Translational Health Sciences
Online ISSN: 3009-7150
Sector: Veterinary Medicine

Research Article

Gross Anatomical and Radio-Graphical Study on The Venous Drainage of The Pelvic Limb in Geese (*Anser Anser Domesticus*) with Special Reference to The Renal Portal Circulation

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Abstract:

The study of the venous drainage of the pelvic limb was carried out on thirty adult, 21 healthy Egyptian native geese. The study of venous drainage of the pelvis was done by routine methods 24 of colored latex injection as well as radiographs of the renal portal valve. The current study revealed that the venous blood of the pelvic limb is drained mostly through the external iliac vein, while a small proportion is drained by the ischiatic vein. The femoral vein communicates with the reduced segment of the ischiatic vein, in the proximal fourth of the femur, to furnish the ischio-femoral anastomosis. The latter anastomosis diverts most of the venous blood returning through the ischiatic vein to the external iliac vein. The basic feature of the goose`s kidney is the presence of the renal portal system, controlled by a renal portal valve. The radiographic examinations of the renal portal valve verified the loss of its effective functional role in controlling the course of the venous blood flow from the external iliac vein to the kidney through the cranial and caudal renal portal veins, which in turn had an impact on the circulation of intramuscular injectable preparations in the thigh muscular mass. The results obtained were discussed with the work of other authors in geese and other domestic and wild birds.

Keywords: External iliac vein, Ischiatic vein, renal portal valve, Pelvic limb, Geese, radiography.

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Article History:

Received: 12/1/2025**, Received in revised form:** 26/1/2025, **Accepted:** 27/1/2025**, Available online:** 15/2/2025

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Introduction

Veterinary medicine faces the unique challenge of having to treat many types of domestic animal species, including birds.[1] Avian species have a well-developed renal portal system that allows blood from the caudal portion of the body to flow to the kidneys via the external iliac veins.[2,3] The avian renal portal system is controlled by a renal portal valve. The valve opens in response to a reflex nerve impulse, redirecting portal blood to the caudal vena cava by passing the kidney.[4] Accordingly, this study was conducted to describe the anatomical distribution of the veins of the pelvic limb, anatomical structure of the renal portal system and renal portal valve in geese.

Materials and Methods

2.1 Sampling:

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DOI: 10.21608/ths.2025.344823.1000

The current study was conducted using twenty-five healthy adult domestic geese collected from local markets in El-Giza & Cairo governorates. The 120-140-day old birds were of both sexes and weighted between 2.8-3.5 kg. In February 2019, the experimental protocol was accepted by Cairo University's ethics committee (Vet CU1111201816).

Anatomical study:

Sample preparation:

Before exsanguination, twenty birds were anaesthetized by intramuscular injection of 0.5 cc of xylazine 2% (xylazine hydrochloride, Dutch Farm Veterinary Pharmaceuticals) then injected with heparin (5000 I.U. Cal heparin) in a wing vein. Thirty minutes post heparin injection the geese was slaughtered, according to Islamic methodology, through the common carotid arteries and the jugular veins were opened and the geese bled for 15 minutes. The veins used for injection were cannulated and rinsed with warm normal saline solution NaCl 0.9% containing 5000 I.U. heparin calcium to prevent clotting.[5]

Latex neoprene injection technique:

Immediately following euthanasia, the ribs and the sternum were carefully removed to expose the heart. The ventricular apex of the heart was cut and a Nelaton catheter of size 6F to 8F (MA MEDICAL company) was introduced into the right ventricle of the heart and on into the caudal vena cava for injection of the veins of the pelvic limb of the specimens with 60% latex neoprene colored with blue Rottring ink. The specimens were put in a container of 10% formalin solution, 2% phenol and 1% glycerin for 3-5 days at room temperature (25° C) to allow solidification of the latex. The specimens were dissected to show the distribution of veins and their tributaries.

Radiographic study:

Five geese were slaughtered and used for the radiography of the renal portal circle. Two geese were eviscerated for injection of the external iliac veins with Urografin 76% (SCHERING Company) after hip dislocation, cannulation and heparinization of the external iliac vein. Radiographs were taken at exposure of 0.25 mAs, 20 mA, 48 kv. The remaining slaughtered geese were injected with a warmed (45°C) suspension of 20 gm barium sulphate with 40 gm red lead oxide powder in a 20% gelatin solution. The mixture was injected into the caudal vena cava through the Nelaton catheter in the right ventricle, left for 24 hours to solidify and then specimens were radiographed.

