

A SOFTWARE FOR AUTOMATIC CALCULATION OF GLOMERULAR FILTRATION WITH ⁵¹Cr- EDTA.

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Introduction:

Glomerular filtration rate (GFR) studies with ⁵¹Cr-EDTA are performed in a large number of hospitals throughout the world. There are important methods to determinate GFR: the method of Ham and Piepsz, the method of Mistry and the bicompartamental model proposed by Sapirstein. The calculation of GFR using any of these methods is not very complex, but tedious and time consuming.

Objetive:

The goal of this work is to develop a computing facility to automatically calculate GFR by three different methods.

Material and Methods:

For developing a software incorporating these calculations we have used Visual Basic 6.0 and Visual Studio Installer.

Method of Ham and Piepsz:

$$GFR = 2.602 \times V_{120}^{-0.273}$$

$$V_{120} = \text{Dose} / A_{120}$$

$$A_{120} = A_{(t)} \times e^{(0.008)(t-120)}$$

Bicompartamental Model of Sapirstein:

$$GFR = I \lambda_a \lambda_b (A \lambda_a + B \lambda_b) =$$

$$= I \ln 2 / (A T_{1/2a} + B T_{1/2b})$$

$$A_t = A e^{-\lambda_a t} \text{ (fast exponential)}$$

$$B_t = B e^{-\lambda_b t} \text{ (slow exponential)}$$

I = doses in cpm

$$\lambda = \ln 2 / T_{1/2}$$

Method of Mistry:

$$GFR = \text{Dose} \times 0.693 \times 0.87 \times 1000 / (A_0 \times 1000 \times T_{1/2})$$

Glomerular filtration rate (1 plasma specimen)

Patient data: surname: _____, forename: _____, age: 37 years, height: 161 cm, weight: 54 kg

Study data:

	t (min.)	plasma cpm/ml
Dose syringe:	4.4	
Empty dose syringe:	3.47	120 364 364
Standard syringe:	4.36	cpm background: 52
Empty standard syringe:	3.43	
Standard volume dilution (ml):	250	Standard activity (cpm/ml) = 8895000
cpm/ml dilute standard:	35632	Injected activity (cpm/ml) = 8895000
		A(120) = 312
		VD(120) = 28510

Glomerular filtration rate: GFR = 73.9 ml/min. normalized GFR = 82.1 ml/min.

Glomerular filtration rate (6 plasma specimens)

Patient data: surname: _____, forename: _____, age: 43 years, height: 165 cm, weight: 59 kg

Study data:

	t (min.)	plasma cpm/ml	A	λ _a	T _{1/2a}	R ²	B	λ _b	T _{1/2b}	R ²
Dose syringe:	4.37	4	12056	12040	A = 21117					
Empty dose syringe:	3.49	8	6541	6535	λ _a = -0.1448				T _{1/2a} = 4.78	
Standard syringe:	4.47	16	2154	2136	R ² = 0.9396					
Empty standard syringe:	3.51	60	1155	1136	B = 1559					
Standard volume dilution (ml):	250	80	1001	995	λ _b = -0.006				T _{1/2b} = 114.59	
cpm/ml dilute standard:	60776	100	908	913	R ² = 0.9871					
cpm background:	52									

Glomerular filtration rate: GFR = 34.5 ml/min. normalized GFR = 36.2 ml/min.

Results:

We have developed three forms for automatic calculation of GFR by means of three methods: the method of Ham and Piepsz, the method of Mistry and the bicompartamental model proposed by Sapirstein. Each form relies on a database to store, manage and retrieve the data of GFR studies. Moreover these forms offer the possibility of printing a detailed report of each GFR study. These forms are included in a software called Nucleolab which is available at:

www.radiofarmacia.org/nucleolab-english

Glomerular filtration rate (3 plasma specimens)

Patient data: surname: _____, forename: _____, age: 37 years, height: 161 cm, weight: 54 kg

Study data:

	t (min.)	plasma cpm/ml
Dose syringe:	4.4	120 364 364
Empty dose syringe:	3.47	190 268 268
Standard syringe:	4.36	250 197 197
Empty standard syringe:	3.43	
Standard volume dilution (ml):	250	cpm totales del estándar = 8895000
cpm/ml dilute standard:	35632	cpm totales inyectadas = 8895000
cpm background:	52	Pendiente = -0.006 Origen = 6.462
		cpm/ml (t = 0) = 640
		T _{1/2} = 117.9 VD = 13891.2

Glomerular filtration rate: GFR = 71 ml/min. normalized GFR = 78.8 ml/min.

Conclusion:

The software we have developed has an easy-to-use interface, that makes the calculation complexity of GFR studies hidden for the user, saving you the time that you previously spent on these laborious calculations and reducing the risk of error.