The role of interventional management in renal trauma

Essay

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By

Ahmed khalifa Ali Nafeshi
M.B., B.Ch.

Under supervision of

Prof. Dr. Mohamed Shaker Gazy

Assistant Professor of Radiodiagnosis
Faculty of Medicine-Ain Shams University

Dr. Rania Mohammed RefaatAbd El-Hameed

Lecturer of Radiodiagnosis
Faculty of Medicine-Ain Shams University

Faculty of Medicine
Ain-Shams University
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وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ
عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

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List of Contents

Title	Page

- Introduction and aim of the study 1
- Chapter 1:
  - Anatomy of kidneys..... ..3
- Chapter 2:
  - Pathology of renal trauma..... 17
- Chapter 3:
  - Technique of interventional management in renal trauma..... 26
- Chapter 4:
  - Role of radiological management in renal trauma 42
- Illustrative cases..... 63
- Summary and Conclusion..... 80
- References 83
- Arabic Summary 1

List of Abbreviations

3-D	Three Dimensional
AAST	American Association for the Surgery of Trauma
AVF	Arterio-Venous Fistula
CT	Computed Tomography
D/W	Dextrose / Water
FAST	Focused Assessment with Sonography for Trauma
G5%	Glucose 5 %
HU	Hounsfield Unit
IR	Interventional Radiology
IVC	Inferior Vena Cava
IVU	Intravenous urogram
mL	Millimeter
MPR	Multiplanar Reformatted
MRI	Magnetic Resonance Imaging
PSA	Pseudo-Aneurysm
PVA	Polyvinyl Alcohol
RBCs	Red Blood Cells
US	Ultrasound

List of Figures

Figure	Title	Page
Anatomy of the Kidneys		
1	Drawing illustrates the retroperitoneal position of the kidneys	**3**
2	Drawing illustrates internal structure of the kidney	**5**
3	Drawing illustrates structures related to the posterior surface ofeach kidney	**6**
4	Drawing illustrates structures related to the anterior surface of each kidney	**7**
5	Drawing illustrates organization of fat and fascia surroundingthe kidney	**8**
6	Drawing illustrates the renal arterial supply	**9**
7	Renal lymphatic drainage	**10**
8	Ultrasound images anatomy showing the right kidney	**11**
9	Intravenous urogram (a) Compression view, (b) Intravenous urogram, full-length view	**12**
10	CT scan anatomy	**14**
11	MRI anatomy, (a) Coronal T1W MRI through the kidneys, (b) MR venogram	**15**
12	Renal conventional angiography	**16**
Pathology of Renal Trauma		
13	Drawing illustrates subcapsular renal haematoma	**20**
14	Drawing illustrates renal contusion	**20**

15	Drawing illustrates renal laceration	**21**
16	Drawing illustrates subsegmental renal infarcts	**21**
17	Drawing illustrates Laceration communication with collectingsystem	**22**
18	Drawing illustrates shattered kidney (multiple renal lacerations)	**22**
19	Drawings illustrate avulsion of the main renal artery and thrombosis of the main renal artery	**23**
Technique of Interventional Management in Renal Trauma		
20	Variety of catheters used during renal artery embolization	**30**
21	Variety of catheters used during renal artery embolization	**31**
Role of Radiological Management in Renal Trauma with Illustrative Cases		
22	CT images demonstrating Grade I renal injury; renal contusion and subcapsular hematoma	**51**
23	CT images demonstrating Grade II injury; perinephric hematoma	**52**
24	CT images demonstrating;Grade II and III lacerations	**53**
25	CT images demonstratingGrade IV; renal laceration	**54**
26	CT images demonstratingsegmental infarction	**54**
27	CT images demonstratingGrade V injury; partial tear of the left ureteropelvic junction	**55**
28	CT images demonstrating Grade V injury;ureteropelvic junction avulsion	**55**
29	CT image demonstratingGrade V injury**;**Shattered kidney	**56**

