



DISEASE IN WILDLIFE OR EXOTIC SPECIES

Ischiopagus Tripus Conjoined Twins in a Western Lowland Gorilla (*Gorilla gorilla*)

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Summary

Conjoined twinning is rare in man and non-human primates. The current report describes a case of ischiopagus tripus conjoined Western Lowland gorilla (*Gorilla gorilla*) twins. The female twins were joined at the umbilical and pelvic region, involving the liver, xiphoid, umbilicus, body wall and skin. Computed tomography revealed two complete spines. The combined pelvic space was formed by two sacra, each connected with two iliac bones. The twins were only conjoined by a common pubis. Cause of death was attributed to cardiac and circulatory collapse resulting from a large patent foramen ovale (8 mm in diameter) of one twin and neonatal asphyxia.

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Conjoined twinning is characterized by anomalous development of monovular twins. It is a rare occurrence and has been estimated in man to affect 1 in 100,000 births in the USA, 1 in 75,000 births in Latin America and between 1 in 50,000 and 1 in 100,000 deliveries worldwide (Canfield *et al.*, 2000; Mutchinick *et al.*, 2011). The most well-known conjoined human twins were Chang and Eng Bunker who were born in Siam in 1811 – hence the term ‘Siamese twins’. Conjoined twins are always joined at one of eight sites and are named after the site of union: (1) omphalopagus (united at the umbilicus), (2) thoracopagus (united ventrally at the chest), (3) cephalopagus (united ventrally at the head and chest), (4) ischiopagus (united ventrally at the pelvis), (5) craniopagus (united at the heads), (6) rachipagus (united at the spines), (7) pyopagus (united caudally at the rump) and (8) parapagus (united laterally). Other terms used additionally are the numerical descriptors di-, tri- and tetra-; anatomical structures that may be united (e.g. -proso- (face), -brachius (upper/forelimb) and -pus (lower/hindlimb)); as well as an occasional compound

term used to describe twins intermediate between the standard types (e.g. prosopo-thoracopagus) (Spencer, 2000a).

To the authors’ knowledge, there are few published cases of conjoined twins in Old World monkeys (Bolk, 1926; Hartman, 1943; Peterson *et al.*, 1997; Canfield *et al.*, 2000). Canfield *et al.* (2000) described a case of minimally conjoined omphalopagus rhesus monkey (*Macaca mulatta*) twins and Peterson *et al.* (1997) listed each case of congenital malformations during a 14-year period (1983–1996) for the cynomolgus monkey (*Macaca fascicularis*) and rhesus monkey colonies at the California Regional Primate Research Center, University of California. They described only one case of conjoined twins with cranial duplication in a cynomolgus monkey. No case of conjoined twinning in great apes could be found in the literature. The current report describes the first case of ischiopagus tripus conjoined Western Lowland gorilla (*Gorilla gorilla*) twins born at Zoo Duisburg in Germany.

The 16-year-old female Western Lowland gorilla was born in the Netherlands in June 1996 and came to Zoo Duisburg, Germany, in May 2007. One year later, in August 2008, she gave birth to a female

offspring and in February 2011 she delivered a male offspring. These pregnancies and parturitions progressed uneventfully and development of both offspring was normal. The matings were with the same 16-year-old male gorilla, which came to Duisburg in October 2007 and had previously fathered two other female juveniles. The female gorilla weaned her second offspring after 1.5 years in October–November 2012. A pregnancy test (Clearblue®; Procter & Gamble GmbH, Schwalbach, Germany) was carried out in January 2013 and the result was negative. On the morning of March 2nd, 2013 the keepers found the gorilla holding two dead offspring in her arms, not willing to give them away. The placenta could not be found. During the day it became obvious that the offspring were conjoined. The next day the gorilla appeared weak, and in order to exclude the possibility of a retained placenta or other complications, she was anaesthetized with ketamine (Ketamin® 10%; cp-pharma, Burgdorf, Germany) and xylazine (Rompun® 2%; Bayer Vital GmbH, Leverkusen, Germany) intramuscularly. During anaesthesia, the babies were taken away from her and the assumption of conjoined twins was confirmed. They were two female ischiopagus twins, conjoined at the pelvis with one umbilicus and three legs (tripus) (Figs. 1 and 2). Delivery of the ischiopagus conjoined twins had caused a low-grade perineal laceration of about 1 cm in length. Ultrasound examination of the abdomen revealed no free fluid or signs of a re-



Fig. 1. Ventral view of the ischiopagus gorilla twins.



Fig. 2. Dorsal view of the ischiopagus twins showing the third leg (tripus).

tained placenta. The gorilla received oxytocin (Oxytocin Bengel®, WDT, Garbsen, Germany) intravenously and a broad-spectrum antibiotic. She recovered well after reversal of anaesthesia with atipamezole (Antisedan®; Janssen-Cilag, Neuss, Germany).

A complete necropsy examination was performed on the twins. Samples for microscopical examination were fixed in 10% neutral buffered formalin. Tissues were processed routinely and embedded in paraffin wax. Sections were stained with haematoxylin and eosin (HE).

The left conjoined twin is hereafter referred to as 'twin A' and the right as 'twin B'. Externally, the upper parts of the female twins were grossly normal. The combined body weight was 3,517 g (approximately 1,759 g for each twin), which is slightly below the normal weight range of 2,110 g for a new-born gorilla (Chapman *et al.*, 1990). Each individual had its own head and chest with two arms and a diaphragm. The conjunction started in the umbilical area. There was a conjoined xiphoid through a cartilage bridge, one umbilicus with two arteries and two urachi and interconnected livers. The point of union involved the body wall and skin of the lower abdomen and extended to a shared abdominal and pelvic cavity. Computed tomography revealed two complete

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