

قسم: التشريخ والهستولوجيا .
كلية: الطب البيطرى - جامعة الفاتح - طرابلس - ليبيا .
رئيس القسم : أ.د. / ابراهيم أرناؤوطوفنش .

توزيع الوريد البابى والأوردة الكبدية داخل الكبد فى الأرناب

فؤاد عثمان

أجرى البحث على أربعين كبد أجمعت من أرناب بالغة النمو من الجنسين
وذلك باستخدام طريقتى التشريخ والقوالب المتأكلية .

لقد أوضحت الدراسة بأنه لا توجد اختلافات كبيرة فى تفرعات الوريد البابى
داخل الكبد وأن هذا الوريد ينقسم الى فرع أيمن ، فرع ذيلى وفرع أيسر .
الفرع الأيمن يقتصر توزيعه داخل الفص الأيمن على حين أن الفرع الأيسر وهو الأكبر
يتفرع داخل اجزاء الفص الأيسر والفص الرباعى والفص الحلقى . أما الفرع الذيلى
فهو صغير ويتفرع فى الفص الذيلى فقط .

أوضحت الدراسة أيضا ان الأوردة الكبدية التى تصرف الدم من الكبد تشمل
٥ - ٦ أوردة - الوريد الأيسر ، والوسط والايمن الكبدى تنتهى مجتمعة فى الوريد
الاجوف السفلى على حين أن كل من الوريد الذيلى والحلقى ينتهى باستقلالية تامة
فى الوريد الأجوف السفلى .

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**ANATOMICAL STUDIES ON THE ARRANGEMENT OF THE PORTAL
AND HEPATIC VENOUS SYSTEMS IN RABBIT**
(With 4 Figures)

By
F.A. OSMAN*
(Received at 30/3/1986)

SUMMARY

Fourty livers collected from adult rabbits of both sexes were provided for this study. The study revealed that the right branch of portal vein is distributed only in the right lobe, while the left branch supplies the left lateral, left medial and quadrate lobes as well as the papillary process. However, the caudate process recieves its separate branch from the portal vein. The work also shows that there are 5-6 large hepatic veins entering independantly into the caudal vena cava. The course and distribution of the individual veins described in the test.

INTRODUCTION

The portal and hepatic veins have been investigated in most of the domestic animals; in sheep by HAPPICH (1961) and HEATH (1968); in buffalo by ANIS (1977); in camel by ARNAUTOVIC, FAHMY and ABDALLA (1971); in cat by BRESSOU and VLADUTIU (1944) and in dog by SLIGHT and THOMFORD (1970).

The rabbit is not only an experimental but also a reproductive animal. Macroscopic aspect of the distribution of blood vascular systems in the liver of rabbit is of special importance in comparative anatomy as well as in surgical and pathological fields (GROVE, NEWELL, CARTHY and MERCER, 1966). Despite this fact, a little knowledge is known about the intrahepatic distribution of the portal and hepatic veins of this animal.

MATERIAL and METHODS

Fourty livers collected from adult rabbits of both sexes were provided for this study. Vinilyte was used for the injection of the portal vein and casts were prepared in ten specimens. The portal and hepatic veins were injected in five specimens with coloured latex and dissected after fixation in 10% formalin. Special care was taken to the large veins and followed inside the parenchyma up to the ventral border of the organ. The lobar veins were injected with coloured vinilyte in ten specimens to study the area of distribution and anastomoses between each two adjacent vens. In another ten specimens, the hepatic veins were injected with vinilyte and casts were prepared. In the remaining fresh specimens, the caudal vena cava was cut longitudinally and the openings of the hepatic veins have been counted. The description of the hepatic veins will be against the blood stream. The terminology used in this study is that adopted by the Nomina Anatomica Veterinaria (1975).

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RESULTS

The liver of rabbit is made up of the right, left lateral, left medial and quadrate lobes as well as the papillary and caudate processes.

I- Portal Vein (Vena portae)

The portal vein enters the liver at the Porta hepatis between the hepatic artery dorsally and the bile duct ventrally. Before reaching the papillary process, it divides into right and left branches (Figs. 1 & 2). At the level of the papillary process, the left branch bends ventrally towards the umbilical fissure forming the umbilical part of the left branch (Figs. 1/5, 2/5).