The nomenclature of veins, joints, muscles and description of veins from proximal to distal are adopted by Avian Anatomy: Nomina Anatomica Avium (1993). [6]

3. Results:

Venous blood from the pelvic limb in geese flows through the external iliac (Figs.1, 2, 10 /1) and ischiatic veins (Figs.1, 2, 3, 4 / 7). The former also brings the majority blood from the pelvic limb to the cranial and caudal renal portal veins of the kidneys; finally, the common iliac vein continues distally after the bilateral external iliac veins have come into it.

Circulus portalis renalis:

The renal portal circle (Fig.1) is a venous ring which consists of the cranial and the caudal renal portal veins on both sides. The caudal renal portal vein is continued caudally and communicates with that of the other side to form the interiliac anastomosis which is joined by the coccygeo-mesentric vein, at the median plane. This latter vein is the main link that connects the renal and hepatic portal systems. The cranial renal portal vein is directed cranially to communicate with internal vertebral venous sinus and complete this circle within the renal

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DOI: 10.21608/ths.2025.344823.1000

fossa. The renal portal system is controlled by the renal portal valves. The valve is located at the junction between the caudal renal, external iliac and common iliac veins. The common iliac vein joins with its corresponding of the opposite side to form the caudal vena cava slightly to right of the median plane.

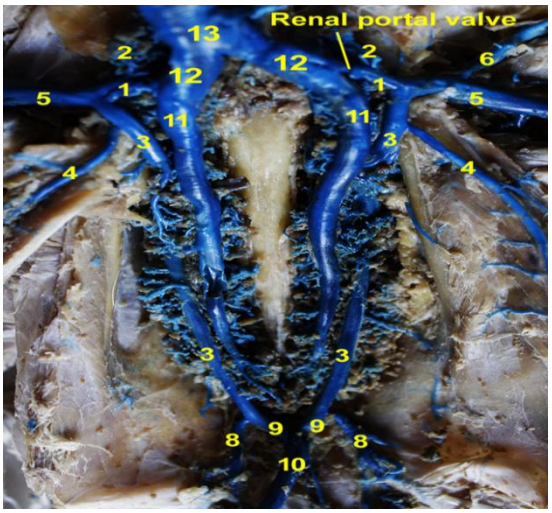

Figure (1). Illustration of the renal portal circle, ventral view.

1. V. Iliaca Externa
2. V. Portalis Renalis Cranialis
3. V. Portalis Renalis Caudalis
4. V. Pubica
5. V. Femoralis
6. V. Femoralis Cranialis
7. V. Ischiadica
8. V. Iliaca Interna
9. Anastomosis Interiliaca
10. V. Coccygomesentrica
11. V. Renalis Caudalis
12. V. Iliaca Communis
13. Vena Cava Caudalis

V. Iliaca communis:

The common iliac vein (Figs.1, 2, 10/12) is a short vessel, formed from union of the external iliac and caudal renal veins at the level of 2nd -3rd synsacrum. It drains into the caudal vena cava as well as shares in the formation of the caudal vena cava through joining the corresponding vein of the other side of the pelvis

V. Iliaca externa:

The external iliac vein (Figs.1, 2, 10 /1) is short stout as it joins the caudal renal vein to form the common iliac vein. The external iliac vein proceeds medially accompanied by the artery of the same name until reaching the head of the femur. During its course within pelvis, it receives the cranial and caudal renal portal veins and the pubic vein.

V. Portalis renalis cranialis:

The cranial renal portal vein (Figs. 1, 10 /2) is a fine vessel, and is the first intrapelvic tributary of the external iliac vein. It proceeds cranially within the cranial lobe of the kidney then leaves the cranial pole to join the internal vertebral venous sinus to complete the cranial portion of the renal portal circle (**Fig.1**).

V. Portalis renalis caudalis:

The caudal renal portal vein (Figs.1, 2, 10 /3) is an intrapelvic tributary of the external iliac vein, originates medial to the cranial renal

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portal vein. It runs caudally, parallel to the caudal renal vein within the renal fossa and joins the corresponding vein in the other side to form the interiliac anastomosis. The latter anastomosis is joined by the coccygeomesenteric vein. Along its course, the caudal renal portal vein detaches the ischiatic vein and fine collateral branches to drain the caudal lobe of the kidney.

V. Pubica:

The pubic vein (Figs. 1, 2, 3, 4/4) is the last intrapelvic tributary of the external iliac vein. It courses oblique caudo-lateral to the ventral border of the pubic bone accompanied by the pubic artery. During its course, it drains the abdominal muscles and peritoneum.

