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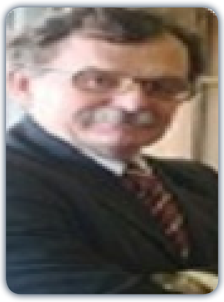

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Nuclear medicine investigation of obstructive uropathy

Obstructive uropathy can be defined as any blockage of urine drainage from the kidney (renal calyces or renal pelvis), ureter, or bladder. As a result of the blockage, urine backs up into the kidneys, causing dilatation of the ureter, renal pelvis, and renal calyces, which can damage the kidney if it is not treated. The appearance of dilated or enlarged renal pelvis and calyces is referred to as hydronephrosis and is a sign of obstructive uropathy. There are many causes of obstructive uropathy; however, the most common causes include stones in kidneys (nephrolithiasis), ureter (ureterolithiasis) or anywhere in the urinary tract (urolithiasis). Other causes of obstructive uropathy include health conditions such as pregnancy, prostate cancer, retroperitoneal fibrosis, spinal cord injury, ureteral stricture, and congenital anomalies (e.g., Ureteropelvic Junction Obstruction [UJO]), which is most common in children but also occurs in adults. The gold standard to assess urinary obstruction is unclear; therefore, several imaging modalities are often used. Helical CT (especially without contrast) rapidly is replacing kidneys-ureters-bladder x-rays as the first step in the radiologic evaluation of the urinary system, MRI, where available, is becoming the imaging study of choice for urinary obstruction. IV Pyelography (IVP) is the procedure of choice for defining the extent and anatomy of obstruction. Invasive pyelography provides the same information as IVP without depending on renal function and can be used when the risks of IVP are considered too great. Ultrasonography is the procedure of choice for determining the presence of hydronephrosis. Other possible methods could include the Whitaker test, which is invasive and has been largely replaced by CT. Diuretic dynamic scintigraphy (renography) has been adopted as a noninvasive clinical management tool to assist in differentiation the various causes of hydronephrosis from that of obstruction.Renal scintigraphy begins with intravenous (IV) administration of a radiotracer immediately followed by acquisition of images for 20 to 30 minutes. An external gamma camera detects emission of gamma rays emitted by the radiotracer, which is reflective of the distribution of radiotracer in the patient. Radiotracers currently used include technetium-99m-labelled mercaptoacetyl trigylcine (99mTc-MAG3), technetium-99m-labelled- diethylenetriamine pentaacetic acid acid (99mTc-DTPA), technetium-99m-labelled ethylenedicysteine (99mTc -EC) or technetium-99m-labelled-dimercaptosuccinic acid (99mTc-DMSA). 99mTc-MAG3, 99mTc -EC and 99mTc-DTPA are rapidly taken up by the kidney and then excreted through the urinary tract. Their mechanism of renal uptake and imaging characteristics, however, differ —99mTc-DTPA is taken up by the kidney through glomerular filtration and is not secreted or reabsorbed by the renal tubules, whereas 99mTc-MAG3 and 99mTc -EC are mostly taken up by the proximal renal tubules and its high plasma protein binding prevents it from being filtered through the glomerular membrane. 99mTc-DMSA remains in the renal parenchyma for an extended period and is used for static renal scintigraphy. 99mTc-DMSA accumulates in the functioning renal cortex, and impaired renal cortex and space-occupying lesions are depicted as hypoactive areas. For diuretic renography furosemide (Lasix), is administered by IV and drainage assessment after a diuretic challenge may be expressed as the rate of change of the post-diuretic curve, that is half-time, or as the shape of the renogram. The moment of furosemide injection (F0, F+20, F-15) does not influence the quality of the final renal washout, and the F0 procedure is recommended in cases of known hydronephrosis because it shortens the time of acquisition on the gamma camera and allows the simultaneous injection of both the tracer and the diuretic. In most of the cases for the calculation of differential renal function, the integral method will provide robust results. Drainage assessment should also include the effect of an empty bladder, postural change and renal function.

Parameters that may consider these variables include renal output efficiency, post-void pelvic excretion efficiency and normalized residual activity. Published results suggest that in asymptomatic children with unilateral ureteropelvic junction dilatation drainage should not be assessed using half-time. Rather, a technique considering renal function, gravity and an empty bladder is recommended, such as renal output efficiency, pelvic excretion efficiency or normalized residual activity. However, even using such techniques a simple universal normal limit to define obstruction is inappropriate. It has not been excluded, according to recent published work, that cortical transit and visual interpretation could be a better predictive factors of the risk of a conservative attitude or the benefits of a surgical procedure, but this procedures has still to be confirmed.

Biography

Boris Ajdinovic is the Head of Institute for the Nuclear Medicine, Military Medical Academy, Belgrade. He is a Professor and has obtained Doctor of Science degree in Nuclear Medicine. He has graduated from University of Belgrade in 1978 and has obtained Nuclear Medicine specialization. He is an Instructor of Nuclear Medicine for students specializing in internal medicine and surgery from 1985. He has over 250 specialized and scientific published articles and is the recipient of many awards and honors.

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