Images in Urology

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Diagnosis and Management

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Preface

The urological image and its role in the management of patients has evolved dramatically over time; the oldest surviving images are Australian Aboriginal cave paintings dating back to at least 10,000 BC. However, these images demonstrate ritual rather than therapeutic acts, portraying circumcision as an adolescent rite of passage. Further paintings showing ritual circumcision were discovered in the Ankhmahor's Tomb (Physician's Tomb) in Saqqara, Egypt, dating from 2,400 BC. One of the earliest surviving medical texts is the Ebers papyrus, a compendium dating from 1,550 BC. This 20 m long papyrus, found between the legs of a Mummy in Luxor and now in the University of Leipzig, describes, for the first time, the diagnosis and treatment of a number of urological conditions including retention, schistosomiasis and even bladder tumours.

Images of urological anatomy and our understanding of the subject was advanced by drawings from the fifteenth to sixteenth centuries, most notably by Leonardo da Vinci, Vesalius, Fallopius and Eustachius. They accurately demonstrated the structure of urological organs and their relations, based on cadaveric studies. However, it was not until 1895 that the first images were generated from a living person. Wilhelm Roentgen, who had discovered X-rays in November of that year, took the first X-ray of his wife Anna Bertha's hand. He was awarded the first Nobel Prize for Physics in 1901 'in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays'.

Radiological imaging of the genitourinary system began the following year when John Macintyre set up the first radiology unit in the world at the Glasgow Royal Infirmary. He performed the first KUB X-ray in a patient with renal stones. This was followed by the first use of intravenous contrast by Dr. Leonard Rowntree of the Mayo Clinic in 1923. Using sodium iodide, he produced images of blood vessels and performed an intravenous urogram.

Over the last 40 years medical imaging has come on apace, particularly with the advent of cross-sectional imaging. Sir Godfrey Hounsfield, working for EMI in England, performed the first CT scan in 1972. Concurrently, a physicist, Dr. Allan Cormack, published work using a computer to reconstruct 3D images from X-ray data. Hounsfield and Cormack were subsequently awarded the Nobel Prize in Physiology or Medicine, in 1979, in recognition for their work.

MRI has its origins in scientific discoveries made in the 1930s when it was realised that the protons of water molecules align in a magnetic field. When the magnet is turned off the atoms revert to their steady state and in doing so emit photons which are detectable by a scanner. Raymond Damadian, a medical doctor and scientist in the United States, found that different tissues emit varying signals in a magnetic field, and in 1974 he filed for a patent for a diagnostic tool to identify cancer. This prompted Paul Lauterbur, Professor of Chemistry at State University New York, to use gradiants in the magnetic field to generate the first MRI images. Sir Peter Mansfield from the University of Nottingham then developed a mathematical technique that would allow scans to take seconds rather than hours and produce clearer images. He performed the first human cross-sectional MR scan in 1977. The importance of their discoveries was acknowledged when both men were awarded the Nobel Prize for Physiology or Medicine in 2003.

In medical practice today we rely heavily on images in the diagnosis and management of almost all our patients. For example, in diagnosis the majority of renal tumours are picked up incidentally on imaging prior to the patient developing symptoms, such that it is now rare to see people with any of the 'classic' triad of haematuria, a mass and loin pain. We use imaging to assess renal physiology, to assess disease extent and treatment response and as a permanent record for patient records, medico-legal and teaching purposes.

On her retirement Dr Parkinson made the collection of pathology images acquired throughout her distinguished career available to me for the purposes of continued education. At a similar time, sitting my exit exams, I was presented at each viva with an image to introduce a subject, in the same way that we are in everyday clinical practice. I had had the good fortune to be taught by Dr. Uday Patel, and reflecting on the advances in imaging and how medical practice had changed as a result, together we agreed to edit this book, collaborating with two outstanding teachers from the world urology stage, Prof. Bob Djavan and Prof. Peter Carroll.

This book is aimed primarily at trainee urologists, although radiology and histopathology trainees may also find it useful. Each chapter has been written as a series of 'cases' and edited by a radiologist, histopathologist and a urologist. The cases bring together a clinical scenario with the pathological process and relevant radiology and ask key questions about the scenario and imaging; below the images are the appropriate responses. The book is intended to cover the majority of urological conditions and the images that a practicing urologist will see. The text has been written to answer the questions posed about the images and does not pretend to cover comprehensively the whole of urology. However, we do hope the format acts as a more enjoyable way of learning, revising or just browsing the speciality of urology.

Simon Bott

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