



## **A Review on Age- Related Changes**

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### **ABSTRACT**

*Aging is inevitable and irreversible. Health care sector is advancing with technological evolutions towards preventive treatments. Focus on early detection is gaining momentum to curb the raising disease burden. Improvisation in the quality of life beyond extension of the life span is of utmost significance for sustainable stability. Knowledge is essential regarding the physiological deteriorations and biological aspects of aging as its extent which is a consequence of combination effect by genetic and environmental factors along life style is necessary for assessment and understanding is crucial for successful coping of the challenges faced by the elders. Health care for senior citizens also needs specialized concern due to the fact that their care gives take part in the decision- making of treatment plan in most cases where patient's autonomy also requires consideration. A comprehensive understanding about the changes taking place with ageing is very much important to incorporate newer innovations in health sector for progress in the care delivery systems. Thus, this paper reviews the past literatures to gain information on the transitions which take place with ageing in terms of biological, physiological and immunological aspects.*

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### **INTRODUCTION**

Changing demographic trend resulting in increased population density of geriatric population has resulted in representing them under area of prioritization to provide care for which thorough knowledge about ageing and associated disorders is essential. Furthermore, aged individuals may not be compliant to lengthy investigations and aggressive or intensive invasive procedures due to comorbidities and hence comprehensive assessment which takes in to account all the relevant factors of their presentation is the need of the hour for accuracy in identification of etiology as well to bring out desirable treatment outcomes. The presenting features of different conditions may be similar that necessitates comprehensive understanding about the elderly. There would be greater demand of health services for the new generation elders than in the past as the former is educated which induce change in their behaviour and attitude in turn significantly impacting oral health care needs particularly prioritizing retention of natural teeth which despite creates challenges for dental health professionals is facilitated with the advent of latest innovative technologies than the latter populace. Geriatric medicine deals with the diagnosis, management and prevention of diseases in older adults incapacitated to illnesses due to coexistence of frailty and disability with focus on their overall well-being especially functionality improvisation by interventions of a multidisciplinary team.

### **Biological basis of Ageing**

Numerous cells and tissues undergo random molecular alterations which fail to respond for multiple reparative and maintenance mechanisms as a result of which impairments occur due to chronic oxidative damage by the action of free radicals produced as transient intermediates in aerobic cellular mechanism characterized by imbalanced homeostasis as mentioned in a study by Sohal in 1993 [1]. A strong *in vivo* correlation between erythrocytes and maximum life span exists in addition to invitro relationship of fibroblasts with the population doubling capacity. There is a failure of the scavenging system and decline

in enzymatic actions to compensate for all the wear and rear processes. The nuclear chromosomal DNA causes mutation resulting in decreased efficiency in the functional ability of genes as stated by Henshaw et al in 1974 [2]. The genes accountable for coding the ribosomal RNA are depleted markedly with age in the nerve cells. Telomeres which are significant for the preservation of biological clock of the body get eroded and shortened in length with time in ageing individuals. Mitochondria which is regarded as the power house of the cells produce less cellular energy and ultimately leads to death in addition to degeneration of proteins. The inquisitiveness on the cause of senescence and demise has always been an interesting area for several researchers for which about 300 different theories are proposed by Medvedev in 1990 [3]. Metabolic alterations with age include decrease BMR with reduction in standard cell water. Basement membrane changes and those affecting the transportation of oxygen, nutrients, hormones and enzymes take place with progressing age. Brown atrophy occurs leading to discolouration of cerebral, cardiovascular and skeletal tissues. Survival of the fittest theory, disposable soma theory by Kierkwood, cross-linking theory in which collagen increases in quantity with more stability making it function in an improper manner are few age- related alterations to be noted while Frolkis VV in 1966 suggests that aging is due to impairment of coordinating or adaptive mechanisms and Shock in 1977 states that multiple complex functions deteriorate with age [4-6]. There is a reduction in the maximum breathing capacity as a consequence of declining neuronal control and adaptive ability to extreme temperatures with age caused by impaired thermoregulation accompanied by reduced responsive capacity of the sweat glands and faint sensory perception. Other autonomic nervous system dysfunctions include orthostatic as well as postprandial hypotension and urinary incontinence that could also be caused by bladder dysfunction. Most of the hormonal changes are subtle while there is a definitive decline in the immunological response and osteoporosis as a consequence of deterioration in the functioning of neuroendocrine regulatory system as reported by Sapolsky et al in 1986 [7]. The role of environment especially the effects of pollution modulating the aging process needs concern. With increasing age, the sympathetic nerve activities increase excepting at certain sites for an instance where cardiac tissues exhibits minimized response to norepinephrine and in terms of parasympathetic system, though meagre is known in the literatures, muscarinic responsiveness is reduced.

