

# A software for automatic calculation of tubular extraction rate

J.L. Gómez Perales<sup>1</sup>, A. García Mendoza<sup>2</sup>

<sup>1</sup>Nuclear Medicine Service. "Puerta del Mar" University Hospital (Cádiz, SPAIN)

<sup>2</sup>Nuclear Medicine Service, "Torrecárdenas" Hospital (Almería, SPAIN)

## INTRODUCTION

Although the renal clearance of <sup>99m</sup>Tc-MAG3 is about 60% of the <sup>131</sup>I-hippurate clearance, <sup>99m</sup>Tc-MAG3 clearance may be useful to estimate effective renal plasma flow. Russell's algorithm and Bubeck's algorithm are widely used for calculation of <sup>99m</sup>Tc-MAG3 clearance with a single blood sample. The calculation of the <sup>99m</sup>Tc-MAG3 clearance using these algorithms is not very complex, but tedious and time-consuming.

## OBJETIVE

The goal of this work is to develop a software to automatically calculate <sup>99m</sup>Tc-MAG3 clearance, using Russell's algorithm and Bubeck's algorithm.

**Patient data**  
surname: \_\_\_\_\_ forename: \_\_\_\_\_  
age: 34 years height: 178 cm weight: 55 kg

**Study data**  
Dose syringe: 7 Standard volume dilution (ml): 50000  
Standard syringe: 6.97 Sample volume dilution (ml): 1  
Empty dose syringe: 0.64 cpm background: 0  
Empty standard syringe: 0.04 cpm/ml dilute standard: 13293  
Time injection - withdrawal (min.): 50 cpm/ml plasma: 8801

**Results**

Algorithm	99mTc-MAG3 clearance	Normalized clearance
Bubeck's algorithm	264 ml/min.	271 ml/min.
Russell's algorithm	330 ml/min.	338 ml/min.

## MATERIALS AND METHODS

For developing a software incorporating these calculations we have used Visual Basic 6.0 and Visual Studio Installer. The equations used in the calculations are:

### Russell's algorithm:

MAG3 clearance =  $F_{max} (1 - \exp(-\alpha (1/c - Vlag)))$  (ml/min.)

where:  $c$  = fraction of dose per liters plasma ( $l^{-1}$ )

$t$  = time between injection and withdrawal of sample (min.)

$F_{max} = 0.04 t^2 - 8.2 t + 915$  (ml/min.)

$\alpha = 6.5 \cdot 10^{-6} t^2 - 8.6 \cdot 10^{-4} t + 0.0391$  ( $l^{-1}$ )

$Vlag = -0.0015 t^2 + 0.01 t + 8.79$  (l)

### Bubeck's algorithm:

TER(MAG3) =  $A + B \cdot \ln(ID/Cnt)$  ( $ml \cdot min^{-1} \cdot 1.73 m^{-2}$ )

where:  $A = -517 \exp(-0.011 t)$  ( $ml \cdot min^{-1} \cdot 1.73 m^{-2}$ )

$B = 295 \exp(-0.016 t)$  ( $ml \cdot min^{-1} \cdot 1.73 m^{-2}$ )

ID = injected dose (MBq)

$t$  = time of blood sampling post-injection (min.)

Cnt = normalized plasma concentration at time  $t$  (% dose  $\cdot l^{-1} \cdot 1.73 m^{-2}$ )

## RESULTS

We have developed a software for automatic calculation of <sup>99m</sup>Tc-MAG3 clearance using Russell's method and Bubeck's method. This software relies on a database to store, manage and retrieve the data of <sup>99m</sup>Tc-MAG3 clearance studies. Moreover, the software offers the possibility of print a detailed report of each study. This software is included in a comprehensive software called Nucleolab, which is available at [www.radiofarmacia.org/nucleolab-english](http://www.radiofarmacia.org/nucleolab-english)

## CONCLUSION

The software we have developed has an easy-to-use interface, that makes the calculation complexity of <sup>99m</sup>Tc-MAG3 clearance studies completely hidden for users, saving the time previously spent on these laborious calculations and reducing the risk of error.