RIT dosimetry

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Aim of the lecture is to review the available data about healthy organ doses, underlining how different methodologies lead to different results. The problem of dose-effect correlation between absorbed dose or BED, and toxicity, both in red marrow and in other organs is also discussed.

Summary

Four extensive dosimetric studies were performed about $^{90}$Y ibritumomab tiuxetan therapy [$^{1,2,3,4}$]. Some other papers are focussed on a restricted number of organs (kidney [$^{5}$], red marrow [$^{6}$], critical organs [$^{7}$]. All refer to healthy organ dose (toxicity oriented dosimetry), and all were performed by $^{111}$In ibritumomab tiuxetan planar scintigram. One paper [$^{8}$] compares a raw planar evaluation with a very refined SPET quantification. While the first [$^{4}$] refers to the registration study and fixed the standard activity pro kilo at 15 MBq/kg for patients in good hematological condition, other studies [$^{2,4,7}$] adopted a myeloablative regimen. In these cases, peripheral blood stem cell support was planned.

Red marrow dose (measured by the blood method), even if in good agreement between different authors, cannot account for the observed toxicity. Previous chemo-therapies or an inappropriate application of the blood model are the two possible explanations for the lacking correlation. The MIRD paper [$^{3}$] adopted the lumbar vertebrae as medullar district for red marrow activity quantification.

Remarkable differences between median doses to liver, kidney, spleen were obtained by different authors, reaching even a factor of 2 ore more. The large inter-patient variability maybe prove to prevent a statistically significant difference between these data, but a systematic bias can be observed comparing values reported by these centres.

A comparison of the quantification and correction method reveals several differences, but further studies are necessary in order to demonstrate which are the factors influencing most heavily the quantification accuracy. The role of the individual CT determined kidney mass is evidenced by ref [$^{9}$], which confirms that Wisemans' kidney doses are too low.

The necessity of standardisation of dosimetric methods is remarked.

References

7. Winter JN, Inwards DJ, Spies S, Wiseman G et al Yttrium-90 ibritumomab tiuxetan doses calculated to deliver up to 15 Gy to the critical organs may be safely combined with high-dose BEAM and autologous transplantation in relapsed or refractory B-cell Non-Hodgkin lymphoma J Clin Onc (2009) 27 No 10 1653–1659