

## A case of monocephalus, tetrabrachious and tetrapod in female newborn goat

Saeedeh Heydarinejad<sup>1\*</sup>, Yazdan Mazaheri<sup>2</sup>, Sina Javidan<sup>3</sup>, Ahmad Izadi<sup>3</sup>

<sup>1</sup> Department of Basic Sciences and Health, Faculty of Veterinary Medicine, Islamic Azad University Science and Research Branch, Tehran, Iran; <sup>2</sup> Department of Anatomy and Embryology, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran; <sup>3</sup> DVM Student, Faculty of Veterinary Medicine, Islamic Azad University, Shoushtar Branch, Shoushtar, Iran.

### Article Info

#### Article history:

Received: 31 July 2019

Accepted: 12 February 2020

Available online: 15 December 2020

#### Keywords:

Conjoined twins

Goat

Monocephalus

Tetrabrachius

Tetrapod

### Abstract

All conjoined twins are originally born as a result of fertilizing one zygote (egg) and also called monozygotic twins experiencing an incomplete division of an embryo into two portions of the embryo usually causing the formation of the primary streak stage. The main reason for the creation of this defect is not obvious. Dead twin goat with one head, one trunk, four anterior limbs, and four posterior organs was referred to the Laboratory of the Faculty of Veterinary Medicine, Islamic Azad University, Shoushtar Branch, Shoushtar, Iran. The radiographic and three-dimensional images showed one normal skull and pelvic bone vertebral column. The ribs and sternum of the newborn goat were quite normal and confirmed two pairs of extra limbs. There were no doubles in describing the internal organs. This report seems to be the first report regarding a case of a monocephalus, tetrabrachius, and tetrapod newborn goat.

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### Introduction

Conjoined twins or Siamese twins are considered as congenital malformations being observed in humans, domestic and wildlife animals, and even birds and fish. In the case of cows, conjoined twins are more common compared to other ruminants. Goat is one of the animals mostly considered in comparative researches, especially concerning the embryos.<sup>1</sup>

The main reason for the creation of this defect is not obvious and is one of the main reasons for death before or after birth this defect is caused during the initial phase, referring to as the primitive streak. If the embryo is nearly complete, the conjoined twins are called diplopagus or the Siamese twins. The twins are classified into eight groups based on the location of these twins including thoracopagus, omphalopagus, cephalopagus, ischiopagus, parapagus (dicephalus: One body and two heads or diprosopus: One body and two faces), craniopagus, pygopagus, and rachipagus.<sup>1-3</sup>

A part of the axial or adjacent structure mostly occurs during the elongation or fracture phase of the

twin line and this phenomenon is named into the categories of two, three, and four, based on the related regions of anomalies such as dicephalus (two heads), diprosopus (two faces), dicaudatus (two tails), tetrabrachius (four forelimbs) and tetrascelus (four hind limbs) twins. The evidence shows that symmetrically attached twins are born as a result of the second coupling of two single-oocyte embryonic disks, resulting in an incomplete binding of two incomplete embryos with two ovules.<sup>4,5</sup>

This study was conducted to describe the anatomical features of single-headed goats with four forelimbs and four hind limbs.

### Case Description

A dead female newborn goat with crown-rump length (CRL) of 34.50 cm weighing about 2.90 kg with one head, one trunk, four anterior limbs, and four posterior limbs was referred to the Laboratory of the Faculty of Veterinary Medicine, Islamic Azad University, Shoushtar Branch, Shoushtar, Iran.

#### \*Correspondence:

Saeedeh Heydarinejad. PhD

Department of Basic Sciences and Health, Faculty of Veterinary Medicine, Islamic Azad University Science and Research Branch, Tehran, Iran