### **Physiology of Aging**

Shock in 1962 has quantified the physiological deteriorations occurring with aging in the presence of pathologies [8]. Rowe and Kahn in 1987 suggested that primary aging causes lesser variations and thus termed it as successful aging which is intrinsic while usual aging is characterized by marked changes [9]. The latter alterations could also be due to interaction between lifestyle and the environment followed by collapse of coping mechanism. The central nervous system gradually loses its cognitive ability with advancing age commonly resulting in alzheimer's disease while the gross structure is morphologically reduced which is evident in MRI and CT as stated in studies done by Haug H, Jernigan TL and DeCarli C in 1985 and 1990 respectively in addition to minor lowering of cerebral blood flow as reported by Hoyer et al in 1990 [10-13]. There is change in the processing pace of psychomotor skills which is evident in EEG as reduced cerebral rhythm having a potential to impact decision making in the aged apart from the neurotransmitter systems. The postural responses are altered in geriatric population due to increased muscular weakness and decreased strength as a result of which impaired fine motor activities, tremor, frequent falls, diminished ankle jerks, Parkinson's disease needs concern. However, it is suggested by Alshuaib WB in 1990 that exercising could retard age related changes at the neuromuscular junctions which is also correlated to stress induced cardiovascular failure as reported by Lakatta EJ in 1990 [14,15]. There is marked reduction in the secretion of glucocorticoids in response to stress among the aged as concluded by Finch CE and Sabatino F in 1990 and 1991 [16,17]. The CVS is characterized by reduction in the intrinsic sinus rhythm with increasing age in addition to arterial alteration resulting in its stiffness. Presbycusis leading to progressive hearing loss affecting speech frequencies, decreased olfaction however intact tastes perception and visual problems such as cataracts, glaucoma and macular degeneration are some of the common changes related to the sensory system in the elderly requiring timely care. The total daily sleep with age increases. Naps and frequent awakening are more common in the elderly during the day and night times respectively apart from interrupted episodes as proven in electroencephalographic studies. The pulmonary functions are also influenced by environmental factors as decline with age which is still further on usage of tobacco as stated by Burr ML et al in 1985 [18]. A good predictor of mortality is the reduction in the vital capacity of the lungs as found by Kannel and Hubert in 1982's Framingham Heart Study [19]. Morphologically the surface area decreases for gaseous exchange along the compliance of the chest, airflow velocities, tidal volume and diffusion capacity as reported by Krumpe PE in 1985, Webster in 1991 and Brischetto MJ in 1984 [20-22]. The renal changes include reduction in the number renal cells, glucose reabsorptive transport, blood flow and increase in the size of the individual cells. The glomerular filtration rate declines at a rapid rate which is evident from the findings of the Baltimore longitudinal study

