Value of the aVL lead in the electrocardiographic diagnosis of Atrioventricular Node Re-entrant Tachycardia (AVNRT)

Thesis

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Contents

List of tables	
List of figures	
Introduction	***1***
Aim of the work	***4***
Review of literature	
· *Supraventricular tachyarrhythmias*	***5***
· *Different methods to differentiate between AVNRT and AVRT*	***27***
Patients and methods	***57***
Results	***65***
Discussion	***103***
Conclusions	***113***
Recommendations	***114***
Summary	***115***
References	***118***
Appendix	
Arabic summary	

List of Tables

Page No.

Table (1): Represents effect of ATP injection during sinus rhythm. 58

Table (2): No. of types of supraventricular tachycardia among the study population. 68

Table (3): Distribution of age among the study population. 69

Table (4): Distribution of sex among the study population. 70

Table (5): Heart rate in different types of supraventricular tachycardia among the study population. 72

Table (6): Site of accessory pathway in patients with AVRT among the study population. 73

Table (7): aVL notch in different types of SVT. 74

Table (8): Correlation of aVL notch with age in the study population. 76

Table (9): Correlation of aVL notch with HR of tachycardia in the study population. 76

Table (10): Correlation of aVL notch with sex in the study population. 77

Table (11): aVL notch in different types of SVT among female patients. 79

Table (12): aVL notch in different types of SVT among male patients. 80

Table (13): Gender difference in the utility of aVL notch in the electrocardiographic diagnosis of AVNRT 81

Table (14): Pseudo-R' in lead V1 in different types of SVT. 83

Table (15): Pseudo-R' in different types of SVT among female patients. 85

Table (16): Pseudo-R' in different types of SVT among male patients. 85

Table (17): Gender difference in the utility of pseudo-R' in the electrocardiographic diagnosis of AVNRT..... 86
Table (18): Pseudo-S in inferior leads in different types of SVT..... 87
Table (19): Pseudo-S in different types of SVT among female patients..... 89
Table (20): Pseudo-S in different types of SVT among male patients. 90
Table (21): Gender difference in the utility of pseudo-S in the electrocardiographic diagnosis of AVNRT..... 90
Table (22): Utility of aVL notch in comparison with the standard criteria in diagnosis of patients with AVNRT 92
Table (23): Utility of aVL notch in comparison with the standard criteria in diagnosis of male patients with AVNRT..... 92
Table (24): Utility of aVL notch in comparison with the standard criteria in diagnosis of female patients with AVNRT..... 93
Table (25): ST elevation in lead aVR in different types of SVT..... 94
Table (26): ST depression / T wave inversion in different types of SVT. 96
Table (27): QRS alternans in different types of SVT. 98
Table (28): Cycle length alternans in different types of SVT..... 100
Table (29): Visible retrograde P waves in different types of SVT..... 102
Table (30): Summarizes the most important statistically significant data regarding different criteria in the electrocardiographic differentiation between AVNRT and AVRT in the study population. 104

List of Figures

Page No.

Figure (1): Diagram showing mechanism of initiation of AVNRT. 19

Figure (2): Surface ECG (monitor lead) during AVNRT and schematic representation of tachycardia circuits 22

Figure (3): Schematic representation of AVNRT and AVRT 26

Figure (4): Pseudo-R' wave in V1 during tachycardia which is not present during sinus rhythm 30

Figure (5): Pseudo-S wave in lead II during tachycardia and disappearance of this deflection with restoration of sinus rhythm 31

Figure (6): QRS alternans, defined as beat-to-beat oscillation in QRS amplitude > 1mm in at least one lead.12 lead ECG with horizontal ST-segment depressions persisting 80 ms beyond J point during SVT....34

Figure (7): Algorithm for differentiation of typical AVNRT from AVRT by concealed accessory pathway proposed by Jaeggi et al. 36

Figure (8): 12-lead ECG in a patient with typical AVNRT. In patients with no visible P wave or RP interval < 100 msec, the lack of ST-segment depression accurately predicted AVNRT as the mechanism of SVT 38

Figure (9): An example of ECG algorithm put by Zhong et al., 2006 for differentiating AVNRT from AVRT....39

Figure (10): Three types of aVL notch (A) during atrioventricular node re-entrant (B) sinus rhythm....40

Figure (11): A patient with atrioventricular node re-entrant with notch in aVL lead without pseudo-R in V1 during atrioventricular node re-entrant 41

