

## **Ectopic Liver Anomaly in Umbilical Region of Newly Born Calves: Clinical, Pathological, Sonographical and Surgical Investigations**

*<sup>1</sup>M. Gomaa and <sup>2</sup>Shimaa, M. Gouda*

<sup>1</sup>Department of Surgery, Faculty of Veterinary Medicine, Zagazig University, Egypt

<sup>2</sup>Department of Animal Medicine, Faculty of Veterinary Medicine, Zagazig University, Egypt

---

**Abstract:** This study was carried out to certain the role of ultrasonography in diagnosis of ectopic liver at umbilical region in neonatal calves. A total of ten calves were enrolled in this study, five of them were apparently healthy and used as control and 5 had ectopic liver at umbilical region. Case history and thorough clinical examination were recorded and the disease was confirmed by the ultrasonography and histopathological investigations. There were no clinical differences between control and diseased calves except presence of mass as child head at their umbilical regions. This mass was covered by blackish necrotizing layer in 3 calves and was fresh and red in color in 2 calves. Ultrasonography reveled presence of a lobe of liver at umbilical region. This lobe appeared more echogenic than the normal and had dilated bile ducts and veins. Two methods of surgical correction were applied, herniotomy with reduction of the prolapsed part (n=4) and complete excision of the prolapsed part (n=1). Histopathological study of the ectopic liver part showed hemorrhage, coagulative necrosis and fatty change. The results of this study provide a reference range of the normal liver in neonatal calves and concluded that it is necessary to use ultrasonography during examination of any swelling or mass at umbilical area especially in neonates.

**Key words:** Ectopic Liver • Umbilicus • Clinicopathology • Ultrasonography • Surgical Interference

---

### **INTRODUCTION**

A congenital anomaly is defined as an abnormality of structure or function present at birth [1]. The terms ectopia, choristoma, aberrant rest or heterotopic and displaced tissue have been applied to microscopically normal tissue in abnormal locations [2]. Anatomic anomalies of the liver have been classified as accessory lobe of the liver with attachment to native liver and ectopic liver tissue without connection to the liver proper [3]. Among the veterinary literature cited, reports of heterotopic testis, spleen and accessory liver lobes have been observed to be few in number whereas comprehensive studies have been carried out in human medicine in this field [4-7]. In a case report of a calf in Turkey, a mass weighing 450 gm and measuring 10x18x9 cm located in the umbilical canal was surgically removed, macroscopical and microscopical examination were performed and the mass was liver tissue. The case was diagnosed as accessory liver lobe [8]. Ectopic liver tissue in human is a rare developmental anomaly. It was seen frequently on gallbladder but was occurred in several

places including intra-, retro- and extra- peritoneal sites [9]. Therefore, the current study aimed to diagnose these swellings in umbilical region of neonatal calves and an effort was also made to apply surgical intervention for them and to examine the normal liver of calf sonographically.

### **MATERIALS AND METHODS**

This study was carried out on ten mixed breeds' calves with age range between one day to 1 month old and weighed 40-80 kg body weight. Five calves were apparently healthy and used as control and 5 had mass approximately as a child's head size in the umbilical region. All control calves were clinically healthy and had negative parasitological examination and collected from a private farm in Sharkia governorate. Meanwhile, the diseased (2 males and 3 females) were submitted to the Surgery Department, Faculty of Veterinary Medicine, Zagazig University, Sharkia province, Egypt during the period (2011 to 2015).

The vital parameters include temperature, heart and respiratory rates/ minute were estimated. Conjunctival mucous membrane, lymph nodes, capillary refill time and suckling reflex were also assessed in all calves under investigation according to Rosenberger [10].

