Commentary

Are there legitimate reasons to retain lead ammunition and fishing gear?

Robert H. Poppenga, DVM, PhD; Pat T. Redig, DVM, PhD; James G. Sikarskie, DVM, MS

Recently, an adult turkey vulture was submitted to a local wildlife care and rehabilitation center after being found in a yard, unable to fly. A radiograph taken at the center showed a metallic object in the stomach. Despite treatment, the bird died and was submitted to the California Animal Health and Food Safety Laboratory in Davis, California, for necropsy. A metal foreign object that appeared to be a bullet fragment was found in the gizzard on postmortem examination, and heavy metal analysis detected lead (18 μg/g [ppm]) in the liver. Because liver lead concentrations in the range of 2 to 10 μg/g are considered consistent with lead intoxication, depending on the species exposed,1 lead intoxication was concluded to be the cause of death. Unfortunately, such cases are common at veterinary diagnostic laboratories throughout the United States.

Lead has been used for a variety of purposes for thousands of years. It is easy to extract, highly malleable, and inexpensive. Inorganic lead has been used as pigments in paint, dyes, and ceramic glazes, and lead-containing organic compounds were once widely used as a gasoline additive. Lead combined with other metals forms alloys that have been used in batteries, radiation shields, water pipes, ammunition, and fishing tackle. Although it is a naturally occurring element in the environment, lead has no functional role in biological systems and is toxic at low doses. In fact, no safe level of exposure has been identified for sensitive human populations such as children, and lead remains a serious public health concern despite restrictions on its use in products such as paint and gasoline. There is no threshold of measurable blood lead concentration below which toxic effects have not been identified. In children, even limited exposure to lead can result in damage to the CNS with long-term effects on mental development and psychomotor skills.2 Many other organ systems can also be adversely affected, including the hematopoietic, renal, cardiovascular, immune, and gastrointestinal systems. Before restrictions were placed on lead use in paint and other products, acute and chronic intoxications were common in dogs and cats. Lead intoxication of pets is relatively infrequent now, but cases of acute lead intoxication in ruminants, particularly cattle, still occur. Most commonly these are a result of ingestion of lead fragments from old vehicular battery plates. Currently, most cases of lead intoxication in animals involve a variety of wild bird species, particularly scavengers or fish-eating species.3,4

At toxic blood and tissue concentrations in birds, lead causes lethargy, gastrointestinal stasis, anorexia, vomiting, diarrhea, anemia, disturbances of cellular metabolic functions, and neurologic injury, leading to blindness, seizures, weakness, and death.5–8 At lower concentrations, lead exposure causes a number of sublethal effects, such as neurologic and reproductive impairment and an overall reduction in fitness.9 Postmortem lesions associated with lead intoxication in birds include emaciation, staining of the vent with bright green fecal material, impaction of the esophagus or proventriculus, a prominent and distended gallbladder, dark or bright green staining of the gizzard lining, and the presence of lead bullets, pellets, or fragments in the gastrointestinal tract.

Lead ammunition and fishing tackle constitute forms of concentrated lead that are commonly inadvertently ingested by birds. As has been recognized for > 100 years,10,11 exposure to these sources of lead is hazardous to waterbirds (eg, ducks, swans, and loons). Upland game birds (eg, doves and quail) and scavengers (eg, condors, turkey vultures, and eagles) have also been shown to be exposed to and lethally affected by lead from spent ammunition.12–17 Exposure to lead occurs as a result of ingestion of lead pellets (shotgun) or lead bullets and fragments (shotgun slugs and high-velocity rifle bullets) embedded in the flesh of unrecovered game or other animals (eg, gophers and coyotes) or in offal (gut piles) and other body parts left in the field following dressing of carcasses.18 Hunter harvest data suggest that approximately 186,000 to 200,000 deer are shot and slaughtered annually in Minnesota, so thousands of offal piles potentially containing many lead ammunition fragments are available for scavengers.18

A recent study19 suggests that more than three-quarters of bald eagles admitted to rehabilitation facilities have detectable blood lead concentrations and 25% have lethal concentrations. Ingestion of spent ammunition and lost fishing tackle by birds is well-documented as triggering a number of negative effects in individual animals and potentially leading to population-level consequences in some species (eg, waterfowl, eagles,
condors, mourning doves, and loons).\textsuperscript{3,16,21} California condors, which have been designated by the federal government as endangered, continue to be at great risk primarily as a result of exposure to lead from spent ammunition found in offal piles and carcasses of shot game and pest species.\textsuperscript{3,16}