30	Axial CT and Aortogram demonstrating post-traumatic renal artery occlusion and renal infarction	**57**
31	CT demonstrating Grade V injury; thrombosis of the left main renal artery	**57**
Illustrative Cases		
Case 1	Penetrating trauma - renal laceration with extensive retroperitoneal hematoma; successful superselective re-embolization	**63**
Case 2	Iatrogenic trauma –pseudoaneurysm; successful superselective re-embolization	**65**
Case 3	Iatrogenic trauma – A-V fistula; successful embolization	**66**
Case 4	Blunt trauma – Active bleeding; successful embolization	**67**
Case 5	Blunt trauma – Active bleeding/pseudoaneurysm; successful embolization	**68**
Case 6	Iatrogenic trauma – bleeding/pseudoaneurysm; successful embolization	**70**
Case 7	Transplanted kidney - Iatrogenic trauma – bleeding/pseudoaneurysm; successful selective embolization	**71**
Case 8	Blunt trauma – Active hemorrhage; Successful embolization	**72**
Case 9	Penetrating trauma – Pseudoaneurysm; Successful embolization	**74**
Case 10	Blunt trauma – Active bleeding; Successful embolization	**76**
Case 11	Iatrogenic trauma – pseudoaneurysm; Successful embolization	**78**
Case 12	Transplanted kidney- Pseudoaneurysm; successful exclusion of the PSA with patency of the transplant renal artery	**79**

List of Tables

Table	Title	Page
Technique of Interventional Management in Renal Trauma		
1	Indications for Renal Artery Embolization and Corresponding General Technique	**34**
2	Indications for Renal Artery Embolization, Endpoints, Pathology, and Corresponding Recommended Embolic Materials	**37**
Role of Radiological Management in Renal Trauma with Illustrative Cases		
3	Renal injury severity scale according to the AAST	**50**

Introduction

The kidney is the third most common abdominal organ to be injured in trauma, following the spleen and liver respectively ***(Titton et al., 2008)***.

Most renal injuries are minor but major renal injury has been reported in up to 25% of blunt, and in up to 70% of penetrating renal trauma cases. The kidneys are well protected by the surrounding structures, therefore major force is required to cause direct blunt injury***(Santucci et al., 2004)***.

Several classification systems convey the severity of injury to kidneys The most commonly used classification scheme is the American Association for the Surgery of Trauma (AAST) classification of blunt renal injuries, which grades renal injury according the size of laceration and its proximity to the renal hilum ***(Patel et al., 2011)***.

The radiologic evaluation of the kidneys in the context of trauma is guided primarily by the nature of the traumatic event and the patient's hemodynamic status ***(Chow et al., 2009).***

Interventional radiology has extended the ability to use a nonoperative approach. Angiography with selective embolization has been used in the setting of isolated renal trauma ***(Breyer et al., 2008)***. With this approach successful nonoperative management of renal lacerations may be achieved in a greater number of patients and minimize need of surgery and exploration and severe complications ***(Lin et al., 2011)***.

Aim of this Work:

To demonstrate the role of interventional management in renal trauma.

Anatomy of the Kidneys

Gross Anatomy of the kidney:

Kidneys are paired, bean-shaped organs that remove excess water, salts, and wastes of protein metabolism from the blood while returning nutrients and chemicals to the blood ***(Moore and Dalley, 2006).***The kidneys lie retroperitoneallyon the posterior abdominal wall on either side of the vertebral column at approximately the levels of L1–L4 **(Figure 1)** ***(Ellis, 2006) and (Rockall and Vinnicombe, 2007).***

