The swim bladder is a hollow organ filled with a gas, whose main functions are to help the fish to maintain its depth, control its buoyancy, oxygen storage, respiratory functions and communication (hearing and sound production) (Petrick, 1975; Grom, 2013; Smith, 2019). In Carassius auratus (Cyprinidae) is constituted by two chambers – anterior and posterior, linked by a narrow isthmus - ductus communicans. The anterior chamber is bigger than the posterior. The anterior portion of the anterior chamber is connected with the tripus of the Weberian apparatus (physostomous duct) (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013). Cyprinidae family members are physostomous species, which means that their swim bladder is connected to the oesophagus by the pneumatic duct (Grom, 2013).
The curvature of the body. The quality of the x-ray is not ideal as it was made in a container with water.

Figure 1: Laterolateral horizontal projection of the goldfish (*Carassius auratus*, Linnaeus 1758) just before (a) and after (b) puncture of the posterior camera.

Due to the impossibility of correcting this condition, the animal’s advanced age and the lack of welfare, the owner decided for euthanasia. Isoflurane was added to the swimming water and with the animal anaesthetized, 1 mL of pentobarbital sodium solution was administered intravenously. Necropsy was performed immediately after death, according to the techniques described for fish, under appropriate conditions of safety and hygiene (Garcês and Pires, 2017).

On post-mortem examination the fat bodies in the celomic cavity were very enlarged, confirming that this fish was obese (Figure 2).

Figure 2: Morphology and location of the coelomic organs of a goldfish (*Carassius auratus*, Linnaeus 1758) after incision (SB – swim bladder; FB – fat bodies; St, stomach)

A complete clockwise torsion of the swim bladder (more than 180°) at *ductus communicans* level was detected. In Figure 3 we can observe the twisting (Figure 3A) and a normal swim bladder without torsion (Figure 3B) to compare. After incision, the lumen of the posterior chamber presents a translucid, limpid mucus in a residual quantity. The wall of the posterior chamber appeared thicker. The bladder had no adhesions to adjacent tissues.

Figure 3: In A swim bladder torsion, the point (arrow) where the torsion happened, and in B a normal swim bladder (anterior chamber -AC, posterior chamber -PC, communicating duct -CD and pneumatic duct -PD). On the left a schematic representation of the torsion (A) and normal swim bladder (B).

Tissue specimens were routinely fixed in 10% neutral buffered formalin and embedded in paraffin, sectioned at 3 μm and stained with haematoxylin and eosin (H&E) for histologic examination at the Laboratory of Histology and Anatomic Pathology of UTAD.

The histopathologic exam revealed no alteration in the cellular architecture of the swim bladder. In the anterior chamber, it was observed a single layer of flattened epithelial cells, with a prominent basal lamina below the epithelial cells. The *lamina propria* of the anterior chamber contained collagen fibrils, elastic fibres, and fibroblasts. The posterior presented of cuboid squamous cells. A thin layer of highly fibrillar elastin adheres closely to the basal lamina of the epithelial cells of the posterior chamber. The tunica externa was composed of two distinct layers of densely packed collagen fibrils. The liver presented a brown pigment in macrophages and hepatic vacuolization consistent with lipidosis (Figure 4). Unfortunately, many structures were degraded due to the rapid decomposition of the corpse.

The swim bladder torsion is a rarely reported condition, with only a few occurrences in ornamental goldfish and rainbow trout (Smith, 2019). References to this pathological condition were found in the textbooks related to pathology, medicine and surgery of fish, but without any proper description of all the case.

Its aetiology is not yet well understood but can be related to buoyancy disorders that can lead to the torsion itself.
later. The over-insufflation of the swim bladder caused by bacterial diseases, tumours, virus or gas supersaturation; displacement of the posterior chamber of the swim bladder due to tumours, polycystic kidney diseases or trauma; the presence of fluid in the swim bladder; intestinal tympany; rupture of the swim bladder could also be implied in this process (Widgoose, 2001; Woo and Bruno, 2011; Roberts, 2012; Smith, 2019).

Figure 4: Anterior chamber presented a single layer of flattened epithelial cells, with a prominent basal lamina below the epithelial cells and lamina propria containing collagen fibrils, elastic fibres, and fibroblasts. In B section in the point where the torsion occurred. Many cells were degraded due to the rapid decomposition of the corpse (H&E, 40x).

In Goldfish, this condition could also be explained by its anatomical features. Goldfish, particularly Asian varieties, have short stout bodies can that lead to a unbalance in the swim bladder (Roberts, 2012).

The diagnose of swim bladder torsion was only possible at post mortem examination. In this case, it was not observed any signs of bacterial or viral infections or the presence of neoplastic nodules. We can presume that this torsion could be a consequence of the previously suffered traumas and changes in its posture. Additionally, its anatomical features and the animal body condition (obesity) could contribute to the torsion of the swim bladder.

This report could improve the knowledge on swim bladder pathology in fishes, especially in goldfish (*Carassius auratus*, Linnaeus 1758) and reinforce the importance of the post-mortem exam in these animals.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

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