Study on Calculation method of Adhesion of cancer cells with Tumor thrombus

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Keywords: Tumor thrombus, the adhesion, Attack the flow around a diffusion process under non-equilibrium distribution function, the tumor doubling

Abstract. During tumor thrombus formation in the cell disease or malignant cancer cell adhesion,it can impact to the invasion of the blood flow around,and Discusses the drug molecules into the tumor tissue, in the law of non-equilibrium diffusion process to identify drug molecules, and tumor tissue of the collision, Find the distribution function of tumor thrombus, to predict the tumor growth, doubling the situation.

Introduction

The Problem Based Learning (PBL) Tumor thrombus formation in cancer cells is not only related to the internal structure, but also in order to adapt to changes in the build environment, it will be subject to internal pressure with the blood pressure deformation, Any deformation of a small micro-group available works linear strain expressed,Due to the laminar flow of blood viscosity, and cell isotropic motility, We use Bernoulli's theorem to the viscous resistance of the induction and regulation,That can be studied on the atomic scale simulation of Stress Analysis of deformation of tumor cells and within the organization by Molecular dynamics and Monte Carlo methods, Therefore, we have established cancer the end of the film image analysis model by Probabilistic cellular automata simulation, and product reference Boltzmann equation,it can to find out

The invasion of cancer cells within the blood flow around analysis

We have chosen the cervical TCT report, as shown in Figure1:

Figure 1 Normal cells

vaginal endocervical cell specimens, If normal cells be attacked from virus, with vascular pressure and deformation, induce capillary cell generation, it can provide nutrition for the growth of malignant tumors. Because that gene sequences and expression regulation of protein sequences affect the viscosity of blood, laminar and turbulent relationship, and change, Because the blood fluid movement with the second law of thermodynamics, the blood viscosity flow equation can be expressed as[1]

$$\frac{dv}{dt} = \gamma\nabla^2 - v\nabla v + \frac{1}{\rho}\nabla\rho$$

In where , v is Flow velocity

Invasion of the flow around a rotation In vivo growth of cancer cells:

$$\lim_{s\to 0}\frac{\oint \vec{v}\vec{dl}}{s}$$

At a temperature of T in body fluids,when a cancer cell particle is moving in body fluids, It receives the viscous resistance of liquid and applied to cancer cell particle reaction,then Cancer cell particle Brown motion equation:

$$m\frac{d^2x}{dt^2} = -f + F_x(t)$$

Reference microcanonical system particle number fluctuations caused by energy fluctuation, Partial differential equations is established:

$$\frac{1}{r}\frac{\partial}{\partial r}(r\frac{\partial\varphi}{\partial t}) + \frac{1\partial^2\varphi}{r^2\phi^2} + \frac{\partial^2\varphi}{\partial z^2} + c = 0 \qquad (1)$$

Due to stickiness flow the flow of a fluid,we can get a speed change rate covering from One layer to another layer:

Velocity gradient:$= \frac{dv_x}{dz}$

While the inner friction force is :

$$f = \eta v_x t\frac{dv}{dz}$$

And then the transport problem:

$$u_t = a^2u_{zz} + bu_x \qquad (2)$$

Cancer embolus boundary conditions uses displacement and stress boundary conditions and mixed boundary condition, We derive the time-dependent Schr dinger equation:

$$-\frac{\hbar^2}{2m}\nabla^2\varphi(r,t) + v(r)\varphi(r,t) = i\hbar\frac{\partial\varphi(r,t)}{\partial t} \qquad (3)$$

Considering the simulation of diffusion phase transition and competitive particle ripening process

We use the true potential function, that Vortex field potential value Available integral equation in peripheral blood:

$$u = \oint(G\frac{\partial u}{\partial n'} - u\frac{\partial G}{\partial n'})dt$$

therefore, the definite solution problem in three dimensional stability of eddy current field:

Helmhdtz equation:

$$\nabla^2u(x_1, y_1) = 0 \qquad x_1, y_1 \in \Omega$$

Tumor Cell Growth Kinetics

Tumor invasion of liquid can be thought of as Isotropic and Continuous body of Anisotropic linear elastic unbounded uniform, It has a stick shape of transfer and flow characteristics.

That tumor blood vessel Growth of dislocations in the field of dislocations can be used in analytic function of complex variable as tectonic stress function based, The rate of tumor growth is minimal in a single connected domain,the potential movement is the kinetic energy of the smallest movement, Its growth rate and blood flow with the stick shape force is concerned,its can be expressed as:

$$\frac{dv}{dt} = r\nabla^2v + \frac{1}{\rho}\nabla\rho + f$$

In where, f is Static pressure, ρ is quality, there is the flow field in the presence of potential motion, It is characterized with mass conservation, Its Euler - Lagrange (Euler - Lagrange) function is expressed as:

$$L = \sum_{i}^{N} m_i D^2 q_i^{'} + \frac{M}{2}\Omega^2 - \Omega..p_0$$

In where, M is Effective mass of analog cellular, Ωis analog cellular size, q_i is Coordinate variables, We use a variety of possible mixed boundary conditions, then the potential kinetic energy is expressed as::

$$T = \frac{1}{2}\rho\int_{v}[(\frac{\partial\phi}{\partial x})^2 - (\frac{\partial\phi}{\partial y})^2]dxdy$$

