THE ROLE OF RENAL ARTERY EMBOLIZATION IN THE MANAGEMENT OF POST TRAUMATIC VASCULAR LESIONS

ESSAY

Submitted for partial fulfillment of

Master Degree in Radiodiagnosis

BY

Amany Tarek Ahmed

M.B.B.Ch

Supervised by

PROF. Dr . HOSSAM FAHMY ABDELHAMED

Professor of Radiodiagnosis
Faculty of Medicine
Ain Shams University

Dr. MERHAN AHMED NASR

Lecturer of Radiodiagnosis
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
2011

ACKNOWLEDGEMENT

First and foremost thanks to GOD, without his help this work would have not been fulfilled.

I would like to express my sincere gratitude to professor Dr. ***HOSSAM FAHMY ABDELHAMED****, Professor of Radiodiagnosis, Ain Shams University, not only for her valuable supervision and great help throughout the study but also for his constant support, encouragement and patience to produce this work in its present form.*

I would like to express my deepest gratitude to Dr. ***MERHAN AHMED NASR****, Lecturer of Radiodiagnosis, Ain Shams University, for her generous guidance, supervision, kindness, and support throughout the process of producing this work.*

To my family

CONTENTS

Pages

LIST OF ABBREVIATIONS

*****

AAST	American Association for the Surgery of Trauma
CT	Computed tomography
UPJ	uretero pelvic junction
US	ultrasonography
MR	Magnetic resonance
IVP	Intravenous pyelography
PVA	polyvinyl alcohol
NBCA	N-butyl cyanoacrylate
FDA	Food and drug administration
AVM	Arterio-venous malformation
DMSO	dimethyl sulfoxide
GDC	Guglielmi detachable coil
PTFE	Polytetrafluoroethylene

LIST OF FIGURES

*****

	arterial branch with segmental renal infarction (B) Enhanced CT shows wedge-shaped non enhancing areas of infarctions in left kidney.	
16	Grade 5 renal injury: (A) Multiple deep lacerations result in a shattered kidney (B) Enhanced CT shows shattered kidney showing multiple deep irregular hypodense lacerations extending through renal parenchyma with haematoma within the lacerations around the kidney and devitalized segments of renal parenchyma	41
17	Grade 5 renal injury: Right ureteropelvic junction avulsion in a 42-year-old woman who was involved in a motor vehicle accident. (a) Portal venous phase CT scan shows right hydronephrosis and a small amount of perinephric fluid near the renal hilum. (b) Delayed excretory phase CT scan helps confirm the presence of posteromedial urinary extravasation . The ureter distal to the point of injury was seen to be unenhanced	42
18	Grade 5 renal injury: left ureteropelvic junction partial tear in a 50-year-old woman who was involved in a motor vehicle accident. (a) Portal venous phase CT scan shows left hydronephrosis and a small amount of perinephric fluid . (b, c) Delayed excretory phase CT scans show medial perinephric urinary extravasation and opacification of the distal ureter	43
19	Grade 5 renal injury: (A) Traumatic occlusion of the main renal artery due to intimal injury with distal arterial thrombosis. (B) Enhanced CT show non enhancing right kidney .note the retrograde enahncement of the renal vein.	44
20	Grade 5 renal injury:Shattered kidney with renal vein thrombosis (incomplete). CT scan of the abdomen with intravenous contrast administration shows shattered right kidney and renal vein thrombus extending slightly into the inferior vena cava.	46
21	Grade 5 renal injury: in a 19-year-old man with severe blunt trauma from a motorbike accident. Arterial phase CT scan shows a shattered right kidney with multiple lacerations and a devitalized fragmen. The left kidney is unenhanced due to vascular damage, except for a slightly enhanced segmental area in the midportion . Bilateral perirenal hematoma, with large amounts of fresh blood between the aorta and kidneys. The aorta and superior mesenteric artery (open arrowheads) are narrowed due to hypovolemia	47
22	Pseudoaneurysm in a 25-year-old man who sustained penetrating trauma from a stab wound. (a) Initial CT scan shows a left renal laceration (arrow). delayed nephrogram of the affected kidney relative to the contralateral kidney. (b, c) Axial CT scan (b) and oblique coronal MPR image (c) obtained during the arterial phase show a lobulated masslike lesion that is isoattenuating relative to the aorta. (d) On a portal venous phase CT scan, the lesion is isoattenuating relative to the blood pool	48

23	Renal arteriovenous fistula in a 48-year-old woman with sudden onset of hematuria and right flank pain. Axial contrast-enhanced CT scan obtained during the corticomedullary phase shows tortuous, dilated, enhancing vascular structures in the right renal sinus. Note the mildly dilated right renal pelvis and the double-J catheter in the renal pelvis	49
24	Iatrogenic arteriovenous fistula, 55-year-old woman sustained during biopsy. Maximum intensity projection in coronal plane shows fistula	50
25	Grade I renal injury. US image for a 29-year-old woman who was struck by a car shows a small subcapsular hematoma	52
26	Grade III renal injury. (a) Severe renal laceration in a 27-year-old man involved in a jet ski accident. Longitudinal US scan shows a mixed isoechoic-hyperechoic region in the renal fossa , (b) Severe renal laceration in a 14-year-old girl hit by an automobile while on a bicycle. US scan shows an echogenic region in the right renal fossa with loss of the reniform shape	52
27	Intra-renal pseudoaneurysm secondary to renal biopsy. A small pseudoaneurysm confirmed with a spectral pattern showing bidirectional flow	53
28	Arteriovenous fistula in a patient post renal biopsy.Color and Doppler sonography shows an arteriovenous fistula at the renal hilum	54
29	Traumatic occlusion of the main renal artery in a 17-year-old boy who had sustained blunt abdominal traum.Digital subtraction aortogram demonstrates the characteristic tapered occlusion of the proximal left main renal artery	57
30	Active arterial bleeding. Selective angiogram of the right main renal artery obtained following exploratory laparotomy demonstrates vascular extravasation from the upper pole of the right kidney .	57
31	Pseudoaneurysm in the lower pole of the right kidney . Subsegmental infarction is noted in the upper pole in a patient who had sustained a stab wound and had undergone exploratory laparotomy	58
32	Arterio-venous fistula .arteriogram shows early visualization of renal vein during arterial phase due to AVF	58
33	Renal laceration from blunt trauma. (a) Axial fat-saturated fast spin-echo T2-weighted MR image reveals a hypointense right renal laceration. (b) Contrast-enhanced 3D FSPGR MR image reveals that enhancement in the right kidney is less than that in the left kidney. The region of hematoma is the nonenhanced focus at the lateral lower pole. A small amount of fluid is also seen around the left kidney	59
34	Rotating hemostatic valve	66
35	Gelfoam gelatin sponge powder	72
36	Gelfoam pledget is shaved with blade. The slurry is mixed with contrast	73
37	Three-way stopcock	73

