

Imaging in Retroperitoneal Haemorrhages

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Abstract

Introduction: Blunt trauma to abdomen and pelvis can sometimes cause life-threatening injuries to retroperitoneal structures such as duodenal, pancreatic, vascular, renal and adrenal injuries. The presence of abnormal blood, fluid, and air within the retroperitoneal space may also be associated with these injuries, and their recognition is key to identify the injury correctly. Physical examination and laboratory test may prove to be unreliable in detecting abdominal injuries, especially retroperitoneal injuries. Peritoneal lavage and focused ultrasonography may also give negative findings or fail to help identify the signs of retroperitoneal injuries since these methods principally assess peritoneal space. Thus imaging, particularly computed tomography (CT) plays a vital role in assessment of retroperitoneal structures and injuries. Multidetector computed tomography (CT) can also accurately assess retroperitoneal injuries, many of which are clinically occult.

Aim of the Study: Objective of review is to detect and describe the imaging finding of retroperitoneal injuries and importance of imaging in evaluation and treatment of patients with retroperitoneal injuries.

Methodology: The review is a comprehensive research of PUBMED, Medline from year to 1989 to 2016.

Conclusion: The clinical presentation of retroperitoneal hemorrhage varies depending on the amount of bleeding. In terms of diagnostics assessment ultrasound is an excellent method to identify but is not specific. Therefore, CT remains the gold standard to characterize and evaluate the active bleeding.

Keywords: Retroperitoneal Hemorrhage; Diagnostic Procedure; CT-Angiography; CT-Emergency; Multidetector CT Findings

Introduction

Retroperitoneal hemorrhage (RPH) is a rare condition which is increasingly diagnosed more due to recent advancement in radiological studies. The retroperitoneal space contains various vascular and visceral organs such as gastrointestinal, genitourinary, vascular, musculo-skeletal, structures such as kidney, adrenals, ureters, and bladder may be linked into retroperitoneal hematoma [1].

RPH can be classified as [1]:

- Spontaneous retroperitoneal haemorrhage: This may occur due to local diseases such as ruptured aneurysms, tumors and systemic illness such as polyarteritis nodosa. With multifactorial etiology the blood extravasation occurs in any 3 retroperitoneal compartments - anterior, posterior and perirenal pararenal.
- A secondary retroperitoneal haematoma occurs secondary to trauma and vascular or urological procedures. The incidence is higher among men in 5th and 7th decades of life.

Methodology

We did a systematic search for imaging in retroperitoneal haemorrhage using PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>). All relevant studies were retrieved and discussed. We only included full articles.

The terms used in the search were: Retroperitoneal haemorrhage, diagnostic procedure, CT-angiography, CT-emergency, multidetector CT findings.

Relevant anatomy of retroperitoneum

Retroperitoneum is that portion of abdomen present posterior to the peritoneal cavity from the diaphragm to pelvic inlet. Separated from peritoneum anteriorly from posterior peritoneal fascia and bounded posteriorly by transversalis fascia. It contains a specific portion of duodenum, colon, pancreas, kidneys, adrenal glands, inferior vena cava, abdominal aorta. It has been traditionally divided as posterior pararenal spaces containing fat mostly and perirenal spaces containing renal pelvis, kidneys, proximal ureters, adrenal gland and fat and anterior pararenal area containing segment of colon, duodenum, pancreas. The fascia separating the spaces is laminar and variably fused. The retroperitoneal haemorrhage or rapidly expanding fluid collection can spread via this interfascial connection [2,3].

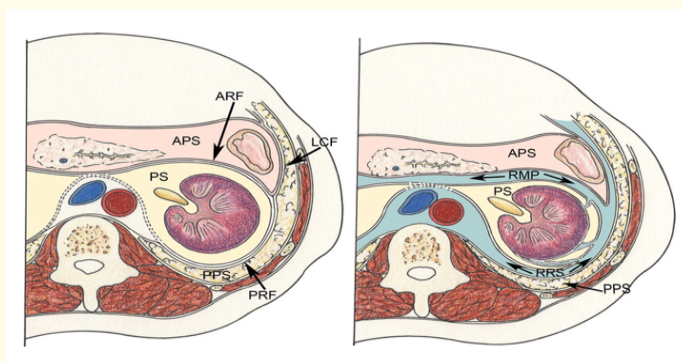


Figure 1: Spaces and fascia. Anterior pararenal space (APS), Anterior renal fascia (ARF), Posterior pararenal area (PPS), Posterior renal fascia (PRF), Perirenal space (PS), lateroconal fascia (LCF), Retrorenal space (RRS), Retromesenteric plane (RMP) are potential interfascial communication [4].

