



## **Anatomical Description of Liver and intrahepatic Distribution of Hepatic vein and Hepatic portal vein in pigeon (Columbia domestica)**

**Duaa Abdullah Khoder , Bader Khatlan Hameed**

*Department of Anatomy and Histology / College of Veterinary Medicine / University of Tikrit, Tikrit, Iraq*

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#### **Corresponding Author:**

##### **Name:**

**Duaa Abdullah Khoder**

##### **E-mail:**

##### **Tel:**

### **ABSTRACT**

This study was carried out to determine the anatomical characteristics of the pigeon liver and the anatomical description of the location of the hepatic portal vein and hepatic vein within the liver, which is to enhance research, whether it be for academic study. The current research was conducted on 12 pigeons of both sexes. The birds were divided into two groups, each one containing six birds. The bird was anesthetized and slaughtered. The two groups were injected with the liquid latex, where the first group was injected into the caudal vena cava, and the second group was injected with latex into the hepatic portal vein. According to the findings of the liver's anatomical analysis, the pigeon's liver is composed of both right and left lobes, is situated in the thoraco-abdominal cavity, and has a red-brown in color. The right vein, transverse portion (the connecting part between the right and left portal vein), and left vein comprised the hepatic portal vein. The hepatic vein is composed of four branches (right, left, middle and umbilical). with slight differences in the number of intrahepatic vein tributaries and the distribution pattern between male and female pigeons.

## Introduction

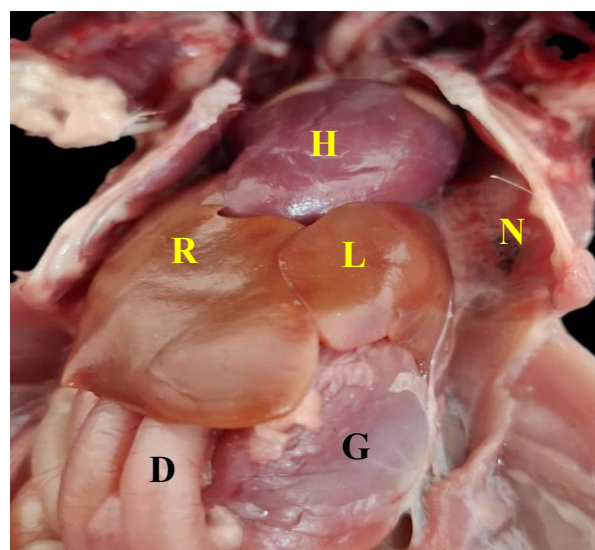
The domestic pigeon, which belongs to the Columbidae family, originated in Europe, India, and North Africa. The Pigeons have been used for many centuries as a source of food for humans (1). Pigeons have been regarded as domestic birds for thousands of years, with pigeon hubs located all over the world. Pigeon breeders have recently begun to employ their birds for "racing" (2). Pigeons' livers had only two lobes, with the left being smaller than the right. Pigeons without a gallbladder have the liver in their mid-body cavity (3). The liver serves many tasks in birds, including metabolic functions and internal balance, as it is a chemical factory responsible for metabolism, synthesis, excretion, and detoxification. It is essential for digestion and metabolism, as well as for controlling fat, protein, and carbohydrate production, storage, and secretion. The liver is responsible for producing blood proteins, enzymes, hormones, clotting factors, and immunity. In contrast, the liver is considered an exocrine endocrine gland (4). While, the hepatic portal vein transports deoxygenated blood from the digestive tract, which contains nutrients, medications, and toxins. The liver receives oxygenated blood from the hepatic artery. The liver cells release metabolites into the bloodstream as the blood passes through the sinusoids. The blood then travels via the central vein, hepatic vein, and finally reaches the caudal vena cava (5, 6).