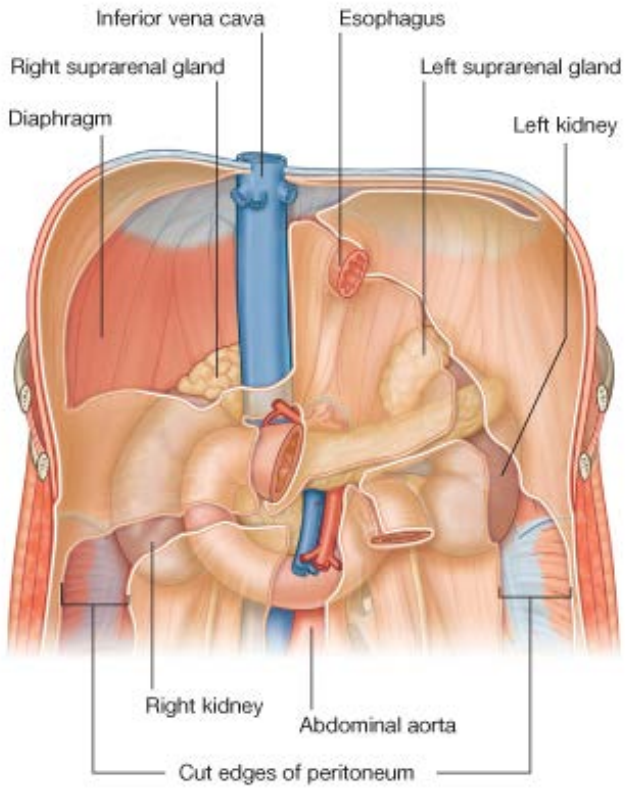

Figure 1: Drawing illustrates the retroperitoneal position of the kidneys in the posterior abdominal region ***(Quoted from Drake et al., 2007).***

The right kidney is 0.5 inch (12 mm) lower than the left, presumably because of its downward displacement by the bulk of the liver ***(Ellis, 2006).*** The kidneys move up and down by 1–2 cm during deep inspiration and expiration. In the adult, the bipolar length of the kidney is usually approximately 11 cm. Discrepancy between right and left renal length of up to 1.5 cm is within normal limits. Each measures 6 cm wide and 4 cm thick ***(Ellis, 2006) and (Rockall and Vinnicombe, 2007).*** Although they are nearly similar in size and shape, the left kidney is a longer and more slender organ than the right kidney, and nearer to the midline ***(Drake et al., 2007).***

Structure of the kidney

Each kidney consists of an outer renal cortex and an inner renal medulla ***(Drake et al., 2007).***

The renal cortexthat completely surrounds the renal medulla contains renal corpuscles (glomeruli, vessels), proximal portions of collecting tubules and loop of Henle.The renal medulla forming the inner two thirds contains the renal pyramids, which are cone-shaped, with the apex (the papilla) pointing into the renal hilum. The medullary rays run from the cortex into the papilla. Each papilla projects into the cup of a renal calyx, which drains via an infundibulum into the renal pelvis **(Figure 2)** ***(Drake et al., 2007) (Rockall and Vinnicombe, 2007).***

The renal pelvis is a funnel-shaped structure at the upper end of the ureter. It normally divides into two or three major calyces: the upper and lower pole calyces and in some cases a third calyx between those at each pole. Each major calyx then divides into two or three minor calyces which have a cup-shape,

indented by the apex of the accompanying renal pyramid ***(Rockall and Vinnicombe, 2007).***

At the concave medial margin of each kidney is a vertical cleft, the renal hilum, where the renal artery enters and the renal vein and renal pelvis leave the renal sinus. At the hilum, the renal vein is anterior to the renal artery which is anterior to the renal pelvis. The renal hilum is the entrance to a space within the kidney, the renal sinus which is occupied by the renal pelvis, calices, vessels, and nerves and a variable amount of fat ***(Moore and Dalley, 2006).***

