

# 5 Distribution of arteries within the vertebrae

H. V. Crock et al., *The blood supply of the vertebral column and spinal cord in man*  
© Springer Science+Business Media New York 1977

---

Within the interstices of the cancellous bone of the vertebral bodies lie dense and complicated arterial networks (Fig. 5.1). To study these vessels in detail the vertebral bodies should be divided into thin slices (0.5 to 0.75 cm) in three planes. It will be found that entrant vessels are arranged in constant basic patterns within the vertebral bodies, with most of their branches destined to be focussed on the vertebral end-plate zones.

In this chapter the distribution of arteries within the vertebrae from the various segments of the spine are illustrated. To avoid repetition, the description given in the text is of the intraosseous vessel distribution in lumbar vertebrae. Readers interested in other vertebral segments should therefore refer to the appropriate illustrations and their legends.

The centrum is penetrated radially in the horizontal plane by small arteries derived from the abdominal portions of the lumbar arteries anterolaterally and posteriorly by somewhat larger arteries derived from the arcuate branches of the anterior spinal canal division of the lumbar arteries (Fig. 5.2). An arterial grid is formed in the center of the vertebral body, from which vertical branches ascend and descend in slightly tortuous paths toward the respective vertebral end-plates, forming a brush border of arterioles which pass vertically into the vertebral end-plate cartilage capillary beds.

In coronal and sagittal sections (Figs. 5.3–5.8), the contributions from the ascending and descending branches of the lumbar arteries and analogous branches from the anterior spinal canal arcuate arteries to the vertebral bodies can be seen; these, too, have their entry points orientated circumferentially around the vertebral bodies. However, as the branches which enter the anterolateral aspects of the body penetrate to the interior, their main stems form triangular

wedge-shaped patterns viewed in both the coronal and sagittal planes with apices near the junctions of the lateral and middle thirds or anterior and middle thirds of the vertebral body. From the sloping sides of these triangles, vertical branches turn upward or downward toward the vertebral end-plate areas. From the study of pure arterial injections it appears that the arterial grid in the centrum is concerned ultimately with the blood supply of the central third of the vertebral body and its respective vertebral end-plates. The remaining segments of the vertebral end-plates are supplied anterolaterally by the vertical branches arising from the triangular watershed described above and posteriorly by the ascending and descending branches of the arcuate arteries on the anterior wall of the spinal canal (Figs. 5.6–5.8).

The basic intraosseous patterns just described are established at birth and, as in other bones, remain unchanged throughout life except for certain details in the regions of the growing ends of the vertebrae. In the newborn child, the primary center of ossification for the body is surrounded superiorly and inferiorly by cartilage caps which merge with the intervertebral discs related to the upper and lower surfaces of the particular vertebral body. Already at this stage of development there is a central arterial grid which gives rise to a multiplicity of fine arterial branches spreading out in the directions described above. Some of these fine arteries penetrate the cartilage caps in the form of sinusoidal expansions (Fig. 5.9).

On the other hand, the cartilage caps are penetrated circumferentially by fine arteries branching from the ascending and descending branches of the lumbar arteries themselves. The terminations of these vessels in cartilage are clearly shown in a number of the accompanying illustrations (Figs. 5.9–5.12). These fine arteries narrow to arteriolar size and then branch out into sinusoidal terminations which are often Y-shaped with clublike endings. Small veins are formed within these sinusoids and they run back in the cartilage canals alongside the entrant arteries.

As the ossification of the vertebral body extends near to the final vertebral end-plate zone, so these sinusoidal systems disappear and in the adult a complicated vertebral end-plate capillary bed is formed with subarticular collecting vein systems which are described and illustrated in Chapter 6.

For practical purposes, the blood supply of the posterior vertebral elements has already been described in Chapter 1 (Fig. 1.12). The essential details of the arterial supply of sacral cervical and thoracic vertebrae are illustrated in Figures 5.15–5.23.





figure 5.1

A midsagittal section from the fifth lumbar vertebral body of a child aged 15 years, to show the density of intraosseous arterial branching within a normal vertebral body.

