Comparison of In vivo / In vivo-in vitro methods of Red blood cells labelled with $^{99m}$Tc


$^1$UGC Medicina Nuclear, Hospital Universitario “San Cecilio”, Granada.
$^2$Servicio de Medicina Nuclear, Hospital Universitario “Puerta del Mar”, Cádiz.

Introduction

Autologous red blood cells labelled with $^{99m}$Tc ($^{99m}$Tc-RBCs) is the radiopharmaceutical of choice for the evaluation of left ventricular ejection fraction (LVEF). There are three different methods for the preparation of this autologous radiopharmaceutical: in vitro, in vivo and in vivo-in vitro.

The aim of this study is the comparison of labelling efficiency (LE) of $^{99m}$Tc-RBCs between in vivo and in vivo-in vitro methods.

Material and Methods

We have performed 81 evaluations of LVEF, 39 evaluations were performed following in vivo method and 42 evaluations were performed following in vivo/in vitro method. In every case LE was tested:

**In vivo-in vitro method**: 0.05-0.10 mL $^{99m}$Tc-RBC aliquots were added into 2 mL of NaCl 0.9% solution into sterile vacuum blood collection tubes (BD Vacutainer® SST II Advance). The tubes were centrifugated at 1300 $g$ for 3 minutes and supernatant (cell-free plasma) was transferred into plastic test tubes. LE was calculated by measurement, both cell-free plasma and RBCs packed, activities using a dose calibrator (Capintec CRC®-15R).

**In vivo method**: 4 mL whole-blood was withdrawn from a peripheral vein using a 5 mL heparinized syringe. It was centrifuged at 1300 $g$ for 5 minutes and supernatant (cell-free plasma) was transferred into plastic test tubes.

LE was calculated by measurement, both cell-free plasma and RBCs packed, activities using a well counter (Biodex Medical Mod. 187-246).

Labelling Efficiency (%)

<table>
<thead>
<tr>
<th>Methods</th>
<th>Low value</th>
<th>High Value</th>
<th>Average Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>In vivo-in vitro</td>
<td>89.36</td>
<td>99.38</td>
<td>93.26</td>
<td>2.24</td>
</tr>
<tr>
<td>In vivo</td>
<td>91.59</td>
<td>100</td>
<td>97.45</td>
<td>2.19</td>
</tr>
</tbody>
</table>

In each case, gammagraphics images were tested by two different independent testers, neither of them detected any undesirable uptake because of low quality of $^{99m}$Tc-RBCs, or by any in vivo unlabelling.

Conclusions

According to our results, the LE using in vivo methods was slightly lower than LE by in vivo-in vitro method. Perhaps, both of them were into an acceptable range to be used for LVEF studies. Moreover, LVEF studies performed have not shown any significant difference, so both methods are useful to get $^{99m}$Tc-RBCs.

In fact, we think that the use of $^{99m}$Tc-RBCs by in vivo method is preferable, because it is a simple system, easy to perform, safe and efficient to assess LVEF getting good results and image quality.