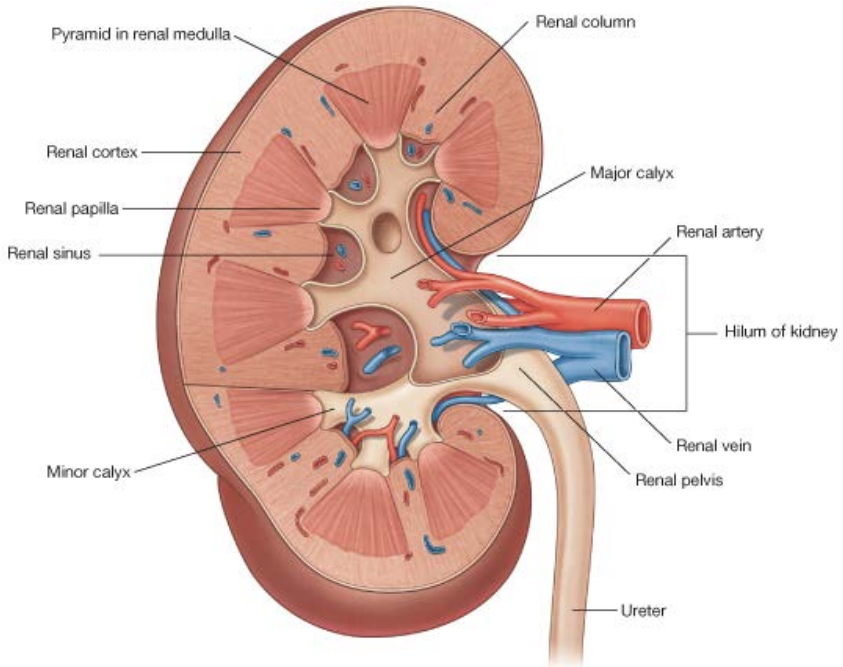

Figure 2: Drawing illustrates internal structure of the kidney ***(Quoted from Drake et al., 2007).***

Relations of the kidneys

Each kidney has a smooth anterior and posterior surface covered by a fibrous capsule which is easily removable except during disease ***(Drake et al., 2007).***

Posteriorly: the diaphragm (separating pleura), quadratuslumborum, psoas, transversusabdominis, the 12th rib and three nerves; the subcostal (T12), iliohypogastric and ilio-inguinal (L1) **(Figure 3)** ***(Ellis, 2006).***

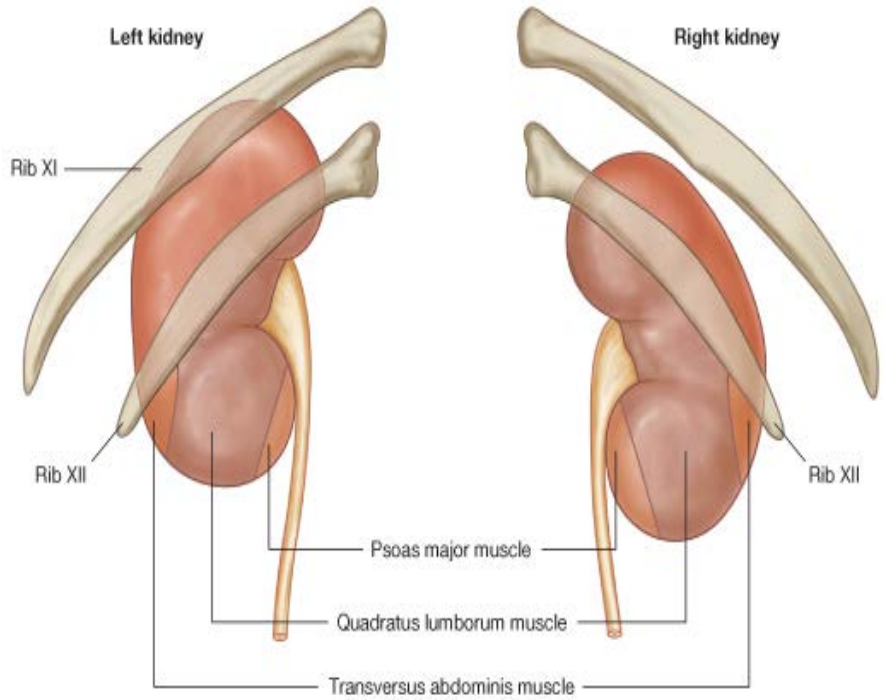

Figure 3: Drawing illustrates structures related to the posterior surface of each kidney ***(Quoted from Drake et al., 2007).***

Anteriorly: The right kidney is related to the liver, the 2nd part of the duodenum (which may be opened accidentally in performing a right nephrectomy), and the ascending colon. In front of the left kidney lie the stomach, the pancreas and its vessels, the spleen and the descending colon **(Figure 4)** ***(Ellis, 2006).***