38	PVA of different sizes	75
39	Trisacryl Gelatin Micro spheres	79
40	Histoacryl	81
41	balloon catheters	85
42	Onyx	86
43	Gianturco coils	89
44	Micro coil	89
45	The white "fuzz" on the coils is Dacron, which promotes stronger thrombosis	90
46	GDC Detachable coil	91
47	Cragg endoprosthesis stent	93
48	(A) self-expandable stent graft. (B) balloon expandable stent grafts	93
49	(A) nonselective angiogram shows active extravasation of contrast material (arrow) in the upper pole of the left kidney. Roughly 20% of viable tissue (arrowheads) remains in the lower part of the left kidney (B) Radiograph obtained in an anteroposterior projection shows massive extravasation of contrast material in the left perirenal space. (C) Selective angiogram after embolization with PVA particles demonstrates occlusion of the previously bleeding branches but preservation of the viable tissue remnants (arrowheads)	98
50	A) selective renal angiogram shows pseudoaneurysm and an AV-shunt draining into the vein (B) Control angiography after embolization revealssuccessful occlusion of the feeding vessel, the lack of perfusion of the aneurysm and the preservation of the other segmental arteries.	100
51	A case of AV fistula Selective right renal arteriography. (A) main trunk of renal artery. (B) segmental artery for upper pole. Arrows show the renal vein that was quickly delineated after the injection of contrast material. The area highlighted by contrast material indicates hematoma in the renal parenchyma caused by blunt trauma.(C): Right renal arteriography after transcatheter arterial embolization (TAE). Arrow shows the metal coil used in TAE. The shunt flow had disappeared	101
52	(A) Selective right renal arteriogram showing a pseudoaneurysm arising from the main renal artery (B) Following deployment of a stent graft, the pseudoaneurysm no longer fills and renal perfusion is maintained	103

LIST OF TABLES

*****

Abstract

High success rate, low incidence of complications, and rapid recovery represent highly appealing reasons for making transcatheter renal artery embolization first-choice treatment option in post traumatic vascular lesions. Hyperselective catheterization and embolization allows parenchymal sparing, thus reducing the incidence of adverse events such as renal dysfunction and hypertension.

(Key Words: Renal – embolization – traumatic - vascular lesions)

INTRODUCTION AND AIM OF THE WORK

INTRODUCTION

Renal vascular lesions may result from interventional urologic procedures such as percutaneous biopsy, nephrostomy, and lithotripsy. Noniatrogenic renal injury is usually associated with blunt trauma caused by, for example, traffic accidents or falls, stab wounds and gunshots ***(Dinkel et al, 2002).***

Renal injuries are classified into five grades of severity according to the American Association for the Surgery of Trauma (AAST). This surgical-pathologic classification system recognizes the progressive nature of parenchymal and vascular damage associated with increasingly severe mechanisms of trauma ***(Alison et al., 2001).***

Successful management of renal trauma, which ranges from minor contusions (grade I) to shattered kidney and pedicle avulsion (grade V) largely depends on accurate diagnostic staging of the injury and detection of vascular complications ***(Dinkel et al., 2002).***

Vascular injury can be effectively treated with angiographic procedures; super selective renal embolization has been reported to be effective in the treatment of iatrogenic and penetrating vascular renal injuries. Even in haemodynamically unstable patients with the most severe forms of injury, surgery can be averted with this technique, which has the potential to enable the salvage of as much viable renal tissue as possible in cases where

open surgery would often result in total nephrectomy ***(Dinkel et al, 2002).***

Management of renal artery pseudoaneurysm is a challenging issue, and a variety of treatment modalities, such as selective angio-embolization, have been exploited so far. Several studies have revealed that selective coil embolization is the ideal alternative with high success rates and low complications. ***(Shakhssalim et al,2010).***

Selective catheterization step is the most critical one for preserving maximum renal tissue, preventing additional renal trauma by minimizing the occlusion of additional proximal branches, and eliminating the potential risk of nephrectomy. ***(Mavili et al, 2009).***

Super selective embolization for blunt renal trauma offers a rapid, precise, and effective cure with excellent tissue preservation. Therefore, Knowledge of different techniques, materials and vascular anatomy and variants is essential to obtain good clinical outcome and minimize complications ***(Dinkel et al, 2002 and Sharafuddin et al., 2006).***

AIM OF THE WORK

The aim of this work is to evaluate the role of renal artery embolization as a therapeutic technique in management of various post traumatic renal vascular injuries.