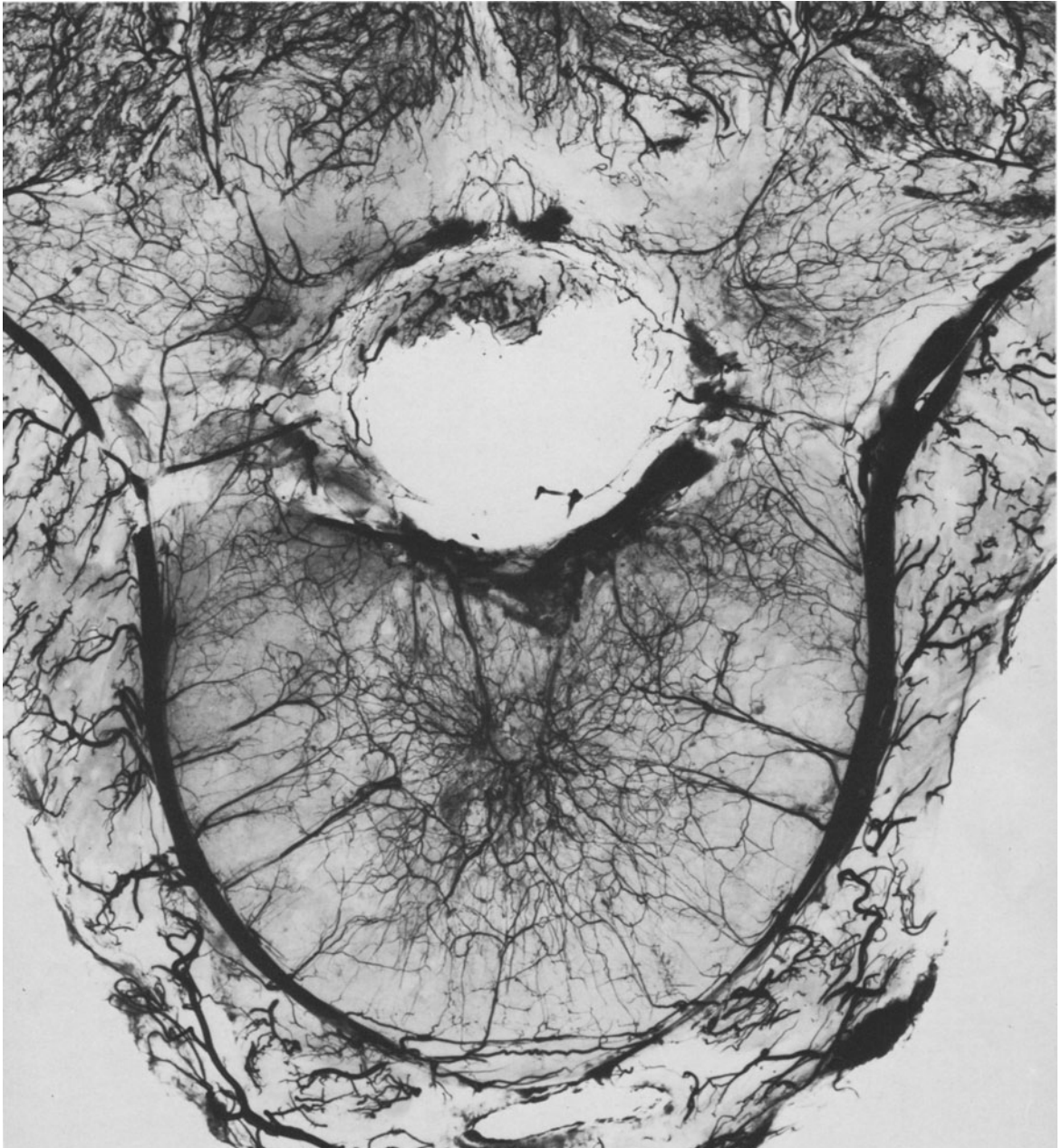


figure 5.2

A transverse section through the lumbar vertebral body of a child aged 13 years. The radiate distribution of centrum branches arising from the inner surface of the lumbar arteries on each side has been shown. Note the muscular branches passing directly into the muscles from the outer side of the main trunk of each lumbar artery. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)



figure 5.3a and b

(a)  
Line drawing to indicate the coronal planes of section of a lumbar vertebral body. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)

(b)  
A coronal section of the second lumbar vertebral body from a male aged 36 years corresponding to section 2 in the line drawing (b). On the left of this specimen the portals of entry of branches from the abdominal portion of the lumbar artery are shown. These are, in the center, the centrum branches, and above and below vessels derived from the ascending and the descending branches of the lumbar artery. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)



