The Pharma Innovation Journal 2023; SP-12(12): 1281-1283

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(12): 1281-1283

www.thepharmajournal.com
Received: 20-09-2023
Accepted: 25-10-2023

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Review on care and management of geriatric pet animals

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Abstract
Aging is physiological process that comprises molecular, cellular and organ-specific change that occurs to all living organisms which directly related to lifespan and all age-related diseases to all living beings. With advanced age animal's body organ systems experience wear and tear resulting in an overall decrease in the function of organ systems. There is progressive decline in the function of the digestive tract, immune system, kidneys, and other organs. Effects of aging takes place on various systems including cardiovascular system, renal system, hepatic system, musculo-skeletal system, eyes and ears. A complete examination including blood test might reveal various sub-clinical problems that could be resolved with dietary modification in ageing animals. In geriatric pets animal, anemia, hypoalbuminemia, hypokalemia, increased serum creatinine or hyperglycemia may indicate various diseases that could managed from dietary modification as part of the management, which could be diagnosed though routine hemato-biochemical examination.

Keywords: Aging, geriatric, osteoarthritis, aggression

Introduction
"Aging is not a Disease", it is a natural phenomenon that occurs to all residing organisms. Ageing is a physiological process which contains molecular, cellular and organ-unique exchange which might be without delay linked to lifespan and all age-related disease to all living beings. As pets age, they undergo each physical and metabolic modifications which affect most in their body systems. According to American Veterinary scientific association (AVMA) dogs and cats are considered as seniors approximately on the age of 7 years, moreover it depends on the size and breed of the dogs and cats. Very large breeds go through ageing more rapidly than smaller breeds of dog. Getting old is a principal element of various age-related sicknesses in pets like neuro-degenerative diseases, cardiovascular diseases, neoplasms, immune system problems, and musculoskeletal problems. Biological ageing is one of the most important risk component for diverse ailment, disability and death in geriatric pets [22].

Physiological changes associated with aging in pet animals
As animals age, body organ systems experience wear and tear, ensuing decrease in the characteristic of organ structures. Consequences of ageing on the cardiovascular system can lead to decrease in blood flow and baro-receptor activity. There might also be an increase in circulatory time and vagal tone. There can be changes within the vasculature that might consist of thickened elastic fibers, increased wall collagen and wall calcification, which affects normal blood flow. Loss of elasticity results in dilatation of vessels, as a result there will be increased impedance to left ventricular output and progressive hypertrophy of the ventricle. That might occur as a consequence of hypertension. With increase age there is reduction of adrenergic receptors in the coronary heart, peripheral vasculature and kidney. This leads to a decreased in heart rate, increased preload on the right atrium and decreased ejection fraction. Thus, the geriatric patient is dependent on preload and is less tolerant of volume depletion in comparison to a younger animal [1].
The kidneys undergo significant aging process prior to onset of any clinical signs. Normally, functional nephrons decreases by 50% in the aging animal. Cardiovascular changes can lead to a considerable decreased renal blood flow and a reduction in glomerular filtration rate. Further, the renin-angiotensin system can become less responsive in older animals which subsequently affects in sodium and water retention in the body.

All this phenomenon creates a physiologic alterations in geriatric patient and hence the body is less able to tolerate hypovolemia, hemorrhage, electrolyte and acid-base disturbances [1]. Hepatocytes also undergo a significant change with age. Geriatric animals may have a decrease in liver mass along with a subsequent decrease in hepatic enzymes. This results in a decrease in the rate of drug metabolism and excretion. With a decline in cardiac output there is a decrease in blood flow to the liver, thus the delivery of drugs for metabolism and excretion slows down. Ocular changes like cataract formation, glaucoma, iris atrophy and macular degeneration can be found in the geriatric animal. Some of these changes are very painful. Further, the visual compromise might affect the behavior of the animal and could affect social status in a group [22]. Osteoarthritis or degenerative joint disease which is a common finding in geriatric animals. Osteoarthritis is associated with inflammation and an increased degradation of proteoglycans from the extracellular matrix, resulting in a breakdown of articular cartilage. Age can also have an overall effect on body conformation and metabolism. Older animals tend to have less muscle mass and a larger percentage of fat. These changes can affect the distribution of fat-soluble or water-soluble drugs in body of geriatric animals. The basal metabolic rate and thermoregulatory ability also decreases with advanced age [22].

Nutritional care for aging animals

Body weight and body condition are important parameters to monitor with advanced age. Through diet history is an important part of the health assessment in geriatric animal [22]. Older animals tend to have reduced energy needs and tends to gain weight [22]. With advanced age, there is a considerable progressive decline in the function of the digestive tract, immune system, kidneys, and other organs. A complete examination including blood test should be done to reveal any sub-clinical problems that could be resolved with dietary modification. Some clinical findings such as anemia, hypoalbuminemia, hypokalemia, increased serum creatinine, or hyperglycemia may indicate problems that could managed from dietary modification as part of the overall medical management, which could be diagnosed though routine hemato-biochemical examination [14]. In addition to hemato-biochemical examination, muscle mass should be evaluated in older animals. Older animals may lose lean muscle mass despite an abundance of body fat. This decrease in lean muscle mass along with a decline in activity, contributes to the reduction in maintenance energy requirements [10, 11].

