponin does not indicate the presence of coronary artery disease in patients presenting with supraventricular tachycardia

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## Abstract

**Background:** *Patients with supraventricular tachycardia (SVT) and patients with coronary artery disease (CAD) often present with similar symptoms (chest pain, shortness of breath), similar electrocardiographic changes and elevated high-sensitivity troponin (Tn). It is not clear whether troponin reflects critical CAD or is elevated due to other causes in patients presenting with SVT. The aim of this study was to assess the role of elevated troponin in patients presenting with SVT.*

**Methods:** *Patients undergoing radiofrequency ablation (RFA) for SVT and simultaneous coronary angiography at the Heart Centre Lucerne, Switzerland between January 2010 and October 2014 were included in this analysis. Significant CAD was defined as diameter-stenosis  $\geq 75\%$  in vessels  $> 2.0$  mm. The level of Tn was compared between patients with the presence or absence of CAD on coronary angiography. A Tn value of  $\geq 0.014$   $\mu\text{g/L}$  was considered as elevated.*

**Results:** *During the study period a total of 473 patients underwent RFA for SVT. The study population consisted of 326 patients (69%, mean age  $60 \pm 12$  years) who underwent invasive coronary angiography during the same session. The prevalence of significant CAD was 14% (45/326 patients). The highest prevalence of CAD was found in patients with atrial flutter (35%, 18/45 patients). Tn was elevated in 83% (10/12 patients) with significant CAD and in 47% (26/55 patients) without CAD.*

**Conclusions:** *The prevalence of CAD is low in patients with SVT, which questions the role of routine invasive coronary angiography during RFA. Tn measurement did not reliably exclude or confirm CAD in these patients. (Cardiol J 2017; 24, 6: 642–648)*

**Key words:** coronary artery disease, prevalence of coronary artery disease, supraventricular tachycardia, high-sensitivity troponin, radiofrequency ablation

## Introduction

Supraventricular tachycardias (SVT) are amongst the most common cardiac arrhythmias and are related to significant morbidity and mortality [1, 2]. SVT can be paroxysmal, sometimes persistent or rarely life threatening [1]. The prevalence of paroxysmal SVT is estimated to

be 3.5% at an incidence of 35 per 100,000 person years [3]. Age influences the occurrence of SVT with atrial fibrillation (AF) mainly affecting the older population. The SVT population is younger than the population with other cardiovascular diseases (CVD) [3]. Furthermore, women are twice as likely to develop a paroxysmal SVT compared to men [3].

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Symptoms of patients presenting with SVT are heterogenic including palpitations, exercise intolerance, dizziness, dyspnea, angina, pre-syncope or syncope [1] and can very often not be clearly differentiated from symptoms related to other CVD (e.g. cardiac ischemia) [4, 5].

Coronary artery disease (CAD) is common in the Western world and can present as stable angina or as acute coronary syndrome (ACS) [6]. Prolonged cardiac ischemia leads to myocardial injury and cardiac biomarkers are being used as a tool to diagnose and quantify myocardial damage [6]. New cardiac troponin (Tn) assays have a high sensitivity to detect myocardial injury [7, 8] and are now widely used in clinical practice. Increased Tn is not only a marker for ischemic heart disease and it is well known that several more conditions can be associated with elevated Tn: e.g. heart failure, myocarditis, dissection of the aorta and chronic renal failure [9].

Patients with SVT are often assessed in the emergency department (ED) and cardiac biomarkers are regularly measured in order to exclude acute myocardial injury requiring percutaneous or surgical revascularization. In patients with SVT, elevated Tn-levels may be observed [5] but case reports and small case series indicate that elevated Tn in patients with SVT does not necessarily indicate the presence of CAD [10–12].

The aim of this study was to highlight the role of elevated Tn in patients presenting with SVT and undergoing invasive coronary angiography.

## Methods

This was a retrospective study performed in the Heart Centre Lucerne, Luzerner Kantons-spital, Lucerne, Switzerland. The Heart Centre Lucerne is a tertiary care center performing > 350 radiofrequency-ablations (RFA) and 2500 coronary angiograms per year.

### Study populations

The cohort consisted of patients undergoing RFA for SVT who underwent invasive coronary angiography in the same session. The procedure took place within 7 days after the presentation of the patients in our ED. Coronary angiography was performed as part of routine clinical care to exclude relevant CAD. The study period lasted from January 2010 to October 2014.

### Supraventricular tachycardia

The following categories of SVT's were treated: AF, atrial flutter (AFL), atrioventricular nodal

re-entry tachycardia (AVNRT), atrioventricular re-entry tachycardia (AVRT), atrial tachycardia (AT).

