Introduction

A reduced appetite and subsequent weight loss was observed in a 2.7m female Sand Tiger shark (Carcharias taurus) at the SeaLife London Aquarium. The shark had been a resident in the aquarium for 12 years, having arrived as a juvenile.

There were no obvious signs that would account for the refusal of food and the other sharks in the exhibit continued to feed normally. A variety of fresh and frozen food items were tried with inconsistent results. Over a period of 18 months separate treatments with antibiotics, non steroidal anti inflammatory drugs and anabolic steroids did not return the feeding rate to normal.

Operation

A midline incision at the approximate position of the stomach was made. At this time, the liver was noted to be abnormally reduced in size (atrophied), enabling easier access to the stomach and intestines. Some of the gas contained within the stomach was aspirated to reduce its size before lifting it out of the body cavity.

Anaesthesia

MS222 at 100mg/L was used for induction. This was increased over the following hour to 325mg/L and was reduced at the end of surgery to reduce the recovery time. Oxygen levels were kept between 120-140% saturation for the duration of the operation.

Operation

A solid mass was found at the entry to the spiral valve and removed.

Enterolith

Analysis using X-ray diffraction showed that it consisted of calcium hydroxyapatite (calcium phosphate carbonate), the main component of fish scales and skeletons.

Any undigested remains were removed from the intestines, the incision cleaned, closed and the intestines returned to the body cavity.

The technique used to close the abdominal wall involved the use of 19 gauge hypodermic needles to provide a channel for the suture material as the suture needles were unable to repeatedly penetrate the shark’s skin.

The shark was ventilated and kept under sedation by pumping water from the anaesthesia tank over the gills. The eyes and nostrils were also kept moist during the operation by periodically flooding with water.

The shark was returned to the exhibit immediately after the incision had been sealed and was forced ventilated to aid recovery. Respirations increased and it appeared to recover but unfortunately deteriorated and died 7 hours later.

Discussion

Enteroliths are generally rare, but have been described in a range of vertebrates, particularly horses (1). To the authors’ knowledge this is the first record of an enterolith from an elasmobranch. An enterolith around a stringray nidus has been described in a bottlenose dolphin (2).

The exact reason the enterolith formed is unclear but changes in the pH of the intestine and a diet high in minerals can contribute to their formation following the ingestion and intestinal impaction of any indigestible object capable of acting as a nidus.

The female Sand Tiger shark shared the exhibit with two males and several other species of large shark and none have shown any signs of being affected with the same disorder.

Post Mortem examination

When an octopus is fed to the sharks the beak is now removed and to reduce the amount of calcium in the diet the heads from large fish are also removed.

Changes to shark husbandry

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Enterolith

The mass was identified as an enterolith. Enteroliths are formed by mineral deposition in concentric layers around a central nidus of ingested material. The composition of the mineral is determined by the chemistry of the intestinal content. It is suspected that this enterolith formed over a period of many months to years, but the exact duration cannot be determined.

Enterolith

In this instance a beak from an octopus was found at the centre of the enterolith. Octopuses are used as food for several species in this exhibit, though it is possible that the beak was consumed in the wild.