V. Femoralis: The femoral vein (Figs. 1, 2, 3 /5) is a slender vessel and continues the external iliac vein through the inguinal hiatus. It courses cranio-lateral to the hip joint accompanying the femoral artery within the M.femorotibialis where it receives the reduced segment of the ischiatic vein to form ischio-femoral anastomosis (Figs. 2, 3, 4/14). Along its course, the femoral vein dispatches the cranial coxal, the cranial femoral and the cranial cutaneous femoral veins.

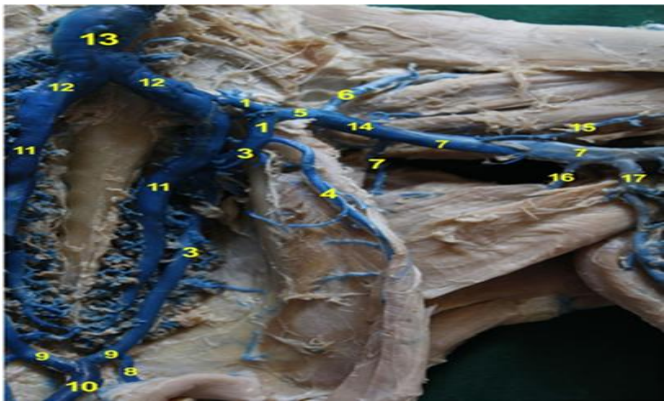

Figure (2). A photograph showing the veins of the thigh region of the left pelvic limb, medial view.

1. V.iliaca externa
3. V.portalis renalis caudalis
4. V.pubica
5. V.femoralis
6. V.femoralis cranialis
7. V.ischiadica
8. V.iliaca interna
9. Anastomosis interiliaca
10. V.coccygomesentrica
11. V.renalis caudalis
12. V.iliaca communis
13. Vena cava caudalis
14. V.anastomosis ischiofemoralis
15. V.femoralis medialis
16. V.femoralis caudalis
17. V.suralis

V. Femoralis cranialis:

The cranial femoral vein (Figs. 1, 2, 3 /6) departs from the dorsal aspect of the femoral vein. It is distributed along whole length of the cranial surface of the femur accompanying the artery of the same name to drain the M.femorotibialis cranialis, M.femorotibialis accessories and M.iliotibialis cranialis.

V. Ischiadicus:

The first portion of ischiatic vein (Figs. 1, 2, 3, 4 / 7) is reduced, long and slender, and leaves the caudal renal portal vein laterally, caudal to the pubic vein at the level of sixth segment of synsacrum. The ischiatic vein penetrates the ilioischiatic foramen, accompanied by the artery and nerve of the same name and detaches the caudal coxal

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vein, then joins the femoral vein to form the strong ischiofemoral anastomosis. The ischiofemoral anastomosis is located at the proximal third of the thigh region and continues on the caudal aspect of femur as the large stout ischiatic vein. During its course, the ischiatic vein gives off the medial femoral, caudal femoral, proximal nutrient femoral, and sural veins.

V. Femoralis medialis:

The medial femoral vein (Figs. 2, 3, 4/15) is detached from the dorsal aspect of the parent trunk and courses craniomedially in the thigh region till reach the medial face of the stifle joint where it joins the medial tibial artery. Along its course, it drains the Mm.adductor, puboischiofemoralis complex, femorotibialis medius, femorotibialis internus, iliotrochantricus cranialis and iliotrochantricus caudalis.

V. Femoralis caudalis:

The caudal femoral vein (Figs. 2, 3, 4 /16) emanates from the ventral aspect of the large ischiatic vein and directed caudo-ventrally in the thigh region accompanying the caudal femoral artery to drain the Mm.fibularis, pubo-ischiofemoralis, semimembranosus and semitendinosus.

V. Suralis:

The sural vein (Figs.2, 3, 4/17) drains into ventral aspect of ischiatic vein at the distal third of the femur. It runs caudoventrally accompanied by the sural artery to the caudal aspect of the leg region where it gives the lateral and caudal cutaneous femoral veins. The sural vein terminates by dividing into lateral and medial sural veins.

V. Poplitea:

The popliteal vein (Figs. 3, 4/20) is the direct continuation of the ischiatic vein in the leg region, passes oblique caudomedial to stifle joint then continues distally to medial tibiotarsus where it is ramified and drains Mm.gastrocnemius, fibularis longus and tibialis cranialis. Along its course, the popliteal vein gives off the Vv.genus lateralis, nutricia femoralis distalis, tibialis medialis, tibialis caudalis and fibularis and continues as v. tibialis cranialis.