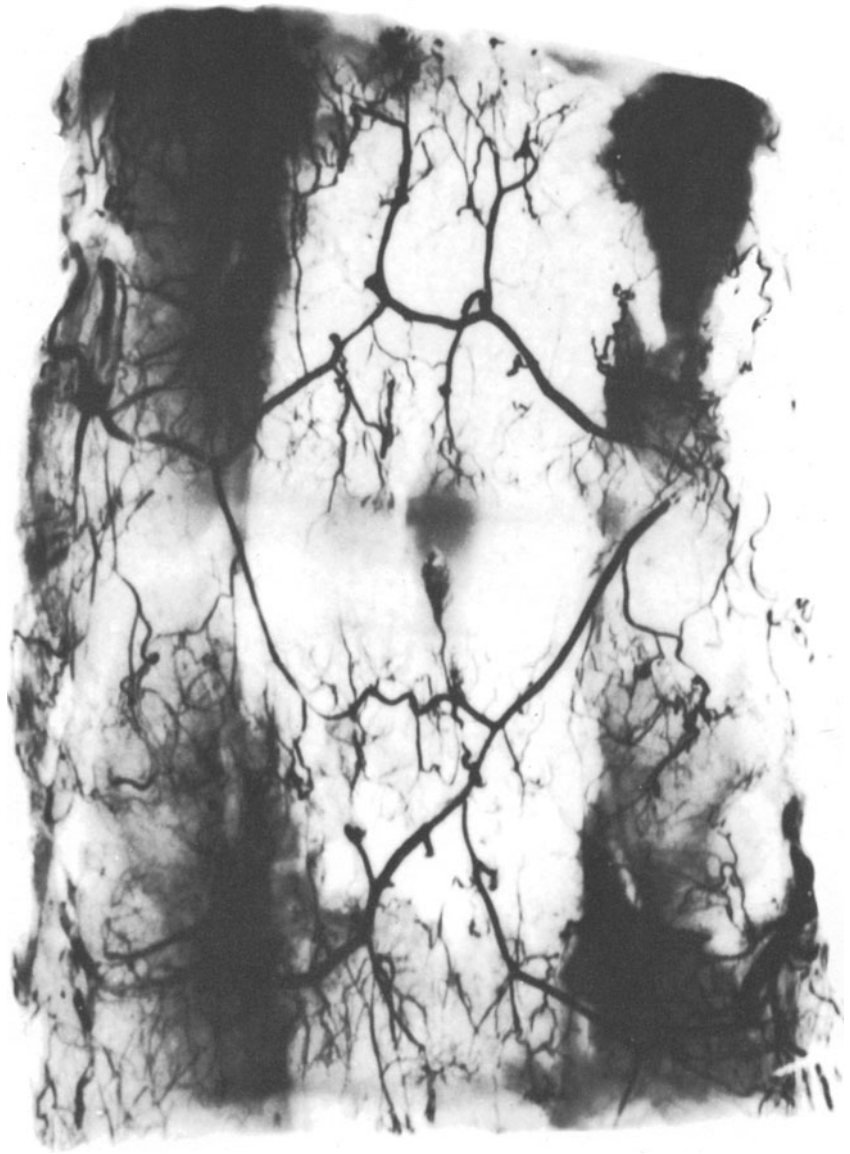


figure 5.4

A radiograph to show the distribution of anterior spinal canal branches of the lumbar arteries on the posterior surfaces of two adjacent lumbar vertebral bodies from a male aged 65 years. The main intraosseous tributaries from this arcuate system correspond to the ascending and descending branches of the abdominal portion of the lumbar arteries and to the centrum branches. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)

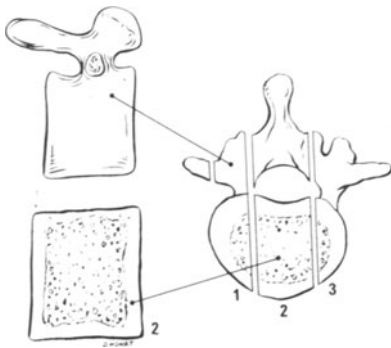


figure 5.5

Line drawings indicating the division of a lumbar vertebra into sagittal sections. Sections 1 and 2 of the specimen alongside show the distribution of arteries within the vertebral body from a male aged 30 years. The feeding branches to the centrum grid can be seen in both sections. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)

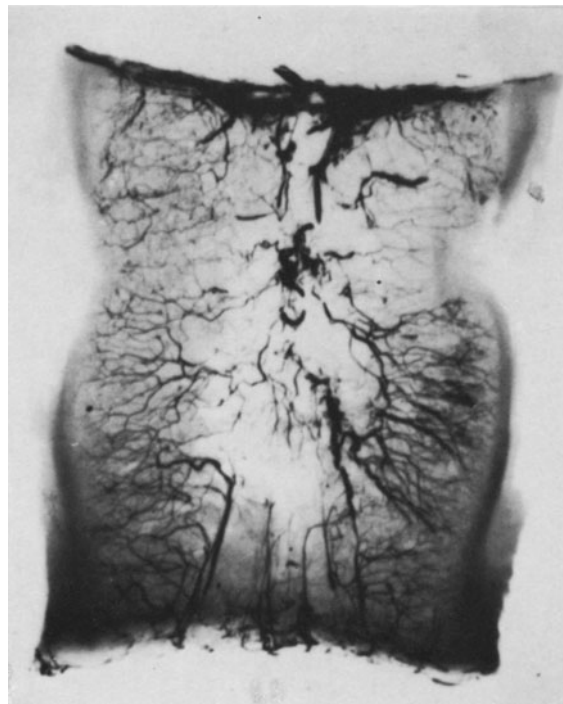
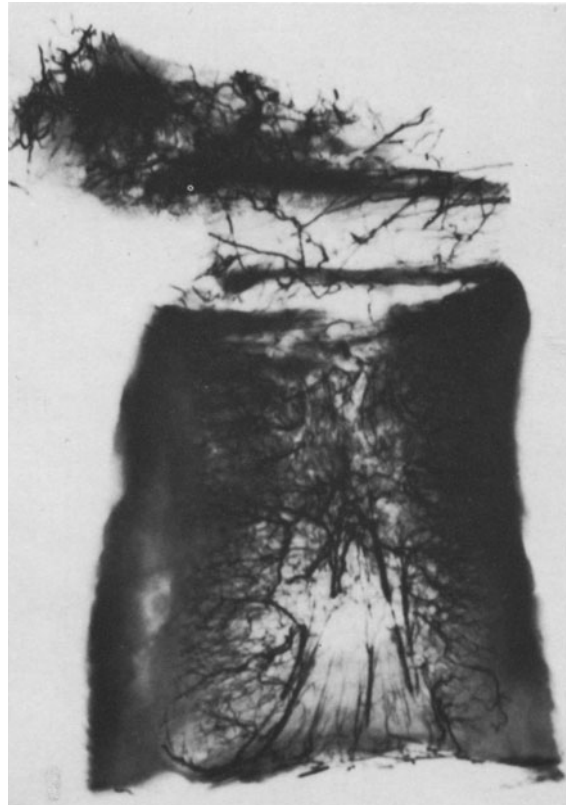




figure 5.6

A thin coronal section through the center of two adjacent lumbar vertebral bodies from a male aged 65 years showing details of the intraosseous distribution of arteries. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)

