

# Contents

<b>Subjects</b>	<b>Page</b>
List of abbreviations.....	II
List of Figures.....	IV
List of Tables.....	XI
• <b>Introduction</b> .....	1
• <b>Aim of the Work</b> .....	4
• <b>Review of Literature</b>	
◆ Supraventricular tachycardia.....	5
◆ Electro physiologic testing to differentiate various types of SVT.....	11
• <b>Patients and Methods</b> .....	63
• <b>Results</b> .....	81
• <b>Discussion</b> .....	117
• <b>Conclusion</b> .....	132
• <b>Recommendation</b> .....	134
• <b>Summary</b> .....	135
• <b>References</b> .....	139
• <b>Arabic Summary</b>	

## List of Abbreviations

---

<b>Abbrev.</b>	<b>Meaning</b>
<b>BT</b>	: Atrioventricular bypass tract
<b>AVN</b>	: Atrioventricular node
<b>AVN-HPS</b>	: AV nodal- His Purkinje system
<b>AA</b>	: Atrial to atrial
<b>AES</b>	: Atrial extra stimulation
<b>AF</b>	: Atrial fibrillation
<b>AFL</b>	: Atrial flutter
<b>AH</b>	: Atrial to His
<b>AP</b>	: Accessory pathway
<b>AT</b>	: Atrial tachycardia
<b>AUC</b>	: Area under the curve
<b>AV</b>	: Atrioventricular
<b>AVNRT</b>	: Atrioventricular Nodal Re-entrant Tachycardia
<b>AVRT</b>	: Atrioventricular Reciprocating Tachycardia
<b>BBB</b>	: Bundle branch block
<b>bpm</b>	: Beats per minute
<b>BT</b>	: Bypass tract
<b>CS</b>	: Coronary sinus
<b>ECG</b>	: Electrocardiogram
<b>EGM</b>	: Electrogram
<b>EP</b>	: Electrophysiology
<b>EPS</b>	: Electrophysiological study
<b>ERP</b>	: Effective refractory period
<b>H-A</b>	: His to Atrial
<b>H-H</b>	: His to His
<b>HB</b>	: His bundle
<b>HB-RB</b>	: His bundle and Right bundle
<b>HPS</b>	: His Purkinje system
<b>HR</b>	: Heart rate

---

<b>HRA</b>	: High right atrium
<b>HV</b>	: His to Ventricle
<b>Hz</b>	: Hertz
<b>IEGM</b>	: Intracardiac electrogram
<b>JT</b>	: Junctional tachycardia
<b>LAO</b>	: Left anterior oblique
<b>MAT</b>	: Multifocal atrial tachycardia
<b>msec</b>	: Millisecond
<b>NPV</b>	: Negative predictive value
<b>NSR</b>	: Normal sinus rhythm
<b>ORT</b>	: Orthodromic reciprocating tachycardia
<b>PAC</b>	: Premature atrial contraction
<b>PCL</b>	: Pacing cycle length
<b>PI</b>	: Pre-excitation index
<b>PPI</b>	: Post pacing interval
<b>PPV</b>	: Positive predictive value
<b>PVC</b>	: Premature ventricular contraction
<b>RAO</b>	: Right anterior oblique
<b>RB</b>	: Right bundle
<b>RV</b>	: Right ventricle
<b>SA</b>	: Stimulus–atrial
<b>SCL</b>	: Sinus cycle length
<b>SD</b>	: Standard deviation
<b>S-H</b>	: Stimulus to His
<b>SVT</b>	: Supraventricular tachycardia
<b>TCL</b>	: Tachycardia cycle length
<b>WCL</b>	: Wenckebach cycle length
<b>V-V</b>	: Ventricle to ventricle
<b>VA</b>	: Ventriculoatrial
<b>VES</b>	: Ventricular extra stimulation
<b>V-H</b>	: Ventricle to His