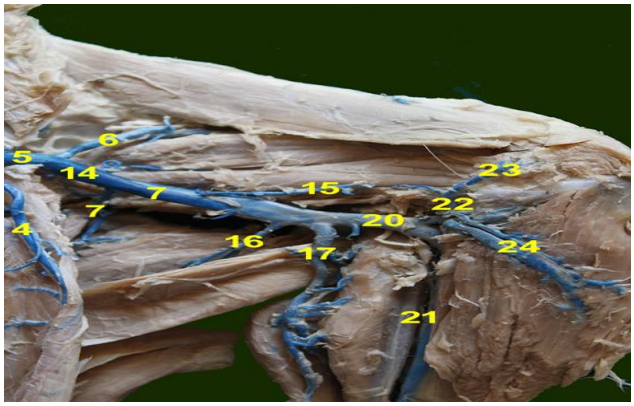

Figure (3). A photograph demonstrating the main veins in the left thigh region in pelvic limb, medial view.

4. V. Pubica
5. V. Femoralis
6. V. Femoralis Cranialis
7. V. Ischiadica
14. V.Anastomosis Ischiofemoralis
15. V. Femoralis Medialis
16. V. Femoralis Caudalis
17. V. Suralis
20. V. Popliteal.
21. V. Tibialis Caudalis
22. V. Tibialis Medialis
23. V. Genus Medialis
24. V. Cruralis Medialis

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V. Tibialis medialis:
The medial tibial vein (Figs. 3, 4/22); departs from the caudal aspect of the popliteal vein. It represents the venous drainage of the distal thigh, proximal crural regions and the craniomedial aspect of the stifle joint. The medial tibial vein courses along the medial aspect of the stifle joint between pars externus, internus and medialis of the gastrocnemius muscle then terminates by anastomosing with the medial femoral vein at the level of distal half of the femur. Along its course, it detaches the medial geniculate and medial crural veins.

V. Cruralis medialis:
The medial crural vein (Figs.3, 4/24) is a long branch of the medial tibial vein which is distributed along medial aspect of the crural region to drain the Mm. gastrocnemius, plantaris and flexor perforates complex, then continues distally to anastomose with caudal tibial vein at the level of the distal third of the tibia.

V. Tibialis caudalis: The caudal tibial vein (Figs. 3, 4, 5 /21); drains the caudal aspect of the crural region, then opens into the caudal aspect of the popliteal vein. It courses caudoventrally in the leg region accompanied by the caudal tibial artery and anastomoses with the medial crural vein in the distal third of the tibia. The caudal tibial vein receives the venous blood from flexor muscles of leg as well as pars intermedia of m.gastrocnemius and continues distally as the tarsal plantar vein (Figs.4, 5, 6, 7/25) at the plantar aspect of the tibiotarsal joint. At the level of proximal third of tarsometatarsus, it runs on the plantar side as the plantar metatarsal vein that divides into medial and lateral plantar metatarsal veins which are joined together in the metatarsal pad forming Arcus plantaris superficialis.

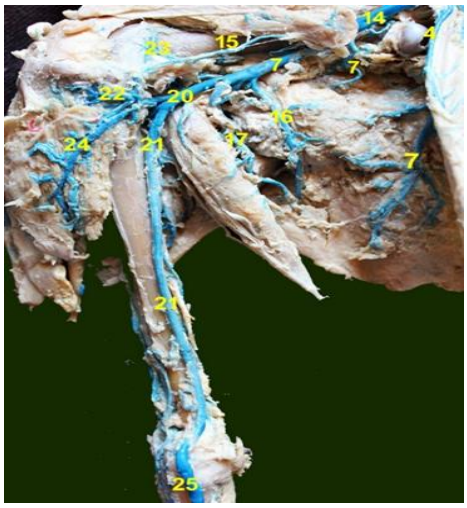

Figure (4). A picture of the left pelvic limb's ischiatic vein distribution, medial view.

4. V.pubica
7. V.ischiadica
14. V.anastomosis ischiofemoralis
15. V.femoralis medialis
16. V.femoralis caudalis
17. V.suralis
20. V. popliteal
21. V.tibialis caudalis
22. V.tibialis medialis
23. V.genus medialis
24. V.cruralis medialis
25. Vv.plantares tarsales

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V. Tibialis cranialis:
The cranial tibial vein (Figs. 5, 7/27) is considered the continuation of the popliteal vein which proceeds cranioventrally to the proximal third of tibia and transverses the proximal part of the interosseous space in company with the fibular artery and vein then passes distally to the cranial surface of tibia for a long course to drain m.fibularis longus and m.tibialis cranialis. The cranial tibial vein joins the deep and superficial fibular veins forming a venous rete that becomes intermingled with fine branches from the arteries of like name at the distal third of tibia creating an arterio-venous network called Rete tibiotarsale (Figs.5, 7/28) whereas the cranial tibial vein continues distally as the common dorsal metatarsal vein in the dorsal tarsometatarsus.

