On the potential of new biodosimetry techniques: detection of dicentric chromosomes with telomere and centromere (TC) staining in metaphases and PCC - optimization and comparison to the current gold standard method

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Study Goal: We propose a new approach for the detection of dicentric chromosomes by the introduction of telomere and centromere (TC) staining. This approach allows for better scoring of dicentrics in metaphases, improving the dose response relationship. The resulting curve is more reliable and robust than those based on the classical dicentric assay, considered to be the gold standard in the field of the biodosimetry.

Abstract: Manual scoring following TC staining of metaphases revealed a significantly higher frequency of dicentrics (p<10⁻³) (up to 30%) and estimated double strand breaks (p<10⁻⁴) compared to uniform staining.

By introducing the premature chromosome condensation (PCC) technique, we have successfully established the first chromosomal aberrations dose response curve for PCC fusions. TC staining of PCC fusions increases the potential of this technique, as a result can be obtained in a relatively short time (< 24 hours after exposure), compared to metaphases (3 days), which is a critical asset for a biodosimetry method for radiation emergency medicine.

TC staining not only renders the scoring of dicentrics easier and more reliable, but has also made it possible to automate the scoring process for both metaphases and PCC. The efficiency of detection of dicentrics using dedicated software leads to a more reproducible process and reduced uncertainties.

Dicentric scoring, in metaphases and PCC, after TC staining will be tested within the RENEB network and will be compared to other methods including the scoring of translocations, micronuclei, gH2AX foci and physical techniques such as EPR and OSL.


Conclusion: The use of TC staining has permitted a reevaluation of the dose response curve with a highly efficient scoring process, giving a new potential approach for biological dosimetry and marking a new step in the management and follow-up of populations exposed to ionizing radiations.