ROLE OF DIFFERENT IMAGING MODALITIES IN ASSESSMENT OF RENAL TRAUMA

Essay

Submitted for partial fulfillment for
Master degree in radiodiagnosis

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2009

بسم الله الرحمن الرحيم

(قـــالوا سبحـــانك لا علـــم لـــنا إلا مـــا علمـــتنا

انـــك أنت العلـــيم الحكـــيم)

صدق الله العظيم

(البقره / ٣٣)

ACKNOWLEDGEMENT

First and foremost I feel always deeply indebted to **ALLAH** the most kind and the most merciful.

I would like to express my great thanks and deep gratitude to **Prof. Dr. Sameh Abdel-Aziz Zaki Hanna,** proffesor of radiodiagnosis, faculty of medicine, Cairo University, for his kind support, guidance and valuable remarks necessary for achieving this work.

I would like to express my deepest thanks to **Dr. Mohamed Abdel-Latif Shahin,** Lecturer of radiodiagnosis, faculty of medicine, Cairo University, for his generous help, continous encouragement and valuable comments.

I wish also, to express my sincere appreciation to **my family** for their pateince, cooperation and helpful assistance in every step throughout my life.

Momen Gamal

ABSTRACT

Blunt and penetrating abdominal trauma can cause significant injury to the kidneys, and radiologic imaging plays a critical role both in diagnosing these injuries and in determining the management. In this article, we describe and illustrate the spectrum of injuries that can occur in the kidneys in order to facilitate accurate and rapid recognition of the significant injuries.

Imaging plays a crucial role in the evaluation of the kidneys in a patient who has suffered either blunt or penetrating trauma because multiorgan injury is common in such patients. Ultrasonography, conventional radiography, MRI, and angiography are used in imaging such cases, however contrast-enhanced CT is the primary imaging technique used to evaluate the upper urinary tract for trauma.

Interventional radiography also, plays an important role in non surgical management of renovascular injuries.

Keywords: blunt trauma • renal trauma • genitourinary trauma • kidney • penetrating trauma • cortical laceration • tear • renal injury.

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LIST OF ABBREVIATIONS

- 3D : THREE DIMENTIONAL.
- CM : CONTRAST MEDIUM.
- CT : COMPUTED TOMOGRAPHY.
- CTA : COMPUTED TOMOMOGRAPHIC ANGIOGRAPHY.
- ESRD : END-STAGE RENAL DISEASE.
- ESWL : EXTRACORPORIAL SHOCKWAVE LITHOTREPSY.
- GFR : GLOMERULAR FILTRATION RATE.
- IVU : INTRAVENOUS UROGRAPHY.
- MDCT : MULTIDETECTOR COMPUTED TOMOGRAPHY.
- MRA : MAGNETIC RESONANCE ANGIGRAPHY.
- MRI : MAGNETIC RESONANCE IMAGING.
- MRU : MAGNETIC RESONANCE UROGRAPHY.
- NSF : NEPHROGENIC SYSTEMIC FIBROSIS.
- PVA : POLYVINYL ALCOHOL.
- SNR : SEGNAL TO NOISE RATIO.
- T : TESLA.
- UPJ : URETERO-PELVIC JUNCTION.
- US : ULTRASONOGRAPHY.

INTRODUCTION

Abdominal trauma may cause injury to the liver, spleen, pancreas, kidney, spine, retro peritoneum, or pelvic viscera. Among all abdominal injuries, those involving the kidney rank at or near the top in frequency as injury to the kidney is seen in approximately 8%–10% of patients with blunt or penetrating abdominal injuries. **(Kwashima et al, 2001)**

Worldwide, blunt trauma is responsible for the majority of renal injuries (80%), but the number attributable to penetrating wounds increases dramatically with violent crime. **(Shanmuganathan et al, 2001**).

Whatever the mechanisms of injury, renal trauma is often accompanied by damage to other important structures. This is more common with penetrating injuries, where associated damage to the liver, intestine, stomach, or chest is encountered in 80% of cases. Injuries to the liver and spleen and, less often, to the pancreas, bowel, chest, and central nervous system are seen in approximately 20% of cases of closed renal trauma. (**Smith et al, 2003**)

Kidneys that are abnormal by virtue of congenital anomaly, hypertrophy, ureteral obstruction, or underlying tumor are more susceptible to traumatic injury than normal kidneys. (**Goldman et al, 2004**).

Introduction

Preexisting disease first brought to light by trauma is more common in children than adults. Mitchell reported that 10% of renal injuries seen at the Bristol Children's Hospital were superimposed on a ready abnormal organs, therefore, the radiologist is well served by a high degree of suspicion for occult lesions accompanying renal injury. **(Park et al, 2006).**

Adequate radiologic characterization of suspected renal injuries following abdominal trauma is an important guide to therapy, as unstable patients or patients suspected with renal pedicle injury need prompt work-up and immediate surgery. On the other hand in minor blunt injury of the kidney no surgical intervention is necessary, so it is important to clearly identify which patients require diagnostic imaging, the nature and timing of such studies, and the appropriate indications for operative intervention. (**Kwashima et al, 2001**).

Conventional radiography, radionuclide scanning, angiography, ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) may be employed for early diagnosis and accurate evaluation of such abdominal injuries. **(Harris et al, 2001).**

The selection of the appropriate modality in any one clinical situation depends upon accessibility to diagnostic equipment, the sensitivity, specificity, cost, and safety of each diagnostic procedure, and the experience and expertise of the attending radiologist.(**McAninch et al, 2002**).

Introduction

The various radiological examinations provide a mass of data which can be used to assess the functional status and morphology of the injured kidney which were used to assess the sensitivity, specificity, and accuracy of the various modalities, particularly ultrasonography and CT. Based upon this information, it should be possible to determine which approach is most capable of establishing the diagnosis with acceptable confidence, accuracy, and speed (not to mention the least cost and risk to the patient) in any given situation. (**Goldman et al, 2004**).

All authors stress the need for prompt and accurate evaluation of the type and extent of injury so that appropriate treatment can be planned, so the radiologist's mission is to define the extent of the renal injury so that the maximum amount of functioning renal parenchyma can be preserved. (**Santucci et al, 2004**).

THE AIM OF THE WORK:

The purpose of this review is to provide a logical framework for better understanding of the problems involved in imaging the injured kidney, to clarify controversial points regarding competitive imaging modalities, and to establish a suitable protocol for assessment of renal trauma through clear definition of efficacy of different imaging modalities in diagnosis and staging of such cases.

A number of representative cases will be demonstrated.

ANATOMY OF THE KIDNEYS:

GROSS ANATOMY OF THE KIDNEYS:

The kidneys come to lie in the retroperitoneal space high on the posterior abdominal wall. They are bean-shaped with their concave aspect pointing medially. The right kidney lies a variable distance lower than the left in most subjects, owing to the presence of the liver. In quiet respiration they move up and down approximately 2-3cm but this may be more than double with deep inspiration. (**Andreoli et al, 1993**).

The hilum of the kidney is a vertical opening on the medial aspect which contains the renal pelvis. The renal vein and one or two branches of the renal artery pass through the hilum to enter the kidney anterior to the renal pelvis, a further branch of' the renal artery passing through the hilum posterior to the renal pelvis. The hilum also contains fat, sympathetic nerve fibers and lymphatic channels that drain to the lateral aortic lymph nodes around the origins of the renal arteries from the aorta. (**Williams et al, 1995**).