## Materials and Methods

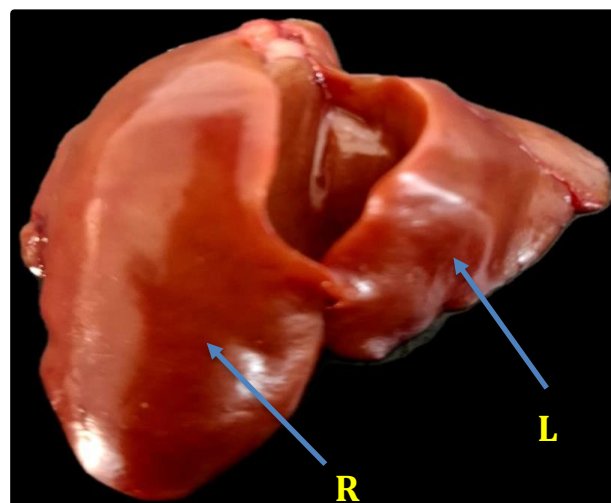
Twelve healthy pigeons, both genders, at adult ages and weights ranging from 300-450 gm, were used in the current study. Samples were bought from Salah al-Din Governorate local markets. The birds were anesthetized using 98% ether by inhalation, then slaughtered and left to extract a huge amount of blood from the blood vessels for five minutes. Then the feathers and skin were removed, and the sides of the thoracic cage were cut and raised upward to reveal the location of the liver. The birds were split into two groups, each of which contained six birds. The distribution of the hepatic and portal veins within the liver was demonstrated using the latex injection technique. The first group received a liquid latex injection into the inferior vena cava, which is situated in the liver's upper right lobe, and the second group received an injection into the portal vein, which is situated in the liver's portals and receives its blood from the digestive system (7, 8). The findings were photographed with a Nikon digital camera D5200.

## Results

This investigation revealed that the liver is located in the mid-coelomic cavity, as the bird's body does not contain a diaphragm. The liver in pigeons lied in closed with the spleen and gizzard, ventral to the end of the lung, kidneys, and reproductive organ, dorsal to the sternum, and caudal to the heart, it is bilobed organ, right lobe consists of two secondary lobes while the left lobe consists of three secondary lobes. reddish-brown in color and irregular in shape, does not contain a gall bladder (Fig. 1, 2).



**Figure (1):** Demonstrate the position and form of the pigeon's liver. (H) Heart, (N) Lung, (G) Gizzard, (D) Duodenum, (R) Right Lobe, (L) Left Lobe.

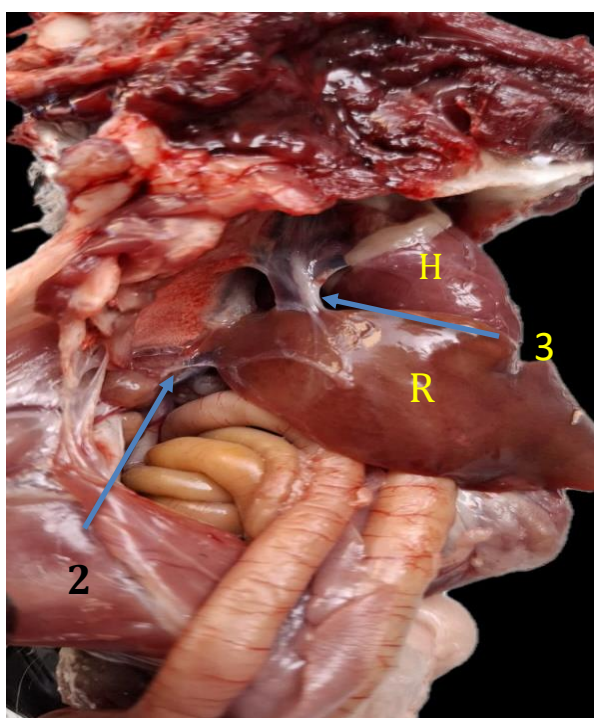
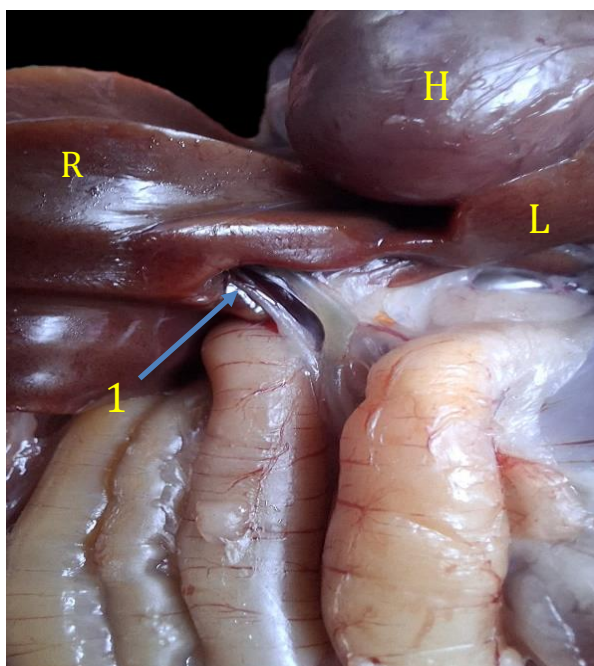