V. Metatarsalis dorsalis communis:
The common dorsal metatarsal vein (Figs.5, 6, 7/29) is the direct continuation of the cranial tibial vein, on the dorsal aspect of the tarsometatarsus accompanying the artery of the same name. It divides into lateral dorsal and medial dorsal (Figs. 5, 6, 7, 8/30) metatarsal veins at the middle third of the dorsal aspect of tarsometatarsus which pass distally till receive the digital veins in the metatarsal pad.

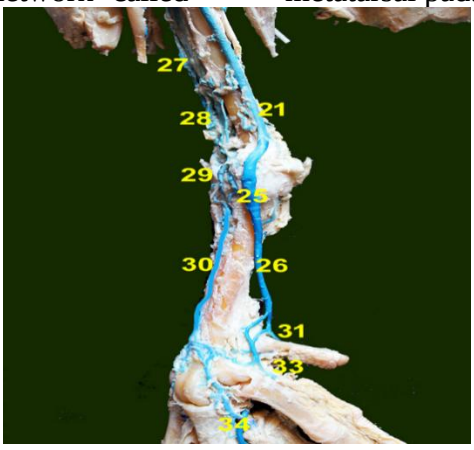

Figure (5): A photograph showing the course of the caudal tibial vein, dorso-medial view.

21. V.tibialis caudalis.
25. Vv.tarsales plantares
26. V.metatarsalis plantaris medialis.
27. V.tibialis cranialis
28. Rete tibiotarsale
29. V.metatarsalis dorsalis communis
30. V. metatarsalis dorsalis medialis
31. V.digital I medialis
33. V.digital II medialis
34. Common trunk of V.digital III medialis and V.digital II lateralis.

Arcus plantaris superficialis:
The superficial plantar arch (Fig. 9/41) is the horizontal curved network, formed by the joining of the lateral and medial plantar metatarsal veins and fine branch of lateral dorsal metatarsal vein which is located proximal to plantar aspect of the metatarsophalyngeal joints within the metatarsal pad. The venous plantar arch detaches the pulvinar (Fig. 9/43) and digital veins.

Vv. Digitales:
The drainage of the digital veins (Figs.6,8) is variable. Most of the digital veins drain directly into the venous plantar arch, while the rest of digital veins drain into the medial plantar metatarsal, the medial and the lateral dorsal metatarsal veins. The digital veins are

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anastomosed with corresponding digital arteries to form network that play a role in the body thermoregulatory mechanism.

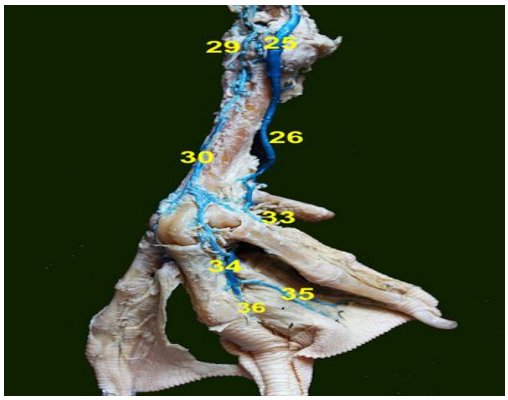

Figure (6). A photograph showing the distribution of the digital veins, dorsal view.

25. Vv.tarsales plantares
26. V.metatarsalis plantaris medialis
29. V.metatarsalis dorsalis communis
30. V.metatarsalis dorsalis medialis
36. V.digital III medialis
33. V. digital II medialis
34. Common trunk of V.digital III medialis and V.digital II lateralis.
35. Rr.interdigitales

Vv. Digitales I medialis et lateralis:

The medial digital I vein (Figs. 5/31& 9/44) arises from the venous plantar arch and passes ventromedially to drain the medial side of the first digit. The lateral digital I vein (Figs. 8/32) is departs from medial plantar metatarsal vein and directed ventrolaterally to drain the lateral side of first digit.

