

Twin fetuses in an Atlantic white-sided dolphin (*Lagenorhynchus acutus*) stranded on the coast of Scotland, UK

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The present study is the first record of twinning in Lagenorhynchus acutus and indeed any Lagenorhynchus sp. Both fetuses were male and located in the left uterine horn, had distinct grossly normal placentas and amniotic sacs, and were therefore likely dizygotic twins. The twins were an incidental finding in an animal that died of a systemic Brucella ceti infection.

Keywords: *Lagenorhynchus acutus*, twins, Scottish Marine Animal Stranding Scheme, UK

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INTRODUCTION

Twinning in odontocetes appears to be a rare occurrence but has been reported in several species upon examination of dead animals (González *et al.*, 1999; Nakamatsu, 2001; Ijsseldijk *et al.*, 2014). No reports exist of the survival of multiparous births in this sub-order, where uniparous births are the norm (Perrin & Donovan, 1984).

MATERIALS AND METHODS

An adult female Atlantic white-sided dolphin (*Lagenorhynchus acutus*) was found stranded dead at Weyland Bay, near Kirkwall, Orkney, Scotland (58°59'18.5316"N – 2°57'12.8448"W) on 3 October 2008. The animal was subjected to a standardized cetacean necropsy (Kuiken & García Hartmann, 1991) within 24 h of being reported. Routine bacterial cultures were performed on a selection of tissues and a range of tissues were examined histologically (Davison *et al.*, 2013). Age was estimated using methods adapted from Lockyer (1993). The ovaries were fixed in formalin, weighed and sectioned at 1–2 mm intervals along the broad ligament. The presence of corpora lutea or albicantia scars (an indication of maturity) were recorded.

RESULTS

The carcase was in a good state of preservation with only slight decomposition. The animal weighed 130.5 kg, was 217 cm

long, and had a girth measured cranial to the dorsal fin of 124 cm. Teeth ageing estimated the dolphin to be 12 years old. The mean of three standard blubber thickness measurements was 16 mm and the nutritive condition of the animal was moderate to poor (Kuiken & García Hartmann, 1991). Externally the animal was unremarkable with no obvious parasites or scars and no evidence of bruising within the blubber or sub cutis. The lungs showed asymmetry consistent with live stranding; hyperinflation of the left lung and hypostatic congestion of the right lung. Stable foam was present in the trachea and bronchi and ruptured small emphysematous bullae in the left lung. All sections of the stomach were empty.

Two corpora lutea (CL) were present on the left ovary associated with grossly normal twin male fetuses in the left uterine horn. The left ovary weighed 12.44 g, CL 1 measured 17.53 mm (Height), 16.71 mm (Length), 16.61 mm (Width) and CL 2 measured 17.73 mm (H), 12.81 mm (L), 14.60 mm (W). The right ovary weighed 2.69 g and no corpora lutea were present. No corpora albicantia were observed on either ovary.

Both fetuses had distinct grossly normal placentas and amniotic sacs and they were therefore probably dizygotic twins. Foetus A weighed 7.20 g, was 56 mm in length with a maximum girth of 43 mm. Foetus B was slightly larger weighing 8.00 g, 64 mm long with a maximum girth of 49 mm (Figure 1).

An abscessed plerocercoid parasitic cyst (probably *Monorygma grimaldii*) was present in the mesovarium. There were no abnormalities noted within the vagina. There were multiple pale coloured fibrino-necrotic nodules present in the spleen. The remainder of the carcase was grossly unremarkable.

Brucella ceti was isolated from the liver, kidney, spleen, mesenteric lymph nodes and the mesovarium abscess in the dam suggesting a systemic distribution. Neither the fetuses

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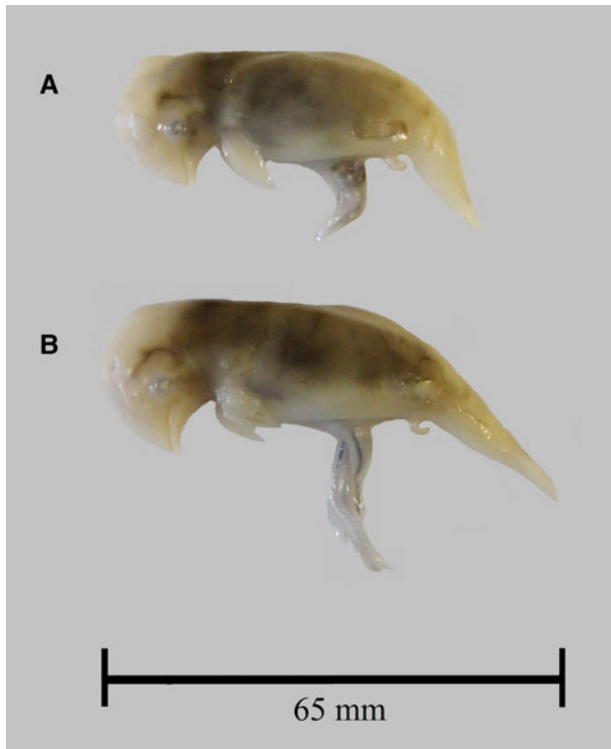


Fig. 1. Twin Atlantic white-sided dolphin (*Lagenorhynchus acutus*) foetuses A and B.

nor placentas were subjected to bacteriological or histological examination.