The portal vein (Figs. 1/1, 2/1) and its branches form a kind of skeleton for the liver. Its pattern of branching undergoes little variations. The size and number of branches of the portal vein and the portion of the liver which supplies are more or less constant. The right branch is limited only to the right lobe, while the left branch supplies the left lateral, left medial and quadrate lobes as well as the papillary process. However, the caudate process receives its separate branch from the portal vein.

1. Ramus dexter (Figs. 1/3 , 2/3) :-

The right branch extends ventrally inside the central part of the right lobe for a distance about 2 cm and divides into two unequal branches, lateral and medial. The lateral smaller branch, runs for a short distance within the corresponding part of the lobe and redivides into two unequal branches, the larger of which ramifies within the ventro-lateral part of the lobe, while the smaller one ascends toward the corresponding dorsal part. The medial branch can be considered as the continuation of the parent vein, curves toward the ventral border of the lobe. The ramifications of the right branch follow those of the corresponding hepatic vein.

2. Ramus sinister (Figs. 1/4 , 2/4) :-

The left branch gives off the following branches.

2.1. Ramus lobi quadrati (Figs. 1/6 , 2/6) :-

The branch of quadrate lobe, can be considered as the ventral continuation of the umbilical part of the left branch. It curves ventral and to the right towards the central border. Along its course, the vein gives off a large number of small branches, running in different directions towards the corresponding divisions of the lobe.

2.2. Ramus lobi medialis sinistri (Figs. 1/7 , 2/7) :-

It arises from the umbilical part of the left branch, extending for about 1 cm within the parenchyma of the left medial lobe and divides into two unequal branches. The smaller branch ramifies into the ventral division of the lobe, while the larger branch continues towards the peripheral part of the lobe, giving variable number of branches (6 - 10) along its course.

2.3. Rami lobi lateralis sinistri (Figs. 1/8, 8', 8'', 2/8, 8', 8'') :-

They are three in number, dorsal, intermediate and ventral, and of variable origin. In 20 specimens, the dorsal and intermediate branches arise by a common stem, while in 10 specimens, the intermediate and ventral branches arise together, however, in the remaining specimens, the three branches arise independently. The dorsal large branch (Figs. 1/8 , 2/8) extends dorsally for about 5 mm and divides into two branches which ramify within the dorsal segment. The intermediate branch (Figs. 1/8' , 2/8') extends within the parenchyma of the

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intermediate segment for about 3 cm and divides into two branches which arborize within the segment in a tree-like manner. The ventral branch (Figs. 1/8", 2/8") is the smallest, and soon divides into two nearly equal branches, that extend toward the peripheral part of the segment. Each of these ranches gives off a variable number of collateral branches along its course.

2.4. Ramus processus papillaris (Figs. 1/9 , 2/9) :-

It is a small branch, which arises from the dorsal aspect of the left branch. It divides into small medial and large lateral branches, which ramify in the corresponding portion of the process.

3. Ramus processus caudatus (Fig. 1/2) :-

It arises from the ventral aspect of the portal vein, 3 cm before the origin of the Ramus dexter. It extends within the parenchyma for about 3-4 mm and divides into lateral and medial branches. Each ramifies in the corresponding portion of the process.

II- Hepatic Veins (Venae hepaicae)

There are 5-6 large hepatic veins, entering the caudal vena cava independantly. The veins of the left, right and quadrate lobes empty themselves close to each other, while those of the caudate and papillary processes open separately and away from the other hepatic veins.

1. Vena processus caudatus (Figs. 3/2 , 4/2) :-

It arises from the ventral aspect of the caudal vena cava, extending in a ventro-lateral direction towards the apex of the process. Along its course, the vena processus caudatus gives off 4-5 lateral and 6-8 larger medial branches.

2. Vena hepatica dextra (Figs. 3/4 , 4/4) :-

It originates from the caudal vena cava in a level with the Vena hepatica sinistra, extending towards the ventral border of the lobe. Along its course, it detaches 3-4 medial and 4-5 lateral branches.

3. Vena processus papillaris (Figs. 3/3 , 4/3) :-

It is detached independantly from the dorsal aspect of the caudal vena cava, 1-2 cm before the origin of the Vena hepatica sinistra. It extends dorsally for about 6-8 mm to ramify within the parenchyma of the papillary process.