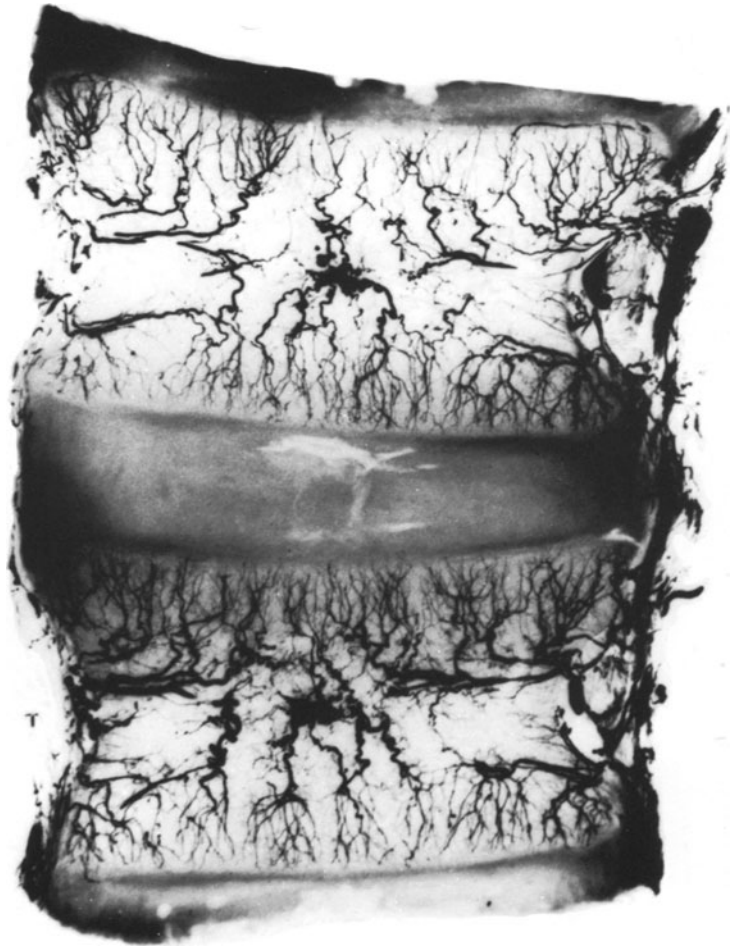
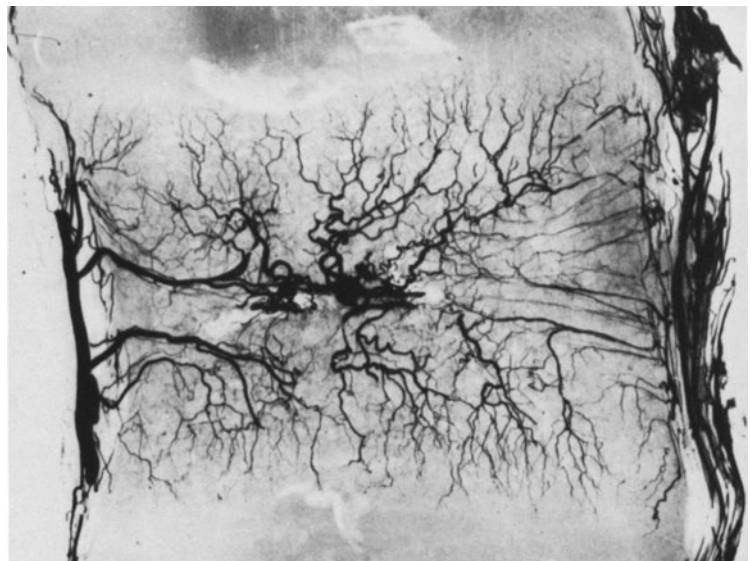


figure 5.7

A thin sagittal section through the center of the fifth lumbar vertebra from a young adult showing the intraosseous arterial patterns described in the text. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)



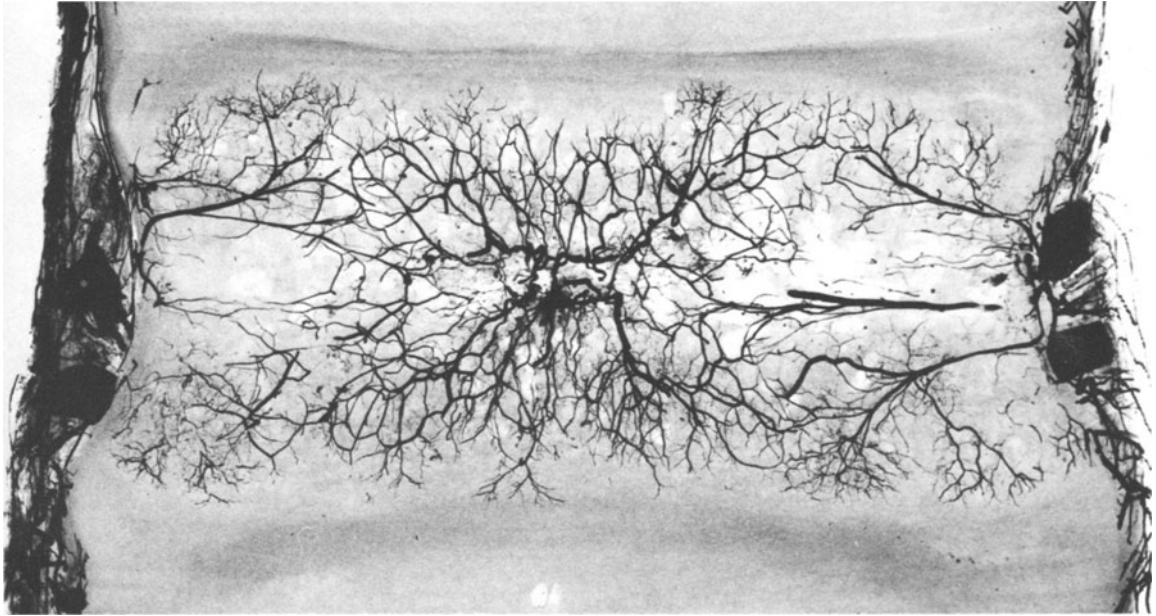


figure 5.8

A thin coronal section from the body of the eleventh thoracic vertebra of a child aged 13 years. On the right side of the photograph the three distinct entrant vessels can be seen.

