The umbilical cord is a narrow tube like structure that connects the developing fetus to the placenta. The morphological changes registered at birth in the local anatomical structures around the umbilical cord area form a complex structure provided by nature to help the newborn organism to severe relation with the placenta. Prenatal developmental studies on the umbilical cord were made in sheep (Coceani et al., 1984), in dogs (Burton and White, 1999) and in camel (Elgozouli and Osman, 2012). But scanty literature is available on the umbilical cord of buffalo. So, the present study was conducted to elucidate the histological and histochemical studies on umbilical cord of buffalo during different gestational periods.

The study was conducted on the umbilical cord of the 18 buffalo foetii from 3.7 cm CVRL to 92 cm CVRL procured from Gazipur slaughter house, New Delhi and Teaching Veterinary Clinical Complex, GADV ASU. The foetii were fixed in 10% neutral buffer formalin immediately after measuring their CVR length and their age in days was calculated as per formula given by Soliman (1975) in buffalo.

\[ Y = 28.66 + 4.496 \times ( \text{CVRL} \leq 20 \text{ cm}) \]
\[ Y = 73.544 + 2.256 \times ( \text{CVRL} \geq 20 \text{ cm}) \]

Where Y is the age in days and X is the CVR length in cm.

These fetuses were divided into 3 groups based on their CVR length. Group-I (between 0-20 cm), group-II (above 20 cm to 40 cm) and group-III (above 40 cm).

The umbilical cords were processed for paraffin sectioning and 5-6 µ sections were stained with hematoxylin and eosin (Luna, 1968), Masson's trichrome, Gridley's (Sheehan and Hrapchak, 1973), periodic acid Schiff-Alcian blue (Luna, 1968) and bromphenol blue (Shyamasundri and Rao, 2007).

The umbilical cord of buffalo foetus was comprised of two umbilical arteries, two umbilical veins and urachus in the loose connective tissue fibres. The umbilical arteries were having star shaped lumen whereas umbilical veins had oval/elliptical lumen in all the age groups. The thickness of all the layers of arteries and veins increased with advancing age of fetus. The matrix of umbilical cord was composed mostly of stroma cells with few collagen fibres. The allantoic duct was present between the arteries and had a great number of small nourishing vessels.

**Key words**: Buffalo, Umbilical artery, Umbilical vein

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The umbilical cord of buffalo foetus was comprised of two umbilical arteries, two umbilical veins and urachus in the loose embryonic connective tissue called Wharton's jelly (Fig. 1). These structures were covered by the thick stratified epithelium of mesenchymal tissue as reported by Miglino et al. (2007) in bovines and Ferreira et al. (2009) in buffalo.

The umbilical arteries were having star shaped lumen as reported earlier by Ferreira et al. (2009) with all the three layers i.e. tunica intima, media and externa in all the age groups. The thickness of all the layers increased with advancing age of fetus. The tunica intima was composed of squamous endothelium with thin internal elastic lamina. The later disappeared with the increase in fetal age. Similarly, Elgozouli and Osman (2012) found that the tunica intima of umbilical arteries consisted of elongated endothelium lying parallel to the long axis of the vessel in camel.

Tunica media was composed of two layers i.e. inner longitudinal and outer circular smooth muscle fibres along with few collagen, elastic and reticular fibres in group I.
The thickness of muscle fibres increased in group-II and III as reported earlier.

Tunica adventitia was composed of collagen, elastic and smooth muscle fibres and was almost of same thickness to tunica media in group-II but with advancing age of fetus, the tunica adventitia became thinner as compared to tunica media.

The umbilical veins had oval / elliptical lumen in all the age groups and was composed of all the three tunics. Tunica intima was composed of squamous endothelial cells. Similarly, Elgozouli and Osman (2012) reported rounded endothelial cells along with lack of internal elastic lamina in camel.

Tunica media was composed of smooth muscle fibres arranged in inner longitudinal and outer circular layer with few elastic, reticular and collagen fibres in group-I. With advancing age of fetus, tunica media increased in thickness and was arranged in 3 layers i.e. inner and outer circular and middle longitudinal layer (Fig. 1).

Tunica adventitia was thicker than tunica media in all the age groups and was composed of collagen, elastic, reticular and smooth muscle fibres along with vasa vasorum as reported by Elgozouli and Osman (2012) in camel.

The matrix of umbilical cord was composed mostly of mesenchymal cells, stroma cells with few collagen fibres. The allantoid duct was present between the arteries and had a great number of small nourishing vessels. Strong PAS positive reaction was observed in blood vessels but very weak reaction was noticed in the wharton's jelly (Fig. 2). Bromphenol blue reaction was also more in blood vessels as compared to the ground substance.

REFERENCES


