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The Transverse Septum Morphology of the Farmed Adult African Catfish (*Clarias gariepinus* B.) from Eastern Nigeria

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ABSTRACT

The morphology of the adult African catfish transverse septum was studied to establish its functional anatomy as there is dearth of information on it from available literature. The fish sourced from commercial aquaculture was immobilized and the specimen- transverse septum dissected out, and investigated using haematoxyline and eosin stain. Grossly, the septum transversum was a milkish white membranous sheath separating the pericardial cavity from the thoraco-abdominal cavity. Histologically, the septum transversum was lined by simple squamous cells. The subepithelial region was composed mainly of loose irregular collagen fibres. Reticular fibres were also observed. Muscle tissue of mainly skeletal fibres and scant smooth muscle cells were seen embedded irregularly in the loose areolar tissue. Nerve fibres and blood vessels were also contained in this loose areolar tissue that formed the matrix of the septum transversum.

Keywords: Histology, Transverse septum, African Catfish .

The body coelomic cavities in teleosts have been described to include pericardial and pleuriperitoneal cavities. Whereas the pericardial cavity houses the heart, the pleuriperitoneal cavity contains visceral organs like liver, spleen, stomach and gonads. The septum transversum has been documented to be the membranous sheath separating the pericardial cavity from plueriperitoneal cavity (Farag *et al.*, 2014); as the teleost does not possess the typical mammalian diaphragm separating the thoracic cavity from the abdominal cavity.

Whereas the presence of this transverse septum ST, has been reported in the scaled common carp fish- *Cyprinus carpio* (Farag *et al.*, 2014). The hypoplasia/aplasia of septum transversum in Atlantic salmon *Salmo salar* has been reported (Poppe *et al.*, 1998); but there is no report on its morphology in the farmed African catfish from available literature. The African catfish is an important culture fish species in Nigerian commercial aquaculture (Emokaro *et al.*, 2010). Hence, this study that will fill this dearth in information especially its histology. It will also help clinicians in disease diagnosis including neoplasia and congenital anormalies of the sheath.

MATERIALS AND METHODS

Five adult African catfish sourced from a commercial aquaculture in Eastern Nigeria were used for the study. They weighed an average of 900g and measured a standard body length of 45cm in length. The fish were humanely immobilized by chloroform sedation and slight blow to the head. The body cavity was cut open through the mid lateral area from the commissure of the upper maxilla and lower mandible to the point midway between the pectoral fin cranially and genital duct caudally. The specimen under study – the transverse septum was excised and sections were immediately fixed in 10% neutral buffered formalin solution. The tissues were passed through graded ethanol, cleared in xylene, impregnated and embedded in paraffin wax. Sections 5µm thick were obtained and stained with haematoxylin and eosin for light microscopy examination (Bancroft and Stevens, 1977).

RESULTS AND DISCUSSION

Grossly, the septum transversum was a milkish white tough membranous sheath separating the pericardial cavity from the thoraco-abdominal cavity. The peripheral portion attached itself firmly to the internal body wall at the most caudal end of the dendritic organ near the attachment of the pectoral fin. The central area of the sheath formed an in-folding into the tubular structure –oesophagus that connected the oropharyngeal cavity to the stomach located in the thoraco-abdominal cavity.

Histologically, the septum transversum was lined by simple squamous cells. The subepithelial region was composed mainly of loose irregular collagen fibres (Figure 1).

Reticular cells and fibres were also observed (figure 2). Muscle tissue of mainly skeletal fibres and scant smooth muscle cells were seen embedded irregularly in the loose areolar tissue (figure 1, 2 and 3). Nerve fibres and blood vessels were also contained in this loose areolar that formed the matrix of the septum transversum (2, 4).

Figure 1: section Septum transversum showing skeletal muscle fibres SK, sandwinched in the abundant loose irregular connective tissue L. H&E (Scale bar = 40µm).