## List of Figures

### *Figures of Review of Literature*

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>1</u></b>	Types of supraventricular tachycardia & the relation, between the QRS complex and P wave, during tachycardia.	<b>7</b>
<b><u>2</u></b>	Schematic representation of AVNRT and AVRT circuits.	<b>9</b>
<b><u>3</u></b>	Anterograde dual atrioventricular nodal pathways.	<b>13</b>
<b><u>4</u></b>	Effect of atrial extra-stimulation on pre-excitation.	<b>14</b>
<b><u>5</u></b>	Reentry in the Wolff-Parkinson-White syndrome.	<b>15</b>
<b><u>6</u></b>	Retrograde conduction during ventricular extra-stimulation (VES) in a patient with a left lateral accessory pathway.	<b>17</b>
<b><u>7</u></b>	Induction of typical AVNRT with atrial pacing.	<b>19</b>
<b><u>8</u></b>	Surface ECG and IEGM of the different types of ANVRT.	<b>21</b>
<b><u>9</u></b>	Intermittent AV block during tachycardia in a patient with AVNRT.	<b>23</b>
<b><u>10</u></b>	Intermittent VA block during tachycardia in a patient with AVNRT.	<b>23</b>
<b><u>11</u></b>	Atrial tachycardia showing constant AA and variable AH and VA intervals.	<b>24</b>
<b><u>12</u></b>	Atrial tachycardia showing constant AA and variable RP intervals.	<b>25</b>
<b><u>13</u></b>	Atypical AVNRT showing changes in the atrial CL predicting changes in the subsequent ventricular CL and spontaneous termination.	<b>26</b>

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>14</u></b>	Schematic illustration of the effect of bundle branch block on the reentrant circuit during AVRT using an ipsilateral AP.	<b>27</b>
<b><u>15</u></b>	Effect of right bundle branch block on AVRT.	<b>28</b>
<b><u>16</u></b>	Induction of AVRT with ventricular extra stimulation.	<b>28</b>
<b><u>17</u></b>	AVRT with constant VA interval and termination with an atrial complex.	<b>29</b>
<b><u>18</u></b>	Atrial entrainment of AVRT showing atrial fusion and constant VA interval.	<b>31</b>
<b><u>19</u></b>	Ventricular-induced atrial pre-excitation in AVRT (A) & AVNRT (B).	<b>34</b>
<b><u>20</u></b>	Summary of salient features and findings with premature ventricular contraction delivered during SVT.	<b>36</b>
<b><u>21</u></b>	Ventricular extra stimulation during AVRT using a left lateral bypass tract.	<b>37</b>
<b><u>22</u></b>	Ladder diagram demonstrating VAV response in AVNRT (A) & VAAV response in atrial tachycardia (B).	<b>39</b>
<b><u>23</u></b>	Overdrive ventricular pacing during SVT fails to entrain the tachycardia or capture the atrium excluding AVRT.	<b>39</b>
<b><u>24</u></b>	Anti tachycardia pacing during atypical AVNRT in a patient with ICD showing pseudo VAAV response.	<b>40</b>
<b><u>25</u></b>	Entrainment of SVT; AVNRT showing absence of fusion (left) & AVRT showing progressive fusion (right).	<b>42</b>
<b><u>26</u></b>	Ladder diagrams showing response to RV apical entrainment in AVNRT (A) and AVRT (B).	<b>44</b>

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>27</u></b>	Anterograde His capture in AVRT.	<b>44</b>
<b><u>28</u></b>	Retrograde His capture in atypical AVNRT.	<b>45</b>
<b><u>29</u></b>	The use of transition zone at entrainment in atypical AVNRT and in AVRT.	<b>47</b>
<b><u>30</u></b>	Ventricular entrainment of orthodromic AVRT with assessment of $\Delta$ HA and $\Delta$ VA intervals.	<b>49</b>
<b><u>31</u></b>	The SA-VA difference (differential entrainment) in AVNRT and AVRT.	<b>50</b>
<b><u>32</u></b>	HA intervals during AVNRT, junctional tachycardia during radiofrequency application and during ventricular pacing.	<b>53</b>
<b><u>33</u></b>	Differential-site RV pacing in a patient with concealed superoparaseptal bypass tract.	<b>54</b>
<b><u>34</u></b>	Algorithm for interpreting the response to para-Hisian pacing.	<b>56</b>
<b><u>35</u></b>	Schematic representation of responses to para-Hisian pacing.	<b>58</b>
<b><u>36</u></b>	Para-Hisian pacing in a patient with an AVRT showing constant SA interval before ablation (A) and prolongation of SA interval with loss of His capture after ablation (B).	<b>59</b>
<b><u>37</u></b>	Ventricular pacing at apex with right bundle branch block.	<b>60</b>
<b><u>38</u></b>	Effect of retrograde right bundle branch block on atrial activation.	<b>61</b>