V. Digitalis II medialis:

The medial digital II vein (Figs.5, 6, 7, 8, 10/33) emanates from venous plantar arch to drain the medial aspect of digit II.

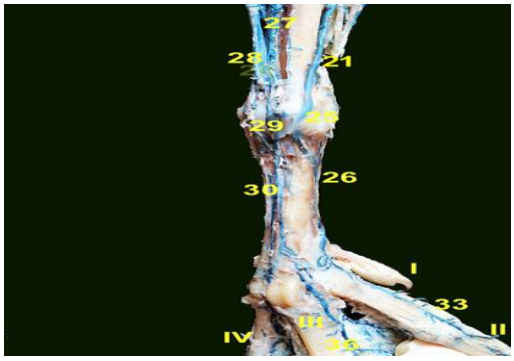

Figure (7). A photograph showing the venous drainage of shank region, dorsomedial view.

21. V.tibialis caudalis.
25. Vv.Plantares tarsales.
26. V.metatarsalis plantaris medialis.
27. V.tibialis cranialis.
28. Rete tibiotarsale.
29. V.metatarsalis dorsalis communis.
33.V.digital II medialis
36.V.digital III medialis
I. first digit
II. second digit
III. third digit
IV. fourth digit

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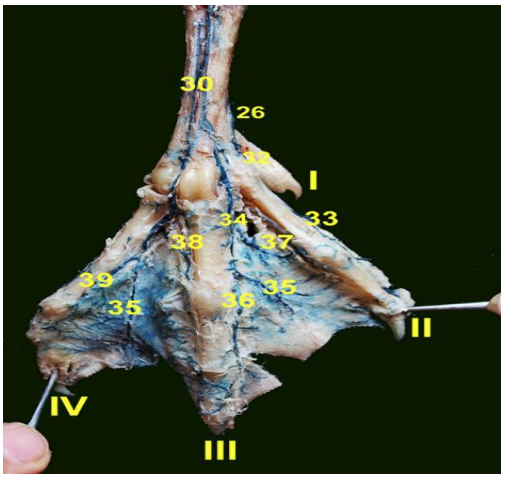

30. V.metatarsalis dorsalis medialis.

Figure (8). A photograph showing the distribution of the digital veins, dorsal view.

26. V. metatarsalis plantaris medialis.
30. V. metatarsalis dorsalis medialis
32. V.digital I lateralis
33. V.digital II medialis
34. Common trunk of V. digital III medialis and V.digital II lateralis.
35. Rr. Interdigitales
36. V.digital III medialis
37. V.digital II lateralis
38. V.digital III lateralis
39. V.digital IV medialis

Vv. Digitales II lateralis et III medialis:
The lateral digital II vein (Fig.8/37) and medial digital III vein (Figs.6, 7, 8/36) emerge by common stem from the medial dorsal metatarsal vein (Figs.5, 6, 7, 8/30). They are distributed on the digital web to drain the lateral side of the second digit and medial aspect of the third digit respectively.

Vv. Digitales III lateralis et IV medialis: The lateral digital III vein (Fig.8/38) and medial digital IV vein (Fig.8 /39) are originated by common stem from medial dorsal metatarsal vein to drain the lateral side of the third digit and medial aspect of fourth digit respectively.

V. Digitalis IV lateralis:
The lateral digital IV vein (Fig. 9/42) springs independently from the plantar arch where it ramifies into lateral side of the fourth digit.

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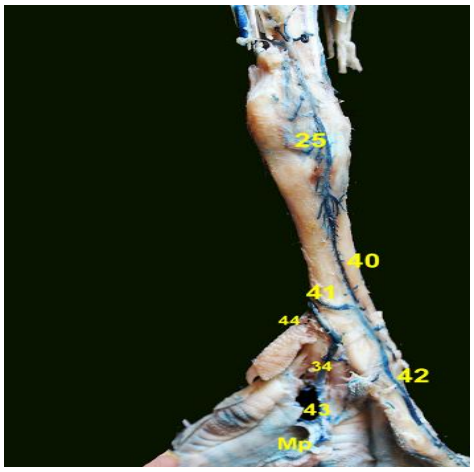

Figure (9). A photograph showing the plantar arch, plantar view.

25. Vv.plantares tarsales.
34. Common trunk of V.digital III medialis and V.digital II lateralis
40. V. metatarsalis plantaris lateralis
41. Arcus plantaris superficialis.
42. V.digital IV lateralis
43. Vv.Pulvinarum
44. V.digital I medialis
Mp. Metatarsal pad

Rr. Interdigitales:

The interdigital branches (Figs.6, 8/35), the collateral fine vessels which emanate from the medial digital III and medial digital IV veins. They are distributed towards the digital web between the 2nd, 3rd and 4th digits.