### Troponin analysis

In patients presenting with an acute episode of SVT in our ED plasma samples were analyzed for high-sensitivity troponin (Tn) using the Roche Cobas e601 device. An increased Tn-level was defined at a value of  $\geq 0.014 \mu\text{g/L}$ . The peak value within 24 h post-presentation was used for statistical analysis. Patients with point-of-care troponin measurements or troponin measurements of other hospitals were excluded.

### Coronary angiography findings

Significant coronary artery stenosis was defined as a diameter-stenosis  $\geq 75\%$  in two orthogonal views in a coronary artery  $\geq 2.0$  mm. SYNTAX score was calculated using the web calculator [13].

### Ethical considerations

Approval was granted by the regional ethical committee (Northwestern-Switzerland). All patients provided written informed consent for electronic data acquisition and follow-up examinations.

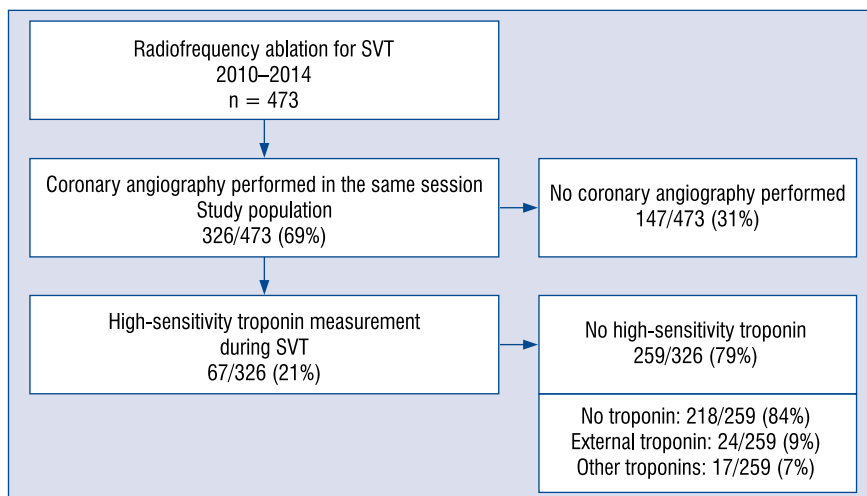
### Statistical analysis

Continuous data are presented as mean value  $\pm$  the standard deviation and categorical data are given as n (%). Comparisons were performed with Student's t test for continuous variables in cases of normal distribution and the Fisher's exact test for categorical variables. The relationship between Tn-level and the Syntax score was evaluated by linear regression analysis. A two-sided p value  $< 0.05$  was considered statistically significant. A logistic regression analysis was performed to identify predictors of CAD. The statistics were conducted with SPSS statistical program. The diagnostic value to detect significant coronary artery stenosis concerning sensitivity and specificity was admitted with a receiver operating characteristic (ROC) curve.

## Results

During the study period a total of 473 patients underwent RFA. 326 (69%) patients underwent invasive coronary angiography to exclude CAD in the same session (Fig. 1) and these patients were included in the study population.

Baseline characteristics of the study population are shown in Table 1. Briefly, mean age was  $60 \pm 12$  years and 211 (65%) patients were male.



**Figure 1.** Definition of the study population; SVT — supraventricular tachycardia.

**Table 1.** Baseline characteristics of the study population (n = 326).

<b>Demographics</b>	
Age [years]	60 ± 12
Sex, women	115 (35%)
<b>Cardiovascular risk factors</b>	
No risk factors	73 (22%)
Arterial hypertension	141 (43%)
Hypercholesterolemia	120 (37%)
Diabetes mellitus	25 (8%)
Insulin dependent	10 (3%)
Smoking	85 (26%)
Positive family history	70 (21%)
<b>Initial symptoms</b>	
Asymptomatic	5 (2%)
Typical angina	38 (12%)
Atypical angina	104 (32%)
Dyspnea	103 (32%)
Palpitation	283 (87%)
Syncope	20 (6%)
<b>Type of SVT</b>	
AF	108 (33%)
AFL	51 (16%)
AF + AFL	29 (9%)
AVNRT	95 (29%)
AVRT	15 (5%)
WPW	15 (5%)
Ectopic AT	10 (3%)

AF — atrial fibrillation; AFL — atrial flutter; AVNRT — atrioventricular nodal re-entry tachycardia; AVRT — atrioventricular re-entry tachycardia; AT — atrial tachycardia; SVT — supraventricular tachycardia; WPW — Wolff-Parkinson-White syndrome

The most cardiovascular risk factor (cvRF) was arterial hypertension (43%, 141/326 patients) and 73 (22%) patients of the study population had no cvRF. Palpitation was very common (87%, 283/326 patients), 104 (32%) of the patients had atypical angina and 38 (12%) had typical angina. AF (33%, 108/326 patients) and AVNRT (29%, 95/326 patients) were the most common arrhythmias.