Using the second law of thermodynamics, considering the blood fluid by stick shape influence, free energy F special function, then the acceleration and the stick shaped relationship can be expressed as:

$$dF = sdT - adA$$

In where, $S = -(\frac{\partial F}{\partial T})_A, a = (\frac{\partial F}{\partial A})_T$

Then, $F = aA + F_a$

Internal energy change:

$$dU = Tds + pdv - \mu dn$$

In where, $\mu = (\frac{\partial U}{\partial n})_{s,v}$ is Chemical potential ,

The above formula is similarity with multipole theory explains the eddy current field, The diffusion process of quality change rule:is :

$$dm = -H(t,x,y,z)\frac{\partial u}{\partial n}dsdt$$

Combined with free boundary condition:

$$\phi(x,y) = g(x,y)$$

In where, ϕ is Potential function,So then Tumor cell reaction diffusion theory can be expressed as the more commonly used Onsager diffusion formula:

$$\frac{\partial\psi_i}{\partial t} = \hat{M}_{ij}\frac{\delta\overline{F}}{\partial\varphi}$$

In where, $\hat{M}_{ij}$ is symmetric the Onager dynamics operator matrix, i=1,2,3,……, $\overline{F}$ is is a different function, ψ_i is the free energy functional, $\frac{\delta\hat{F}}{\partial\varphi}$ is Forces learn the function of the driving force,.

Phase transition from α phase to β-phase, assuming that the intrinsic proliferative potential phase transition for L, we can derive the tumor thrombus formation,then Kela Bai Long equation:

$$\frac{dp}{dT} = \frac{L}{T(v^\beta - v^\alpha)}, \qquad \delta F^\alpha = p^\alpha\delta v^\alpha - \mu^\alpha\delta n^\alpha, \qquad \delta F^\beta = p^\beta\delta v^\beta - \mu^\beta\delta n^\beta,$$

$$\delta F^\gamma = \sigma\partial A,$$

$$\delta F = \delta F^\alpha + \delta F^\beta + \delta^\gamma = [(p^\alpha + p^\beta) + \frac{2\sigma}{r}]\delta v^\alpha - (\mu^\alpha - \mu^\beta)\delta n^\alpha$$

According to the characteristics of the spherical volume, we can draw the phase equilibrium conditions of the spherical tumor thrombus [2]

$$RT\ln\frac{p^{'}}{p} = v^\alpha[(p^{'} - p) - \frac{2\sigma}{r}], \quad \frac{p^{'}}{p} = e^{\frac{v^\alpha 2\sigma}{RTr}}$$

Reaction diffusion equation of the tumor cells

When the anticancer drug molecules overcome the physiological barrier, to enter the block within the tumor tissue, Anticancer drug molecules and tumor cells are in non-equilibrium in the tissue space, Because of the larger organizational gap distance and pressure of the mass transfer, that the nature and variation of the distribution function of the tumor thrombus is a great difference apparent equilibrium conditions, there are three mechanism of tumor thrombus of affect the tumor thrombus, They are the speed of drug molecules to change the location of the tumor tissue; Collision between the drug molecules and tumor; Heterogeneity of the blood supply.

We use x , y , z , ω_x , ω_y , ω_z , T_x , T_y , T_z to discuss the distribution function:, $f(r,w,T,t)dwdVdT$ can indicate the number of molecules of Studied systemat in Volume element $dV = dxdydz$, temperature intervalat $dT = dT_X - dT_y - dT_z$ and Velocity interval $dv = dw_x dw_y dw_z$ at time t, Tumor growth in non-equilibrium state, that the number of drug molecules in the dw in the same volume element dV and the same velocity interval become : $f(r,w,T,t+dt)dVdvdT$

When dt is very small, the increment of the number of molecules take the Taylor series,then $\frac{\partial f}{\partial t}dtdVdvdT$, Drug net number of molecules into the dVdw within as follows,

$$[\frac{\partial}{\partial x}(fw_x)+\frac{\partial}{\partial y}(fw_y)+\frac{\partial}{\partial z}(fw_z)+\frac{\partial}{\partial w_x}(fa_x)$$

$$=\frac{\partial}{\partial}(fa_y)+\frac{\partial}{\partial}(fa_z)]dtdVdvdT$$

a_x indicates that the component of acceleration in the x direction, the drift is rate of change of this type for the distribution function:

$$\left(\frac{\partial f}{\partial t}\right)=(w_x\frac{\partial f}{\partial x}+w_y\frac{\partial f}{\partial y}+w_z\frac{\partial f}{\partial z}+\frac{X}{m}\frac{\partial f}{\partial w_x}+\frac{Y}{m}\frac{\partial f}{\partial w_y}+\frac{Z}{m}\frac{\partial f}{\partial w_z}+dT\frac{\partial f}{\partial x}\frac{\partial f}{\partial y}\frac{\partial f}{\partial z}$$