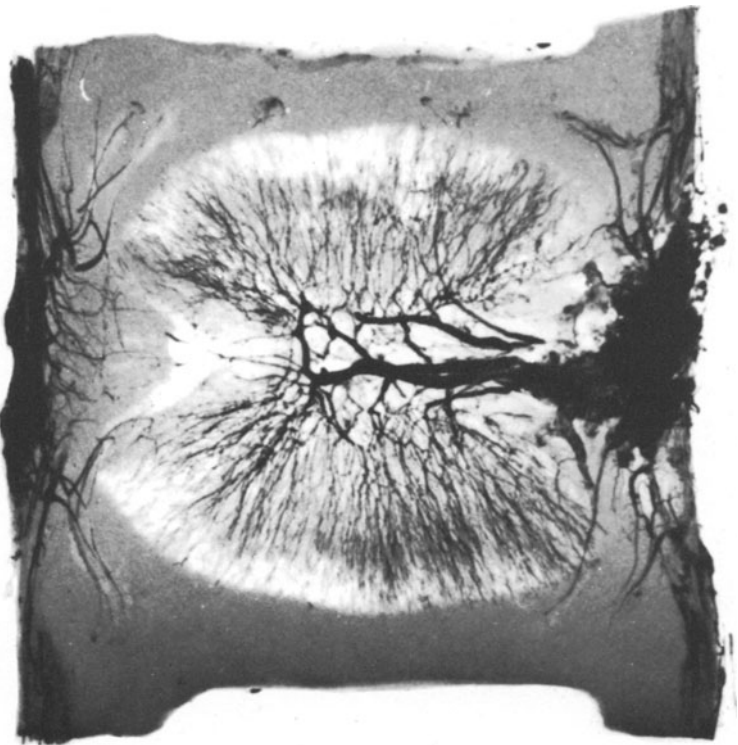


figure 5.9

A radiograph of a thin median sagittal section of a typical lumbar vertebra from a newborn infant, showing the pattern of distribution of arteries within the vertebral body. Note the sinusoidal terminations within the cartilage caps of the vertebral body.

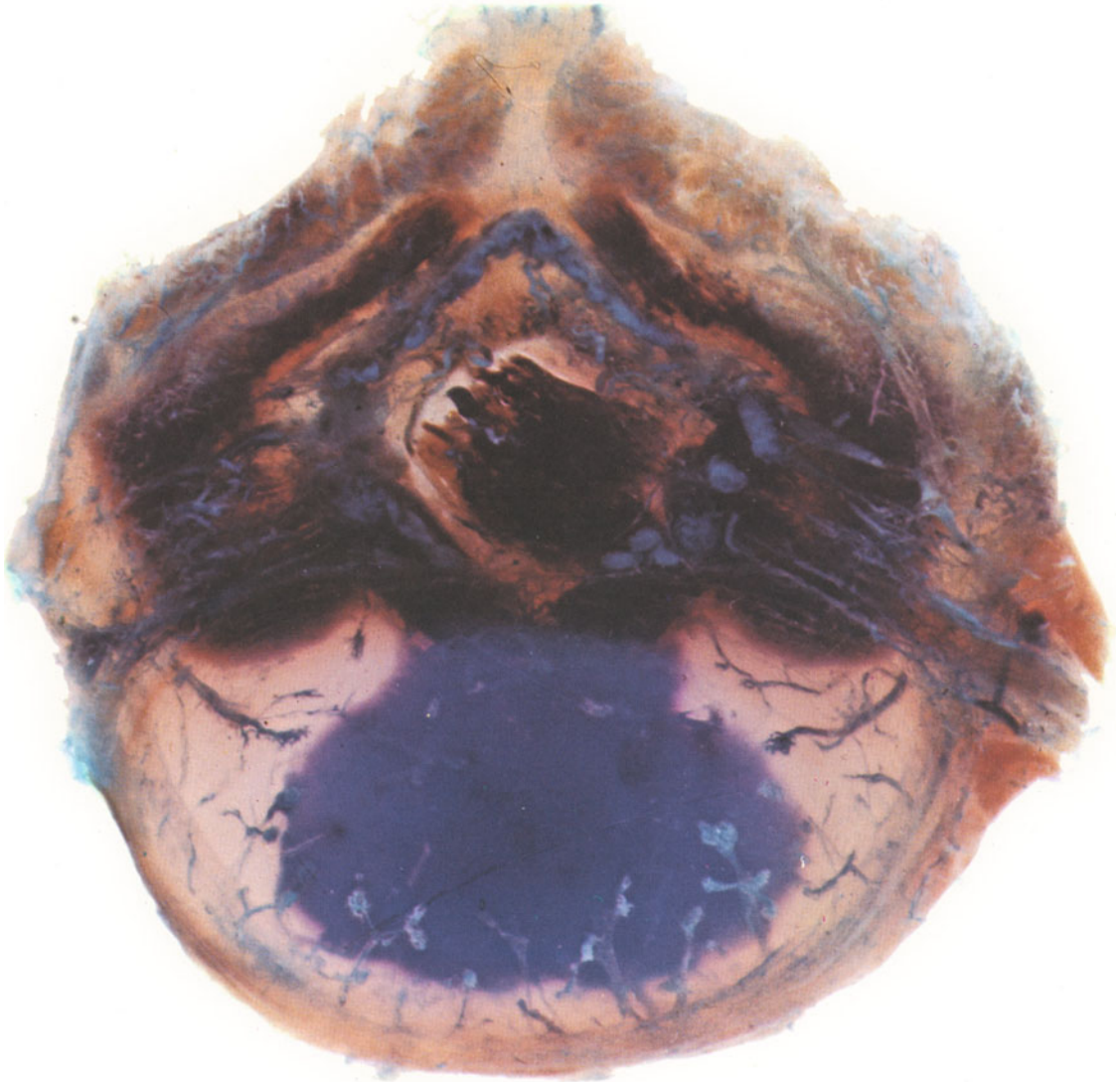


figure 5.10

A photograph of a thin transverse section from a lumbar vertebra in a newborn child. An arterial injection in which the venous side of the circulation has also been filled. The specimen is viewed through the intervertebral disc. The clublike endings of sinusoids in the cartilage cap of the vertebral body can be seen. The basic radiate pattern of distribution of the entrant arteries is also shown.