4. Vena hepatica media (Figs. 3/5 , 4/5) :-

It is a relatively large vessel, originating from the caudal vena cava between the orifices of the Vena hepatica sinistra and Vena hepatica dextra. It extends ventrally for about 6 cm and divides into left medial and quadrate branches, each of which drains the corresponding lobe. Along the course of the Vena hepatica media, it gives off variable number of collateral branches which share in draining the befre mentioned lobes.

5. Vena hepatica sinistra (Figs. 3/6 , 4/6) :-

It is a very short trunk (3-4 mm), starts from the caudal vena cava dorsal to the Vena hepatica media and divides into dorsal and ventral branches. The smaller, ventral branch (Figs. 3/7 , 4/7), drains the corresponding segment of the left lateral lobe by means of large number of colateral branches. The dorsal branch (Figs. 3/8 , 4/8) arborizes in a tree-like manner within the dorsal two thirds of the left lateral lobe.

DISCUSSION

The course of portal vein and its relation to the bile duct and hepatic artery as revealed in the present work is in accordance with the results of ARNAUTOVIC and KRČMAR (1964) in sheep; ARNAUTOVIC, FAHMY and ABDALLA (1971) in camel and ANIS (1977) in buffalo. However, the pattern of distribution of the portal vein in rabbit possessed distinctive features which may be related to the physiological demands made upon the liver.

GROVE, NEWELL, CARTHY and MERCUR (1966) reported that the liver of rabbit made up of five lobes, right, left medial, left lateral, caudate and papillary processes. This is in accordance with the results of the present work, but they did not refer to the quadrate lobe which is demonstrated in this study. GROVE *et al.* (1966) concluded that each lobe receives its branch from the portal vein. The present work shows that the portal vein of this animal divides into caudate, right and left branches. Each of the caudate and right branches is limited to its lobe, however, the left branch supplies the left lateral, left medial and quadrate lobes as well as the papillary process. Similar number of branches reported by HAPPICH (1961) and HEATH (1968) in sheep. ARNAUTOVIC, FAHMY and ABDALLA (1971) termed the three primary branches of the portal vein in camel as cranial, ventral and caudo-dorsal. On the other hand, BRESSOU and VLADUTIU (1944) in cat, LEON and ELIAS (1954) in rat and SLIGHT and THOMFORD (1970) in dog agreed that the initial branches of portal vein are the right and left only. However, ARNAUTOVIC and KRČMAR (1964) in sheep stated that the portal vein have about nine branches, whose capillary regions represent separated functional entities called functional lobes as they said.

The present work revealed that there are 5-6 large hepatic veins, entering the caudal vena cava independently. The veins of the left, right and quadrate lobes empty themselves close to each other, while those of the caudate and papillary processes open separately and away from the other hepatic veins. In this connection, BRESSOU and VLADUTIU (1944) observed 4 main hepatic veins in cat, however, LEON and ELIAS (1954) in rat demonstrated two large hepatic veins, left and middle, while the right vein is represented by 2-3 separate veins. Such result is similar to that of ANIS (1977) in buffalo, but he found that the right hepatic vein is substituted by 4-6 medium-sized veins. KLAGES (1962) in sheep recorded three hepatic veins, while ARNAUTOVIC and KRČMAR (1964) in the same animal observed two large, two medium-sized and about 43 small hepatic veins. SLIGHT and THOMFORD (1970) reported that in canines the number of hepatic veins of significant size varies from 6-8, of which two are large which drain the left and central divisions. The remaining veins are less constant in their location, size and portion of the liver they drain.

The membranous flap over the entrance of the hepatic veins into the caudal vena cava observed by KATZ and BERGMAN (1969) in sheep and BRIKAS and TSIAMITAS (1980) in goat is not present in rabbit as revealed by this study.