**Prevalence of CAD**

Of the 326 patients who underwent invasive coronary angiography, 45 (14%) patients had relevant CAD and 281 (86%) patients had normal coronaries or minor CAD (Fig. 2).

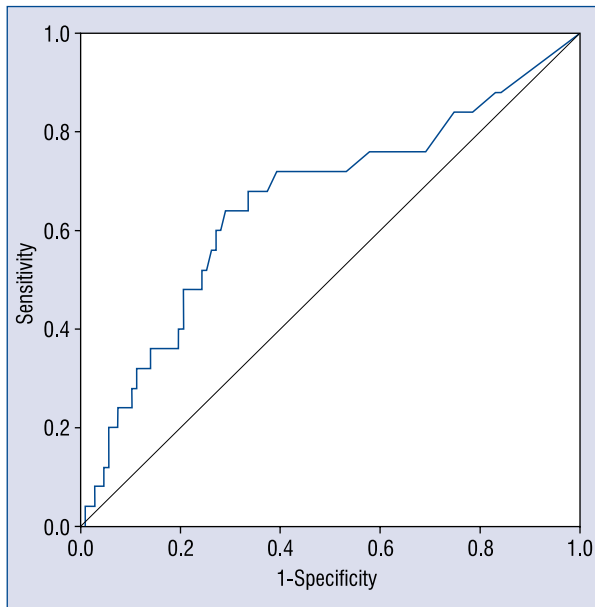
The comparison of cvRF depending on the presence or absence of significant CAD is shown in Table 2. In the univariate analysis arterial hypertension, hypercholesterolemia and male gender were all significantly more common in patients with CAD (p < 0.001 for all).

Table 3 compares the various presenting symptoms according to the presence or absence of significant CAD. No statistically significant differences in the prevalence of symptoms were found between the groups.

The prevalence of CAD according to arrhythmia type is shown in Table 4. CAD was numerically more common in patients presenting with AFL (35%, 18/51 patients).

**Role of Tn**

A total of 67 patients (14% of the total population) presented in the ED due to tachycardia and had Tn-levels measured in the acute episode.



**Figure 2.** Receiver operating characteristic, sensitivity and specificity of high-sensitivity troponin for the diagnosis of relevant coronary artery disease in patients presenting with supraventricular tachycardia.

Cardiac troponin was elevated ( $\geq 0.014 \mu\text{g/L}$ ) in 36 (54%) patients, who all underwent invasive coronary angiography. Increased Tn was found in 83% (10/12 patients) with CAD and in 47% (26/55 patients) without CAD (Table 5). Even patients with a Tn level  $> 1.0 \mu\text{g/L}$  had normal coronaries or minor CAD and on the other hand patients with CAD and SVT had normal Tn levels. Increased Tn did not correlate with significant coronary artery stenosis and a normal cTn-level did not exclude CAD (Figs. 2, 3).

### Discussion

The main findings in the present study are: a) The prevalence of CAD is low in patients presenting with SVT and undergoing RFA. b) Tn did not have a relevant impact on confirmation or exclusion of significant CAD in these patients.

Symptoms of CAD and SVT may be very similar, electrocardiogram (ECG) is often difficult to interpret regarding ischemic signs and it is common practice in many centers to perform

**Table 2.** Comparison of cardiovascular risk factors between patients with and without coronary artery disease (CAD) (n = 326).

	CAD (n = 45; 14%)	No CAD (n = 281; 86%)	P
Age [years]	64 ± 8	59 ± 12	0.20
Male	40 (89%)	171 (61%)	< 0.001
No risk factors	0 (0%)	73 (26%)	0.002
Arterial hypertension	34 (76%)	107 (38%)	< 0.001
Hypercholesterolemia	33 (73%)	87 (31%)	< 0.001
Diabetes mellitus	8 (18%)	17 (6%)	0.74
Insulin dependent	5 (11%)	5 (2%)	0.08
Nicotine	13 (29%)	72 (26%)	0.40
Positive family history	15 (33%)	55 (20%)	0.23

**Table 3.** Comparison of clinical characteristics between patients with and without coronary artery disease (CAD) (n = 326).