E-mail: s.heidarinejad@gmail.com



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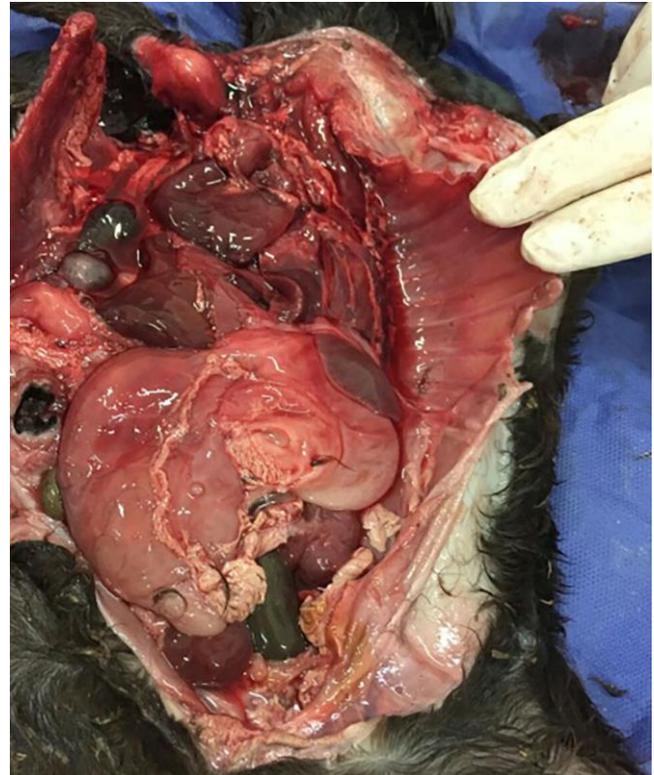
The birth happened at term as a seventh birth of the indigenous goat nest from the Bushehr-Dashti goat and the newborn goat was born with two other healthy and normal newborn goats by the 10-year-old mothers having a natural graze. The information reported by the Veterinary Office of the Dashti County, Bushehr, Iran shows that the mother goat has not been under the influence of any specific drug or teratogenic agent. The present case has died about 3 hr after birth.

The frigid newborn goat was transferred to Faculty of Veterinary Medicine, Islamic Azad University, Shoushtar Branch, Shoushtar, Iran. Three-dimensional (3D) radiography and imaging (in collaboration with the Radiology Department of Amir-Al-Momenin and Sepidar Hospitals, Ahvaz, Iran) were performed after providing gross and conventional imaging. Then, the necropsy was performed to examine the internal structures and skeletal, cardiovascular, respiratory, and digestive systems abnormalities as well as possible binary structures presence.

**Gross anatomical observations.** The newborn goat had four pairs of limbs; the two-paired limbs of the case were smaller than the others. The first pair was in front of the manubrium and the second pair in the abdominal region was connected to the trunk. This case had a female external genital organ and the parasitic conjoined twins had no external genital organ. The CRL was equal to 34.50 cm and the length of forelimbs, the large embryo (from the hoof and third phalanx to upper edges of the scapula), and the length of both posterior organs from the hoof to ischiatic tuberosity were about 28.50 cm. The length of the two forelimbs of the parasitic conjoined twins was equal to 22.00 and 23.00 cm, respectively, and the posterior limb length was equal to 21.00 and 22.00 cm, respectively. The newborn goat had a larynx, trachea, lung, esophagus, spleen, liver, and pancreas and there was a digestive tract from the beginning to the end in a single unit. There was also one pair of lungs and one heart, in other words, the structure of the abdominal cavity and chest was normal and the chest and abdomen were separated by a normal diaphragm (Fig. 1). The heart, aortic arch, abdominal and thoracic aorta, and brachio-cephalicus and pulmonary trunks were single, except an artery from the brachiocephalicus trunk that was separated from the heart (right ventricle) and directly entered into the anterior limb of parasitic conjoined twins (second fetus).

**Three-dimensional radiography and imaging findings.** The radiographic image (Fig. 2) and computerized tomography scans (Figs. 3 and 4) showed one normal skull and pelvic bone vertebral column. The ribs and sternum of the newborn goat were quite normal (Figs. 2 and 4). There were eight limbs including four brachial (tetrabrachius) and four pelvic (tetrascelus) limbs. One forelimb of them was placed on the normal

position and other pairs were connected to a piece of bone and the anterior part of the sternum in a different direction being in the opposite side of the elbow angle. The right scapula had an abnormal shape with two horns and the anterior limb was placed in the opposite direction without a scapular bone. Two hind limbs from four limbs were connected to the pelvic bone and two additional posterior organs were connected to the body by soft tissue with no bone joints. The calcaneal tuberosity in the extra limbs was poorly developed and generally seemed to be smaller in the extra limbs.