Posteriorly in the spinal canal, the internal vertebral venous plexus is clearly shown.



figure 5.11

A photograph of a thin median sagittal section at the lumbosacral junction from a male child aged 13 months. The cartilage caps on the ends of the vertebral bodies are clearly shown and the demarcation between the cartilage end-plate zones and the intervertebral disc stand out well in this transilluminated specimen. The crude details of distribution of the arteries within the cartilage can be seen. Note the Y-shaped bifurcations and clublike endings described in the text.



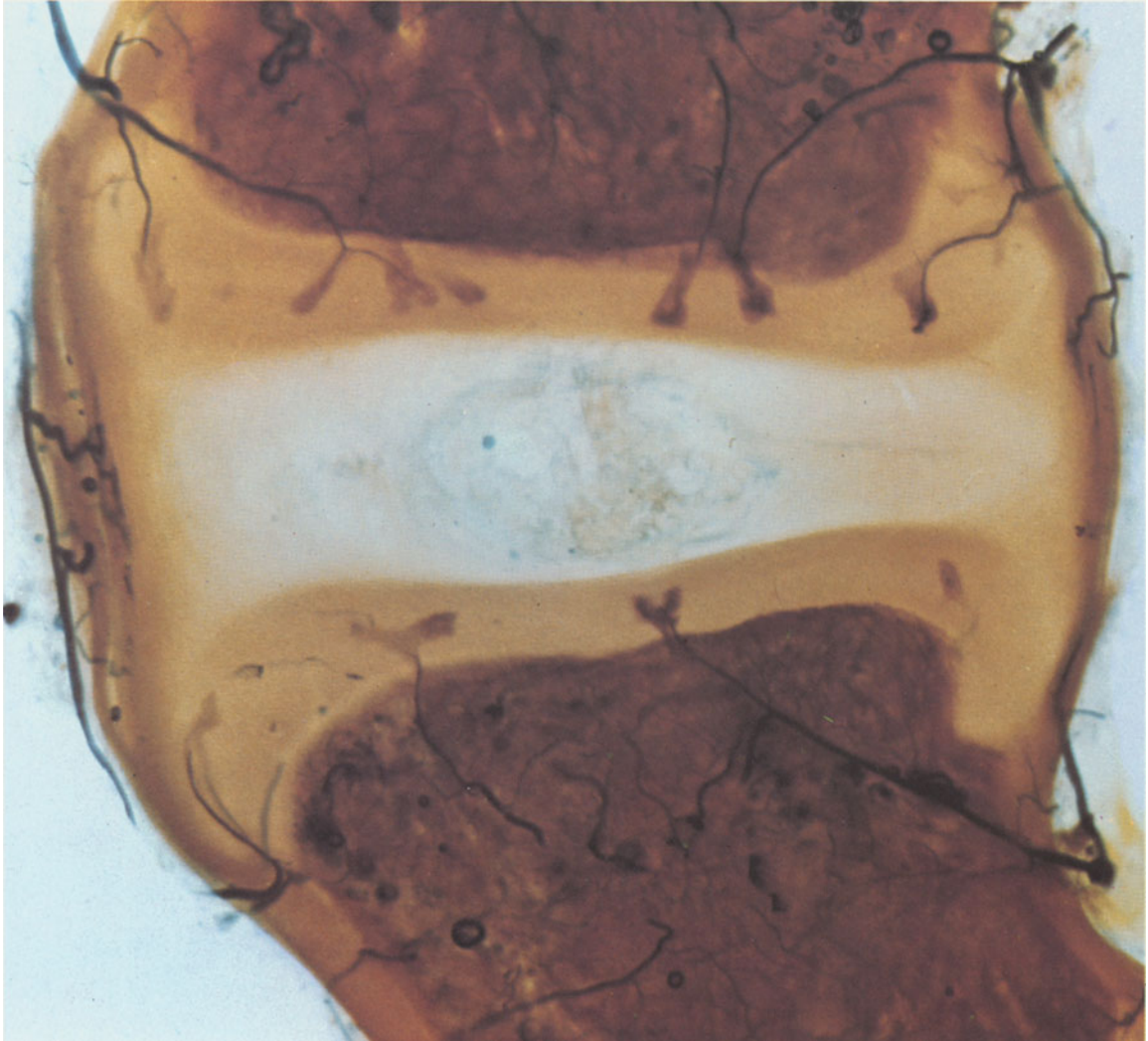


figure 5.12

A radiograph of a thin median sagittal section through the fifth lumbar and upper two sacral vertebral bodies from a newborn child. The basic pattern of distribution of the intraosseous arteries is clearly seen. Note the terminations of some of the vessels in cartilage, particularly those based on the ascending and descending branches of the lumbar artery on the anterior surface of the body. Similar branches based on the anterior spinal canal branches of the lumbar artery can be seen posteriorly.



figure 5.13

A radiograph of a thin median sagittal section through the fifth lumbar vertebra and sacrum, showing the basic intraosseous arterial patterns in an adult spine.



figure 5.14

A thin transverse section to show details of the arterial distribution in relation to the spinal canal, the vertebral body in front, and the lamina and spinous process behind. At the level of the intervertebral foramen, note: 1, the anterior abdominal wall branches and 2, the intermediate or spinal canal branches, and posterior to the intervertebral foramen, the posterior branches in relation to the lamina and spinous process. (Reproduced by courtesy of J. B. Lippincott and Company from *Clinical Orthopaedics and Related Research*, No. 115, 1976.)