**Figure (2):** Demonstrate the pigeon's liver's form and color. (R)The right lobe, (L)The left lobe.

The current study results showed that the liver has three entrances. The first is the hepatic porta, which allows the hepatic portal vein to enter. The second entry is the top orifice of the dorsal area of



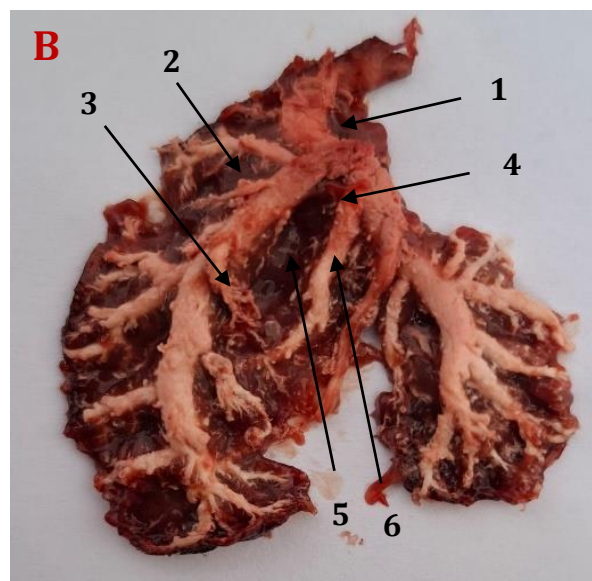
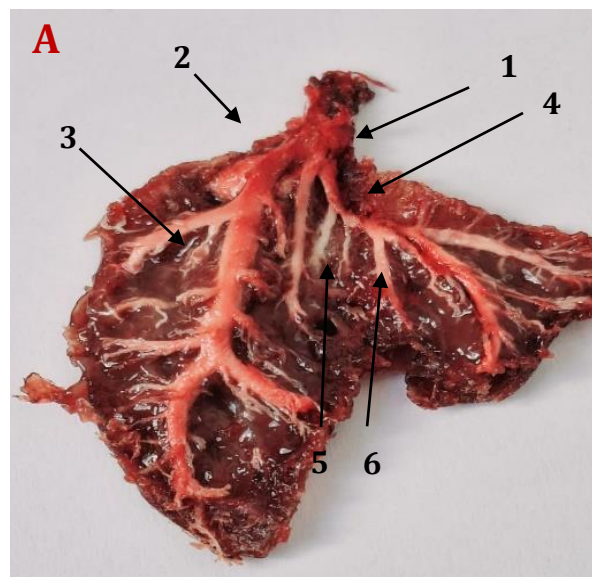
the liver's right lobe, which allows the renal portal vein to enter. The third entry is the exit location of the main hepatic vein. This branch is located near the top of the liver's right lobe (Fig.3).



