



PICTORIAL REVIEW / *Gastrointestinal imaging*

Radioanatomy of the retroperitoneal space



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KEYWORDS

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Abstract The retroperitoneum is a space situated behind the parietal peritoneum and in front of the transversalis fascia. It contains further spaces that are separated by the fasciae, between which communication is possible with both the peritoneal cavity and the pelvis, according to the theory of interfascial spread. The perirenal space has the shape of an inverted cone and contains the kidneys, adrenal glands, and related vasculature. It is delineated by the anterior and posterior renal fasciae, which surround the ureter and allow communication towards the pelvis. At the upper right pole, the perirenal space connects to the retrohepatic space at the bare area of the liver. There is communication between these two spaces through the Kneeland channel. The anterior pararenal space contains the duodenum, pancreas, and the ascending and descending colon. There is free communication within this space, and towards the mesenteries along the vessels. The posterior pararenal space, which contains fat, communicates with the preperitoneal space at the anterior surface of the abdomen between the peritoneum and the transversalis fascia, and allows communication with the contralateral posterior pararenal space. This space follows the length of the ureter to the pelvis, which explains the communication between these areas and the length of the pelvic fasciae.

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An accurate understanding of the anatomy of the retroperitoneum is essential in order to understand most of the pathological phenomena that occur in this space and how they spread within the various retroperitoneal compartments. As well as knowledge of the retroperitoneal compartments, an accurate understanding of the interconnections between the retroperitoneum, peritoneal cavity, and other extra-peritoneal spaces is crucial in order to understand the spread of inflammatory pathological processes or tumours.

Abbreviations: APR, Anterior Pararenal Space; PPR, Posterior Pararenal Space; ARf, Anterior Renal Fascia; PRf, Posterior Renal Fascia.

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This review based on a description and interpretation of imaging findings aims to review the radiological anatomy of the retroperitoneum, with emphasis on the theory of interfascial spread to explain the various communications between this space and the peritoneal cavity.

Review of anatomy

The retroperitoneal space is an anatomical structure delineated by the parietal peritoneum and the transversalis fascia. It is divided into five compartments (Fig. 1). a) The lateral compartments: these are an asymmetrical pair containing the kidneys and other organs. Each lateral compartment is divided by the fasciae into three separate spaces: the anterior pararenal (APR), perirenal, and posterior pararenal (PPR) spaces. The APR space contains part of the ascending colon, descending colon, and the duodenum and pancreas. The perirenal spaces contain the kidneys, adrenal glands, ureters, blood vessels and lymphatics. The PPR space only contains fat. b) A central vascular compartment, extending from D12 to L4-L5, located between the two perirenal spaces, behind the anterior perirenal space, and in front of the spine. This contains the abdominal aorta and its branches, the inferior vena cava and its afferent vasculature, lymphatic chains and the abdominal sympathetic trunk. c) Two symmetrical posterior compartments, containing the psoas major, which joins the iliopsoas muscle and sometimes the psoas minor, terminating at the arch of the hip bone. The psoas major extends from T12 to the lesser trochanter, and it is covered with transversalis fascia, which is known as iliac fascia in this area. The iliopsoas compartment is generally considered to be retroperitoneal even though it is behind the transversalis fascia because it is frequently involved in processes that begin in the retroperitoneum.

Review of embryology

It is necessary to review the embryology in order to understand the formation of the perirenal compartment and to introduce the theory of planes of interfascial spread.

The mesenchyme is the posterior part of the embryo, and it develops into the elements of the body wall [1]. It is covered by the transversalis fascia, a lamina of continuous connective tissue that separates its components from the abdominal cavity. Fig. 2a summarizes the embryological organization of the retroperitoneal space. The intermediary mesoderm forms the primordium of the genitourinary system, and it is shown in Fig. 2b and c. The metanephros develops into the secretory urinary apparatus, and from here the initially caudal renal primordia will ascend in a posterior and caudo-rostral direction, in parallel with the descent of the excretory urinary apparatus and gonads.

Fig. 3 summarizes the organization of the retroperitoneum after the ascension of the renal primordia.

This is a key moment in the formation of the retroperitoneum, delineating a fat-containing space into different spaces bordered by fasciae. The fasciae are lamina of connective tissue approximately 2 mm thick that will make up the partitions between the various compartments of the retroperitoneum [1].

Perirenal space

The fasciae

The perirenal space has the shape of an inverted cone with the point directed at the pelvis, and the base resting on the diaphragm [5]. Fig. 4 summarizes the borders of the perirenal space. The PRf is in fact made up of two apposed lamina, one superficial and one deep, which explains why it is more easily visible on imaging [1]. The superficial lamina of the PRf is made up of the lateroconal fascia, which extends in front and attaches to the peritoneum. Fig. 5 summarizes the anatomy of the PRf. Fig. 6 shows invasion of the renal fasciae secondary to acute pancreatitis.

Superior border of the perirenal space

The right perirenal space has an unusual feature. Here, the perirenal space is in direct contact with the posterior surface of the right kidney, and has no peritoneal covering: this is the bare area of the liver. This feature is explained by the

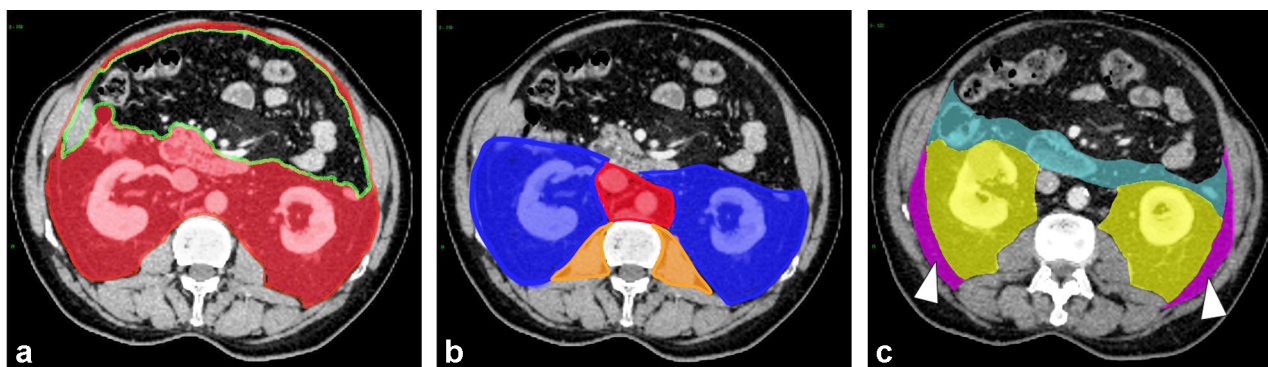


Figure 1. Mapping the retroperitoneum. a): view of the retroperitoneal space on an axial CT cross-section passing through both kidneys: the retroperitoneal space (in red) is located between the parietal peritoneum (in green) and the transversalis fascia (in brown). b): the five retroperitoneal compartments: Lateral retroperitoneal compartments (in blue), median “vascular” retroperitoneal compartment (in red), posterior “iliopsoas” retroperitoneal compartments (in orange). c): three spaces of the lateral compartment: APR (in blue), perirenal (in yellow), PPR (in purple).

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