

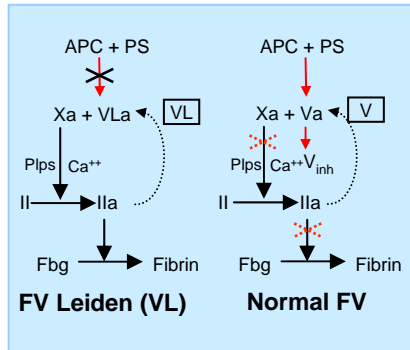
# QUANTITATIVE MEASUREMENT OF FACTOR V LEIDEN IN HETEROZYGOUS AND HOMOZYGOUS PATIENTS FOR THE R506Q FACTOR V MUTATION

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## INTRODUCTION

- Presence of FV-L (Factor V Leiden: R506Q mutation) is usually evidenced with clotting methods using the clotting time ratio, using a two step assay performed with or without activated Protein C (APC).
- Genetic status of FV-L carriers is confirmed with molecular biology. When the APC-r ratio is used, there is sometimes overlapping between heterozygous and normal plasmas and the assay is only qualitative.
- We used a new quantitative clotting assay (HEMOCLOT Quanti-V-L – CK065K) for measuring FV-L in plasma, from normals and patients with APC-Resistance (confirmed by Molecular Biology for R506Q mutation).
- The aim of this study was to test citrated plasma from normal, heterozygous and homozygous patients for FV-L, using this new method comparatively to the conventional assay performed in the absence, or presence, of APC.



## 1. PRINCIPLE AND REAGENTS

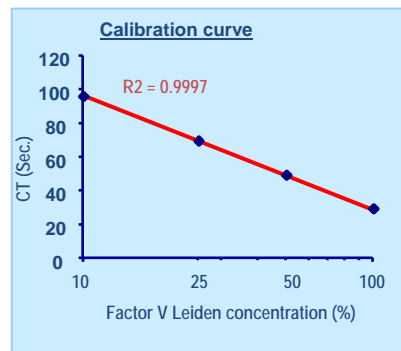
- HEMOCLOT Quanti V-L (CK065K):** Diluted plasma is mixed with a purified clotting factor mixture, in a constant and optimized concentration, (R1 : Fibrinogen, Prothrombin, Protein S and APC). Purified FXa, with phospholipids (R2), is then added. Coagulation is initiated by the addition of calcium (Ca<sup>2+</sup>) and the clotting time (CT) is measured. The CT obtained is inversely proportional to the FV-L concentration. An inverse linear relationship is obtained, on lin-log coordinates, between the CT and the FV-L concentration.
- HEMOCLOT Factor V-L (CK061K):** Clotting assay performed without or with APC and calculating the CT ratio (APC-r ratio).
- Both assays are performed using automatic methods on STA-R.
- FV clotting activity was measured with **HemoClot Factor V Reagent (CK071K)** and Factor V antigen with **Zymustest Factor V (RK009A)**.
- FV assays were calibrated using the **NIBSC** secondary standard, lot 2.

## 2. BLOOD COLLECTION

- Blood was collected on 0.109M or 0.129M citrate anticoagulant centrifuged at 3,000g for 20 mn at 18°C or below and plasma decanted into a plastic tube.
- Tested samples: Normal plasmas (NI, N=30) (from a French blood bank), plasmas of patients carrying the R506Q mutation (FVL) identified as heterozygous (HTZ, N=61) (including 19 Dicoumarol treated) and homozygous (HMZ, N=18) (all from H. Mondor Hospital, Créteil, France).
- Molecular biology was used for classifying patients as heterozygous or homozygous and performed at H. Mondor Hospital.

## ASSAY CALIBRATION FOR HEMOCLOT QUANTI V-L

Calibration is performed using various mixtures of a (R506Q) heterozygous plasma pool (for which the FV-L concentration corresponds to 50 % of that of total FV), and a normal plasma pool (containing by definition 0 % FV-L and 100 % of normal FV).



- The standard assay dilution being 1:20, the 1:20 heterozygous plasma pool dilution contains 50% Factor V-L, and the 1:10 dilution, 100%.
- The 1:1 mixtures of the heterozygous and the normal plasma pools mixture, diluted 1:20, corresponds to 25 % FV-L.
- The mixture of one part of the FV-L heterozygous pool with 4 parts of the normal pool, diluted 1:20, corresponds to 10 % FV-L.