	CAD (n = 45, 14%)	No CAD (n = 281, 86%)	P
Asymptomatic	0 (0%)	5 (2%)	1.0
Typical angina	14 (31%)	27 (10%)	0.20
Atypical angina	14 (31%)	90 (32%)	0.55
Dyspnea	21 (47%)	82 (29%)	0.06
Palpitations	37 (82%)	246 (88%)	1.0
Syncope	1 (2%)	19 (7%)	0.32

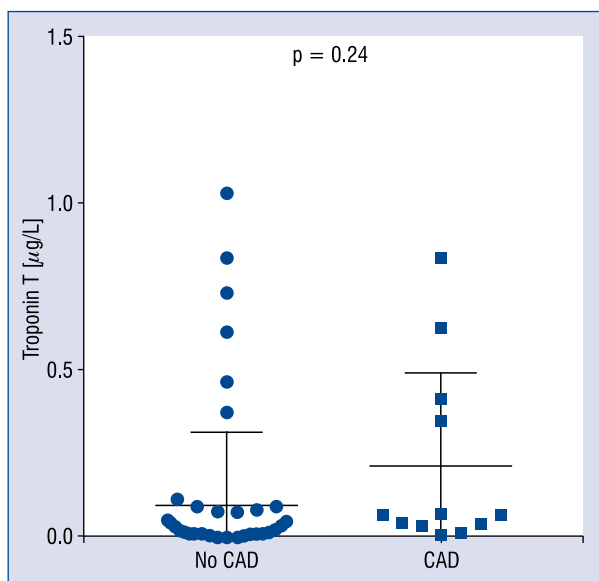
**Table 4.** Comparison of supraventricular tachycardia between patients with and without coronary artery disease (CAD) (n = 326).

	CAD (n = 45, 14%)	No CAD (n = 281, 86%)	P
AF	8 (7%)	100 (93%)	0.60
AFL	18 (35%)	33 (65%)	<b>0.04</b>
AF + AFL	3 (10%)	26 (90%)	0.21
AVNRT	14 (15%)	81 (85%)	1.0
AVRT	0 (0%)	15 (100%)	0.16
WPW	0 (0%)	15 (100%)	0.16
Ectopic AT	3 (30%)	7 (70%)	0.08

AF — atrial fibrillation; AFL — atrial flutter; AVNRT — atrioventricular nodal re-entry tachycardia; AVRT — atrioventricular re-entry tachycardia; AT — atrial tachycardia; WPW — Wolff-Parkinson-White syndrome

**Table 5.** Comparison of high-sensitivity troponin between patients with and without coronary artery disease (CAD) (n = 67).

	Total (n = 67, 14%)	CAD (n = 12, 18%)	No CAD (n = 55, 82%)	P
Troponin-hs $\geq$ 0.014 $\mu$ g/L	36 (54%)	10 (83%)	26 (47%)	0.17
Troponin-hs < 0.014 $\mu$ g/L	31 (46%)	2 (17%)	29 (53%)	0.32



**Figure 3.** Comparison of high-sensitivity troponin between patients with and without coronary artery disease (CAD).

invasive coronary angiography in order to exclude or confirm CAD.

The present study demonstrates a relatively low prevalence of CAD in this group of patients and thus questions the role of routine invasive coronary angiography. This study was not able to identify a Tn cut-off, which reliably predicts the presence

of CAD in patients with SVT. The assessment of Tn in patients with SVT, who easily convert into sinus rhythm, can lead to unnecessary diagnostic tests or wrong diagnosis [14, 15]. SalimRezaie [15] postulated that the evaluation of Tn in patients with SVT should be reserved for patients with persisting symptoms in the absence of an SVT-episode and for patients with abnormal ECG findings after conversion into sinus rhythm. On the other hand, increased Tn-levels in patients without CAD, independent of its etiology, tend to be a predictor of worse outcomes [16]. Increased Tn-levels were found to accompany an increased mortality rate [17–20] and should be rated as an indicator of critical medical status [21]. The mortality risk of patients with a ten time increased Tn-level is twice as high as for patients with normal Tn-levels [22].

There are several reasons for Tn elevations in patients with SVT. Given the fact that Tn can be elevated even in patients < 21 years it is fair to conclude that the presence of CAD is not a *condicio-sine-qua-non*. From the pathophysiologic point of view heart rate, duration of SVT and mean arterial blood pressure, end-diastolic left ventricular pressure all have an important impact on coronary perfusion and could lead to mild ischemia and troponin “leak” [23]. It is also important to realize that troponin elevation does not always indicate cell death and therefore

myocardial ischemia is only one of probably many reasons for Tn elevation [24].

Patients should be evaluated with an established risk-score to estimate the probability of CAD, e.g. Framingham Coronary Heart Disease Risk Score [25] and the decision to perform invasive coronary angiography should be based on the risk-score rather than the presence of elevated Tn in SVT patients [26].

### Limitations of the study

This study has several limitations, which need to be mentioned. It is a retrospective analysis from a single centre in Switzerland with all the limitations of retrospective analysis. The indication to perform a coronary angiography was arbitrary and made on the clinical judgement of different operators. A prospective, multi-centre study could address this important question in a more appropriate way.

### Conclusions

Measurement of Tn in patients presenting with SVT was not of assistance in reliably confirming or excluding CAD. Routine invasive coronary angiography is not warranted in patients undergoing RFA and the decision should be made on clinical grounds rather than the presence of Tn elevation.

**Conflict of interest:** None declared

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