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LEGENDS OF FIGURS

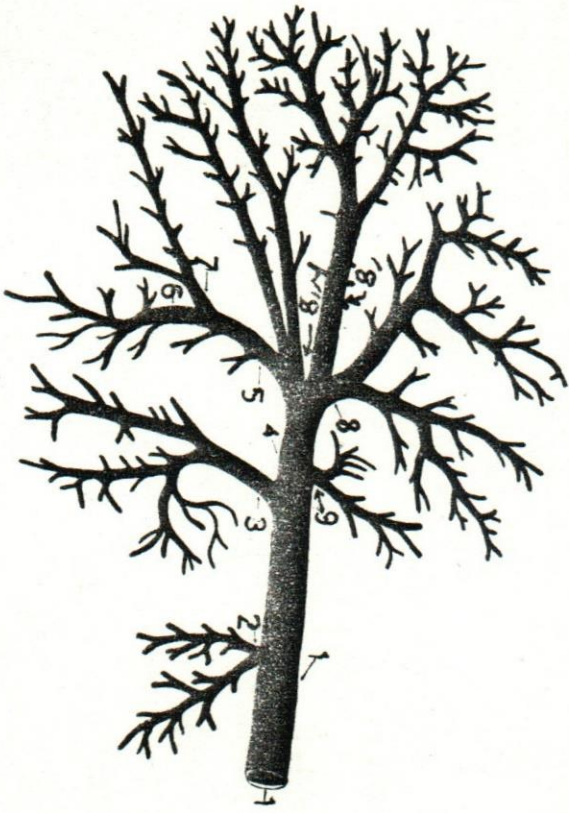
- Fig. (1):** Intrahepatic distribution of portal vein of rabbit, Visceral view, Schematic.
- Fig. (2):** Vinilyte cast showing the intrahepatic distribution of portal vein of rabbit, visceral view. Note that the Ramus processus caudatus is not injected and the Ramus processus papillaris is turned ventrally.
1- Vena portae, 2- Ramus processus caudatus, 3- Ramus dexter, 4- Ramus sinister, 5- Ramus sinister (Pars umbilicalis), 6- Ramus lobi quadrati, 7- Ramus lobi medialis sinistri, 8- Ramus dorsalis lobi lateralis sinistri, 8'- Ramus intermedius lobi lateralis sinistri, 8''- Ramus ventralis lobi lateralis sinistri, 9- Ramus processus papillaris.
- Fig. (3):** Distribution of hepatic veins in rabbit, Visceral view, Schematic.
- Fig. (4):** Vinilyte cast showing the distribution of hepatic veins in rabbit, Visceral view.
1- Vena cava caudalis, 2- Vena processus caudatus, 3- Vena processus papillaris, 4- Vena hepatica dextra, 5- Vena hepatica media, 6- Vena hepatica sinistra, 7- Ramus ventralis of (6), 8- Ramus dorsalis of (6).

THE HISTORY OF THE UNITED STATES

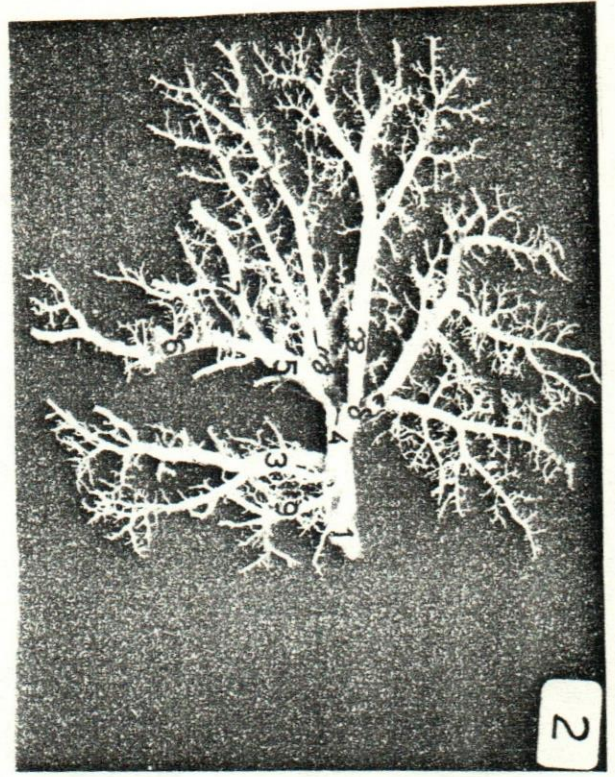
The history of the United States is a story of growth and change. From the first European settlers to the present day, the nation has evolved through various stages of development. The early years were marked by exploration and the establishment of colonies. The American Revolution led to the birth of a new nation, and the subsequent years saw the expansion of territory and the growth of industry. The Civil War was a pivotal moment in the nation's history, leading to the abolition of slavery and the strengthening of the federal government. The 20th century brought significant social and economic changes, including the rise of the industrial revolution and the emergence of the United States as a global superpower. Today, the United States continues to play a leading role in the world, facing new challenges and opportunities.

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