Imaging techniques in the diagnosis of retroperitoneal injuries

The current imaging and radiological test should not only detect retroperitoneal haematoma but provide an etiological diagnosis as well to avoid any unnecessary surgical explorations. In the past, the plain abdominal radiography and intravenous urography were included in the diagnostic evaluation of injuries to detect the indirect signs of retroperitoneal occupation (antalgic scoliosis, poor definition of renal silhouette mass with soft tissue density moves kidneys or delete the line psoas). However, at present radiological tests have mainly been displaced by ultrasound and computed tomography as a gold standard [1].

Ultrasound

Ultrasound has proven to be rapid, simple, non-invasive, and highly sensitive scan. Thus, ultrasound is recommended in initial diagnosis of disease. However, it is less precise in defining the nature of process and is not able to locate the source of bleeding or cause [1].

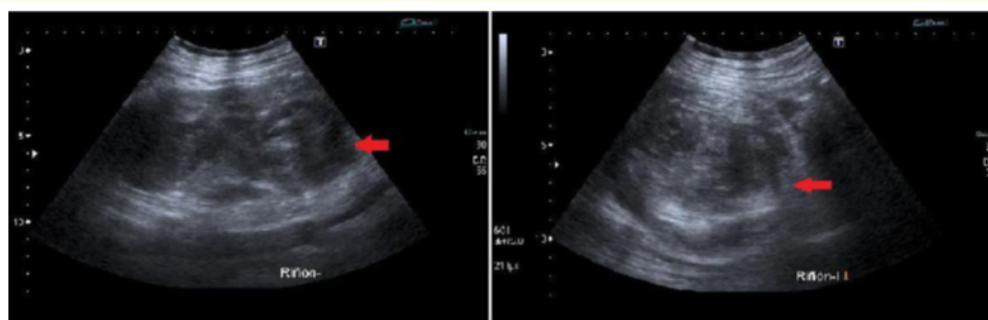


Figure 2: Ultrasound images: Left renal angioliopoma. Retroperitoneal haemorrhage, renal explosion on the left, longitudinal section of left kidney. On the right, a cross-section of mass of lower pole of left kidney, heterogenous echogenicity with red arrow showing severe active bleeding from ruptured angiomyolipoma [1].

Magnetic resonance imaging (MRI)

MRI is useful diagnostics in the scan of abdomen and pelvis region for detection of retroperitoneum injuries. However, the diagnosis of atraumatic retroperitoneal haemorrhage remains challenging even when high- resolution MRI is used since a large number of benign and malignant lesion can mimic this condition. Despite this limitation, MRI imaging is superior to ultrasound and is choice for primary investigation [5-7].



Figure 3: MRI - transverse plan (L4) with IV contrast gadolinium-BOPTA, revealing a well-defined mass, a substantial retroperitoneal haematoma [8].

Computed tomography

CT has become the test of choice for the diagnosis of retroperitoneal haemorrhage. CT with contrast can be useful in detecting bruising, pinpoint bleeding, heart attacks, mass, abscess, compression structures while unenhanced CT can demonstrate vascular or parenchymal haemorrhage and calcifications. Various injuries to different retroperitoneal structures and CT findings are as follow [4].

Duodenal and pancreas injuries

The deep, central, and retroperitoneal location of duodenum protects it against most of the injuries despite that the morbidity and mortality rates of traumatic duodenal injuries are high ranges from 6 - 25%. The complications include abscess, fistula, renal and respiratory failure. The severity of injuries ranges from minor duodenal haematoma and partial-thickness laceration to complex laceration and massive disruption of structure. The CT findings are duodenal wall thickening, peri-duodenal fluid, fluid in right anterior pararenal space, extraluminal air, extraluminal oral contrast material, and the “sentinel clot” sign [9-11].