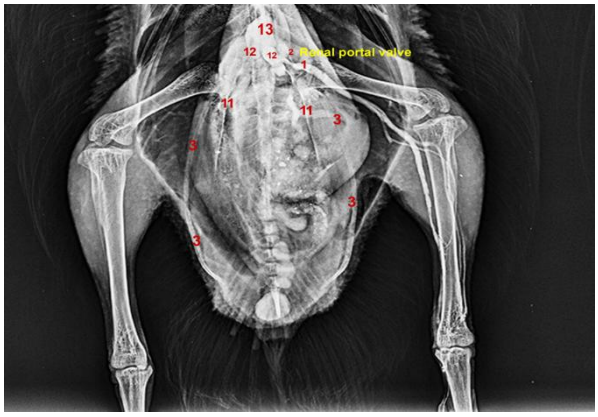

Figure (10). A radiographic picture showing the formation of the renal portal circle, dorsoventral view.

1. V. iliaca externa
2. V. portalis renalis cranialis
3. V. portalis renalis caudalis
11. V. renalis caudalis
12. V. iliaca communis
13. V. vena cavae caudalis

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Discussion

The present findings clarified that the venous blood flow of the pelvic limb in geese was mainly drained by the external iliac and ischiatic veins, similar to that reported in domestic fowl, [7] in chickens, [1,8] in ostrich,[9] and in owl, flamingo and ostrich.[10] The renal portal circle was a venous ring consisting of the left and right cranial renal portal and caudal renal portal veins within the renal fossa. These findings were in agreement with previous findings reported by Havenga et al. (2020) in raptor, [11]in chickens,[1] in ostrich[9] and in the fowl. [12,13]

The present investigation showed that the renal portal valve of geese does not have an effective role in the function of the valve. Contrary to the literature that stated that the valve was not only very active but also very powerful in diverting the course of the venous blood from the pelvic limb to the renal tissue instead of the caudal vena cava in chickens[1] and in domestic fowls. [14]

The cranial renal portal vein drained into the external iliac vein. Likewise, [1] in chickens, [7] and in domestic fowls. [15,16] Earlier findings in raptor[11] in ostrich[9] and in ducks [17] supported our observations, that the cranial renal portal vein was located within the cranial lobe of the kidney. The cranial renal portal vein joined with internal vertebral venous sinus to complete the renal portal circle. These findings were in accordance with that recorded by Baumel *et al.* (1993) in domestic fowls[12] While Magras & Asteriadis (1989) described that the cranial renal portal vein was rudimentary in ducks. [17] In the current investigation, the caudal renal portal vein passed parallel to the caudal renal vein within the renal fossa which was similar to that shown by Swielim *et al.* (2012) in chickens. [1] On the other hand, Carvalho [et al.] (2007) recorded that the caudal renal portal vein was located on the dorsal surface of the kidney between the cranial and caudal division then left the kidney as internal iliac vein in ostrich. [9] The caudal renal portal vein was joined with the corresponding side to form the coccygeo-mesentric vein. Similarly, [12] and **[11]** found identical results.

Regarding the common iliac vein, the current work clarified that it was formed from the union of the external iliac vein with the caudal renal vein, which was confirmed by Swielim *et al.* (2012) in chickens [1,7] in ostrich, [1,7,12] in domestic fowls. The last authors in fowl decided that the common iliac vein was the initial short trunk of the afferent renal vein. The present study added that the common iliac vein joined with its corresponding of the other side and formed the caudal vena cava, similar to that explained by Havenga *et al.* (2020) in raptor [11] and [9] in ostrich. The external iliac vein proceeded caudo-ventrally till reach the head of femur and continued as vena anastomosis ischiofemoralis outside the pelvis through inguinal hiatus and extends to the thigh region of the pelvic limb, similar information was given by (Midtgård, 2009) in different birds. These findings were disagreed with Sisson S. (1975) in chickens [13] and [9] in ostrich who revealed that the femoral vein penetrates the pelvis and passed through pectin process to become as external iliac vein which located between the cranial and middle lobes of the kidney.

Concerning the pubic vein, it drained into the external iliac vein, as observed by Bock (1978) in domestic fowls [7] and Midtgård (2009) in owl, [10] flamingo and ostrich. On the other hand, the cranial coxal vein drained into the external iliac vein and zcaudal gluteal veins in domestic fowls. [7] Regarding the femoral vein, the present work proved that it was the continuation of the external iliac vein after piercing the inguinal hiatus and detached the cranial coxal, cranial femoral, cranial cutaneous femoral veins.