Ultrasonographic examination was conducted on every calf at control group after suckling by 2 hours. The area from the right 5<sup>th</sup> intercostal space to the last rib and extending ventrally to the ventral midline was clipped, cleaned and then coupled by gel. Linear (6.0-MHz) and microconvex (5.0-MHz) transducers (A real-time B-mode-Sono Scape machine, China) were used. Dorsal and ventral margin and size of the liver were assessed in different intercostal spaces after the method adopted from Braun and Krüger [11]. The dorsal and ventral margins of the liver were measured in relation to the midline of the back by using measuring tape. The intercostal spaces in which the gallbladder could be seen were determined. Relative size (RS) of liver was estimated from the formula adopted from goat by Braun and Steininger [12], as  $RS = (\text{size of liver: half of abdominal circumference}) \times 100$ . The half of abdominal circumference was determined by measuring tape from the dorsal line of the back till the ventral midline of the abdomen. Moreover, ultrasonography was applied on a swelled part at umbilical region in diseased calves. Surgical intervention was applied for reduction or excision of the prolapsed accessory liver lobe under local infiltration anesthesia.

The collected liver specimens for histopathological study were fixed in 10 % neutral buffered formalin and processed in the routine paraffin histopathological technique (washing in running water, dehydration in ascending grades of ethyl alcohol, clearance in xylol and embedding in paraffin). Later, paraffin blocks were sectioned to prepare 5 um thick sections that were stained with hematoxylin and eosin stain then examined microscopically for detection of lesions [13].

The mean and standard deviation (SD) of the collected clinical and ultrasonographical data were estimated by using Excel- Word 2010.

## RESULTS

**Clinical Investigations:** The vital parameters and other clinical data are shown in Table 1. All examined parameters were not affected in diseased calves when compared with control one. Only a child head size mass at their umbilical regions was the complaint of the owners of the diseased calves. This mass was covered by blackish necrotizing layer in 3 calves and was fresh and red in color in 2 calves (Figure 1).

**Ultrasonographic Investigations:** At control group, the liver was seen in the 6<sup>th</sup> to 11<sup>th</sup> intercostal spaces in right side in all examined control calves and extended to 12<sup>th</sup> intercostal space only in one calf. Liver parenchyma

Table 1: Clinical parameters of healthy calves and calves with ectopic liver

| Clinical parameter       | Healthy calves  | Calves with ectopic liver |
|--------------------------|-----------------|---------------------------|
| Temperature °C           | 38.5-39.2       | 38.5-39.5                 |
| Heart rate/ minute       | 65-85           | 70-90                     |
| Respiratory rate/ minute | 20-30           | 20-35                     |
| Mucous membrane          | Bright rosy red | Bright rosy red           |
| Lymph nodes*             | Normal          | Normal                    |
| Capillary refill time    | 1-2 seconds     | 1-3 seconds               |
| Suckling reflex          | Positive        | Positive                  |

\* Lymph nodes (pre-scapular and pre-femoral) are described normal due to presence signs of healthiness include, normal size, no pain, movable and not adhere with neighboring tissues.



Fig. 1: Calf with circumscribed swelling at umbilical region confirmed as ectopic liver. The swelled part appeared blackish and covered by superficial necrotic tissue (a). Second calf has a fresh ectopic liver at umbilicus (b).

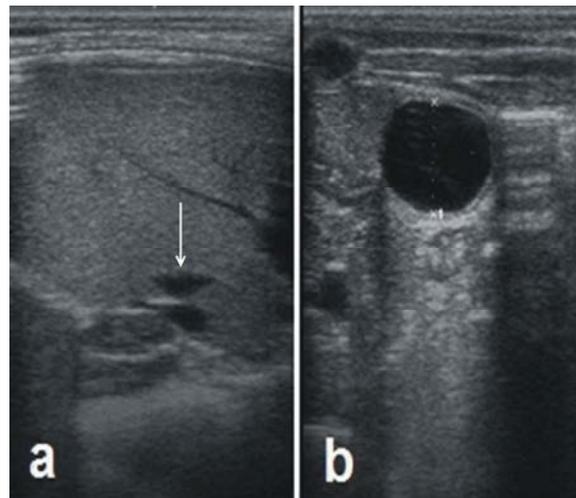


Fig. 2: Ultrasonogram of normal liver using linear probe, 6 MHz shows the hypoechoic appearance of hepatic parenchyma and triangular vena cava at 10th intercostal space (arrow) (a), gallbladder appeared as anechoic round sac obtained at 9th intercostal space (b).