**Fig. 1.** Photograph of single organs in the thoracic and abdominal cavities.



**Fig. 2.** Digital radiography.

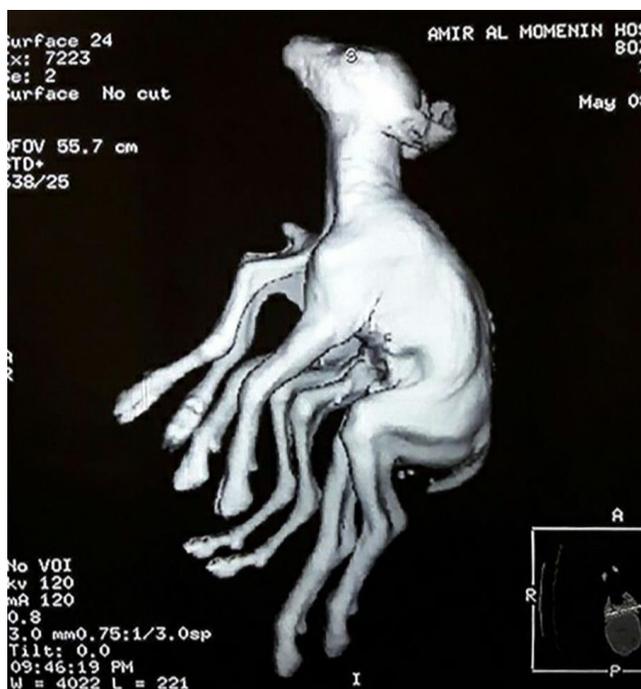


Fig. 3. Computerized tomography scan, soft tissue window.

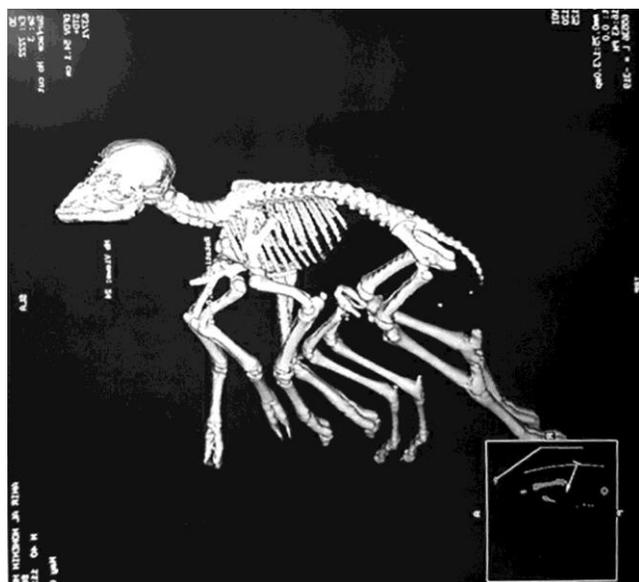


Fig. 4. Computerized tomography scan, bone window.

## Discussion

Conjoined twins are considered as a congenital malformation occurring in the germinal layer arising from a single-oocyte. This abnormality has been reported in humans<sup>6</sup> and other species such as dogs,<sup>7</sup> mice,<sup>8</sup> lambs,<sup>9</sup> cattle,<sup>10</sup> buffaloes,<sup>11</sup> and goats.<sup>12</sup>

There are different categories regarding adjoining twins according to the anatomy and location of the connection as well as the degree of symmetry.<sup>13</sup> These categories usually cause primitive node and streak

elongation or regression.<sup>9</sup> There is not sufficient evidence about congenital malformations in veterinary researches compared to human medicine.

It has been shown that these abnormalities are caused by genetic, environmental, and geographical factors.<sup>14</sup>

Conjoined twins are born as a result of the abnormalities in the anatomy during prenatal development and these abnormalities can result in organ dysfunction and failure or even death.

Duplication of the cranial portion ratio of the caudal portion in the fetus is more common.<sup>15</sup> The rate of recurrence of caudally duplicated conjoined twins has been reported in different studies.<sup>9</sup> The gross and radiological findings showed that the newborn goat had one head and four pairs of organs, while two pairs of organs were smaller than the other ones. Other structures such as abdominal and thoracic organs, sternum, and vertebral column were observed to be single.

The newborn goat in this research had been born under natural grazing and had not been under the influence of any specific drug or teratogenic agent.

Sonfada *et al.* indicated that an incorrect diet can cause developmental abnormalities and conjoined twins.<sup>16</sup> Based on this concept, they have examined the effect of environment and grazing on developmental abnormalities in small ruminants. Environmental toxicants, chemicals, pesticides, herbicides, and some drugs can also contribute to the developmental abnormalities formation. However, toxic plants can also be dangerous, depending on the season in some cases, as reported previously by Samuel *et al.*<sup>17</sup>

To the best of our knowledge, this is the first report on the monocephalus, tetrabrachious, and tetrapod female newborn goat in Iran.

## Acknowledgments

The authors would like to thank Dr. Hossein Javidan, Mr. Bineshfar, the staff at Sepidar Hospital, Ahvaz, Iran, Veterinary Office in Dashti County, Bushehr, Iran, Mr. Mousavinida and Mr. Barfar for their assistance and cooperation in the present study.

## Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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