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These finding simulated that found by Midtgård (2009) in the different birds[10] and Swielim *et al.* (2012) in chickens. [1]

In agreement with the previous findings in different birds, the current study pointed that the femoral vein received the reduced segment of the ischiatic vein to form ischio- femoral anastomosis and the ischiatic vein emitted from the lateral aspect of the caudal renal portal vein. In domestic fowls the ischiatic vein arose from afferent renal vein at the caudal lobe of the kidney. [7] In the current work, the caudal femoral vein was observed to be stemming out from the caudal aspect of large ischiatic vein. Same observation was obtained in domestic fowls [12] and in chickens**.** [1] The caudal femoral vein had substitute term for the V. profunda femoris in domestic fowls, [13] while the caudal femoral vein was usually single in most species. [10]

In accordance with [10] in the different birds, the popliteal vein was the direct continuation of the ischiatic vein in geese and it is detached the medial tibial, fibular and distal nutrient femoral veins while the caudal femoral vein was one of the branches of the popliteal vein in domestic fowls. [7] In agreement to our study, the rete tibiotarsale was an arterio-venous rete, formed by the anastomosis of the cranial tibial vein with the fibular veins, intermingled with the fine branches from arteries of the same name. The cranial tibial vein continued as common dorsal metatarsal vein at the level hock joint, which was the same finding in domestic fowls. [7] Baumel *et al.* (1993) added that the cranial tibial vein joined the caudal tibial vein distal to the knee joint in domestic fowl. [12] It was noted that the caudal tibial vein drained into the popliteal vein. This finding was the same as that given by Baumel et al. (1993) in domestic fowl[12] and Midtgård (2009) in different birds[10] The present findings designed that it anastomosed with the medial crural vein and then continued distally as the plantar tarsal vein at the level of the plantar aspect of the hock joint, then passed distally till the level of proximal third of tarsometatarsus where it continued as the plantar metatarsal veins. In the examined geese, the common dorsal metatarsal vein began as the continuation of the cranial tibial vein at the level of the dorsal aspect of the hock joint accompanied by common dorsal metatarsal artery and divided at the dorsal aspect of tarsometatarsus into medial and lateral dorsal metatarsal veins. These results were in agreement with that presented by Swielim *et al.* (2012) in chickens. [1] On the other hand, the dorsal metatarsal veins drained into common dorsal metatarsal vein which itself emptied into the medial superficial planter metatarsal vein in gallus domesticus. The medial plantar metatarsal vein was the main venous drainage of the foot and digits which drained into caudal tibial vein, similar to that reported by Midtgård (2009) in 478 different birds [10] and [7] in domestic fowls.

The present study showed that the superficial plantar arch was formed by medial and lateral plantar metatarsal veins in addition to fine branch of lateral dorsal metatarsal vein. These findings were in accordance with that discussed by Bock (1978) in domestic fowls[7] and Swielim *et al.* (2012) in chickens. [1] Concerning the venous drainage of the digital veins, the current study illustrated that the medial digital I, medial digital II and lateral digital IV veins drained into the superficial plantar arch. The lateral digital I vein, lateral digital II, medial and lateral digital III and medial digital IV veins drained into medial dorsal metatarsal vein. Our findings were similar to that reported by Swielim *et al.* (2012) in chickens. [1] On the other hand, Midtgård (2009) observed that the digital veins drained into the planter venous arch in nearly all the birds**.** [10] Bock

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(1978) stated that the digital veins were anastomosed with the corresponding digital arteries to perform a role in the body thermoregulatory mechanism in domestic fowls. [7]

In conclusion, this study documents for the first time the renal portal system is controlled by a very weak renal portal valve. The Radiographic studies showed the incompetence of the renal portal valve by revealing the weakness of its structure which in turn leads to the loss of the known role of the valve in diverting the venous blood from the limb to the renal tissue. The thigh musculature is a properly drained with the tributaries of the external iliac and ischiatic veins, which eventually connect with their corresponding of the opposite side of the pelvis through the renal portal circle which in turn diverts the venous blood to the caudal vena cava by passing the kidney. Consequently, it is recommended for the parenteral preparations to be injected in the thigh musculature in domestic geese

Confilct of intreset

The author has declared no conflict of interest.

Acknowledgments:

Special thanks to my colleagues in the anatomy and embryology, department, Faculty of Veterinary Medicine, ECU.

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