## *Figures of Patients & Methods*

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>1</u></b>	Position of catheters at start of electrophysiological study.	<b>66</b>
<b><u>2</u></b>	AH jump and induction of AVNRT during atrial extra-stimulation.	<b>70</b>
<b><u>3</u></b>	Calculation of PPI-TCL.	<b>72</b>
<b><u>4</u></b>	Anterograde His capture during entrainment from the right ventricular apex in AVRT.	<b>73</b>
<b><u>5</u></b>	PVC-induced atrial pre-excitation in AV nodal reentry.	<b>75</b>
<b><u>6</u></b>	The method of determining pre-excitation index (PI).	<b>75</b>
<b><u>7</u></b>	Para-Hisian pacing demonstrating retrograde conduction over the AV node.	<b>77</b>

## *Figures of Results*

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>1</u></b>	Types of SVT in the study population.	<b>82</b>
<b><u>2</u></b>	Types of AVRT among the studied patients according to the location of accessory pathway.	<b>82</b>
<b><u>3</u></b>	Types of AVNRT among the study population.	<b>83</b>
<b><u>4</u></b>	Sex distribution among the studied patients.	<b>84</b>
<b><u>5</u></b>	Relation between age and type of tachycardia.	<b>85</b>
<b><u>6</u></b>	Relation between gender and type of tachycardia.	<b>86</b>
<b><u>7</u></b>	Relation between type of SVT and HR during tachycardia.	<b>88</b>
<b><u>8</u></b>	Comparison between subtypes of AVRT regarding HR during tachycardia.	<b>89</b>
<b><u>9</u></b>	Difference between types of SVT regarding atrial response to cessation of right ventricular pacing during tachycardia.	<b>91</b>
<b><u>10</u></b>	Case no. 4; VAV response to RV pacing in a patient with AVRT.	<b>92</b>
<b><u>11</u></b>	Case no. 66; VAAV response to RV pacing in a patient with atrial tachycardia.	<b>92</b>
<b><u>12</u></b>	Difference between types of SVT regarding (PPI – TCL).	<b>93</b>
<b><u>13</u></b>	Difference between subtypes of AVRT regarding (PPI – TCL).	<b>94</b>
<b><u>14</u></b>	Difference between types of SVT regarding (PPI – TCL) (according to cut off 115 msec).	<b>96</b>
<b><u>15</u></b>	Difference between subtypes of AVRT regarding (PPI – TCL) (according to cut off 115 msec).	<b>97</b>
<b><u>16</u></b>	Validity of (PPI – TCL) for differentiation between types of tachycardia (AVNRT vs AVRT).	<b>98</b>

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>17</u></b>	Entrainment of the tachycardia in case no.47 (AVRT), PPI-TCL = 28 msec.	<b>99</b>
<b><u>18</u></b>	Entrainment of the tachycardia in case no.15 (AVNRT), PPI-TCL = 242 msec.	<b>99</b>
<b><u>19</u></b>	Distribution of Anterograde conduction to His bundle according to type of SVT.	<b>100</b>
<b><u>20</u></b>	Distribution of Anterograde conduction to His bundle according to AVRT subtype.	<b>102</b>
<b><u>21</u></b>	Case no. 16 (AVRT), showing anterograde conduction to His bundle during RV entrainment.	<b>103</b>
<b><u>22</u></b>	Case no. 19 (AVNRT), showing retrograde conduction to His bundle during RV entrainment.	<b>103</b>
<b><u>23</u></b>	Distribution of types of SVT regarding atrial pre-excitation in response to PVCs introduced during tachycardia.	<b>105</b>
<b><u>24</u></b>	Distribution of AVRT subtypes regarding atrial pre-excitation in response to PVCs.	<b>106</b>
<b><u>25</u></b>	Difference between types of SVT regarding pre-excitation index.	<b>107</b>
<b><u>26</u></b>	Difference between subtypes of AVRT regarding pre-excitation index.	<b>108</b>
<b><u>27</u></b>	ROC curve for validity of pre-excitation index to differentiate between different types of SVT (AVNRT vs AVRT).	<b>110</b>
<b><u>28</u></b>	Case no. 17 (AVRT), showing atrial pre-excitation in response to VES with pre-excitation index = 70 msec.	<b>111</b>
<b><u>29</u></b>	Case no. 31 (AVNRT), showing no atrial pre-excitation in response to VES.	<b>111</b>

