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## بعض الدراسات على تطور المسال المرارى في الجاموس

عبد الله حنفي ، أنور قاسم ، عبد السلام جموده ، رأفت البطرى

طول المسال المرارى يزداد تدريجيا من بداية الفترة قبل الولادة وينتهي مع فترة النهاية بعد الولادة .

ويقع المسال المرارى في الحفرة المطولة الممتدة من الحفرة التي تقع فيها الحويصلة الصفراوية بين الفص المربع والفص الأيمن مع الكبد محاط بالنسيج الضام .

أما اتجاه المسال المرارى فهو متجه للخلف ولأسفل في مراحل النمو المختلفة في الجاموس واتحاد المسال المرارى والقناة الكبدية بزاوية حادة خارج البوابة الكبدية .

يتكون جدار قناة الحويصلة المرارية في المراحل الجنينية المبكرة من صفيحة طلائية ذات خلايا مكعبة أو عمودية وطبقة تحت طلائية مكونة من نسيج ضام غير متماسك .

أما في المراحل الجنينية المتأخرة والمراحل المبكرة فيما بعد الولادة فنجد أن هذا الجدار يتكون من طبقة مخاطية وطبقة ليفية وطبقة سيروزية .

تبدأ التنيات المخاطية في الظهور في الأجنة التي تتراوح أطوالها بين 16 - 20 سم .

تفتقد قناة الحويصلة المرارية جدارا عضليا واضحا ولكنها ربما تحتوى على خلايا عضلية وخاصة مراحل ما بعد الولادة .

يغطي الجزء الطليق من القناة طبقة سيروزية أما جزؤها الملتصق بالكبد فيغطي بطبقة ليفية متماسكة .



Dept. of Anatomy, Histology and Embryology,  
Faculty of Vet. Med., Alexandria University.  
Head of Dept. dr. A.M. Kassem.

**SOME DEVELOPMENTAL STUDIES ON THE CYSTIC  
DUCT OF THE BUFFALO IN EGYPT (*Bos Bubalus L.*)**  
(With 3 Figures)

By

**A. HIFNY,\* A.M. KASSEM, A.K. HEMMODA and R.M. EL-BAKARY**  
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**SUMMARY**

The cystic duct lies in the elongated Fossa vesicaefelleae, between the quadrate and right lobes of the liver, which is filled by connective tissue and the lesser omentum. The direction of the cystic duct is caudoventral in the developmental stages of the buffalo. In these stages, union occurs between the cystic and hepatic ducts at an acute angle outside the porta hepatis.

In the early prenatal stages, the wall of the cystic duct is formed of lamina epithelialis which consists of cuboidal or low columnar cells and subepithelial layer formed of lobes connective tissue. In late prenatal and postnatal stages, the wall of the cystic duct is formed of a mucosal layer, fibrous layer and tunica serosa and adventitia.

At 16 cm - 20 cm CVRL foetal stages, the mucosal folds begin to appear. The cystic duct has no distinct muscular layer, but may have muscle cells, especially in the postnatal stages. The outer layer of the cystic duct consists of the serosa in the free part of the duct and adventitia in its attached part to the liver.

**INTRODUCTION**

Recently, the buffalo in Egypt received increasing attentions of investigators in the field of Veterinary Anatomy in order to reveal any obscure knowledge between it and other related ruminants namely the Ox. The biliary system which is an important part of the digestive system due to its role in food digestion has been put under the scope of our attention from the view of its development. Little informations were only given by NICKEL *et al.* (1973) in the ox and ZIVKA (1978) in man. In spite of this, nothing could be traced in the buffalo. The cystic duct, as a part of the biliary system was the point of choice to begin with an attempt of our studies which may be of help for further studies in the future.

**MATERIAL and METHODS**

Forty four foetal samples of different ages were collected from Cairo abattoir and the postnatal from Edfina and Damanhour abattoirs. The crown vertebral rump length (CVRL)

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\* Faculty of Vet. Med. Assiut University.



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was measured by a flexible cloth tape and the samples were immediately fixed in 10% formaline.

The foetal lengths ranges between 4 cm and 95 cms. For postnatal studies, samples from 30 buffalo calves (30-60 days), 15 buffaloes of 3 years of age, and 10 of 8 - 10 years were collected.

The length of the duct and the distance between the pylorus and duodenal papilla in prenatal and postnatal stages were measured. The proper hepatic artery was injected with latex to study the arterial blood supply in the prenatal and postnatal stages.

For histological studies, samples were taken from 28 foetuses, two newborn buffaloes (45 days) and four adults 3 - 8 years of age. They were treated according to the classical methods of paraffin sections.

The following stains were applied:-

- (1) Harris Hematoxylin and eosin.
- (2) Van Gieson stain.
- (3) Elastic stain.
- (4) Reticulin stain.
- (5) PAS-Alcian blue.

## RESULTS

The cystic duct lies in the elongated Fossa vesicaefellae, between the quadrate and right medial lobes of the liver filled by connective tissue and the lesser omentum.

The direction of the cystic duct is caudo-ventral in its developmental stages and union between the cystic and hepatic ducts in an acute angle has been observed. Such union occurs outside the Porta hepatis.

In early prenatal stages, the wall of the cystic duct is formed of the Lamina epithelialis and a subepithelial layer (Fig. 1 & 2). The Lamina epithelialis consists of cuboidal or low columnar cells. These cells have their apical border bullated with oval or nearly elongated nuclei resting on a basement membrane.

The subepithelial layer is formed of loose connective tissue. The cells of which increase in number towards the lining epithelium.