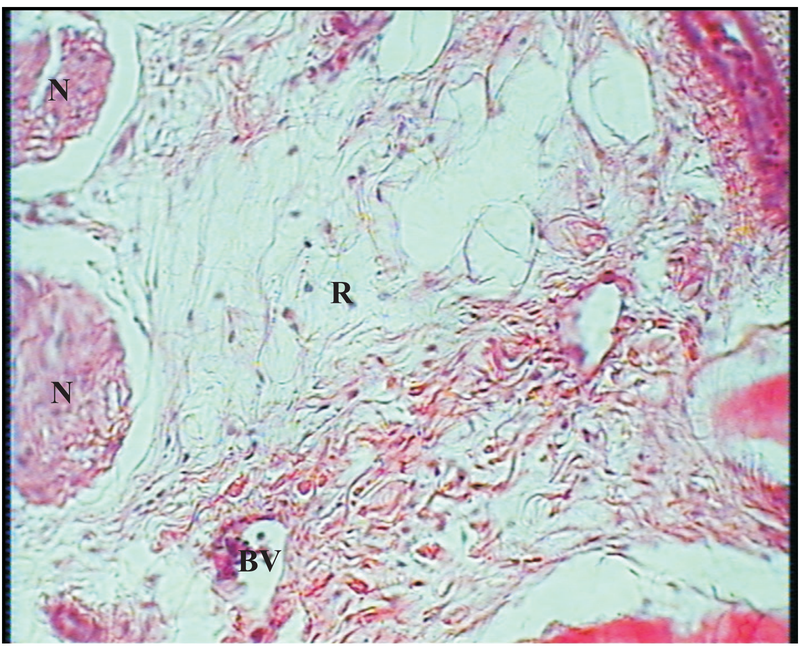

Figure 2. section of Septum transversum showing abundant loose areolar tissue L, containing nerve fibres N, blood vessels BV. Note the reticular fibres R, surrounding the nerve fibres. H&E (Scale bar = 40µm).

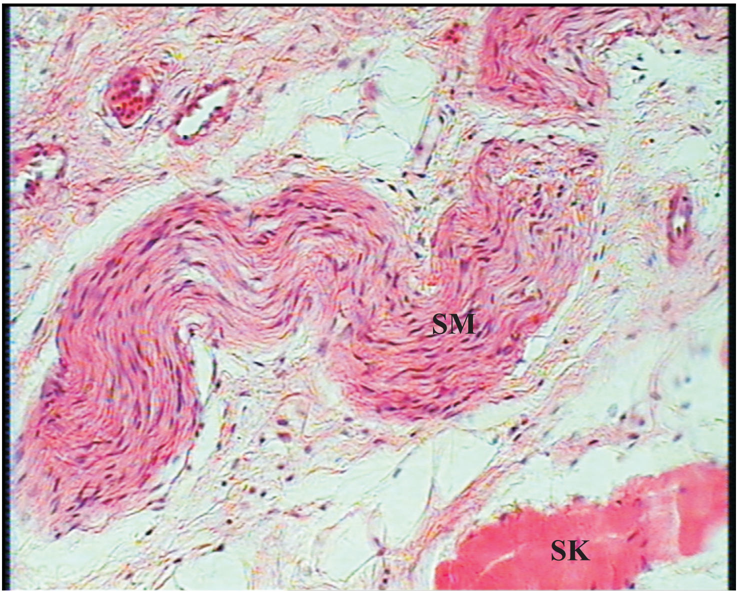

Figure 3. Section of the septum transversum showing Smooth muscles SM, skeletal muscle SK, loose irregular fibres L and blood vessels (black arrow). H&E (Scale bar = 40µm).