of ageing by Rowe JW et al in 1976 [23]. The blood pH is lowered and the duration at which the bicarbonate concentration in response to acid load is longer. Minor changes in the gastro intestinal tract includes altered swallowing, disordered oesophageal contractions, spontaneous gastroesophageal reflux, reduced HCL and pepsin secretions with delayed gastric emptying and minor intestinal morphological changes occur in the aged individuals than the young. Dietary fat and protein digestive pattern like 100 grams of the former are not different with age which might however alter with increased intake but the ability to digest lactose and absorb calcium is very compromised. It is important to keep in mind that hypothyroidism is more prevalent in old than young. There is functional change of the thyroid gland with age which is indicated in a study by Runnels BL et al in 1991 [24]. The other changes are decreased plasma concentration of T3 and T4 while elevated TSH found in those elders having normal plasma concentration of T3 and T4 as the young. The secretion of growth hormone tends to decline with age. Alterations occur in the hypothalamic-neurohypophyseal vasopressin which is also the antidiuretic hormone in terms of its secretion that plays a vital role in osmotic balance, regulation of the blood pressure and sodium homeostasis. Few target tissues in the aged appears to show blunted response to epinephrine which is important for visceral functioning. According to Laws A in 1990, glucose intolerance increases in prevalence with age because of resistance to insulin action caused by factors associated with aging such as polypharmacy, multiple chronic comorbidities and adherence to sedentary life style in addition to compromised hepatic glucose production due to transformation in the secretion of glucagon [25]. Loss of bone mass also called osteopenia occur increasing the risk of acquiring fractures as stated by Mooradian AD in 1988 [26]. Thinning of the cortical plate with increase in porosity occurs with age in both sexes but the compensatory periosteal bone expansion in males maintains its strength which is absent in females despite acceleration of fragility by estrogen thus increases their vulnerability. The trabecular width decreases in male whereas in females, reductions in numbers are evident. The serum parathyroid hormone increases significantly and plasma calcitonin response to calcium intake wanes with age per studies by Sherman SS and Deftos LJ in 1990 and 1980 respectively [27,28]. Osteoid and hematopoietic tissues decrease in volume with increase in the content of adipose tissues. Other hormonal age related changes include decreased levels of androgen and estrogens in males and females respectively. Plasma prolactin levels increase and bioavailable testosterone markedly reduce in elderly men while gonadotropins concentration increase in the aged women. Despite decline in muscle mass, centralization and internalization of fat mass occurs in the older adults and this distribution pattern could be risk factor for numerous lifestyle disorders.

### **Immunological Aspects of Aging**

A scientifically proven established link exists between the host immune response and oral diseases such as dental caries and periodontitis. Age related decrease of the former influences the incidence and severity of the latter as suggested by Caton JG in 1991 [29]. The immune response system undergoes modulation leading to impairment of defence mechanism thus bolstering it may be the future treatment of disease especially paving ways through methods for delaying and prevention. There is a limitation of the stem cell reserve which could be contributory to osteopenia. The phagocytose potential of the neutrophils are reduced. Macrophage interaction with lymphocytes appears to be reduced with age due to defective interleukin production. Bradley and Terpenning in 1990 suggested that older people show febrile response to infection [30]. The levels of IgG and IgA immunoglobulins elevate with advancing age and there is susceptibility for idiopathic paraproteinemia. B cells undergo qualitative changes with impaired response to T-cell dependent antigens as per Callard RE in 1978 [31]. An onset of decline in the antibody response is evident in the elderly. Aging of the thymus take place and it also affects the proliferative capacity of T cells and may increase the vulnerability for septicemia and pneumonia leading to mortality as per a study done by Anusaksathien O in 1992 [32]. T cell deficiency fails to protect against opportunistic infections. An immune system change thus predisposes the elderly to a wide range of infections where membrane level changes like the receptors alter cellular and molecular interactions causing immune complex diseases. Age related increase in facultative pathological autoimmune disorders is due to aberrant immune-regulation of antibodies.

### **CONCLUSION**

It is important to understand the changes taking place in the elderly in order to deliver appropriate treatments with ensured success rates and to provide timely preventive interventions as this group is highly vulnerable. As ageing is a natural process that occurs in senior citizens which is inevitable and global, knowledge about the alterations is essential to develop standardized holistic care approaches for evidence based practice and it helps researchers to unite for developmental progress targeted towards improvising the quality of life. The different changes in an elderly person affect their knowledge, attitude, perception and behaviour towards health care and it has an impact on their management and long- term follow-up care services. It influences the interaction of polypharmacy taken for multimorbid conditions. It also helps

in risk profiling both at individual as well as community levels in terms of early diagnosis and prompt treatment and target oral health polices, programmes and promotion so that the most susceptible individuals are prioritized for care services. It also enables inter-sectoral coordination and facilitates effective multidisciplinary health care team approach led by the primary care physician especially in terms of planning, organizing, implementing, monitoring and evaluating health services for the delivery of curative, preventive and rehabilitative treatments.

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