## Results obtained for each group of patients with both FV-L methods

Patients		Ratio	Quanti V-L (%)
NI (N=30)	Mean	2.22	<10
	Min-Max	2.05-2.44	<10
HTZ (N=61)	Mean	1.72	50.2
	Min-Max	1.56-1.84	27-75
HMZ (N=18)	Mean	1.43	90
	Min-Max	1.24-1.49	73-188

➤ Excellent classification of normal, heterozygous and homozygous with the quantitative method

## Determination of the Factor V clotting activity and Factor V antigen for each group of patients

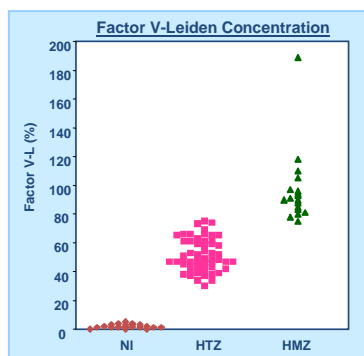
Patients	FV-L (%)	FV:Ag (%)	FV clotting (%)	FVL/FV ratio (%)
Normal	<10	93	107	<0.05
HTZ (N=42)	49	102	89	0.55
HTZ* (N=19) <small>* Dicoumarol treated</small>	52	108	85	0.62
HMZ	90	106	71	1.30

- Calculating FV-L/FV:Ag or FV-L/FV:clotting ratios show:
- Normals < 0.1
  - Heterozygous : 0.5 ± 0.1
  - Homozygous : 1.00 ± 0.2

## Results obtained with qualitative and quantitative methods on Normal and Abnormal controls.

	CK061K (ratio)		CK065K (%)	
	Exp. Values	FV-L ratio	Exp. values	% FV-L (STAR)
Normal control	2.56	2.15	<5%	1
Act PCR Abnormal control	1.70	1.69	51 [41-61]	46

- FV-L was quantitated in the various groups and allowed discriminating accurately between patients without or with FV-L.
- Normal plasma containing only normal FV has always: **FV-L <10%**.
- In this study, plasmas from patients with FV-Leiden identified as:
  - Heterozygous plasmas contained between >25% and <75% FV-L (no interference of Dicoumarol therapy).
  - Homozygous plasmas contained >70% FV-L.



## CONCLUSIONS

- This new clotting method allows an accurate and quantitative measurement of Factor V Leiden clotting activity (resistant to the action of Activated Protein C) and could be very useful for routine classification of patients carrying the Factor V Leiden mutation. But only molecular biology allows confirming the diagnosis, and classifying patients as heterozygous or homozygous.
- Only one clotting test is necessary, and result is fully quantitative.
- This assay offers a single and easy way to diagnose patients carrying FV-L.
- It is recommended to also measure FV clotting activity, when a FV decreased concentration is suspected (<25%), and to calculate the FV-L/FV clotting ratio.
- The **FV-L/FV** clotting activity ratio duly confirmed the classification established and complies with the genetic status.
- Quantitation of Factor V Leiden could be an helpful tool for grading the thrombotic risk in patients with the R506Q Factor V mutation.

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## Quantitative measurement of Factor V Leiden in heterozygous and homozygous patients for the R506Q Factor V mutation

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A new quantitative clotting assay for measuring Factor V-Leiden (R506Q mutation) in citrated plasma is available. It allows to overcome the diagnosis variability linked to clotting methods based on the APC-R ratio (clotting time with or without APC), and to grade the risk in patients with the same genetic profile. This new method was used for quantitating Factor V Leiden in normal population (N=30), and in patients carrying the R506Q Factor V mutation (N=61 heterozygous, including 19 dicoumarol treated, and N=18 homozygous). All normals and patients were classified using molecular biology. Other factor V activities (Factor V clotting activity and Factor V antigen were also measured. Factor V Leiden was always < 10 % in normals (usually non measurable), whilst it was in the normal range for Factor V clotting activity and Factor V antigen. Factor V Leiden clotting activity (resistant to APC) ranged from 25 % to 75 % in heterozygous patients (Mean of 49 %, with no significant difference in the dicoumarol treated patients' group), and from 70 % to 190 % in homozygous (Mean value of 90 %). This clotting activity correlated well with the normal Factor V clotting activity or Factor V antigen in homozygous, and was about half these activities in heterozygous. In patients with a low level of Factor V, diagnosis and classification of Factor V Leiden can be improved by calculating the ratio between Factor V Leiden concentration and Factor V clotting activity or antigen (ratio of about 0.5 for heterozygous, and of 1.00 for homozygous, but < 0.1 for normals). This new clotting method allows an accurate measurement of Factor V Leiden clotting activity (resistant to the action of Activated Protein C) and could be very useful for routine classification of patients carrying the Factor V Leiden mutation. Only one clotting test is necessary, and result is fully quantitative. Furthermore, quantitation of Factor V Leiden could be an helpful tool for grading the thrombotic risk in patients with the R506Q Factor V mutation.