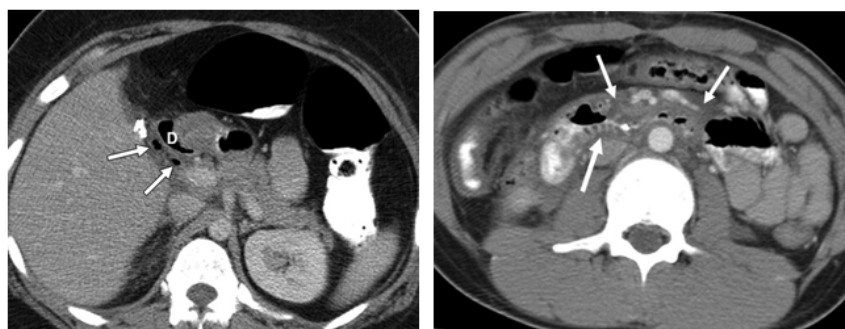


Figure 4: On left showing abdominal CT scan with intravenous and oral contrast material showing extraluminal air (arrows) adjacent to the duodenum (D) while the right showing traumatic duodenal intramural haematoma Abdominal CT scan obtained with oral and intravenous contrast material shows wall thickening of the third and fourth portions of the duodenum (arrows). No extraluminal air (a finding that would have suggested perforation) was seen [4].

Pancreatic injuries occur less often with major abdominal injuries because of the retroperitoneal location of the pancreas which protects it from most of the blunt trauma to abdomen. The trauma is usually due to direct impact or deceleration injury in conjugation with other visceral injuries such as to liver, spleen, duodenum, stomach, and kidneys. The damage typically results from a severe anterior to posterior force vector compressing the pancreas against the spine [2]. The CT findings of pancreatic injuries include contusions and laceration that range from minor to massive disruption of gland. The bruise on CT appears as focal areas of hypoattenuation surrounded by healthy pancreatic tissues while laceration appears as linear hypoattenuation perpendicular to long axis of the pancreas. The pancreatic transaction is a full-thickness laceration that results in transection of pancreatic ducts. CT findings include fracture of pancreas, injury, focal or diffuse pancreatic enlargement or edema, pancreatic hematoma, active bleeding or extravasation of intravenous contrast material [12].

Adrenal injuries

Adrenal injuries account up to 2% with blunt abdominal trauma. Isolated adrenal injuries are uncommon and are mostly associated with significant abdominal and thoracic injuries among which liver injury is the most common associated injury. The typical CT findings round or oval haematoma expanding the gland. Irregular hemorrhage obliterating the margin of gland, glandular swelling and adrenal-



Figure 5: On the left showing Pancreatic transection the abdominal CT scan obtained with intravenous contrast material at the level of the pancreas shows a full-thickness linear low-attenuation laceration of the pancreatic neck (arrow) just anterior to the proximal portal vein. On right laceration of pancreatic neck [4].



Figure 6: On left showing pancreatic laceration that includes more than 50% of gland thickness while on right show involvement of full thickness of gland [4].

mass, periadrenal discharge. Retroperitoneal hemorrhage in posterior pararenal space and thickening of the ipsilateral diaphragmatic-crus is also evident [13].

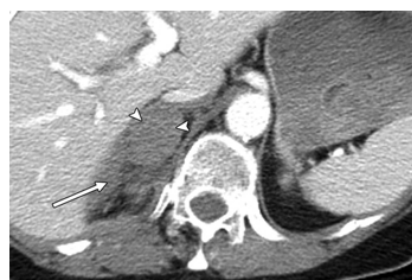


Figure 7: Showing Traumatic adrenal haemorrhage, the abdominal CT scan obtained with intravenous contrast material shows a right adrenal haaemorrhage (arrowheads) with periadrenal haemorrhage (arrow). An associated hepatic contusion and lower posterior rib fractures were also present [4].

Vascular injuries

The retroperitoneal vascular structure is abdominal aorta, IVC, renal vessels, proximal celiac axis and superior mesenteric arteries and vein, lumbar arteries and veins, iliac vessels within pelvis. Injury to abdominal aorta is 20 times less likely than thoracic aortic injuries. The degree of injury may vary from minimal intimal to frank transection [14].