Figure (12): During pacing, the end of the QRS in aVL lead was clear, and the notch at the end of QRS in aVL

lead appears after the atrioventricular node re-entrant induction.....42

Figure (13): (A) A patient with a notch in aVL lead without pseudo-S-wave in the inferior leads during atrioventricular node re-entrant. (B) A patients with a notch in aVL lead without pseudo-R' in V1 and pseudo-S-wave in the inferior leads during atrioventricular node re-entrant.....43

Figure (14): Schematic representation of the responses to Para-Hisian pacing. (The Para-Hisian catheter was positioned at anterobasal right ventricular septum 1 -2 cm anterior and apical to His bundle catheter) 51

Figure (15): Reveals the intervals measured during and after entrainment of tachycardia.....54

Figure (16): Surface ECG during tachycardia belonging to case no 5 of the current study showing aVL notch, pseudo-R' in V1 and visible retrograde P waves (evident in lead aVR).No aVR ST elevation or QRS alternans, favouring the diagnosis of AVNRT. 63

Figure (17): Showing No. of types of supraventricular tachycardia among the study population.....68

Figure (18): Sex distribution among the study population.....71

Figure (19): Site of accessory pathway in patients with AVRT among the study population. 73

Figure (20): aVL notch in different types of SVT.....75

Figure (21): Correlation of aVL notch with sex in the study population.....77

Figure (22): aVL notch in different types of SVT in correlation with sex among the study population.....81

Figure (23): Pseudo-R' and pseudo-S among AVNRT patients with aVL notch.....82

Figure (24): Pseudo-R' in lead V1 in different types of SVT. 83

Figure (25): Pseudo-S in inferior leads in different types of SVT. 88

Figure (26): ST elevation in lead aVR in different types of SVT. 95

Figure (27): ST depression / T wave inversion in different types of SVT. 97

Figure (28): QRS alternans in different types of SVT. 99

Figure (29): Cycle length alternans in different types of SVT.....101

Figure (30): Visible retrograde P waves in different types of SVT. 103

Figure (31): A case of AVNRT (surface ECG during tachycardia), notice the presence of aVL notch without pseudo-R' in lead V1 or pseudo-S in the inferior leads.....III

Figure (32): Intracardiac tracing of a case of AVNRT during tachycardia (same previous patient)..... IV

Figure (33): A case of AVRT (surface ECG during tachycardia), notice the absence of aVL notch. V

Figure (34): Intracardiac tracing during tachycardia of a case of AVRT (same previous patient). VI

Figure (35): (Above): showing the systems used the EP labs: GE CardioLab v6.5 , (below):A fluoroscopic image showing a decapolar catheter in the coronary sinus and two quadripolar catheters, one in the His-bundle position and the other in the right ventricle. VII

List of abbreviations

%	Percentage
AF	Atrial fibrillation
AH	Atrial to His
AP	Accessory pathway
AT	Atrial tachycardia
ATP	Adenosine triphosphate
AUC	Area under the curve
AV	atrioventricular
AVN	Atrioventricular node
AVNRT	Atrioventricular Nodal Re-entrant Tachycardia
AVRT	Atrioventricular Reciprocating Tachycardia
bpm	Beats per minute
CHF	Congestive heart failure
COPD	Chronic obstructive pulmonary disease
CS	Coronary sinus
DAD	Delayed after depolarization
DAVNP	Dual AV nodal pathology
ECG	Electrocardiogram
ERP	Effective refractory period
EP	Electrophysiology
EPS	Electrophysiological study
HBE	His-bundle electrogram
HR	Heart rate
HRA	High right atrium
HS	Highly significant
Hz	Hertz
LOSS-CAPT	Loss of capture
MAT	Multifocal atrial tachycardia
min	minimum
mm	Millimeter

msec	Millisecond
n	Number
NPV	Negative predictive value
NS	Non-significant
ORT	Orthodromic reciprocating tachycardia
p	Probability of chance
PAC	Premature atrial contraction
PH	Para-hisian
PI	Pre-excitation index
PPI	Post pacing interval
PPV	Positive predictive value
PSVT	Paroxysmal Supraventricular tachycardia
RB	Right bundle
RV	Right ventricle
SCL	Sinus cycle length
SD	Standard deviation
SVT	Supraventricular tachycardia
TCL	Tachycardia cycle length
vs.	Versus

Introduction

Supraventricular arrhythmias represent a common group of rhythm disturbances including rhythms emanating from the sinus node, atrial tissue (atrial flutter), junctional/reciprocating or accessory pathway-mediated tachycardia.[1]

