hypersensitivity phenomenon in hydatid protoscolices irradiated by alpha particles.

ظاهرة فرط الحساسية في رؤيسات السائل العدري المشععة بجسيمات الفا

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Abstract:-

The phenomenon of hypersensitivity in hydatid protoscolices ,which isolated from infected sheep livers with hydatid cysts was studied. This protoscolices were irradiated by Polonium source (^{210}Po) emitted alpha particles. The result showed that hypersensitivity occurs at low doses (0.04 mGy) which means the cells were high sensitive to the radiation. at (0.13 mGy) the cells show higher resistance for radiation .

الملخص:-

تمت دراسة ظاهرة فرط الحساسية في رؤيسات السائل العدري(المعزولة من أكباد الأغنام المصابة بالأكياس العدرية)المشععة بجسيمات الفا المنبعثة من مصدر البولونيوم (^{210}Po). اظهرت الخلايا فرط حساسية عند(0.04 mGy)وهذا يعني أن الخلايا حساسة للأشعاع عند الجرع الواطئة,وكانت أعلى نسبة مقاومة الخلايا للإشعاع عند الجرعة(0.13 mGy) .

Introduction :-

Low-dose irradiation is taking a particular importance for the time being, especially because of the observation of the hypersensitivity phenomena in the living cells win some resistance after irradiation to about 0.5 Gy, where the usual nearly exponential shape of the survival curve, represented by the survival versus dose in Gy, starts to increase at about 0.5 Gy to a higher survival rate as the dose increase before falling down in a usual manner [1].

This phenomena has been observed in conventional irradiation experiments and in micro beam experiments[2,3,4, 5, 6].

Hydatidosis (hydatid cyst disease) is a parasitic disease caused by *Echinococcus granulosus* [7]. The adult form of the parasite found in dog, fox and wolf. The larvae cause the disease in human beings, cows, sheep and other domestic animals [8]. Cysts could be also detected in the spleen, kidney, heart, bones, the central nervous system, and other organs but with less frequency [9].

Procedure :-

The samples were collected from sheep livers infected with hydatidosis from AlMuthanna abattoir. Hydatid fluid was aspirated by syringe from hydatid cyst and protoscolices were scraped from sides of germinal layer and kept in the test tubes then centrifuged at 2500 rpm for 5 minutes.

Then the supernatant discharged and the sediment used for measuring the viability of protoscolices by using Iosin stain. The red protoscolices consider dead while green protoscolices

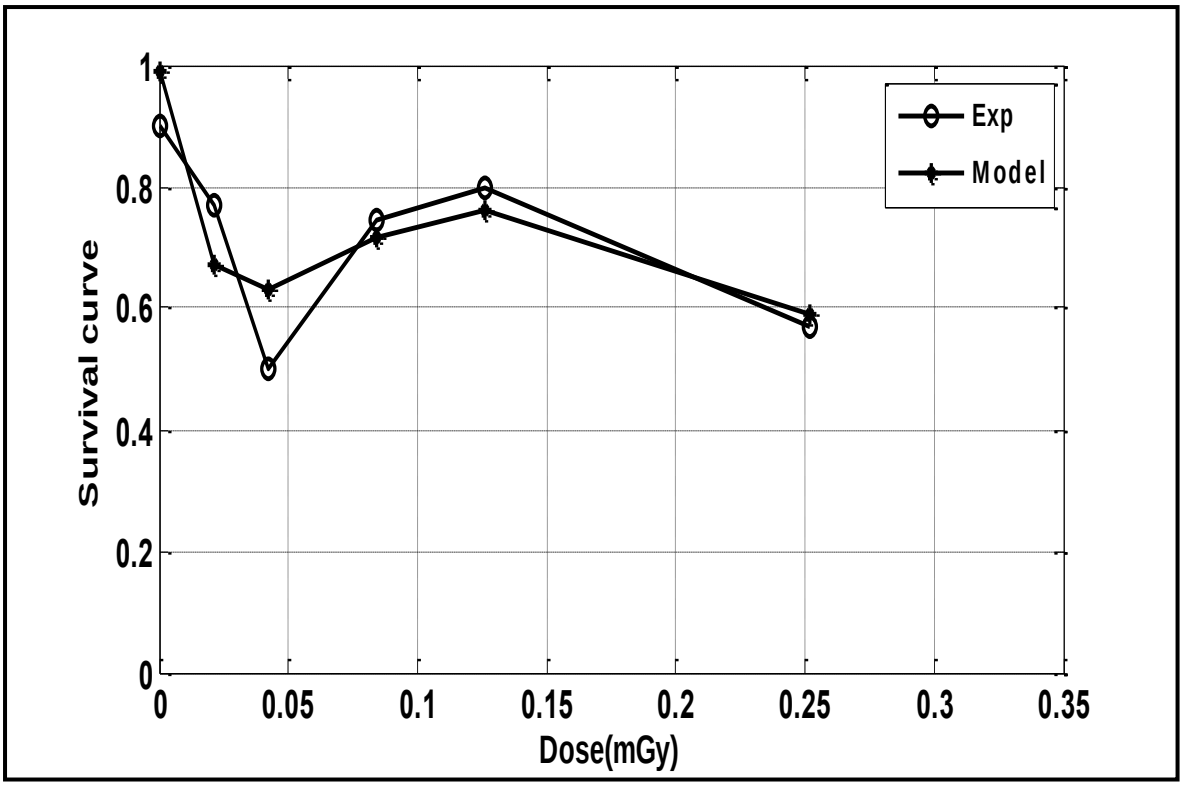
represent alive [10,11]. The Specimen examined under light microscope at (40X) then samples were irradiated for different times.
After measuring protoscolices viability, it irradiated by using ^{210}Po point source which emits Alpha particles of energy(3.34 MeV) was used for irradiation, the source was placed at (2cm) distance from the Petri dishes (without cover).The dose rate at the dish surface was calculated according to the equation (1) [12].