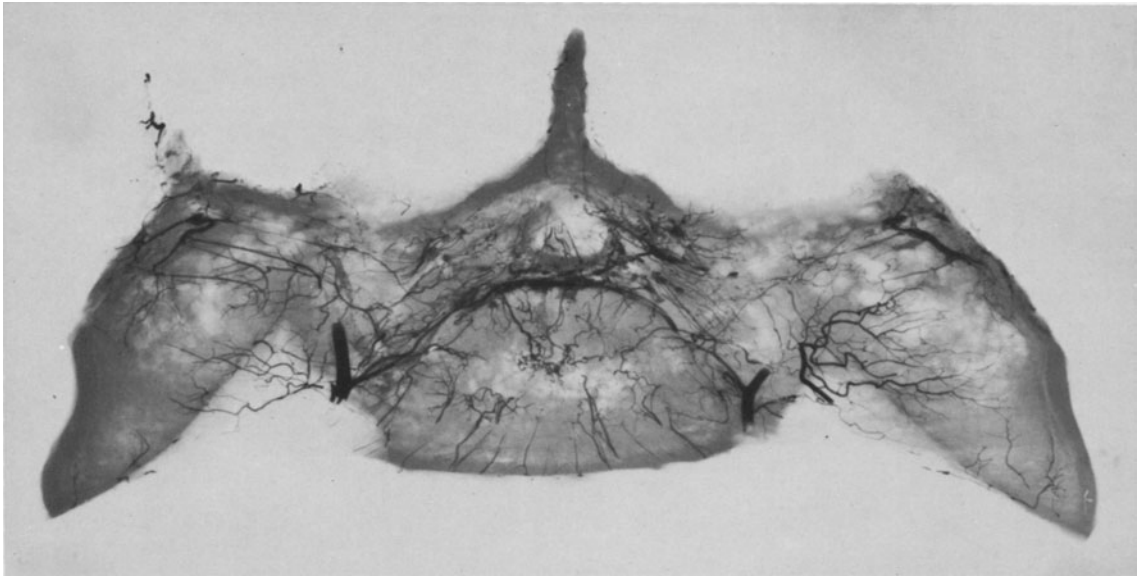


figure 5.15

A radiograph of a transverse section through the alar of the sacrum and middle of the first sacral vertebral body from an adult, showing the centrum grid in the vertebral body.

figure 5.16

A radiograph of a midsagittal section through two adjacent thoracic vertebral bodies from a male aged 34 years, showing the intraosseous arteries.



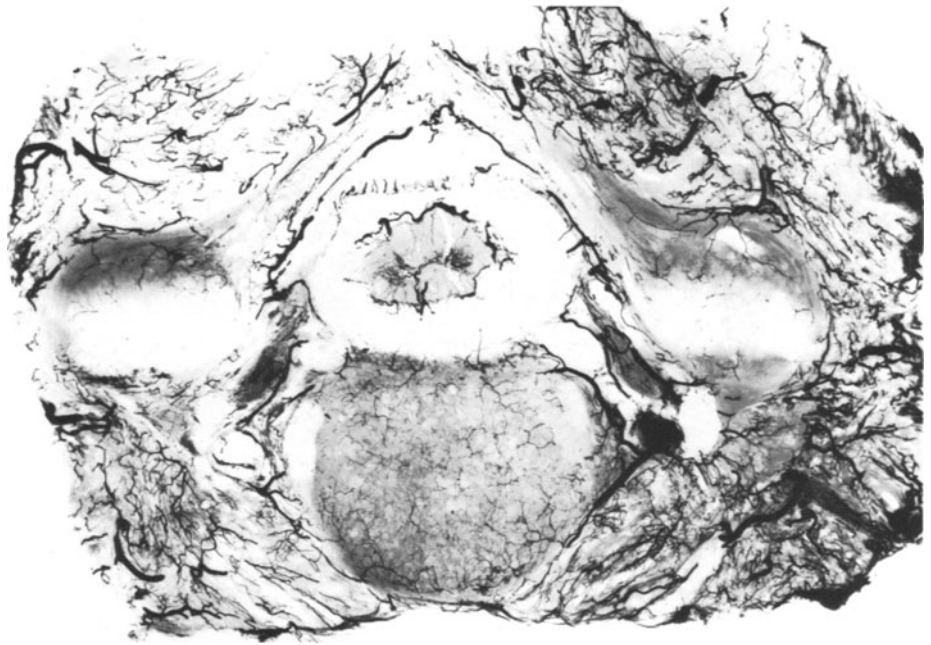


figure 5.17

A transverse section through the vertebral body of a midcervical vertebra from a female aged 20 years. The section has been cut near the vertebral end-plate area. On the right side of the photograph, the origin of the arteries supplying the vertebral body from the vertebral artery can be seen.

figure 5.18

A radiograph of a thin transverse section through the centrum area of a typical cervical vertebral body from a female aged 20 years from the specimen illustrated in Figure 5.17. The radiate vessels contributing to the centrum grid can be seen. Posteriorly details of the blood supply of the lamina arch are well shown. The spinal cord is somewhat distorted, but its intrinsic arterial circulation is well shown.

