

ARTHROGRYPOSIS MULTIPLEX CONGENITA IN A MALE MOUFLON (*OVIS AMMON MUSIMON*) LAMB

PETER LAZAR¹, JAN ČURLÍK¹, DEAN KONJEVIĆ² & RUŽA SABOČANEC³

¹Department for Breeding and Diseases of Game and Fish,
University of Veterinary Medicine, Komenského 73, 041 81 Košice
(e-mail: lazarp@uvm.sk)

²Department for Game Biology, Pathology and Breeding,
University of Zagreb Veterinary Faculty, Heinzelova 55, 10 000 Zagreb

³Department of General Pathology and Pathological Morphology,
University of Zagreb Veterinary Faculty, Heinzelova 55, 10 000 Zagreb

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In March 2007 a few days old male mouflon (*Ovis ammon musimon*) lamb was found within an enclosure for fallow deer (*Dama dama*) and mouflon rearing, managed by the Rozhanovce Game Management Centre, Košice University of Veterinary Medicine. Because of its severe limb malformations and consequent inability to stand up, the lamb was caught and euthanized. Following the euthanasia procedure the lamb was subjected to macroscopic and X-ray examination, necropsy and histopathological examination. Multiple alterations were observed and classified as arthrogyposis, kyphosis and deviation and reduced length of the left hind leg. Arthrogyposis is a term for constant contraction of joint/s found throughout the body at birth. It is generally associated with fetal akinesia due to different fetal abnormalities or maternal disorders. It can also be related to damage of the central nervous system (i.e. intrauterine infection with Akabane, bluetongue or some other viruses), ingestion of poisonous plants by the pregnant female, fetal inactivity or other anomalies such as scoliosis, torticollis or cleft palate. The combination of observed alterations along with non-specific results of histopathology and the fact that this was a single case excludes an infectious agent as a cause of this condition.

Key words: mouflon lamb, fetal abnormalities, arthrogyposis, kyphosis

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Tijekom ožujka 2007. godine, nekoliko dana staro muflonsko janje pronađeno je na području ograđenog uzgajališta jelena lopatara (*Dama dama*) i muflona (*Ovis ammon musimon*). Navedenim uzgojem rukovodi Centar za uzgoj divljači Rozhanovce kao sastavnica Sveučilišta veterinarske medicine

u Košicama. Zbog teških deformiteta udova i nemogućnosti stajanja spomenuto je janje uhvaćeno i eutanazirano. Nakon eutanazije janje je pregledano makroskopski, rendgenski, patološkoanatomski i patohistološki. Uočene promjene klasificirane su kao artrogripoza, kifoza te uvrnuće i skraćenje lijeve stražnje noge. Artrogripoza je naziv za stalnu kontranturu zgloba/ova prisutnu već pri rođenju životinje. Uglavnom je artrogripoza povezana s otežanim pokretanjem ploda tijekom bređosti uslijed različitih anomalija ploda ili maternice. Također se povezuje s oštećenjima središnjeg živčanog sustava (intrauterine infekcije virusima Akabane ili bolesti plavoga jezika), konzumiranjem otrovnih biljaka te neaktivnošću ploda uzrokovanu drugim anomalijama poput skolioze, tortikolisa ili rascijepljenog nepca. Kombinacija navedenih alteracija u sprezi sa nespecifičnim histološkim nalazom i činjenicom kako je u pitanju svega jedan utvrđen slučaj, isključuje mikroorganizme kao uzročnike ovog stanja.

Ključne riječi: muflonsko janje, anomalije ploda, artrogripoza, kifoza

INTRODUCTION

Abnormalities developing during fetal life are rarely reported in wildlife, mainly due to the rapid disappearance of such disabled animals in nature due to starvation, disposition to illness, or predation. Reports on debilitating bone and joint anomalies among wildlife include brachygnathia, syndactylism (ROLLOR, 1993), arthrogryposis, bowing of the radius and ulna (BARRETT & CHALMERS, 1975), medial rotation of the leg/s (WOBESER & RUNGE, 1973), metacarpal deviation and patellar luxation (SUNDBERG & NIELSEN, 1981), and others. Arthrogryposis multiplex congenita (AMC) is a complex condition that originally means hooked or curved

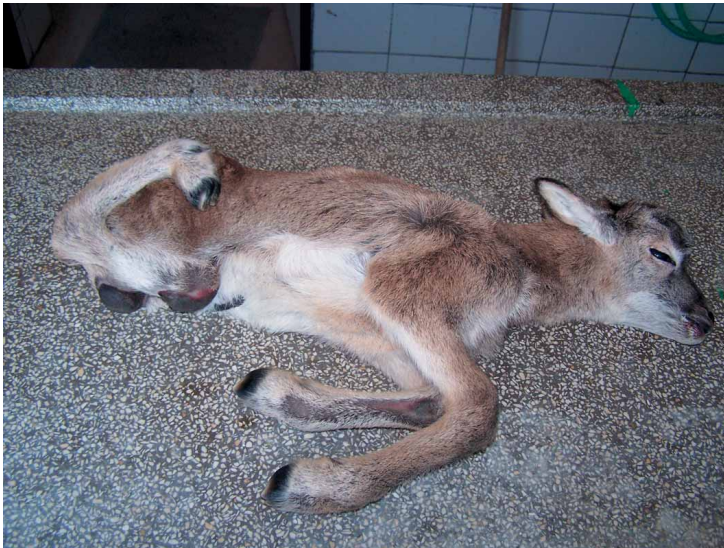


Fig. 1. Few days old mouflon lamb with severe malformations of the hind limbs. Fur loss on the carpal and metacarpal area indicates tendon contracture and consequent inability to reduce front legs to normal conformation.