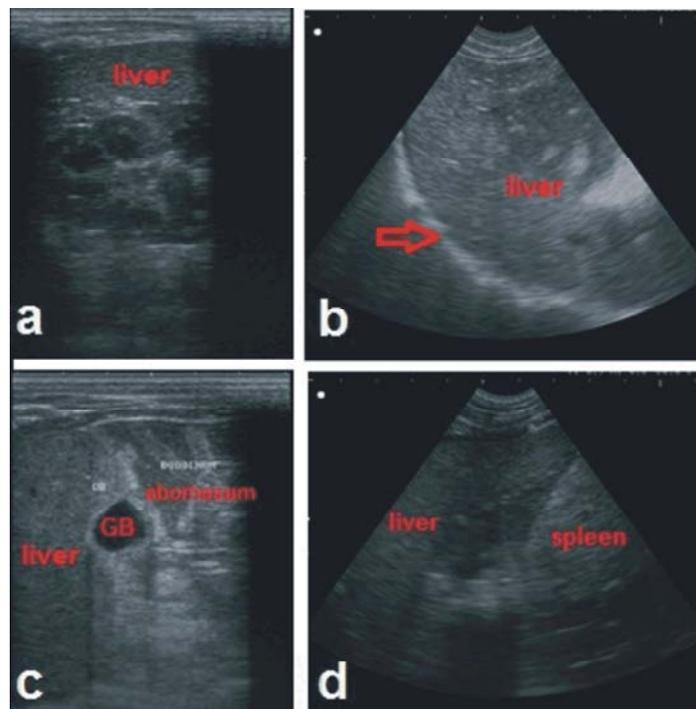


Fig. 3: Ultrasonogram of normal liver and kidney at 12th intercostal space (a), liver and diaphragm (arrow) at 6th intercostal space (b), liver and abomasum at 9th intercostal space (c) and liver and spleen at ventral abdomen with slight deviation toward left side (d).

appeared hypoechoic, caudal vena cava had a triangular shape on cross section and the portal vein was circular to oval on cross section. Portal and hepatic veins and caudal vena cava were clearly visible while the bile ducts were not detected. Gallbladder was detected as round sac containing anechoic material at 9<sup>th</sup> to 10<sup>th</sup> intercostal

spaces (Figure 2). Liver was surrounded by kidney caudally, diaphragm cranially and abomasum ventrally. Spleen was detected medial to abomasum when the transducer was placed at ventral midline between 6<sup>th</sup> to 7<sup>th</sup> ribs with slight deviation toward left side (Figure 3). Size and relative size of the liver of apparently healthy

Table 2: Ultrasonographic measurement of the liver in 5 healthy calves

| Intercostal space | Dorsal margin/ cm | Ventral margin/ cm | Liver size/ cm | Hemi-circumference/ cm | Relative size of liver % |
|-------------------|-------------------|--------------------|----------------|------------------------|--------------------------|
| 6 <sup>th</sup>   | 25.2±1.3          | 35.7±3.03          | 10.5±1.1       | 41.3±2.04              | 25.4±2.8                 |
| 7 <sup>th</sup>   | 21.7±2.3          | 32.7±1.08          | 11.25±1.8      | 40.8±1.6               | 27.8±5.1                 |
| 8 <sup>th</sup>   | 17.5±2.06         | 32.7±2.7           | 16.25±1.5      | 41.8±1.9               | 38.9±2.9                 |
| 9 <sup>th</sup>   | 15.25±1.08        | 31.7±1.9           | 17.75±2.16     | 42.8±2.7               | 41.8±6.6                 |
| 10 <sup>th</sup>  | 12.57±3.1         | 29.75±1.9          | 17.0±3.08      | 44.0±2.9               | 38.4±5.3                 |
| 11 <sup>th</sup>  | 8.75±0.8          | 27.5±3.5           | 16.5±3.7       | 43.8±3.3               | 37.9±8.5                 |
| 12 <sup>th</sup>  | 8.5±1.8           | 23.6±4.1           | 12.11±3.6      | 42.8±2.5               | 35.5±5.3                 |