$D(Gy/sec) = \Phi_o \times 1.602\times10^{-10}(dT/ \rho dx)$…….(1)
D:- is the Dose.
Where Φ_o is the flux in unite of particles/cm^2.sec .
(ρ) is the air density and equal to 0.00129 g/cm^3.
dT/dx is the linear energy transfer in KeV/μm [13, 14].
Irradiation carried out at room temperature, the viability of protoscolices were measured after each irradiation time.
SF(Survival Fraction) $=e^{-(aD+bD)}+cD^2e^{-dD}$ [15] …….(2)
a=8.643, b= 8,216 , c =113,8 , d= 8,878
a= Cσ dir/LET……(2-a)
b= Cσ indir/LET….(2-b)
σ dir:- the direct inactivation cross section,
σ indir:- the indirect inactivation cross section, LET:- the Linear Energy Transfer, C is a conversion constant, The second term in equation (2) , (cD^2e^{-dD}):- describe the repair for both direct and indirect effects.

Results and Discussion :-

The percentage of survival of protoscolices versus dose of irradiation by(3.34MeV) Alpha particle was illustrated in figure (1) which revealed that the curve did not take the usual semi experimental shape of the survival curve. The percentage of survival falls down to (0.5) at (0.04)mGy and started to increase to about (0.08)mGy, then reach to maximum at (0.13)mGy

Then started to decrease slowly, this implies that the protoscolices had gained some resistance against radiation similar to the mentioned by Azooz.[1] who showed that hypersensitivity in mammalian cells occurs at about(0.5)Gy.
Table (1) shows the phenomenon of hypersensitivity by using Haval model[15] while figure (2) shows the match this model with the data we have obtained.



Figure(1) The relationship between survival percentage of protoscolices and dose of irradiation(mGy)

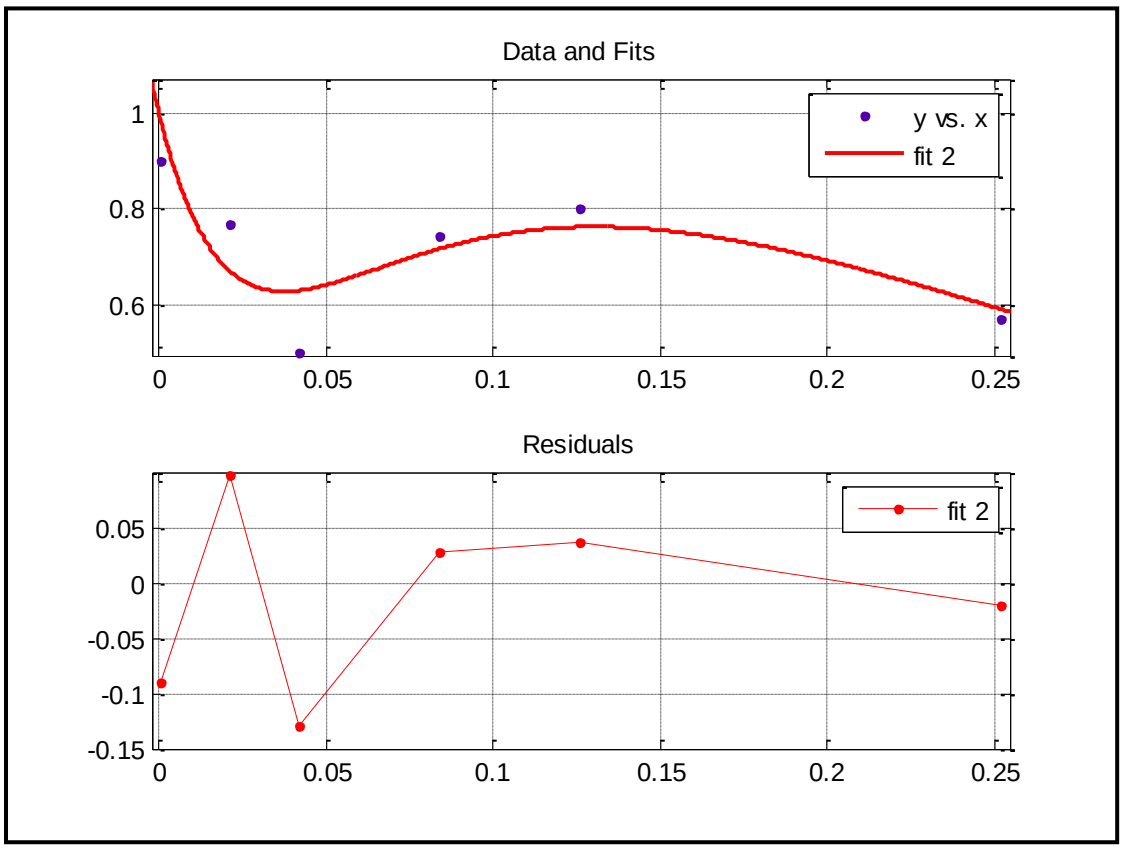


Figure (2) The relationship of the fitted of data with the results of the model

Table (1) Relationship between alive protoscolices percentage, the dose and the time.

Survival percentage of protoscolices (%)	Dose(mGy/sec)	Time(sec)	Time(min)
90	0.35	0	0
77	21	60	1
50	42	120	2
74.5	84	240	4
80	126	360	6
57	252	720	12

Conclusion

- 1- Hypersensitivity phenomenon of Hydatid protoscolices appears at very low dose (0.04 mGy)
- 2- Highest dose in which cell's resistance to radiation increase to (0.13 mGy)

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