Fig. 2. Radiographs of the front and both hind legs. The front legs with contracted tendons can not be fully extended (A). Right hind leg was rotated but of normal length (B), while the left was contracted and reduced in length (C).

joints and presents as a constant contraction of joint/s found throughout the body at birth (WEISBRODE & DOIGE, 2001). AMC can occur in the forelimbs, hind limbs and/or the vertebral column, leading to various degrees of flexion or extension at birth. Moreover, AMC can affect ligaments, skeletal muscles, central or peripheral nerves, solely or in combination. It is generally associated with fetal akinesia due to different fetal abnormalities or maternal disorders, different disorders of the central nervous system, or even difficulties of transferring the signals between nerves and muscles, and therefore AMC is classified as neurogenic and myogenic (ADAMS *et al.*, 1962). One of the possible causes of AMC are toxins produced by several plant species (i.e. *Lupinus sericus*, *Lupinus caudatus*, *Nicotiana tabacum*, *Conium maculatum*) that can induce arthrogryposis if ingested by a female, between the 40th and 100th day of pregnancy in cattle for example (PLUMLEE, 2004). Furthermore, it was also confirmed that certain infectious agents are able to produce this abnormality. For example, in Japan, Australia and Israel, arthrogryposis is usually associated with congenital infections with Akabane and Aino virus (KUROGI *et al.*, 1977; COVERDALE 1978; KONNO *et al.*, 1982), while Cache Valley virus was associated with same lesions in sheep in North America (EDWARDS *et al.*, 1989). Finally, a genetic origin of

this condition is mainly suspected in the case of symmetrical contracture of all four legs. GENINI *et al.* (2004) reported on a genetic form of AMC in Swiss Large White (SLW) pigs, controlled by a single autosomal recessive allele designated as *amc* (as proposed by LOMO, 1985). They also report that at least 25% of the SLW population are carriers of the *amc* allele.

AMC is described frequently in humans and livestock including calves, lambs, piglets and foals, while kittens and puppies are less affected. To our knowledge, this report describes the first recognized case of AMC, metatarsal deviation and kyphosis in a male mouflon lamb.

CASE REPORT

During regular inspection on March 2007, an alert and active few days old male mouflon lamb with perceived movement problems was found in an enclosure for fallow deer (*Dama dama*) and mouflon rearing, managed by the Rozhanovce Game Management Centre, Košice University of Veterinary Medicine. Because of severe limb malformations and consequent inability to stand up, the lamb was caught and euthanized using a butyramide (T61) injection solution. Following the euthanasia procedure the lamb was subjected to thorough macroscopic and X-ray examination (conditions were 45kV and 18mAs), before and after the removal of the limbs. The lamb was further examined by standard necropsy procedure and representative samples of heart, lungs, liver and brain were taken for routine histopathological examination (ŠVOB, 1974).



Fig. 3. Subcutaneous hemorrhages and joint swelling, matching in position surface fur loss.

RESULTS AND DISCUSSION

Macroscopically, the arthrogryptic lamb was in poor condition, with severe malformations of the hind legs (Fig. 1). The mobility of the front legs was reduced due to partial contracture of the carpal joints (contracture of tendons), which prevented full extension of the limbs. The right hind leg was of normal length, but rotated 180° to the right, while the left hind leg was reduced in length, mainly between the femoral and metatarsal bones (Fig. 2). Legs could not be reduced to normal conformation. As a consequence of this condition, the animal was walking on the dorsal surfaces of the distal part of its limbs, which resulted in injuries on the front legs (metacarpal area) and hind legs (knees). Following the removal of the skin, subcutaneous haemorrhages and slight swelling of the joints were observed (Fig. 3), matching in position the surface loss of fur and skin reactions (i.e. change in colour). The leg deformations were accompanied by kyphosis. No other deformations or pathological conditions were noticed during the examination. Histologically, tissue sections appeared to be of normal structure.

Given that motion is essential for normal development of joints and their contiguous structures, it is completely understandable that a lack of movement through excessive development of connective tissues will result in fixation of a joint and consequent limitation of movement. Therefore, congenital flexures are usually related to joints being held in flexion without relief during late gestation. However, despite that, the actual (underlying) cause of arthrogryposis still remains obscure. In this case, the mouflon lamb showed arthrogryposis in the most common form, non-symmetrically affecting front and hind limbs. The fact that no previous cases were recorded in the Rozhanovce GMC (despite the regular, daily inspections of the hunting ground) and that no other cases were involved here, suggests that the most probable cause for this condition is poisoning of the pregnant female via uptake of contaminated imported hay during the winter feeding period. For example, poison-hemlock (*Conium maculatum*) is a plant species native to Europe and Asia, and it is known that contamination of hay with vegetative parts and grains with seeds of this plant can induce toxicoses (PLUMLEE, 2004). The mechanisms underlying the toxicity of this plant species are still not completely delineated. Probably, the toxic compounds, which are piperidine alkaloids, block ion channels directly or through their actions at receptors, thereby inhibiting foetal movement (PANTER *et al.*, 1988; LOPEZ *et al.*, 1999). Observed associated anomalies like kyphosis, and deviation and reduction in length of both or just left hind limb fits into the statement that other defects are frequently observed in arthrogryptic animals. Their occurrence and type vary between the species. Therefore, SCHILD *et al.* (2003) have concluded that such variations are probably a result of phenotypic expression of the defect.

To conclude, the accurate cause of the condition observed in the male mouflon lamb still remains open to debate. Therefore, further studies regarding the hay composition and genetic studies on affected animals (if they are found) are encouraged.

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