

// ()
 // , ,

^{99m}Tc-MIBI

*

^{99m}Tc -MIBI :

^{99m}Tc

:

^{99m}Tc -MIBI

Micronucleus assay

Paired t- test

:

/ ±

/ ± / / ± /

/ ± / / ± /

^{99m}Tc -MIBI

^{99m}Tc

:

^{99m}Tc -MIBI

:

)

)

(DNA

DNA (DNA

∴ , ... ∴ ,

...

...

,

,

,

,

,

,

^{99m}Tc

()

.()

^{99m}Tc

.()

.()

^{99m}Tc -MIBI

.()

(Sequential)

.()

DNA

)

(

()

)

(DNA

)

()

(

•

;

^{99m}Tc -MIBI

()

.(-)

)

(Sigma (blind)

:

-

)

(Biosera -

:

RPMI

Viability

:

g

:

-

:

-

)

.(

Hanks

g ()

:

-

:

(Sigma)

(Viability

(

(Gibco)

%)

(

RPMI) Gibco

%)

(

^{99m}Tc -MIBI

()

set up

•

(%) . / /) ()

(%)

(%)

. /

paired t-test

•

-(P < /)

SPSS 15

^{99m}Tc -MIBI

-

paired t-test

independent samples t-test

P- value < /

/ ± / / ± /

/ ± / / ± /

(%))

/ ± /

((%)

/ ± /

-

/ ± /

-

% ± /

(/ ± /)

.(P > /)

-

^{99m}Tc -MIBI

)

. (

/ ± /

/ ± /

(

)

% / ± /

% / ± /

() ^{99m}Tc –MIBI
 .()
 ^{99m}Tc -HMPAO

.()

^{99m}Tc -HMPAO

.()

^{99m}Tc -HMPAO

^{99m}Tc –MIBI

Taibi

.()

()

ex vivo

in vivo

.()

.(-)

FISH

^{99m}Tc

in vitro

.()

in vivo

FISH

blind

 ^{99m}Tc -MIBI

REFERENCES

1. Rinchik EM, Stoye JP, Frankel WN. Molecular analysis of viable spontaneous and radiation-induced albino (c)-locus mutations in the mouse. *Mutat Res* 1993; 286:199-207.
2. Tacker J. Radiation induced mutation in mammalian cells at low doses and dose rates. In: Nygaard OF, Sinclair WK, Lett JT, editors. *Effects of low dose rate radiation*. New York: Academic Press. 1992; PP: 77-124.
3. Tabeie F, Neshandar AI, Agha miri SMR. Staff and patient radiation absorbed dose from diagnostic nuclear medicine. *Iranian J Radiat Res* 2003; 2: 150-4.
4. Zakavi SR. Nuclear cardiology in Iran in 2002. *Iranian J Nuclear Med* 2004; 21: 73-7.
5. Iwnica-worms D, Holman BL. Non cardiac application of hexakis (alkylisonitril)-technetium- 99m complexes. *J Nucl Med* 1990; 31: 1166-7.
6. Rao DV, Govelitz GF, Sastry KS. Radiotoxicity of thallium-201 in mouse testes: inadequacy of conventional dosimetry. *J Nucl Med* 1983; 24: 145-53.
7. Fenech M, Holland N, Chang W, Zeiger E, Bonassi S. The Human MicroNucleus project—an international collaborative study on the use of the micronucleus technique for measuring DNA damage in humans. *Mutat Res* 1999; 428: 271-83.

8. Miller B, Albertini S, Locher F, Thybaud V, Lorge E. Comparative evaluation of the in vitro micronucleus test and the in vitro chromosome aberration. *Mutat Res* 1997; 392: 187-208.
9. Albertini S, Miller B, Chetelat A, Locher F. Detailed data on in vitro MNT and in vitro CA: industrial experience. *Mutat Res* 1997; 392: 187-208.
10. Miller B, Pötter-Locher F, Seelbach A, Stopper H, Utesch D, Madle S. Evaluation of the in vitro micronucleus test as an alternative to the in vitro chromosomal aberration assay: position of the GUM working group on the in vitro micronucleus test. *Mutat Res* 1998; 410: 81-116.
11. Matsushima T, Hayashi M, Matsuoka A, Ishidate M, Miura KF, Shimizu H, et al. Validation study of the in vitro micronucleus test in a Chinese hamster lung cell line (CHL/IU). *Mutagenesis* 1999; 14: 569-80.
12. Violot D, Kacher R, Adjaj E, Dossou J, de Vataire F, Parmentier C. Evidence of increased chromosomal abnormalities in French Polynesian thyroid cancer patients. *Eur J Nucl Med* 2005; 32: 174-9.
13. Ak I, Vardereli E, Durak B, Gulbas Z, Basaran N, Stokkel Mp, et al. Labeling of mixed leucocytes with ^{99m}Tc-HMPAO causes severe chromosomal aberrations in lymphocytes. *J Nucl Med* 2002; 43: 203-6.
14. Taibi N, Aka P, Kirsch-Volders M, Bourgeois P, Frühling J, Szpireer C. Radiobiological effect of ^{99m}Techetium-MIBI in human peripheral blood lymphocytes: Ex vivo study using micronucleus /FISH assay. *Cancer Lett* 2006; 233:68-78.
15. Jacquet N, Bourahla K, Guiraud-Vitau F, Petiet A, Voisin P, Colas-Linhart N. Biological consequences of irradiation by low doses of technetium 99m: ultra structural studies, p53 protein expression and cytogenetic effects. *Cell Mol Biol* 1999; 45: 1139-47.
16. Kelsey KT, Donohoe KJ, Memisoglu A, Baxter B, Caggana M, LiberHL. In vivo exposure of human lymphocytes to technetium-99 m in nuclear medicine patients does not induce detectable genetic effects. *Mutat Res* 1991; 264: 213-8.
17. Liberatore M, Poscente M, Prosperi D, Mancini B, Iurilli AP, Donnetti M, et al. The effects of ^{99m}Tc-HMPAO- labeled leukocyte scan on human karyotype. *Eur J Nucl Med Mol Imaging* 2003; 30: 1365-70.
18. Labriolle-Vaylet C, Colas Linhart N, Sala-Trepas M, Petiet A, Voisin P, Bok B. Biological consequences of the heterogeneous irradiation of lymphocytes during technetium-99m hexamethylpropylene amine oxime white blood cell labeling. *Eur J Nucl Med* 1998; 25: 1423-8.
19. Matsushima T, Hayashi M, Matsuoka A, Ishidate M, Miura K.F, Shimizu H, et al. Validation study of the in vitro micronucleus test in a Chinese hamster lung cell line (CHL/IU). *Mutagenesis* 1999; 14: 569-80.
20. Von der Hude W, Kalweit S, Engelhardt G, McKiernan S, Kasper P, Slacik-Erben R, et al. In vitro micronucleus assay with Chinese hamster V79 cells—results of a collaborative study with in situ exposure to 26 chemical substances. *Mutat Res* 2000; 468: 137-63.