<b><u>No.</u></b>	<b><u>Figure</u></b>	<b><u>Page</u></b>
<b><u>30</u></b>	Distribution of types of SVT regarding SA interval during loss of HB-RB capture compared with SA interval during HB-RB capture.	<b>112</b>
<b><u>31</u></b>	Distribution of types of AVRT regarding SA interval with loss of HB-RB capture when compared with SA interval during HB-RB capture.	<b>114</b>
<b><u>32</u></b>	Case no.3 (AVNRT), showing longer SA interval with His non-capture (A) than in His capture (B).	<b>115</b>
<b><u>33</u></b>	Case no. 59 (AVRT), showing identical SA interval both with HB-RB capture (left) and upon loss of HB-RB capture (right).	<b>116</b>

## List of Tables

<b><u>No.</u></b>	<b><u>Table</u></b>	<b><u>Page</u></b>
<b><u>1</u></b>	Types of SVT among the study population.	<b>81</b>
<b><u>2</u></b>	Age and gender distribution in the study population.	<b>84</b>
<b><u>3</u></b>	Relation between age and type of SVT.	<b>85</b>
<b><u>4</u></b>	Relation between gender and type of SVT.	<b>86</b>
<b><u>5</u></b>	Heart rate during tachycardia in the studied patients.	<b>87</b>
<b><u>6</u></b>	Relation between type of SVT and HR during tachycardia.	<b>87</b>
<b><u>7</u></b>	Comparison between subtypes of AVRT regarding HR during tachycardia.	<b>89</b>
<b><u>8</u></b>	Difference between types of SVT regarding atrial response to cessation of right ventricular pacing during tachycardia.	<b>91</b>
<b><u>9</u></b>	Difference between types of SVT regarding (PPI – TCL).	<b>93</b>
<b><u>10</u></b>	Difference between subtypes of AVRT regarding (PPI – TCL).	<b>94</b>
<b><u>11</u></b>	Difference between types of SVT regarding (PPI – TCL) (according to cut off 115 msec) (Michaud et al.,2001)	<b>96</b>
<b><u>12</u></b>	Difference between subtypes of AVRT regarding (PPI – TCL) (according to cut off 115 msec) (Michaud et al., 2001).	<b>97</b>
<b><u>13</u></b>	Distribution of Anterograde conduction to His bundle according to type of SVT.	<b>100</b>
<b><u>14</u></b>	Validity of Anterograde conduction to His bundle for detection of AVRT.	<b>101</b>

<b><u>No.</u></b>	<b><u>Table</u></b>	<b><u>Page</u></b>
<b><u>15</u></b>	Distribution of Anterograde conduction to His bundle according to AVRT subtype.	<b>102</b>
<b><u>16</u></b>	Distribution of types of SVT regarding atrial pre-excitation in response to PVCs introduced during tachycardia.	<b>104</b>
<b><u>17</u></b>	Validity of atrial pre-excitation in response to PVCs for detection of AVRT.	<b>105</b>
<b><u>18</u></b>	Distribution of AVRT subtypes regarding atrial pre-excitation in response to PVCs introduced during tachycardia.	<b>106</b>
<b><u>19</u></b>	Difference between types of SVT regarding pre-excitation index.	<b>107</b>
<b><u>20</u></b>	Difference between subtypes of AVRT regarding pre-excitation index.	<b>108</b>
<b><u>21</u></b>	Difference between types of SVT regarding pre-excitation index (according to cut off values proposed by Miles et al, 1986).	<b>109</b>
<b><u>22</u></b>	Difference between subtypes of AVRT regarding pre-excitation index (according to cut off values proposed by Miles et al., 1986).	<b>109</b>
<b><u>23</u></b>	Distribution of types of SVT regarding SA interval during loss of HB-RB capture compared with SA interval during HB-RB capture.	<b>112</b>
<b><u>24</u></b>	Validity of parahisian pacing maneuver for detection of AVRT.	<b>113</b>
<b><u>25</u></b>	Distribution of types of AVRT regarding SA interval with loss of HB-RB capture when compared with SA interval during HB-RB capture.	<b>114</b>
<b><u>26</u></b>	Results of electro physiologic studies in atrial tachycardia patients.	<b>116</b>



---

# *Introduction*

---





---

# *Aim of the Work*

---





---

# *Review of Literature*

---