Histological examination of tissues from the dam showed a variably mild to severe, sub-acute to chronic, generalized predominantly lymphocytic meningitis which increased in severity in a rostral to caudal direction. Haemorrhages were present throughout the brain, one relatively large forming a cavity in the cerebral cortex. Multiple necrotic foci and suppuration were present in the congested and haemorrhagic spleen, suggestive of early abscess formation, along with a mixed inflammatory cell sub-capsular and periportal hepatitis. Necrotic foci in the mesenteric lymph node contained eosinophils and occasional multi-nucleate giant cells (presumed parasitic). One lung was congested and oedematous (protein rich fluid within the lumina of both alveoli and bronchi). The other contained over-expanded alveoli with large numbers of erythrocytes within the lumina, consistent with live stranding (Kirkwood *et al.*, 1997). No significant lesions were found in the adrenals, kidneys, urinary bladder, heart, uterus or ovaries. These findings are consistent with a systemic *B. ceti* infection, the histological lesions present are consistent with those of neurobrucellosis in this and other species of pelagic delphinids (Davison *et al.*, 2013). This was considered to be the cause of the live stranding and the ultimate cause of death. The isolation of *B. ceti* from the mesovarium abscess would also suggest the infection involved the reproductive tract.

DISCUSSION

Atlantic white-sided dolphins become sexually mature at around 218 cm in length which corresponds to 6–8 years of

age (Sergeant *et al.*, 1980; Rogan *et al.*, 1997). The gestation period in this species is believed to be 11 months with an oestrus cycle occurring during August and September with parturition in the following June and July (Robeck *et al.*, 2001). This would fit with the pregnancy status of 1–2 months in this animal. Ovulation and pregnancy occur asymmetrically and almost always in the left uterine horn in harbour porpoises (*Phocoena phocoena*) (Addink *et al.*, 1995) and in bottlenose dolphins (*Tursiops truncatus*) where pregnancy occurs in the left horn 68% of the time (Harrison & Ridgeway, 1971). The physiological mechanism for the observed asymmetry is unknown (Robeck *et al.*, 2001). It is not unreasonable to assume a similar frequency in Atlantic white-sided dolphins. Since the corpus luteum graviditatis is formed and preserved both in terms of size and activity throughout the pregnancy in most cetaceans (Slijper, 1966), and as the Atlantic white-sided dolphin in this study had two corpora lutea and two separate placentas, it is likely that this case of twinning resulted from a double ovulation (i.e. dizygotic twins).

Multiparous pregnancies have been described in several species of Mysticetes including sei whale (*Balaenoptera borealis*) (Gambell, 1968; Kawamura, 1969); humpback whale (*Megaptera novaeangliae*) (conjoined twins; Zemsky & Budylenko, 1970; and non-conjoined twins; Kimura, 1957); common minke whale (*Balaenoptera acutorostrata*) (conjoined twins; Zinchenko & Ivashin, 1987; and non-conjoined twins Kato, 1982), Antarctic minke whale (*Balaenoptera bonaerensis*) (Kato, 1982), blue whale (*Balaenoptera musculus*) (Branch, 2008) and fin whale (*Balaenoptera physalus*) (Kimura, 1957; Laws, 1961). Furthermore Jonsgård (1953) reported a fin whale with six foetuses of varying sizes. Multiple foetuses are less frequent in Odontocetes than in Mysticetes (Lockyer, 1984), although they have been reported in sperm whales (*Physeter macrocephalus*) (Matsuura, 1940; Ohsumi, 1965; Gambell, 1972; Best *et al.*, 1984; Clarke *et al.*, 2011), short finned pilot whale (*Globicephala macrorhynchus*) (Escorza *et al.*, 1994), striped dolphin (*Stenella coeruleoalba*) (Tobayama *et al.*, 1970), bottlenose dolphin (*Tursiops truncatus*) (conjoined twins; Dabin *et al.*, 2004; Kompanje, 2005; Aytemiz *et al.*, 2014, and non-conjoined twins; Gray & Conklin, 1974; Lacave, 1991), Risso's dolphin (*Grampus griseus*) (Gassner & Rogan, 1997), beluga whale (*Delphinapterus leucas*) (Osborn *et al.*, 2012), short-beaked common dolphin (*Delphinus delphis*) (González *et al.*, 1999), Dall's porpoise (*Phocoenoides dalli*) (Nakamatsu, 2001) and harbour porpoise (Ijsseldijk *et al.*, 2014). Of these cases, the striped dolphin, sperm whale, common dolphin, Risso's dolphin, Dall's porpoise, harbour porpoise and conjoined twins of the bottlenose dolphins were free-living individuals that stranded dead, the others were all captive animals. The multiple pregnancy in the beluga followed artificial insemination (Osborn *et al.*, 2012). To date, twinning had not been reported in any *Lagenorhynchus* sp.

All multiplets in the above studies were found in utero, and there are no records of the delivery of mature foetuses nor survival of twins in Mysticetes or Odontocetes (Perrin & Donovan, 1984). In delphinid species an offspring's weight is approximately 10–15% that of the dam (Slijper, 1966). This high birth weight would not favour the survival of multiple foetuses and is likely to result in spontaneous abortion or death of the female (Perrin & Donovan, 1984; Ijsseldijk *et al.*, 2014). Infection with *Brucella* is a well known cause of

abortion and reproductive failure in terrestrial animals (Radostits *et al.*, 2007) and *Brucella* sp. has been shown to cause placentitis and subsequent abortion in a bottlenose dolphin (Miller *et al.*, 1999). Although bacteriological and histological examination of the grossly normal reproductive tract and foetuses was not carried out in this case, isolation of *B. ceti* from the mesovarium abscess suggests the infection involved the reproductive tract. It is unlikely that, had the dam in this study lived, the twin foetuses would have survived to full term.

This was an adult sexually mature female, with no evidence of recent feeding along with gross and histological lesions consistent with systemic brucellosis including severe neuro-brucellosis. The twins were an incidental finding in an animal that died of a systemic brucellosis infection. In conclusion, we believe this is the first report of twin foetuses in an Atlantic white-sided dolphin and furthermore the first in any *Lagenorhynchus* sp.

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