Protein is an important nutrient for aging animals. Synthesis of new protein is required by the body and it could be achieved through protein metabolism cycle [2]. When dietary protein is insufficient both catabolism and synthesis process is decreases which results body to mobilize protein from lean body mass to support essential protein synthesis. Overall, the dietary protein requirement of geriatric animals is higher than that of adult animals [22]. The effects of sub-clinical disease on geriatric animal can impair the nutrient balance. Poor absorption or increased loss of water-soluble or fat-soluble nutrients can occur with sub-clinical gastrointestinal disease or with polyuria. Approximately, 30% of geriatric domestic cats have a decreased ability to digest dietary fats. Hence supplementation of these nutrients is necessary in geriatric animals [22].

Common Behavior Problems in senior dogs

Senior pets undergo both physical and metabolic changes with advanced age that affect most body systems. These types of physical and metabolic changes can manifest in terms of alterations in behavior in pet animals. Each body system can result in different metabolic and behavioral abnormalities [15]. Older dogs show arthritis of their joints and/or spondylitic changes in the spine and a decrease in muscle mass. These will affect the mobility of the animal. Geriatric dogs also experience alterations in the visual system and most common change is nuclear sclerosis. Additionally, the formation of age related cataracts results in a functional vision loss [8]. Changes in the central nervous system include a decrease in white and gray matter [7]. Function of neurotransmitter changes with advanced age; *i.e* serotonin, dopamine and acetylcholine levels and also monoamine oxidase levels are altered. These changes mostly occurs in neurons and dendrites. The brain oxygen levels of geriatric dogs are low as compared with young animals [21]. Special senses are decreased in geriatric animals as a result pets show various behavioral abnormalities. Deafness in geriatric dogs is usually due to degeneration of peripheral acoustic structures [28]. Changes in taste have also been noted in older dogs. Both the digestive and respiratory systems are affected in geriatric pets [6].

There are different types of aggression in pet animals. In older dogs, due to underlying painful medical conditions like arthritis and dental disease and pet often observed with recent onset aggression. In an elderly dog one of the most commonly observed aggression is dominance aggression, where previously the dog might have controlled the family with threats. Intra-dog aggression is generally noticed in a multi-dog households [6]. One of the major problem in geriatric dogs is house soiling. Kidney function declines with age results in reduction of number of nephrons, perfusion and reduced concentrating ability of the kidneys [13]. There is also evidence that the decline in kidney function is related to changes in brain neurotransmitters which results in loss of neurons in elderly dogs and hence loss in house training [16]. Changes in behaviour can also result to a separation related distress. Signs include distress at being separated from the owner, vocalization, elimination and destruction [15].

Diagnosis of behavior problems

The proper diagnosis of behavioral problems are very important in geriatric pets as it gives various indications to age-related disease. Behavioral problems are often observed as a consequence of change in internal organ function or special sense organs. Behavioral problems are the indications to different discomforts faced by the geriatric pets. The following criteria are mentioned below in order to make a proper diagnosis [6]: A) A complete history should be taken to identify the cause for the behavior and circumstances that contribute to the occurrence. B) There should be an attempts to be made to determine the origin, duration and progression of the problem. C) When and where the behavior problem occurs. D) The behavioral problem should be noted on daily basis by the people who are involved with the animal. E) Routine interactions should be with the pets should be done and any changes in routine must be examined. F) Intensity of the behaviour should be noted by the owner.

Cognitive Dysfunction Syndrome (CDS)

CDS is defined as "age-related or geriatric onset behavior changes that are not attributable to a general medical condition like neoplasia or organ failure" [25]. This cognitive decline may be manifested by change in behaviour e.g. house training, interest in food, attention and activity, awareness of

surroundings, compulsive behaviors, circling, tremors, changes in sleep patterns, stiffness or weakness and inappropriate vocalization [24]. In dogs, the neuro-pathological changes in the brain of an elderly dog are similar with humans with some forms of dementia [4] These changes consist of amyloid plaques, which seem to inhibit neuronal function. Whereas, the amount of beta amyloid accumulation might correlate with the extent of cognitive decline [4, 5] Usually behavioral changes in CDS can be divided into 4 categories [12]: changes in the sleep-wake cycle; reduction in social interactions; loss of house-training; and disorientation.

According to Landsberg (1995) the changes in brain neurotransmitters, especially dopamine contribute to the cognitive decline in senior dogs. The enzyme Monoamine oxidase-B is responsible for the breakdown of dopamine and levels of MAOB are increased in the brains of elderly dogs [16]. Selective monoamine oxidase inhibitors especially dopamine responsible to improve behavior of dogs experiencing CDS [16]. It is speculated that medications are mainly aimed to aid in normalizing dopamine levels. For the treatment of dogs with CDS, first attempt should be made to normalize the neurotransmitter levels (dopamine, serotonin, norepinephrine and acetylcholine) and secondly to slow down the progression of the disease [27, 28]. In Canada and the United States a selective MAOB inhibitor, selegiline (Anipryl, Pfizer Animal Health) is approved for use in dogs [27]. Selegiline also have neuroprotective effects and decrease free radical load in the brain through decreasing free radical production. In Europe, Nicergoline is used for the treatment of CDS and has shown improvement in behaviors associated with senility [23]. Nicergoline has alpha-adrenergic effects which increase vasodiliation, cerebral circulation and stimulates metabolic activity in the CNS centers [23].

Conclusion

Aging is physiological process that comprises molecular, cellular and organ-specific change that occurs to all living organisms which directly related to lifespan and all age-related diseases to all living beings. Aging affects on various systems including cardiovascular, renal, hepatic, musculo-skeletal, eyes and ears. A complete physical examination along with hemato-biochemical profile might indicate various age-related diseases which could be managed at earliest and minimize the effects of ageing on animals, thus increases the lifespan of the animal.

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