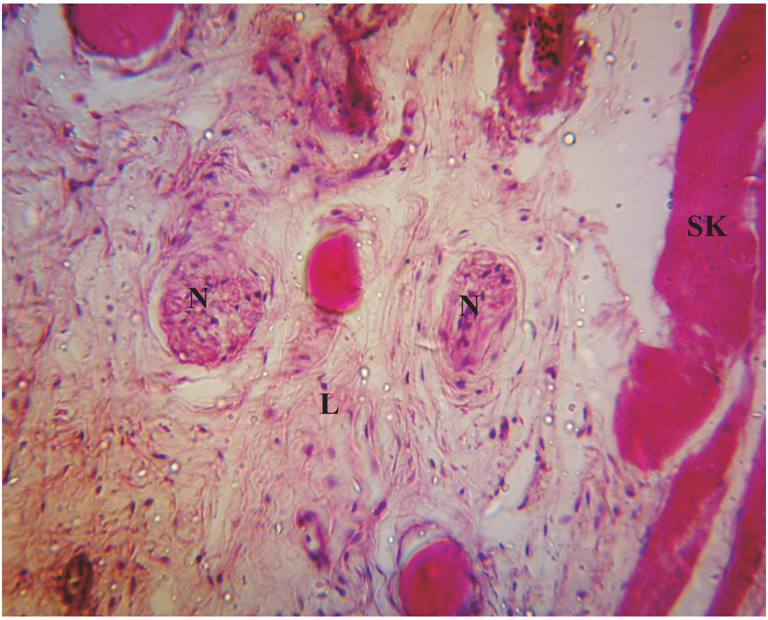

Figure 4. Section of Septum transversum showing abundant loose areolar tissue L, containing nerve fibres N, skeletal muscle SK, and blood vessels (black arrow). H&E (Scale bar = 40µm).

The presence of the septum transversum ST, as seen in this study has been reported in *Xenentodon cancila* (Gupta, 1971) but missing in some farmed Atlantic salmon (Beaverfjord and Helland, 2005). From this study, the ST was grossly seen separating the pericardial cavity from the pleuriperitonal cavity. This has also been reported in the scaled common carp fish- *Cyprinus carpio* (Farag *et al.*, 2014). The ST in this African catfish contributed towards the formation of the cranial oesophagus. This feature will completely seal off any possible contamination of the coelomic cavities with feeds or injurious materials from the oro-pharyngeal cavity. This is a non specific host defense mechanism (Seifert, 1996). It will also ensure that all feed materials pass to the stomach via the oesophagus for continuation of the digestive process (Ikpegbu *et al.*, 2012). This feature of the central portion of the ST infolding to form the cranial oesophagus is at variance to the anatomy of the mammalian diaphragm which has openings for passage of some tubular organs like hiatus aorticus for the passage of the aorta, hiatus oesophagus for the oesophagus and caval foramen for the caudal vena cava (Chibuzo, 2006).

The milky white colouration of the ST is due to the absence of pigment cells as no melanocyte was seen in this study. The presence of abundant loose and dense irregular connective tissue would be responsible for the tough nature of the ST. In the Manatee -*Trichechus manatus latirostris* the ST has been described as a fibrous but not inherently strong structure (Rommel and Reynolds, 2000). The areola tissue readily provides medium for the mobile connective tissue cells especially those of the reticulo-endothelial system as was evidenced by the presence of reticular cells and fibres. The skeletal muscles under voluntary control will help in contractility and expansion of the ST especially those at the central portion. This mechanism when reinforced by the smooth muscle cells will help during deglutition to force food into and through the cranial oesophagus. In mammals the functional role of the diaphragm in swallowing and emesis has been documented (Pickering and Jones, 2002). The presence of both skeletal and smooth muscle cells that were seen in this fish diaphragm differs from the mammalian diaphragm which contains only skeletal muscle (Marrell and kardon, 2013). The nerve fibres present will readily elaborate both voluntary and involuntary stimulation and response. The presence of good number of blood vessels signifies an active organ requiring regular and adequate metabolite supply (Singh, 2006).

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