

รายการอ้างอิง

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ภาคผนวก

VENTRICULAR LATE POTENTIALS

Ventricular late potentials are low amplitude, high frequency (>25 Hz) signals that are continuous with the terminal portion of the QRS complex and persist for a variable time into the ST segment. These potentials appear to correspond to delayed, fragmented activation which has been observed with direct electrogram recordings in patients with ventricular tachycardia. The amplitude of the late potentials on the body surface is typically between 1 and 20 microvolts.

Standard surface recording techniques result in tracings with as much as 20 microvolts of baseline noise from such sources as electrical current and skeletal muscle contractions. By signal averaging the cardiac signal, random noise is significantly reduced which allows for visualization of the low amplitude late potentials. The greater the number of beats averaged, the better the signal-to-noise ratio becomes.

In reviewing the literature, one finds the following to generally be true:

- * The number of beats averaged is 150-200 or more
- * A terminal noise level of > 1 uV is unacceptable and generally should be less than 0.5 uV with 0.2-0.3 uV being optimum
- * Skin preparation and lead placement require good technique for acceptable results
- * For late potential detection and analysis in the time domain, the quantitative values assessed are the filtered QRS duration, the root mean square voltage of the last 40 msec (RMS 40) and the duration of the signal below 40 uV (LAS 40)
- * The most common high pass frequencies used are 25 and 40 Hz with the low pass frequency of 250 Hz
- * Recent studies indicate the best sensitivity and specificity with 40-250 Hz
- * Some studies require only one parameter to be abnormal to classify the patient as being positive whereas others require more than one
- * The following are the most conservative values for a positive result as reflected in literature:

FILTERED AT 40 HZ

Filtered QRS Duration - > 120 ms
RMS of the Last 40 Ms - < 20 uV
Duration below 40 uV - > 40 ms

FILTERED AT 25 HZ

Filtered QRS Duration - > 120 ms
RMS of Last 40 Ms - < 25 uV
Duration below 40 uV - > 40 ms

TECHNIQUES OF DATA ACQUISITION

- * Reassure the patient - explain the procedure.
- * Have patient lie comfortably on a bed or exam table.
- * Prepare the electrode sites by cleaning well with alcohol and rub briskly with dry gauze pad to remove the superficial, dead cells from the surface of the skin. This enhances the electrical contact. Shaving may be necessary to insure good electrode contact. REMEMBER that good electrode contact is critical to obtaining data with a minimum of noise.
- * Inspect the electrode to insure that there is adequate gel.
- * Attach high quality, silver/silver-chloride electrodes to the prepared sites, beginning with the chest and ending with the one on the back. Special, expensive electrodes are not necessary if care is taken for proper skin preparation.
- * While the patient is sitting up or on his/her side, attach the Z-lead to the back.
- * Have the patient lie down and attach the remaining electrodes.
- * Once the leads are attached, instruct the patient to lie still, to not talk unless absolutely necessary, and to place his hands at his sides. Having the patient close his eyes helps him to relax as does reducing the room noise (i.e., turn down TV, close door) and dimming the lights.
- * Once the signal and rhythm seen on the noise/monitoring screen are satisfactory, start the test.
- * After the templating process is complete and the averaging is in process, the heart rate and number of beats in the average will be displayed. At this time, EXAM will allow you to see the morphology of the beat being averaged.
- * An evaluation of the noise level after 40-50 beats will assist you in determining the quality of the signal. If the noise is greater than 1uV, you may wish to evaluate the integrity of the electrodes and, when satisfied, restart the average.
- * When an acceptable noise level has been reached (≤ 0.5 uV), the test may be terminated and saved by pressing STOR. Some physicians may also wish to include a minimum number of beats as another endpoint criteria.

VALUES USED FOR DETERMINATION OF LATE POTENTIALS

<u>COR. FREQ</u>	<u>TOTAL QRS DURATION</u>	<u>DURATION OF SIGNAL BELOW 40 μV</u>	<u>RMS VOLTAGE OF LAST 40 MSEC</u>
25 Hz	> 120 ms	> 40 ms	< 25 μ V
40 Hz	> 120 ms	> 40 ms	< 25 μ V
25 Hz		> 40 ms	< 25 μ V
	> 140 ms		
25 Hz	> 110 ms	> 30 ms	< 25 μ V
25 Hz	> 114 ms	> 32 ms	< 25 μ V
40 Hz	> 114 ms	> 38 ms	< 20 μ V
40 Hz	> 120 ms		< 20 μ V
25 Hz	> 110 ms	> 38 ms	< 25 μ V
40 Hz			< 18.5 μ V
40 Hz		> 39 ms	< 20 μ V
25 Hz	> 120 ms	> 38 ms	< 25 μ V
25 Hz	> 110 ms		< 25 μ V
40 Hz	> 114 ms	> 38 ms	< 20 μ V
25 Hz	> 110 ms	> 38 ms	< 25 μ V
40 Hz			< 18.5 μ V
40 Hz	> 114 ms	> 38 ms	< 20 μ V

QRS duration is measured from an unfiltered lead rather than the vector magnitude

ประวัติผู้เขียน

นายสุชัย กาญจนธารายนตร์ เกิดวันที่ 27 มิถุนายน 2511 ที่กรุงเทพมหานครสำเร็จการศึกษาปริญญาตรีแพทยศาสตรบัณฑิต คณะแพทยศาสตร์ โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล ในปีการศึกษา 2533 ประกาศนียบัตรวิทยาศาสตรการแพทย์คลินิก(สาขาวิชาอายุรศาสตร์) ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2539 และเข้าศึกษาต่อในหลักสูตรวิทยาศาสตรมหาบัณฑิต (สาขาวิชาอายุรศาสตร์) ณ ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2540 ปัจจุบันเป็นแพทย์ประจำโรงพยาบาลบางประกอก1