Drug molecules flow to the wall outside infiltration with the blood,mainly continue to move by diffusion in the drug molecules and tumor tissue collision,figuere2,

(Round 1on behalf of the drug molecules
Circles 2 represent the tumor tissue)

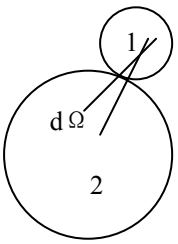

figure 2 drug molecules and tumor tissue collision

When the number density is small, the movement of

molecules is chaotic In addition to the collision instantaneous molecular is no contact between the velocity and position, Therefore, the velocity distribution of each molecule is independent and not associated with, so the number of collisions of the drug molecules are:

$f_1 f_2 dv_1 dv_2 d\Omega dtdVdT$,

Then, we need to consider the impact of the drug molecule collision distribution function of the tumor thrombus, The placement of drug molecular weight m_1 , part of the quality of tumor tissue involved in the collision is m_2 , the collision speeds before and after are v_1 , v_2 , By the assumption of elastic collision, it should be

$$m_1 v_1 + m_2 v_2 = m_1 v_1^{'} + m_2 v_2^{'}, \qquad \frac{1}{2}m_1 v_1^2 + \frac{1}{2}m_2 v_2^2 = \frac{1}{2}m_1 v_1^{'2} + \frac{1}{2}m_2 v_2^{'2}$$

the use of molecular chaos assumptions,we can get arrive at changes in the distribution function of the tumor thrombus

$$\left(\frac{\partial f}{\partial t}\right) = \int\int \left(f_1' f_2' - f_1 f\right)(w_1 - w_2) dv d\Omega dT$$

The clinical description of anti-cancer drugs are much better than the poor results of in vitro test

Simulation of the dynamic process of tumor growth

The use of molecular chaos theory, it can suggest that the blood vessels fill with each part of the body, The tumor cells have a sensitive dependence on initial conditions in the growth process, The movement of the tumor cell population four kinds of at least, Periodic motion, quasi-periodic movement, balance, movement and chaotic motion, Growth doubling time is non-cycle, The growth trajectory is very unstable, we can find method of the Lyapunov exponents, for example,cervical cells are infected by Human Papillomavirus, Existence of the following iterative relations,

$x_{n+1} = \mu x_n (1 - x)$,Promote the application to three-dimensional,

$$\frac{dx}{dt} = 10.5(y - x), \frac{dy}{dt} = 45.82x - xz - y, \frac{dz}{dt} = xy - 5.0x$$

Then it can draw a number of consecutive location of Untreated tumor emboli, as shown in Figure 3,

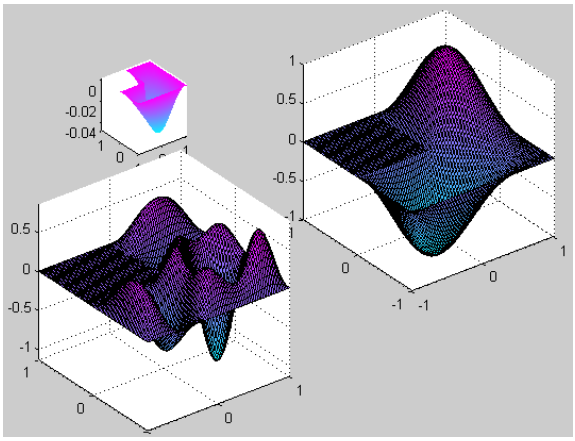

figure 3 tumor rapid growth predictions

tumor thrombus size in mm.

Tumor growth can be predicted. Reflects the non-quantum particles, Embodies the basic principles of energy rely on the basic principles of its energywhich is Non-quantum particles, the probability distribution of the index,it can be linked to the transition probability, the total energy of the massive tumor,

$$Q = \sum_{k=1}^{N}\sum_{l=1}^{N} f(k,l)h(k,l,i,j)$$

Figure 3, the image format is S × S, the recovery of the image can be written as:

$G(i,j) = h(n,w)\cos(\mu n + vm)$

In where, n is the noise, and G for the process image, h is the target image, K-th tumor thrombus particles was reinstated images of the formation[4]

$$g_h(i,j) = \hat{F}(i,k)\frac{1}{i_T}\sum_{m=0}^{i_T-1} e^{-n\frac{2\pi m}{n}k}$$

This is cancer the end of the film image analysis model correspond to with non-cancerous normal cells in Figure 1.

Summary

In this paper, the characteristics of the invasion of cancer cells is identified in the blood flow around by Analysis of tumor emboli boundary conditions,then it has stick-shaped, passing and mobility characteristics, Deduced the formation of the tumor thrombus to identify the tumor thrombus and the role of drug molecules, the nature of the distribution function of the tumor thrombus, for example chaotic motion, according to the differential equations of the probabilistic cellular automata simulation of local transformation rules, and make the overall transformation rules Functional expression experiments,it can be drawn from the existence of chaotic attractors, providing a forecast of tumor thrombusgrowth and loss..

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Published by Atlantis Press, Paris, France.