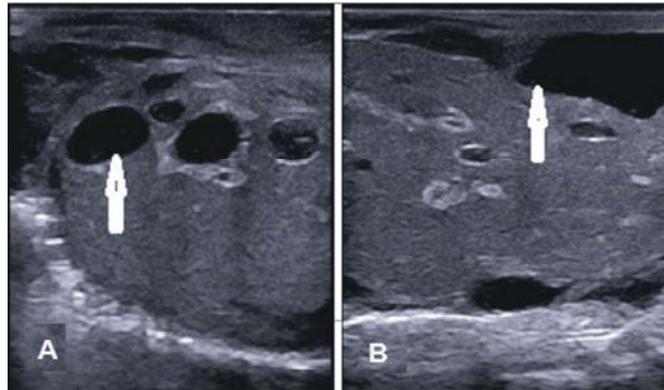


Fig. 4: Ultrasonogram of ectopic liver at umbilical region, liver appears more echogenic than normal with dilated bile ducts (arrow) (a) and anechoic gallbladder (arrow) (b).

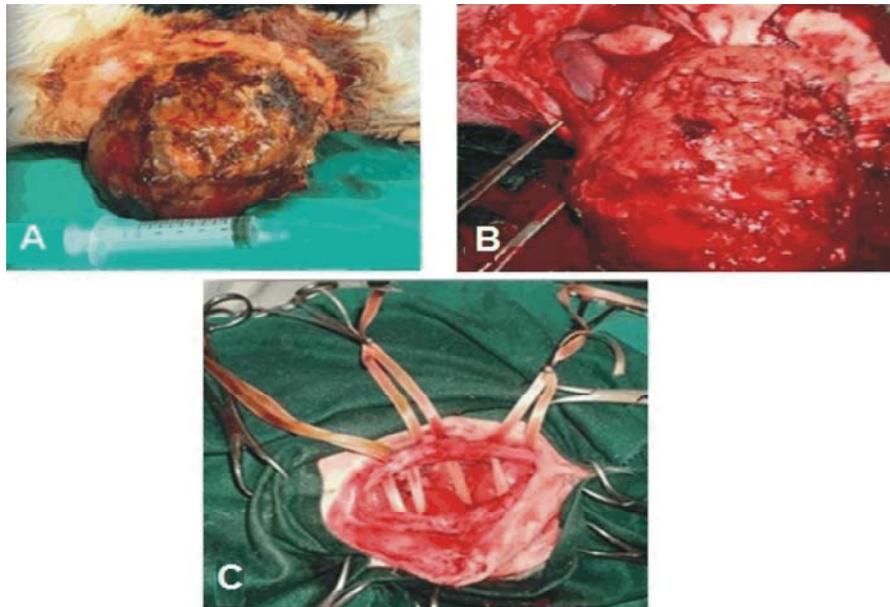


Fig. 5: Surgical intervention and reduction of ectopic part of the liver. Notice the steps of intervention. The prolapsed ectopic liver part (a). Debridement of the necrotizing surface (b). Reduction of this part with routine closure by interrupted horizontal mattress suture using nylon tape (c).

calves were larger at 9<sup>th</sup> intercostal space and smaller at 6<sup>th</sup> intercostal space (Table 2). Comparatively, the liver of diseased calves had nearly the same location with additionally distortion of a part at umbilical region causing

visible swelling. Moreover, the diseased calf liver in one case appeared more echogenic with anechoic dilated bile duct and veins and the gallbladder was anechoic pear shape sac that present adhered to liver tissue (Figure 4).