**Figure (3):** Show liver entrances. (1) hepatic porta. (2) Entrance to the renal portal vein. (3) exit site of the main hepatic vein. (H)Heart. (R)Right lobe. (L)Left lobe.

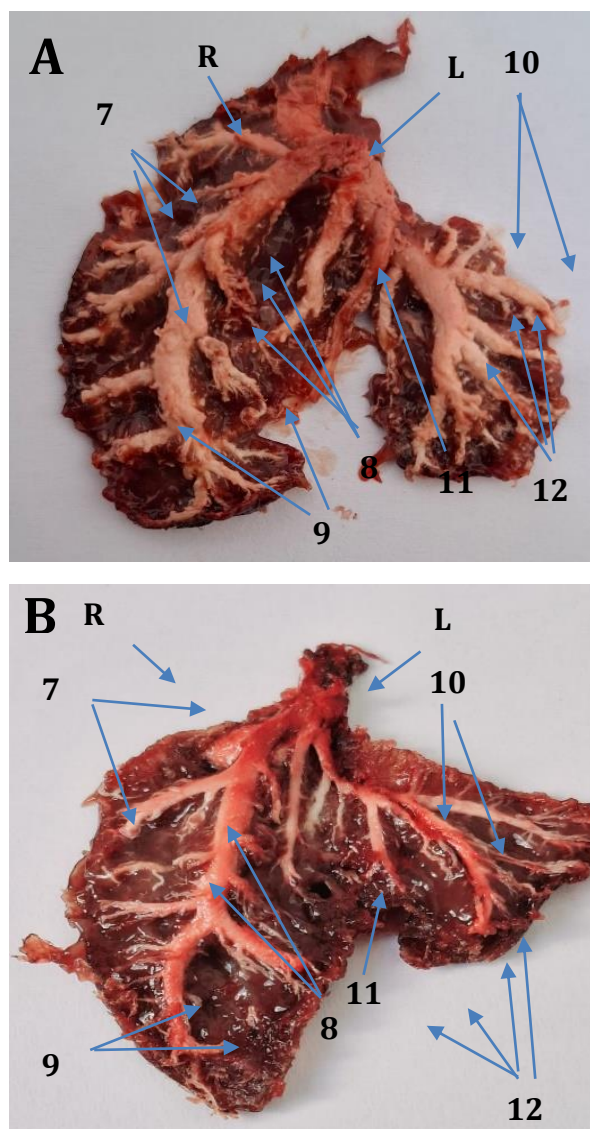
The caudal vena cava receives the hepatic vein's three principal branches, which are the right, left, and middle veins of the liver. The left one gives rise to the umbilical vein. It is a small branch. The left and right veins divide into dorsal

and ventral tributaries. The right ventral hepatic vein in male pigeons gives us two branches (right and left) at the middle of the lobe, while in female pigeons it continues on its course and then branches into two branches at the last third of the right lobe. In male pigeons, the left ventral hepatic vein has three branches, whereas female pigeons have four (Fig. 4, 5).



**Figure (4):** An image of (A) a female pigeon demonstrating the intrahepatic distribution of the liver's hepatic vein, (B) Male, (1) Caudal vena cava, (2) Renal portal vein, (3) Right hepatic vein, (4) Left hepatic vein, (5) Middle hepatic vein, (6) Umbilical vein.





