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ANESTHESIA IN GERIATRIC PATIENTS

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It is suggested that the geriatric age is reached when an individual exceeds the 75-80% of their life expectancy[1,3], important differences between dog breeds have been seen. In practice, it is difficult to specify the time at which a given patient should be considered geriatric, as there are individual differences in the speed and the processes that occur in aging[1,3]. Age is relevant to general anaesthesia, but should not make a myth of it. The elderly have important pathophysiological changes, although several studies several studies of anaesthetic morbidity and mortality show that accidents and complications due to anaesthesia are invariably linked to the presence of concurrent disease. Therefore, we must explore each case individually and not include it automatically in the higher risk anaesthetic categories. Physical condition of the patient more than the age is what is really important[1,3].

Pathophysiology in geriatric patients, anaesthetic implications

Geriatric patients experiment pathophysiological changes,[2,3,5] that should be considered for the anaesthesia selection. Generally, they require a lower dose of tranquillizers and anaesthetics due to changes in body composition and generalised atrophy of the organs. Age does not usually change the active fraction of the anaesthetics, as it does not change the protein plasma levels. The increased fat, loss of muscle mass and decreased body water lead to higher plasma concentrations after rapid intravenous bolus administration via[4]. The lower water level also means a reduction of blood volume and greater vulnerability to dehydration. For this, it is recommended to reduce the anaesthetic dose, split up the administration and make a slow intravenous injection to effect. The increase in fat, increases the distribution volume of lipophylic drugs, which will lengthen the anaesthetic recovery time above what would be expected by the decrease in metabolic/excretory activities in liver and kidneys[1,4]. Age produces atrophy of the brain, decreased activity of the central nervous system neurotransmitter and a reduction of oxygen consumption. In general, the needs of general anaesthetics decrease estimated, for example that the minimum alveolar contraction (MAC) of inhalational anaesthetics decreases by up to 30%[4]. The autonomic reflex activity is slow and largely ineffective thus affecting the mechanisms of thermal and cardiovascular regulation, and various protective reflexes. Therefore, elderly are more prone to hypothermia and aspiration pneumonia. The age produces loss of lung elasticity and an inability to maintain open and ventilated spacious lung areas, due to the weakening of the traction forces that maintain airways open. This increases the risk of bronchoalveolars collapses and atelectasis production. Likewise, the mechanical ventilation is compromised by the ossification of the costochondral joints that makes the thorax more rigid, facilitating, together with the muscle atrophy, the hypoventilation, which can be worsen if the geriatric is obese. In summary, the ability to respond to situations of hypoxia and/or hypercapnia is depressed, which increases the likelihood of respiratory failure during the peri-operative period. It is, therefore, necessary to pre-oxygenate these patients before anaesthetic induction and monitoring of ventilatory function. If necessary, use methods of mechanical intermittent positive pressure ventilation (IPPV)

Cardiac output decreases as a result of lower demand for organic and muscle perfusion. Cardiac output falls up to 30%, although myocardial contractility, if there is no underlying condition, is properly maintained until advanced ages. The mechanisms of cardiovascular regulation and compensation are depressed, so that loss of blood volume due to dehydration, bleeding or vasodilation lead to severe hypotensive crisis, like excessive fluidtherapy rates lead to hypertension and pulmonar oedema. In cases of increase of cardiac output, the geriatric patient has a modest reserve, activated by increases in heart rate and ejection volume due to the elevation of the final diastolic volume in the left ventricle. One goal of anaesthesia in geriatrics will be to avoid situations of tachy/bradycardia, hyper/hypotension or vasoconstriction further limiting there capacity of self-regulation, and preventing falls in preload (as if there is severe bleeding or if artificial ventilation is performed with peaks of excessive pressure). These animals may suffer progressive or degenerative myocardial alterations which affect the conveyance systems and produce arrhythmias. They are very sensitive to the arrhythmogenic action of anaesthetics and sedatives. The second-degree AV block, bundle branch block, extra-systoles or atrial fibrillation are common. For this reason, we should not use arrhythmogenic agents. Finally, we consider the prevalence of

valvular disease in geriatric dogs between 25-30%.

The enzyme activity of the liver remains relatively well despite the ageing processes. However, the atrophy of this organ and basically the reduction of blood flow leading to a slower metabolism, which prolongs the half-life of drugs that are degraded and/or eliminated hepatically. There is also a renal atrophy accompanied by decreased renal perfusion (especially cortical level), which limits the renal function and reserve. Diuresis should be stimulated by the infusion of hypotonic crystalloid fluids and blood pressure needs to be controlled, avoiding hypotension situations. It is also advisable to monitor urine output (1-2 ml/kg/hour).