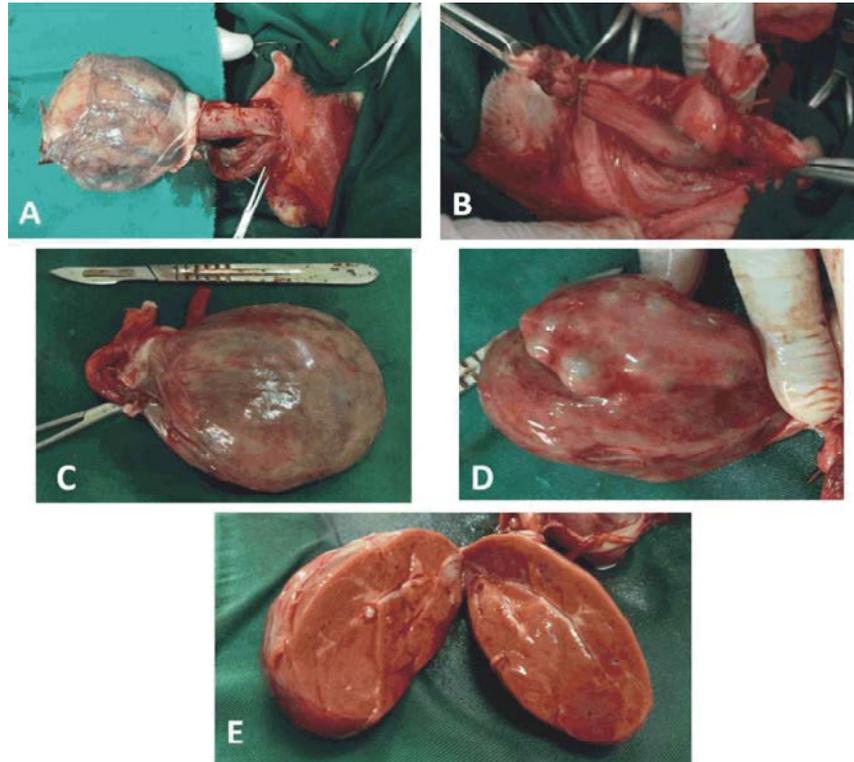


Fig. 6: Surgical intervention and excision of the ectopic liver part. Notice the steps of intervention. The prolapsed ectopic liver part (a). Excision of this part and ligation on the fibrous stump using chromic cat gut no 2 (b). The excised liver part (c). The adhered sticky gallbladder with the excised liver part (d). Cut section in the excised liver part for histopathological study (e).

**Surgical Intervention:** In diseased calves the umbilical area were clipped and aseptically prepared then under local infiltration anesthesia the operations were done.

The umbilical opening was surgically incised and lengthened as herniotomy for easily reduction of the prolapsed liver part after thorough washing with warm normal saline 0.9% making the surface of liver clean. In the calves with blackish necrotizing layer on the ectopic liver, after passing 15 days of age and with slight debridement the layer was removed and the remained surface of ectopic liver was fleshy and fibrosed, After that the reduction process was done (Figure 5). During surgical procedure the normal liver tissue was present in the abdomen toward the right abdominal wall. In one calf, the decision was excision of the prolapsed liver part with adhered sticky gallbladder (Figure 6). Ligation on the fibrous stump at the base of ectopic liver using chromic cat gut no 2. The abdominal wall layers were routinely sutured as in case of hernia repair with different interrupted horizontal mattress suture patterns using nylon tape. The skin was sutured also with interrupted horizontal mattress suture pattern using silk no 1. For all

cases the follow up were done until 3 months of age using ultrasonography and during this period it was found that 3 calves were in a good condition and gain weight and the ultrasonographic picture of the normal liver and ectopic one were normal while in one calf the site of wound was infected and drains pus after 3 weeks of operation and with ultrasonography the image was appeared as hypo to hyperechoic circumscribed structures found at the abdominal cavity near to the umbilicus and at the site of operation diagnosed as abscessation. The calf with resected liver part died after 3 days from operation.

**Histopathological Investigation:** The prolapsed liver showed hemorrhage and local area of coagulative necrosis and diffuse fatty change. Fat cyst besides normal central vein was also found and swollen hepatocytes with granular cytoplasm besides Kupffer cell hyperplasia in the portal area and within the hepatic parenchyma. In one case, proliferation of fibrous connective tissue in the portal area and formation of new bile ductules and hepatocytes with pyknotic nuclei and dark stained cytoplasm were detected (Figure 7).