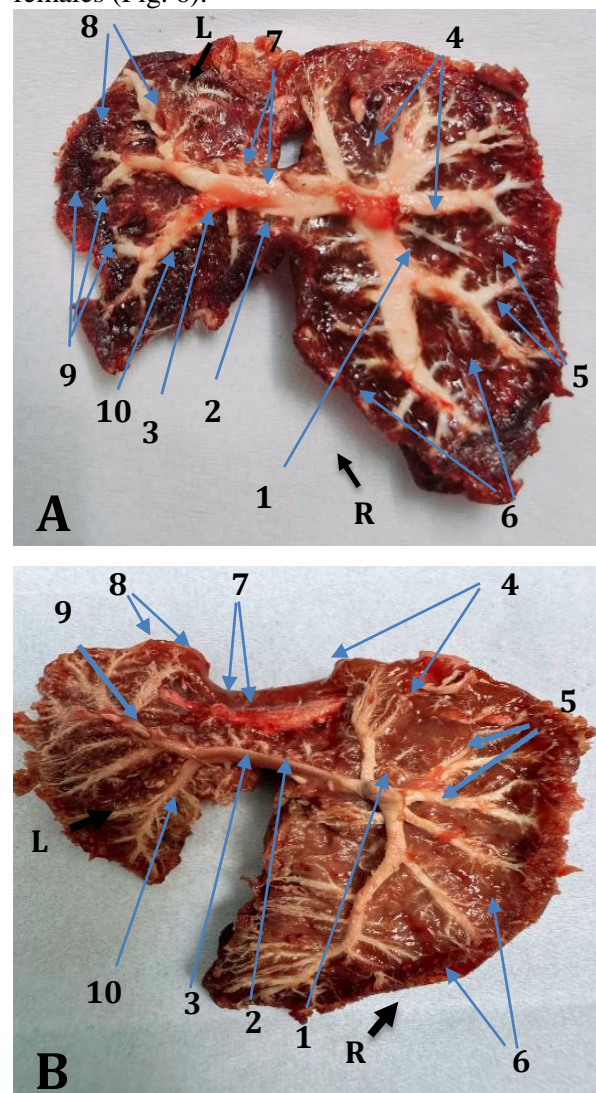
**Figure (5):** An illustration of the intrahepatic distribution of the liver's hepatic vein in (A) a male pigeon. (B) female. (R) Right lobe. (L) Lobe on the left. (7) Craniodorsal branches of right hepatic vein, (8) Caudodorsal branches of right hepatic vein, (9) Ventral branches of right hepatic vein, (10) Craniodorsal branches of left hepatic vein, (11) Caudodorsal branches of left hepatic vein, (12) Ventral branches of left hepatic vein.

The hepatic portal vein splits into three main branches within the liver (right, transverse, and left), according to the results of a latex injection into the vein (Fig. 6).

The cranial, caudal, and lateral branches of the right hepatic portal vein are present in both sexes, with two branches of each. The lateral branch is divided into two large branches in male pigeons and two branches, one large and the other small in female pigeons (Fig. 6).

The transverse part gives a small branch in both sexes (Fig.6).

Additionally, the left portal vein produces cranial, caudal, and lateral branches; however, male pigeons have more lateral branches than females (Fig. 6).



**Figure (6):** An illustration of the intrahepatic distribution of the liver's hepatic portal vein in (A) a male pigeon . (B) female. (R) Right lobe, (L) Lobe on the left, (1) Right hepatic portal vein, (2) Transverse portion, (3) Left hepatic portal vein, (4) Cranial branches of right hepatic portal vein, (5) Lateral branches of right hepatic portal vein, (6) Caudal branches of right hepatic portal vein, (7) Small branches of transverse anastomotic part, (8) Cranial branches of left hepatic portal vein, (9) Lateral branches of left hepatic portal vein, (10) Caudal branches of left hepatic portal vein.

## Discussion

The current study's morphological examination found that the pigeon liver was a bilobed and big gland located in the mid-coelomic cavity. Our findings are consistent with what researchers have

previously reported for pigeons [3,9], domestic fowl, and common moorhens [10].

Our results were consistent with the researcher's [11] description of the pigeon's liver as reddish-brown color, and [12] in the Iraqi pin-tailed sandgrouse *Pterocles alchata*.

The researchers stated [13] in ostriches and [14] in primitive birds of South America and [15] in adult ostrich that the liver has a relationship with the heart caudally, the spleen anteriorly, with the sternum dorsally, and with the lungs ventrally, and our results were consistent with that.

Pigeons had liver without gall bladder which is consistent with previous research [16] who mentioned that there is no gall bladder in pigeons.

