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MOLECULAR AND GENETIC ASPECTS OF SENESCENCE

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INTRODUCTION

Senescence is the last stage of the physiological development of the human body, in which the cell division stops and the accumulation of damaged cells takes place. Trigger factors are DNA damage, telomere shortening, activation of oncogenic mutations/inactivation of tumor suppressor genes.

KEYWORDS

Senescence, oncogenic mutations, DNA, aging, cancer.

PURPOSE

The correlation between the molecular-genetic aspects of senescence and the exponential increase in the risk of developing malignant tumors with age.

MATERIAL AND METHODS

Analysis of 25 PubMed scientific articles.

RESULTS

Senescence has an impact on aging through 2 mechanisms:

1st With age senescent cells accumulate in tissues, maintaining their status like this for years, affecting the normal structure and function.

2nd Senescence can limit the regenerative potential of adult stem cells.

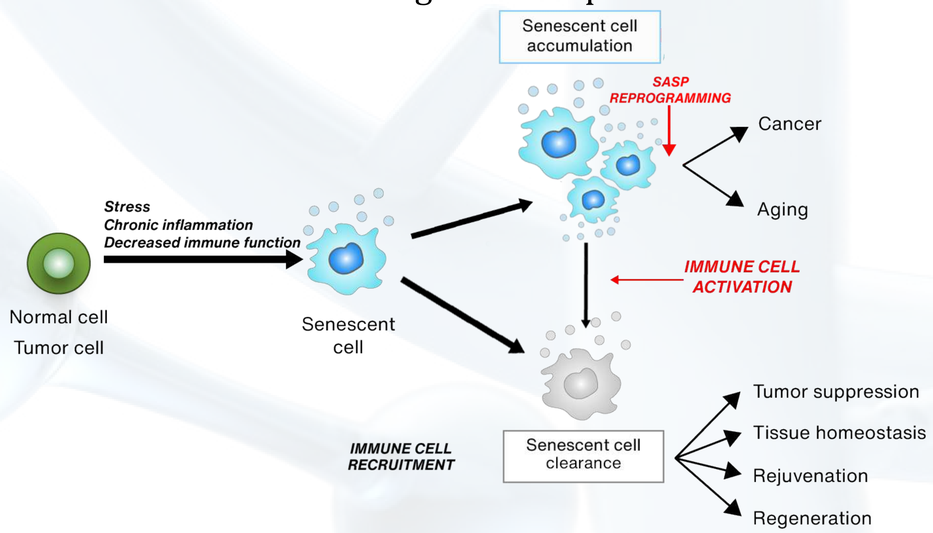

Figure 1. Clearance of senescent cells.

Inside the Cell, Volume: 1, Issue: 2, Pages: 87-95, First published: 12 January 2016, DOI: (10.1002/icl3.1046))

One explanation is that aged organisms accumulate more genetic, epigenetic changes than young do. Having shorter telomeres, higher levels of damaged DNA, aged organisms are more resistant to oncogene proliferation than young are. Studies have shown that a higher incidence of malignancies in old age reflects the time required for the accumulation of oncogenic mutations.

Figure 2. A simplified view about aging and cancer.

Illustration is modified and based upon Finkel T, Serrano M, Blasco MA. The common biology of cancer and aging. Nature.

Besides aging and cancer, the same mechanisms of cellular senescence can contribute to the development of cardiovascular diseases, atherosclerosis, type 2 diabetes, osteoarthritis, sarcopenia, neurodegenerative disorders etc.

CONCLUSIONS

Despite the fact that the genetic program in Homo sapiens provides a longevity of 140 years, the average age is 72.28 years (according to United Nations, World Population Prospects 2019). Numerous genetic factors both inherited and acquired, internal and external environmental factors can accelerate program depletion, cell senescence, aging of the body and the development of cancer.

Considering that senescence can have both beneficial and detrimental effects, pro-senescence and anti-senescence approaches could improve research into the treatment of the age-related diseases, prevention of many geriatric problems and improving the general health span of aged individuals.

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