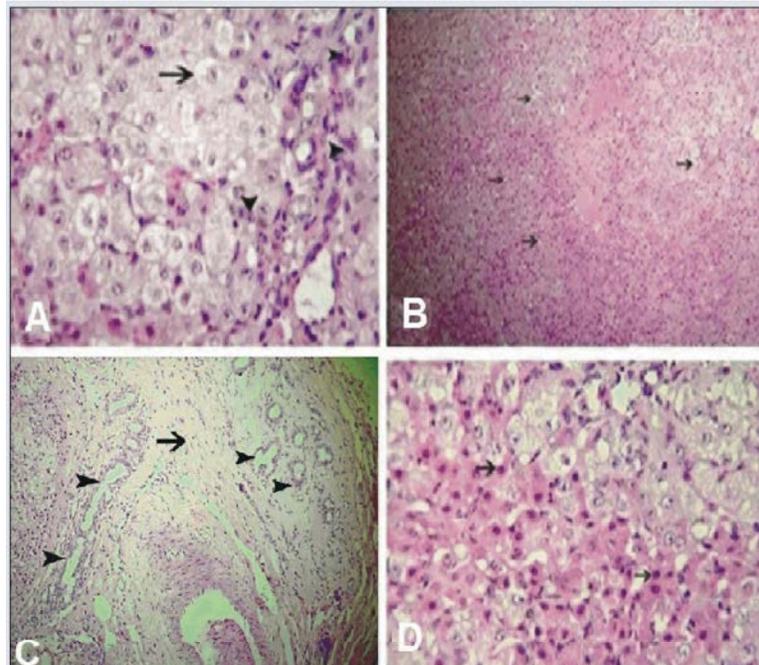


Fig. 7: Histopathology of the ectopic liver of one-day old calf showing swollen hepatocytes with granular cytoplasm (arrow) besides Kupffer cell hyperplasia in the portal area and within the hepatic parenchyma (arrow head), H & E x 1200 (A). Liver of one-day old calf showing diffuse fatty change (arrow), H & E x300 (B). Liver of one-day old calf showing Proliferation of fibrous connective tissue in the portal area (arrow) and formation of new bile ductules (arrow head), H & E x 300 (C). Liver of one-day old calf showing hepatocytes with pyknotic nuclei (arrow) and dark stained cytoplasm, H & E x 1200 (D).

## DISCUSSION

Liver tissue can migrate to various organs during embryogenesis. Sites of ectopic liver include the gallbladder, spleen, retroperitoneum, pancreas, adrenal gland, portal vein, diaphragm, thorax, gastric serosa, testes and umbilical vein [14].

Ectopic liver is a birth defect in which the liver is abnormally located. In the present study, ectopic liver was found in the umbilical region. The ectopic liver is a very rare condition and it was recorded before in on calf in turkey and diagnosed as accessory liver lobe by Atasver *et al.* [8]. There are only a few reports of accessory liver lobes in animals worldwide [15].

In this study, there were no differences between the range of examined parameters between healthy and diseased calves. This result indicates that calves with ectopic liver had no health problem. Only a detectable mass was observed in umbilical region and was hard in consistency. In researches carried out on human medicine in which accessory liver lobes were diagnosed, sometimes the liver tissue was determined to be fully developed with regard to histological structure [3, 5 -7, 16]. Ectopic liver

in human was seen frequently on gallbladder but was occurred in several places including intra-, retro- and extra- peritoneal sites. A 35-year-old female human patient underwent surgery with the diagnosis of gallstones and liver tissue was found attached to gallbladder [9].

Ultrasonography, liver could be seen in 6<sup>th</sup> to 11<sup>th</sup> intercostal spaces in all the control calves and was clearer at 9<sup>th</sup> to 10<sup>th</sup> intercostal spaces. This result was previously observed in sheep [17] and in cattle [18]. Liver parenchyma and blood vessels were the same as described in all ruminants. According to the best of our knowledge, the relation of the liver to surrounding organs as kidney, diaphragm, abomasum, spleen in calves was not clearly investigated before. Only [11] stated the shape of hepatic parenchyma, blood vessels and gall bladder in calves from birth to 104 days of age. Few reports about ectopic liver were conducted and according to the best of our knowledge, there is no report about using of ultrasonography in diagnosis of this disease in calves. In the current study, the changes in echogenicity of hepatic parenchyma and dilation of bile ducts and veins, attributed to the compression on liver by the umbilical orifice.

The surgical intervention of the ectopic liver was done for these five calves and 4 of them were surgically reduced inside the abdomen and one case was excised, during follow up of these cases, it was found that 4 of them survived and gain weight but the calf with excision of the accessory liver lobe with gallbladder was died 3 days later after surgery and could be attributed to respiratory distress and the calf refuse suckling.