Figure 8: Showing traumatic infrarenal aortic injury, the contrast-enhanced abdominal CT showing a concentric intimal flap (arrowhead) within the infrarenal abdominal aorta [4].

Retroperitoneal haemorrhage abnormal finding post-trauma

Retroperitoneal haemorrhage can lead to a significant but clinically occult blood loss post-trauma. It may arise from injuries to a primary vascular structure, hollow viscera, solid organs or musculoskeletal structures or combination. Haematoma location has therapeutic implication, and hence retroperitoneum can be classified in 3 zones as follow [9,15].

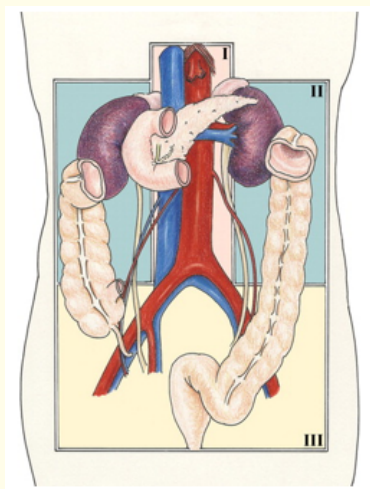


Figure 9: Zonal anatomy of retroperitoneum, which is divided into three zones according to the surgical management of retroperitoneal haemorrhage [4].

Zone I: This includes midline area between the aortic hiatus and sacral promontory and carries highest risk of vascular injury because of the presence of major abdominal vessels in this zone [9].

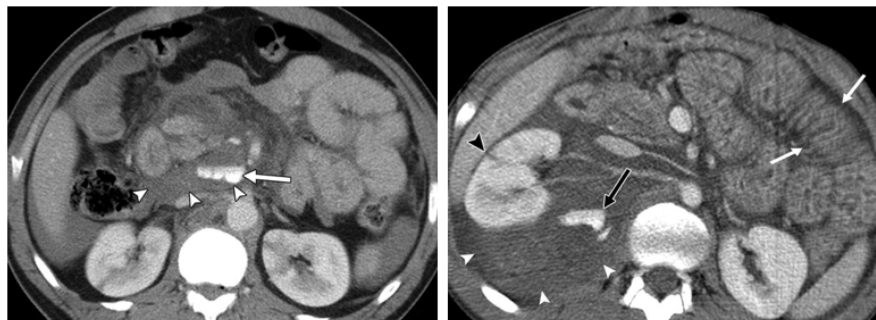


Figure 10: On left showing zone I abdominal CT with intravenous contrast showing central midline retroperitoneal haematoma (arrowheads) with active extravasation (arrow). On the right showing contrast-enhanced CT of right-sided perirenal and posterior pararenal retroperitoneal haematoma (white arrowheads) from right renal laceration with active extravasation of intravascular contrast material (black arrow) due to renal parenchymal injury. Laceration of right kidney (black arrowhead) with hyper enhancing, thickened small bowel (white arrows) [4].

Zone II: This encompasses the flank or lateral retroperitoneum, the right and left perirenal spaces, and the site of the second most common retroperitoneal haemorrhage after pelvis. Many pericolic and perirenal haematomas are self-limiting, and observation alone is sufficient if there is no extraluminal gas or active extravasation of contrast material identified at initial stage of imaging. Follow-up imaging can be useful in assessing the stability of retroperitoneal haemorrhage [16].

Zone III: This zone encompasses the pelvic retroperitoneum and is the most common site of retroperitoneal haemorrhage and is mostly associated with a pelvic fracture [15-17].

Conclusion

Assessment of retroperitoneal is critical from radiological evaluation point of view, especially with those with sustained blunt abdominal trauma. The initial evaluation may include ultrasound and MRI. However computed tomography remains gold standard. Multidetector CT allows accurate post-traumatic assessment of patients with subtle retroperitoneal injuries, abnormal fluid, blood, air within the retroperitoneal spaces. The initial findings require a prompt clinical as well as imaging follow-up for better outcome.

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