AV nodal re-entrant tachycardia (AVNRT) is the most common type of re-entrant supraventricular tachycardia (SVT). It involves an additional accessory pathway through the AV node that becomes a reentry circuit causing the tachycardia.[2] Although controversy still exists about the exact nature of the tachycardia circuit, abundant evidence has indicated that two pathways in the region of AV node participate, one with relatively fast conduction but long refractoriness and the other with shorter refractoriness but slower conduction. PACs can encounter refractoriness in the fast pathway, conduct down the slow pathway, and reenter the fast pathway retrogradely, initiating the AVNRT. Although this is the most common presentation of AVNRT, some patients have what appears to be propagation in the opposite direction in this circuit (antegrade fast, retrograde slow), as well as "slow-slow" variant. Two or more of these variants can exist in the same patient.

AV re-entrant tachycardia (AVRT) actually results from an accessory pathway (AP) of atrioventricular (AV) conduction

that may develop circus movement so as to cause tachycardia. Orthodromic AVRT is the most common form. It occurs as a result of antegrade conduction through the normal AV conduction system and retrograde conduction to the atria via the AP. Less commonly, conduction occurs in the opposite direction resulting in antidromic AVRT.

Therefore, reciprocating atrioventricular tachycardia can be categorized into common slow–fast atrioventricular node re-entrant (AVNRT) and orthodromic atrioventricular reciprocating tachycardia (AVRT).[3]

The electrocardiogram (ECG) during tachycardia is useful in distinguishing these two mechanisms. Several studies examined the diagnosis utility of the ECG, and various algorithms were previously reported.[4 5]

The presence of a pseudo-R'-wave in lead V1 or pseudo-S-wave in the inferior leads has been widely used, although the value of an isolated aVL lead to distinguish both mechanisms has not been thoroughly evaluated yet .

Previous studies have shown that only 80% of narrow QRS supraventricular tachycardia (SVT) types can be differentiated by standard 12-lead electrocardiographic (ECG) criteria.[6]

P waves separate from the QRS complex were observed more frequently in AVRT (70%) and atrial tachycardia (80%).

Pseudo-R' deflection in lead V1, pseudo S wave in inferior leads, and cycle length alternans were more common in AVNRT (55, 20, and 6%, respectively). QRS alternans was also present during AVRT (28%). ST-segment depression (> or = 2 mm) or T-wave inversion, or both, were present more often in AVRT (60%) than in AVNRT (27%). During sinus rhythm, manifest pre-excitation was observed more often in patients with AVRT (42%).[6]

In another study, ST-segment elevation in lead aVR during tachycardia was used to differentiate the narrow QRS complex tachycardia. It appears that aVR ST-segment elevation during narrow QRS complex tachycardia favors the atrioventricular re-entry through an accessory pathway as the mechanism of the tachycardia.[7]

A study that was carried out in 2009 revealed that the aVL notch sensitivity and specificity to determine the final diagnosis was higher than the standard criteria (aVL notch 48.6 and 92.6%; pseudo-S-wave 45 and 91.3%; and pseudo-R'-wave in V1 39.7 and 88.5%, respectively), but it did not reach statistical significance.[3]

Catheter-based slow pathway modification has become a first line treatment of AVNRT with success rates approaching 100 percent.[8]

Predicting the mechanism involved in a supraventricular tachycardia before the beginning of the ablation procedure may help in planning the ablation in advance.[3]

Aim of the work

The purpose of this study is to determine whether an isolated aVL lead of the surface 12-lead ECG is useful for the differential diagnosis between AVNRT and AVRT.

Chapter One

Supraventricular tachyarrhythmias

I. Background:

Supraventricular tachycardia (SVT), a common clinical condition, is any tachyarrhythmia that requires only atrial and/or atrioventricular (AV) nodal tissue for its initiation and maintenance. It is usually a narrow-complex tachycardia that has a regular, rapid rhythm; exceptions include atrial fibrillation (AF) and multifocal atrial tachycardia (MAT). Aberrant conduction during SVT results in a wide-complex tachycardia. SVT occurs in persons of all age groups, and treatment can be challenging. [9 10]

Paroxysmal supraventricular tachycardia (PSVT) is episodic, with an abrupt onset and termination. Manifestations of SVT are quite variable; patients may be asymptomatic or they may present with minor palpitations or more severe symptoms.[11]

II. Epidemiology:

Supraventricular arrhythmias are relatively common, often repetitive, occasionally persistent, and rarely life threatening.[12]

The precipitants of supraventricular arrhythmias vary with age, gender, and associated comorbidity.[13]