Histopathological examination of one day old calf with ectopic liver in this study revealed hemorrhage and local area of coagulative necrosis, diffuse fatty change was also found. Fat cyst besides normal central vein was also found and swollen hepatocytes with granular cytoplasm besides Kupffer cell hyperplasia in the portal area and within the hepatic parenchyma as in the study of Atasever *et al.*, [8] it was found that proliferation of fibrous connective tissue in the portal area and formation of new bile ductules and hepatocytes with pyknotic nuclei and dark stained cytoplasm. Furthermore, regions including A. hepatica, V. hepatica and bile ducts were determined and identified as portal interspace.

#### ACKNOWLEDGEMENT

The authors would like to thank Vet. Mohamed Ibrahim El Hawy for histopathological study.

#### REFERENCES

1. Leopold, H., 1997. Congenital defects of the musculoskeletal system. In: Greenough PR, Weaver AD (eds.). Lameness in Cattle. 3<sup>rd</sup> ed. Saunders, Philadelphia, pp: 79-86.
2. Robins, S.L., 1974. Pathologic Basis of the Disease. Philadelphia, London, Toronto: W.B. Saunders Co., pp: 567.
3. Collan, Y., A. Hakkiluoto and J. Hastbacka, 1978. Ectopic liver. Ann. Chir. Gynaecol., 67: 27-29.
4. Jones, T.C. and R.D. Hund. 1983. Veterinary Pathology, Lea & Febiger, Philadelphia.
5. Fogh J., N. Tromholt and F. Jorgensen, 1989. Persistent impairment of liver function caused by a pendulated accessory liver lobe. Eur. J. Nucl. Med., 15: 326-327.
6. Iacconi, P. and T. Masoni, 1990. Accessory liver. Report of 2 cases. Acta Chir. Belg., 90: 228-230.
7. Koc, Y., Z. Ogurtan, M. Tuzcu, F. Alkan and M.K. Çiftçi, 1998. Bir Buzagıda Paralumbal Bölgede Heteretopik Akciger Olgusu. Vet. Bil. Derg., 14: 151-154.
8. Atasever, A., L. Beyaz and M. Arican, 2004. Accessory liver lobe anomaly in the abdominal region of a calf, Revue Méd. Vét., 155(6): 321-323.
9. Öztürk, A., E. Uçmaklı and Z. Yananlı, 2013. An ectopic liver tissue on the gallbladder, Gaziantep Med. J., 19(1): 46-48.
10. Rosenberger, G., 1990. Die Klinische Untersuchung des Rindes. 3rd edn. Berlin and Munich, Paul Parey, pp: 10-30.
11. Braun, U. and S. Krüger, 2013. Ultrasonography of the spleen, liver, gallbladder, caudal vena cava and portal vein in healthy calves from birth to 104 days of age, Acta Veterinaria Scandinavica, pp: 55:68.
12. Braun, U. and K. Steininger, 2011. Ultrasonographic characterization of the liver, caudal vena cava, portal vein and gallbladder in goats. Am J. Vet. Res., 72(2): 219-25.
13. Suvarna S.K., C. Layton and J.D. Bancroft, 2013. Bancroft's Theory and Practice of Histological Techniques. 7th ed., Churchill Living Stone. Elsevier, England.
14. Curtis, L.E. and D.G. Sheahan, 1969. Heterotopic tissues in the gallbladder. Arch Pathol., 88: 677-683.
15. Cabrera, R., R. Nunez and E. Blesa, 1993. Neonatal hepatocholecystectomy because of an incarcerated umbilical hernia. Cir. Pediatr., 6: 204-205.
16. Gaber, M., 1980. Accessory liver containing metastatic tumour. Virchows Arch Pathol. Anat., 385: 361-364.
17. Braun, U. and K. Hausammann, 1992. Ultrasonographic examination of the liver in sheep. Am J. Vet. Res., 53: 198-202.
18. Braun, U., 2009. Ultrasonography of the Liver in Cattle. Vet Clin North Am Food Anim Pract., 25: 591-609.