8a

The value of renography in hydronephrosis: Physiology and Pathophysiology

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The kidneys receive 20% of the cardiac output and the glomerular ultrafiltrate amounts 180 l/day. The challenging transport processes along the nephron reduce the ultrafiltrate to 1 liter of urine which is expelled into the pelvis. The ureters then propel urine from the renal pelvis to the bladder by peristaltic waves conducted along a syncytium of smooth muscle cells. Thus, the kidneys and urine transport system in a unique fashion combines a high pressure compartment with a low pressure compartment subjected to a large fluid volume and volume reduction. The system is susceptible to numerous minor or major changes leading to reversible or irreversible kidney malfunction as seen during urinary tract obstruction and hydronephrosis. Renography is an excellent technique to identify the changes in renal function in response to hydronephrosis. The technique offers a strong platform to provide reliable and reproducible measurements of relative kidney function. Moreover, renography also provides useful information about how well the drainage from a kidney takes place, especially when the technique is combined with acceleration of the urine flow to overcome possible retention of urine in a dilated pelvis by administration of a diuretic – diuresis renography. This technique was introduced more than 30 years ago by the Manchester-group to discriminate dilated obstructed from dilated un-obstructed kidneys primarily in adults with and without symptoms. This will be discussed in detail together with complementary tests to identify urinary tract obstruction.

However, the natural history of and optimal treatment for asymptomatic hydronephrosis is unknown, mainly because most published series are non-randomised or retrospective with non-standardised followup regimens. Since the introduction of routine ultrasonography during pregnancy, the renographic technique has become the most important method for guiding the management of asymptomatic congenital hydronephrosis. Despite guidelines and consensus protocols, renographic procedures differ among centres, causing difficulties in comparison and controversy in the interpretation of results. Differential renal function (DRF) is a robust measure provided there is adequate background subtraction. Pitfalls are related to the drawing of regions of interest, particularly in infants, to estimating the interval during which DRF is calculated, and to an adequate signal-to-noise ratio. There is no definition of a 'significant' reduction in DRF. The classical variables of the diuretic renogram may not allow an estimate of the best drainage. Poor pelvic emptying may be apparent because the bladder is full and because the effect of gravity on drainage is incomplete. Estimating the drainage as residual activity rather than any parameter on the slope might be more adequate, especially if the time of frusemide administration is changed. Renal function and pelvic volume can influence the quality of drainage. Drainage may be better estimated using new tools.

In conclusion, provided the investigation is standardised and potential pitfalls accounted for, the diuretic renogram provides valuable and reproducible quantitative information on DRF and drainage.