The subepithelial layer in 8 cm and 12 cm CVRL is composed of mesenchymal tissue containing small blood capillaries and blood cells.

At the 16 cm - 20 cm CVRL foetal length the mucosal folds begin to appear less in number and short in length. The wall of the cystic duct differentiates into a mucosal and a fibrous layer tunica serosa and adventitia. In 12 cm CVRL foetus, the mucous layer is formed of cuboidal or low columnar epithelial cells but the fibrous layer is formed of mesenchymal tissue surrounded by a serous tunic. In some foetuses, the epithelium becomes columnar to tall columnar. The lamina propria contains predominantly collagenous and elastic fibers with reticular fibers inbetween. Some muscle bundles are circularly arranged while others longitudinally, they are scattered in the fibrous tunic which is surrounded by a Tunica serosa containing large blood vessels.

The columnar cells gradually increase in height and cover the mucosal folds. They are absent in 12 cm CVRL foetus. The core of such folds is formed of connective tissue. The mucosal folds increase in number, length and goblet cells in the CVRL 26 cm, 34.5 cm and 40 cm foetuses (Fig. 2/4).

Smooth musculature is absent but only some occasional bundles of muscle cells without special orientation could be observed, very clear in CVRL 45 cm, and 50 cm, foetuses.

The wall of the cystic duct is composed of elastic fibers, containing small quantities of smooth muscle cells' Goblet, dark cells and bullated border of columnar cells are characteristic for the muscosal layer of the cystic duct.

Tubulo-alveolar glands are present in the lamina propria of the cystic duct. The muscular coat appears to be more fibrous, being composed of collagenous, reticular and elastic fibers which is clear in the 80 - 85 cm CVRL foetal length. Only some muscle bundles are present.

The lymphocytic infiltrations are seen between the tall columnar cells and epithelial pockets or Rokitansky-Aschoff sinuses in a similar manner as in the gall bladder.

The cystic duct in 85 cm CVRL foetal length resembles those of postnatal life but the wall, in the postnatal life is thicker than that of the previous foetal stages. The mucosal folds are longer and more numerous.

Goblet cells and lymphocytic infiltrations are numerous. The reticular fibres increase in thickness and length and extend into the core of the mucosal folds (Fig. 3).

#### DISCUSSION

The results obtained in the buffalo are in accordance with those of HABEL (1975) and NICKEL et al. (1973) in ox concerning the presence of hepatocystic duct. The presence of a single cystic duct during developmental stages in domestic animals was also seen in the buffalo in similar stages. HIGGINS (1926) in dog stated that there is a double cystic and common bile duct which was not observed here. The position of the cystic duct in the elongated Fossa vesicae fellae, between the quadrate and right medial lobes of the liver resembles that of man as revealed by ROTHMAN (1966).

The direction of the cystic duct in the developmental stages of the buffalo resembles that of man (WARWICK and WILLIAM, 1973) but ROTHMAN (1966) added that the direction is also parallel to the hepatic duct. The inner surface of the cystic duct does not contain a spiral valve as seen in man by ROTHMAN (1966) and BLOOM and FAWCETT (1977). The union outside the Porta hepatis between the cystic and hepatic ducts at an acute angle in the buffalo foetus was in agreement with EL-HAGRI (1967) and GETTY (1975) in domestic animal and ROTHMAN (1966) in man. These results were also given by SINGER and SINGH (1971) in the Indian buffalo. MILLER et al. (1964) in the dog and MAY (1954) in sheep stated that such union takes place at the dorsal end of the Porta hepatis. GETTY (1975) observed it in pig after its emergence from the fissure. WARWICK and WILLIAM (1973) observed it in man below the Porta hepatis.

The smooth musculature is absent except for some occasional bundles of muscle cells without any special orientation in 45 cm, 50 cm, and 55 cm CVRL foetal lengths. This was not seen in man by HAM (1969) and BLOOM and FAWCETT (1977). They stated that these folds are prominent constituting the spiral valve of Heister and containing the smooth muscle bundles. The wall of the cystic duct is composed of elastic fibers with small amounts of smooth muscle cells. This agrees with ZIVKA (1978) in man.



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Goblet cells dark cells and the bullated border of columnar cells are characteristic for the mucosal layer of the cystic duct in the present work. The tubuloalveolar glands are present in the Lamina propria of the cystic duct which were also seen by NICKEL *et al.* (1973) in the ox. They added that the muscular coat appears to be more fibrous, being composed of collagenous, reticular and elastic fibers which is clear in 80 cm and 85 cm CVRL foetal lengths.

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## LEGINDS

- Fig. (1):** Cross section in the cystic duct of buffalo foetus (CVRL 20 cm).  
H & E stain      Obj: 40; Ocular 5 : IK.  
(1) Lamina epithelialis.  
(2) Subepithelial layer.  
(3) Liver tissue.
- Fig. (2):** Cross section in the cystic duct of buffalo foetus (CVRL 40 cm).  
H & E stain      Obj: 25; Ocular 5 : IK  
(1) Lumen of the cystic duct.  
(2) Lamina epithelialis.  
(3) Lamina propria.  
(4) Goblet cells.
- Fig. (3):** Cross section in the cystic duct of an adult buffalo (CVRL 3 years of old).  
Reticulin stain      obj: 25; Ocular 5 : IK  
(1) Mucosal fold.  
(2) Lamina propria.  
(3) Reticular fibers.  
(4) Epithelial pocket.





Fig. ( 1 )



Fig. ( 2 )



Fig. ( 3 )