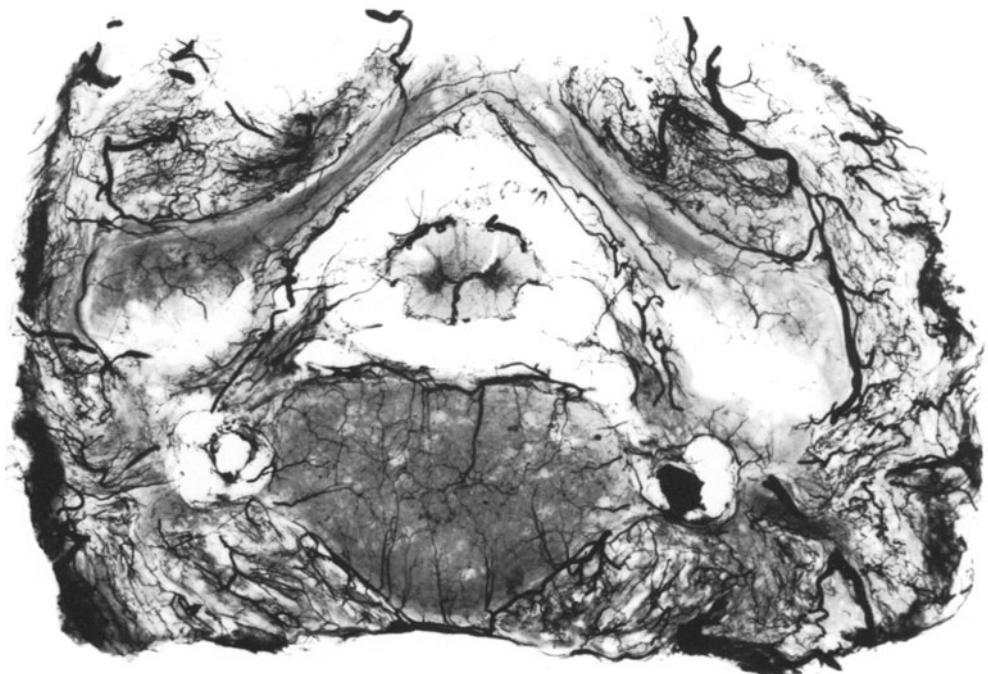




figure 5.19

A radiograph of a thin median sagittal section through two typical adult cervical vertebral bodies from a female aged 20 years, showing the pattern of distribution of arteries within the vertebrae.



figure 5.20

A radiograph showing the distribution of arteries to the facet joints of the atlas from an adult.

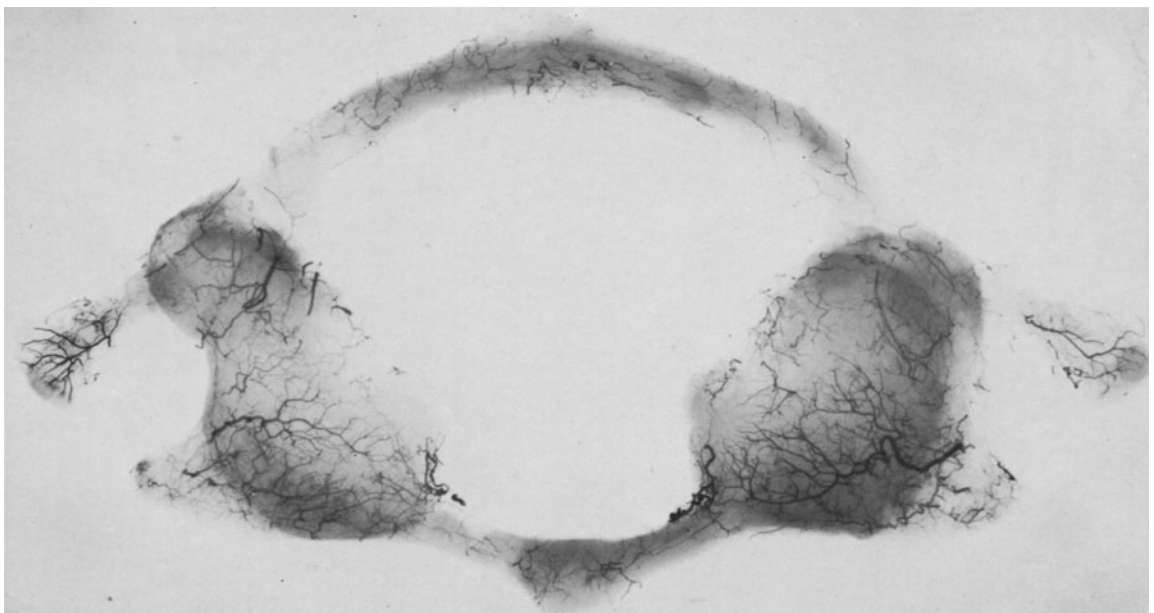




figure 5.21

A transverse section through the atlas from the spine of a female aged 20 years with the odontoid process of the axis shown in the plane of section showing the arterial supply of the odontoid peg and of the facet joints of C2.

figure 5.22

A transverse section through the region of the center of the body of an upper thoracic vertebra from the body of a male child aged 9 months. The neurocentral joints are shown on both sides with radiate arteries in the cartilages terminating in sinusoidal systems with bulbous ends.



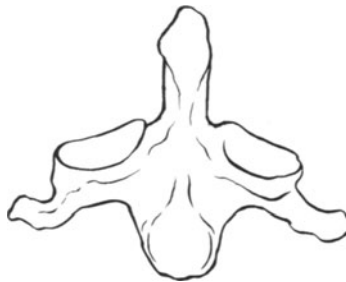
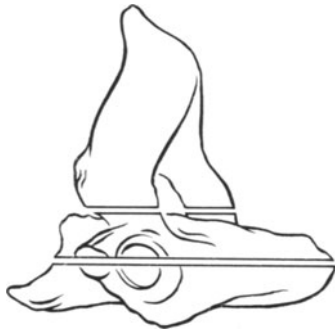


figure 5.23

A line drawing indicating the coronal planes of sectioning of a second cervical vertebra, with the outline of the anterior segment alongside. The radiograph shows the distribution of arteries within the bone.