Current data for raptors and avian scavengers demonstrate a clear, positive relationship between lead exposure and hunting seasons.\textsuperscript{3,12–24} The hazard of ingested lead sinkers and fishing tackle is well-documented in swans and loons, and restrictions on the sale or use of lead weights have been instituted in parts of the United Kingdom, Canada, the United States, and other countries to reduce impacts on these and other vulnerable species.\textsuperscript{25,26} Studies\textsuperscript{27–30} have demonstrated that the respective 1991 and 1999 US and Canadian bans on the use of lead shot for hunting waterfowl and coots in North America successfully reduced lead exposure in these species and some predatory birds. These results suggest that such legislative actions can reduce the risk of intoxication from spent ammunition. Voluntary reductions in lead use for big game hunting have been demonstrated to reduce the risk of lead exposure to condors in Arizona.\textsuperscript{23}

In 2007, California passed legislation requiring the use of nontoxic ammunition by hunters in a limited area of the California condor range. This legislation’s failure to significantly decrease exposure of condors to lead resulted in additional legislation in 2013 that established a 5-year phase-in (2014 to 2019) of a statewide ban on lead ammunition.\textsuperscript{31} The phase-in is designed to impose the least burden on California’s hunters while still adhering to the intent of the law.

Human exposure has been documented to occur following ingestion of lead from spent lead ammunition.\textsuperscript{3,21} Children, the most sensitive human subpopulation, are at particular risk. Increases in blood lead concentrations have been positively correlated with consumption of game taken with lead ammunition.\textsuperscript{34,35} The discharge of lead-based ammunition is known to pose risks of lead exposure to gun users.\textsuperscript{36,37} Lead ammunition fragments on impact, and even if a bullet completely passes through and exits an animal, small amounts of lead are left behind in the tissue. People consuming the meat can, without their knowledge, absorb these fragments and residues.\textsuperscript{3,8,12,33,38}

Many effective nontoxic alternatives to lead-based ammunition and fishing tackle have been developed and are currently available.\textsuperscript{39} Several companies have developed nonlead ammunition that can be used safely in all varieties of rifles and shotguns for hunting large and small game.\textsuperscript{40,41} Firearm experts have confirmed that typically only minor adjustments in technique are required for successful use of nonlead hunting ammunition, and the effectiveness of such ammunition has been demonstrated.\textsuperscript{42} However, the widespread manufacture and use of nontoxic ammunition depends on the development of assured markets supported by education, regulation, and enforcement.\textsuperscript{43} Legislation is the biggest determinant of assured markets for nontoxic alternatives and compliance with their use. Although there is a slight cost differential between lead-based and nonlead alternatives for fishing tackle and ammunition used for hunting, the increased costs to consumers are negligible, compared with the total investments of participants for their hunting and fishing activities. Required use combined with wider availability would likely result in more competitive pricing of nonlead alternatives. Opponents have suggested that requiring the use of nontoxic alternatives is the first step to a ban on hunting or is an attempt to control gun access. However, there is no factual evidence to support such claims or concerns.

Various professional organizations, including the Association of Avian Veterinarians and the Wildlife Society, have endorsed replacing lead hunting ammunition and fishing tackle with nonlead alternatives.\textsuperscript{43,44} We encourage the AVMA to work with other organizations and agencies to increase awareness of the dangers lead ammunition and fishing tackle pose to animals. Further, we urge the AVMA to adopt a policy on lead ammunition and fishing tackle, as we believe that doing so could encourage individuals and agencies to formulate solutions to the problems they pose and generate discussions about how society could better protect our environment. Although the AVMA has not adopted a specific policy on lead, it does have a policy on toxicoses, which states, “The AVMA supports education, legislation, regulations, research, and other actions that prevent toxicoses in wildlife, domestic animals, and human populations.” Even though this policy would nominally include lead, perhaps it is time to take a more proactive stance regarding the replacement of lead in ammunition and fishing tackle.

References


For all commentaries, views expressed are those of the authors and do not necessarily reflect the official policy of the AVMA.