Pigeons' livers have two additional secondary lobes on the right side. This contradicts a prior study [17] that found the liver of Iraqi native ducks had two undivided lobes while the liver of chickens has two equal-sized lobes [18]. While the left lobe in the pigeon consists of three secondary lobes. This result was consistent with what the researcher reached [19] when studying the ostrich liver.

The shape of the liver of the pigeon studied differed from what was described by [20]. The left lobe of the house sparrow is elliptical, whereas the right lobe is cardiac.

Our observations were similar to those of [21] in ostrich and [22] in vertebrate the liver has three entrances: the first is the entrance to the portal vein, the second is the entrance to the renal portal vein, and the third is the exit site of the main hepatic vein.

The present investigation aligned with studies by [23, 24], which demonstrated that the vein of the liver removes blood from the bird's liver and empties into the

posterior vena cava, where it removes blood from the left lobe by a left hepatic vein and the right lobe through a right hepatic vein. Additionally, the space between the lobes contains a few tiny veins that allow blood to drain. The study also agreed with the study conducted by [25] in Broiler Chickens. the existence of the umbilical vein, which emerges from the left vein and aids in the liver's hepatic lobe outflow.

The current investigation was comparable to [2] in domestic pigeons, which collected venous blood from the left and right portal veins and demonstrated that the portal vein reaches the liver by the hepatic porta. The results of a previous study showed that the distribution of the right hepatic portal vein was intertwined with the left hepatic portal vein through the transverse part, with the right and left hepatic portal veins branching into cranial, lateral, and caudal branches. This study was consistent with the results of the current study [26].

## Conclusion:

The hepatic vein has three main branches (right, middle, and left) and a secondary branch, the umbilical vein, with slight differences in the number of tributaries within the liver and distribution between male and female pigeons.

The results of the study showed that there are three openings in the liver of pigeons: the liver's portal for the portal vein, the renal portal vein's entrance on the right lobe's dorsal surface, and the major hepatic vein's exit at the top of the right lobe.

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## الوصف التشريحي للكبد والتوزيع داخل الكبد للوريد الكبدي و الوريد البابي الكبدي في الحمام المحلي

دعاء عبدالله خضر، بدر ختلان حميد

فرع التشريح والأنسجة، كلية الطب البيطري، جامعه تكريت، تكريت، العراق

### الملخص

أجريت هذه الدراسة لتحديد الخصائص التشريحية لكبد الحمام والوصف التشريحي لموقع الوريد الكبدي وكذلك الوريد البابي الكبدي داخل الكبد، وذلك لتعزيز الأبحاث المستخدمة للدراسة الأكاديمية، تم إجراء البحث الحالي على 12 حمامة من كلا الجنسين. تم تقسيم الطيور إلى مجموعتين، كل مجموعة تحتوي على ستة طيور. تم تخدير الطائر وذبحه، بعد ذلك تم حقن المجموعتين بمادة اللاتكس الحليبي، حيث تم حقن المجموعة الأولى في الوريد الأجوف الخلفي، وتم حقن المجموعة الثانية بمادة اللاتكس في الوريد البابي الكبدي. وفقاً لنتائج التحليل التشريحي للكبد، يتكون كبد الحمام من فصين أيمن وأيسر، ويقع في التجويف الصدري-البطني، ذو لون احمر-بنّي، يتكون كل من الوريد الأيمن، الجزء المستعرض (الجزء الذي يربط بين الوريد البابي الأيمن والأيسر) والوريد الأيسر من الوريد البابي الكبدي، ويتكون الوريد الكبدي من أربعة فروع (الأيمن، الأيسر، الوسطي والسري)، مع وجود اختلافات طفيفة في عدد روافد الاوردة داخل الكبد ونمط التوزيع بين ذكور وإناث الحمام.

**الكلمات المفتاحية:** التشريح، الحمام، الكبد، الوريد البابي الكبدي و الوريد الكبدي.