Respiratory diseases

Animals with chronic lung diseases may have severe respiratory insufficiencies when undergo general anaesthesia. The risk of hypoxia can be compensated for supplementing the animal with 100% oxygen during anaesthesia, but little can be done to remove CO2 efficiently unless the use of VPPI techniques. The best guide guide for sensing the degree of potential problems that may occur is to analyse the level of exercise tolerance. In addition, hypoxia can be produced by airway obstruction, hypoventilation or failures in the transport of oxygen. The usual outcome of myocardial hypoxia is the establishment of severe arrhythmias that can cause ventricular fibrillation. Cerebral hypoxia causes neuronal injury and failure to recover the consciousness. The kidney is also sensitive to situations of hypoxia, which together with hypotension, can cause permanent kidney damage.

Heart diseases

Myocardial disease is frequent in older dogs and cats, constituting a serious anaesthetic risk. It should be remembered that the anaesthetics reach the coronary arteries before than the brain, which can cause cardiac arrhythmias and depression immediately. The presence of murmurs, cough and exercise intolerance should not go unnoticed during the pre-anaesthetic examination. Mitral insufficiency is more common in dogs and can lead to congestive heart failure. An estimated 30% of the dogs over 10 years of age of small dog breeds have the disease to some degree. These patients are treated with various drugs including diuretics, anti-arrhythmics and ACE inhibitors that under anaesthesia may produce severe hypotension situations. In these cases a slight intra-operative hypotension may be beneficial to reduce regurgitation, but we must avoid situations of hypotension/severe hypertension, tachycardia and decreases in preload. In giant dog breeds and other breeds such Doberman or Cocker is common the dilated cardiomyopathy characterized by deficits in ventricular contractility that leads to a systolic insufficiency with ventricular congestion. In these patients would be essential to maintain the preload without overloading the heart so the fluidtherapy should be assessed to effect, it will also require cardiovascular support through positive ionotropic infusions (i.e Dobutamine 5-20 µgr/kg/min).Bradycardia is not convenient. These patients can suffer under anaesthesia atrial arrhythmias or more frequently very serious ventricular ones and lead to sudden death.

Kidney disease

Animals with renal insufficiency suffer azotemia and are extremely sensitive to the action of anaesthetics, as well its elimination is slower. We consider the high probability of having anaemia which would limit the ability to carry oxygen to the tissues. The geriatric patient with chronic renal failure depends on a high fluid intake to maintain renal function. Therefore, in these cases must be avoided the water fast and ensure a correct fluidtherapy. The use of NSAID´s, including the COX-2 selective action may exacerbate the situation by altering renal perfusion.

Liver disease

The large functional reserve of the liver causes anaesthetic problems that are only visible in cases of severe failure. In case of hypoproteinemia injectable dose of anaesthetic would be reduced as they will increase their active fraction. Hypoproteinemia also reduces the ability of intravascular water retention, which predisposes to hypovolemia and hypotension and should be corrected by plasma transfusions, albumin or gelatin, dextran or starch base plasma substitutes. In case of hepatic encephalopathy there is an increased sensitivity to benzodiazepines, alterations in neurotransmitters GABA type and an increase in the density of GABA type receptors. In these cases, it is prudent not to use benzodiazepines.

Diabetes

The diabetic patient may become unstable in the peri-operative period, so the best way to handle it is

interfered as little as possible with the meals routine and treatment pattern. The protocol for minimal "interference" is to schedule surgery first thing in the morning, trying to avoid a fast longer than 6-8 hours. The patient will receive an initial insulin dose half of the usual one prior to anaesthesia (presumably on the day of anaesthesia the animal will eat less food). After anaesthetic induction blood glucose is determined to decide the fluidtherapy type and then glycemia will be checked every 20-30 minutes. The remaining insulin dose will be administer if severe hyperglycaemia is detected(Glu > 300 mg/dL). If the anaesthesia is smooth, once awake, the animal will be offered a small amount of food and the remaining dose of insulin. After surgery, is frequent the appearance of glycosuria but if there is no hypoglycaemia and the patient remains alert the prognosis is favourable. Destabilized diabetic patients who present ketoacidosis need to be establish prior to surgery.

