AUA1 : AUA Lecture1

Evolution of Urologic Imaging

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The evolution of urologic diagnosis and treatment has been closely related to the evolution of urologic imaging. This presentation will discuss the development of urologic imaging techniques, the influence of imaging on urology, and the current trends of imaging.

Imaging began when Roentgen discovered x-ray (1896). Crude and invasive retrograde urograms were reported in 1905-1915. Excretory urography (ExU, IVP) was first reported in 1929-1931. Intravenous nephrotomography was developed in the 1950’s.

Iodinated contrast media evolved in the 1950’s. Urologists must be aware of the potential reactions that can occur from iodinated contrast media.

Renal angiography was first reported in 1941 and was improved in 1953 using a guide wire through a percutaneous needle in the femoral artery (Seldinger). Arteriography was used frequently to evaluate renal masses for a few decades.

Radionuclides were first used to measure differential renal function in 1956 (Tuplin). A radionuclear testis scan was described in 1975. Bone scan was first reported in 1959. It became widely used with the introduction of bone seeking complexes of technecium-99m in the early 1970’s.

The discovery of the association of vesico-ureteral reflux and chronic pyelonephritis by performing cystograms in adults with neurogenic bladder in 1952 (Hutch) led to studying children with urinary tract infections resulting in the frequent finding of reflux. A nuclear cystogram (Conway, 1972) has advantages of less radiation exposure, greater sensitivity and reliability, and more quantitative data. A disadvantage of a nuclear cystogram is its inability to define anatomy.

Medical uses of ultrasound developed in the 1960’s. Transrectal ultrasound (TRUS) became popular for prostate biopsy in the 1980’s and started to be used for brachytherapy in the 1990’s. Color Doppler ultrasound was reported to assess vascular flow in evaluation of testicular torsion in 1990. Ultrasound has advantages of lack of invasion, low cost, no nephrotoxic contrast media, and ease of performance in pediatric patients.

Computed tomography (CT) was reported in 1967. Whole body scanning was first reported in 1974 (Ledley). The advantages of CT over ExU are better visualization of renal parenchyma and it shows extra-urinary abdominal abnormalities. Helical or spiral scanners provide quick and better images and permit CT angiography.

Magnetic resonance imaging (MRI) was developed shortly after CT. The advantages of MRI are no radiation exposure, no iodinated contrast, and superior soft tissue resolution. A major disadvantage is the expense. An MRI cannot be used if the patient has metal implants.