Anaesthesia techniques in geriatrics

The use of tranquillizers/sedatives are helpful in reducing stress in these animals. Low dose acepromazine (0,025 mg/Kg) is useful for their anti-arrhythmic properties although the risk of hypotension needs to be controlled, and assess its prolonged effect specially in dehydrated patients, those with hepatic problems or there is severe bleeding. Benzodiazepines (diazepam, midazolam (0,2 mg/Kg)) have fewer cardiovascular side effects but their sedative effect is small and sometimes can lead to excitation if not administered combined or after an opioid that depress the CNS. However, the sedative effect is more profound and prolonged in geriatrics and are a good alternative to acepromazine as they have an antidote (Flumazenil). Apnoea has been described sometimes with the use of benzodiazepines in geriatric patients. Alpha-2 adrenergic agonist sedatives (medetomidine, dexmedotimidine) can be used in patients with good physical condition at a reduce dose. Its use with opioids and/or ketamine facilitates handling aggressive cats. Opioid OP-3 (agonists μ-pure agonists) often cause bradycardia and respiratory depression deeper than the seen in younger patients. Pethidine (2-7 mg/Kg) is preferable in these cases due to the short action in addition to its better tolerance at cardiorespiratory level. The μ receptor partial agonists (buprenorphine) are well tolerated, although its analgesic activity is more limited. Buprenorphine (0,01-0,02 mg/Kg) is an opioid with moderate analgesic activity, useful in sedation of compromised cats and dogs. In cases of severe pain, morphine dose-effect (0,2-0,8 mg/Kg) will be of choice, although respiratory function is monitored to establish, if necessary, mechanical ventilation. Another important route of administration of opioids, alone or in combination with local analgesics, is the epidural route, since it enables to achieve excellent analgesia at low doses. The administration of anticholinergics (atropine, glycopyrrolate) increases cardiac work when tachycardia, hypertension, and a considerable rise in demand for oxygen by the myocardium, therefore should not be administered routinely in geriatric patients. In case of severe bradycardia or first or second degree AV blocks are detected, atropine shall be administered to effect, using reduced doses at first.

For anaesthetic induction, after pre-oxygenating the geriatric patients during 10 minutes injectable agents of ultra-short action can be used. If an intravenous bolus of diazepam or midazolam is administered prior to induction, doses can be reduced. The injection of anaesthetics will be done to low doses (30-50% of the normal dose) and will administered fractioned and slow. Thiopenthal produces cardiovascular depression, vasodilation and apnoea, together, with an increase of body fat, muscle atrophy and decline in body water can result in slow recovery even after a single dose of the barbiturate, which may prolong the recovery after short procedures. Propofol produces a rapid and complete recovery, although its cardiopulmonar depressant effects is similar to thiopenthal. In the elderly with cardiovascular problems etodimate (0,05-1mg/Kg) is the choice, as it produces small changes in heart rate and blood pressure after induction of general anaesthesia. However, respiratory depression occurs in a way similar to propofol and thiopenthal, and must be administered slowly in geriatric patients. Sometimes the use of ketamine (3-8 mg/Kg) or fentanyl (5-20 mg/Kg) are reasonable alternatives. However, ketamine can cause severe tachycardia, which destabilizes the geriatric patients with cardiac problems and predisposes to arrhythmias and myocardial hypoxia. Finally, there is the risk of seizures after administration, especially in dogs, and muscle stiffness and excitement are likely during recovery. If anaesthesia is induced by a mask in geriatrics, the election inhalatory agents are isoflurane and sevofluorane. For maintenance, inhalatory anaesthetics are of choice as they are eliminated almost entirely by the lung. Isoflurane and sevofluorane are characterized by their rapid rate of induction and recovery (especially the latter), they do not sensitize the myocardium against circulating catecholamines and maintain a fairly stable heart rate. The use of local and regional analgesia techniques is considered as a possible reduction in the dose of anaesthetic.

In geriatrics are common the severe bradycardias after the use of opioids, which should be treated with atropine (or more rarely with isoproterenol if no response to anticholinergics) in the case of frequency below 60 beats per minute. Premature ventricular complexes are common in situations of hypoxia and

pain, so their detection requires to asses the provided analgesia and to improve the oxygenation and/or ventilation of the patient. Lidocaine will be administered if no improvement. Mean blood pressure during anaesthesia should not drop below 20-70 mm Hg, for which is important to set appropriate levels of anaesthesia and keep a fluidtherapy rate in accordance with the patient´s needs. The use of sodium rich solutions (PSS) is contraindicated in cardiac patients. In general, the use of balanced hypotonic electrolytic solutions (Ringer Lactate) is elected at a moderate rate (5-10 ml/kg/hour). If hypotension does not respond to fluidtherapy, the use of dopamine and dobutamine dose-effect (2-6 µgr/kg/min) is preferable. Capnography can detect hypoventilation situations quickly, and is vital in making decisions to establish mechanical ventilation. In geriatric patients, it is useful to ventilate using positive end-expiratory pressure (PEEP) with moderate end expiratory pressures of 2-5 cm de H2O. This technique helps to recruit areas collapsed of the lung and prevents the closure and pulmonary atelectasis. The geriatric patients must be protected from cold surfaces and can be supplemented with external sources of heat such as blankets for recirculating hot air or warm fluids. The best way to maintain the diuresis is with fluidtherapy, but if necessary dopamine can be given (1-3 µgr/kg/min) and/or furosemide (0.5-1 mg/kg).

Recovery

Patient should be kept under close observation until they have regained protective reflexes and we rule out the presence of metabolic or cardiopulmonar alterations. It is important to supplement the patient with oxygen if cardiopulmonary compromise exists, or if the patient trembles excessively. Post-operative analgesia should always be appropriate.

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