

Supplemental Table 3: Upper Tract Deterioration and Calculi

Author	Evidence Level	Total N	Percent Female	Study design	Investigation or screening study used	Disease being screened for	Method of Bladder Management	Results
Bih 1994	II	66	***	Observational	Renal scan (voiding and excretory) compared to US, IVP and VCUG	Renal function deterioration, upper tract abnormalities	***	53 kidneys showed abnormalities on US, IVP, and VCUG. Renography showed decreased ERPF and excretion associated with upper tract abnormalities.
Bih 1998	II	67	18	Observational	Renal US (pre and post void) compared to IVP	Hydronephrosis	***	Pre-void US showed hydronephrosis in 18 kidneys found normal on IVP. Post-void US showed hydronephrosis in 6 kidneys found normal on IVP. Sensitivity 95.8%; specificity 84.5%; negative predictive value 99.0%.
Bodner 1990	Level II	86	1	Observational	Office US of kidneys and bladder compared to IVP or CT	Kidney stones, masses or hydronephrosis	CIC or reflex voiding 50, indwelling catheter 33.	US was comparable to IVP in detecting upper tract abnormalities in 68 subjects. US was comparable to CT in detecting upper tract abnormalities in 18 subjects. Compared to the IVP and CT, the US provided adequate information in 86 participants.
Brandt 1981	III	36	***	Observational	Renal and bladder US compared to IVP	Renal parenchymal disease, renal calculi, hydronephrosis, VUR	***	US equivalent to IVP at detecting renal and bladder anomalies, but only 30% of ureter anomalies.
Calenoff 1982	II	54	37	Observational	US of kidney and bladder compared to IVP, VCUG	Kidney and bladder abnormalities	***	All positive radiographic findings of renal and bladder abnormalities on IVP were confirmed by US and yielded additional information not detected on IVP.
Gousse 2003	I	178	***	Observational	US compared to renal scan	Renal function, hydronephrosis, parenchymal disease, renal stones and masses	Voiding 91, CIC 42, sphincterotomy 30, indwelling catheter 40	Functional abnormalities detected on renal scan were present with anatomic abnormalities on US.
Kuhlemeier 1984	II	687	***	Observational	Renal scan to determine relative function of kidney, peak activity of kidney, ERPF	Renal function	***	Plasma flow higher in male than female. Global and individual ERPF decreased after early adulthood; lower in SCI. Ratio peak of 27 counts was affected by age and SCI. Kidney function is not affected significantly by age, sex, SCI status.
Kuhlemeier 1985a (May)	II	236	***	Observational	Renal scan to determine ERPF compared to IVP	Ureterectasis, pyelonephritis, pyelocaliectasis, urinary tract stones	***	Those with clinically significant pyelocaliectasis, ureterectasis, pyelonephritis or urinary tract stones had significantly lower ERPF.
Kuhlemeier 1985 b (Sept)	II	519	***	Observational	Renal scan to determine ERPF	Renal function and renal deterioration	***	Factors associated with decrease in ERPF were age, gender, renal calculi, quadriplegia, chills and fever.
Kuhlemeier 1986	II	78	13	Observational	Renal scan to determine ERPF IVP	Renal function	***	Kidney blood flow varies considerably in healthy SCI subjects. Variations are of little clinical significance provided absolute levels of ERPF remain w/in normal.
Linsenmeyer 2004	II	62	***	Observational	Abdominal xray compared to cystoscopy	bladder stones	Indwelling catheters	Abdominal x-ray detected only 21% of stones.
Lloyd 1981	II	200	***	Observational	Renal scan compared to IVP	Pyelocaliectasis, ureterectasis	***	In 54 subjects with abnormal renal scans but normal IVP, there were 74 renal units with a large number of abnormalities. Only 21 subjects had abnormal IVP but renal scan was normal.
Macdiarmid 2000	II	36	19	Observational	Serum creatinine compared to creatinine clearance	Renal failure	***	31% of 36 subjects had creatinine clearance of less than 100mL/min although had normal serum creatinine level. Serum creatinine is not sensitive in detecting early deterioration of renal function.
Mohler 1988	II	101	22	Observational	Creatinine clearance	Renal function deterioration	***	Creatinine production is significantly lower in SCI compared with age and sex- matched controls. Creatinine clearance was grossly overestimated in SCI.
Morcos 1988	II	75	***	Observational	US compared to IVP	Upper urinary tract damage or stones	***	48 subjects had normal IVP and US. 7 subjects had normal IVP but abnormal US. 7 subjects had abnormal IVP but normal US. 13 subjects had both IVP and US abnormal.
Rao 1986	II	203	1	Observational	US compared to IVP	Hydronephrosis, renal mass, calculi, chronic pyelonephritis	***	US compared to IVP. <i>Masses</i> : US detected 100% compared to IVP 45%. <i>Obstructive uropathy</i> : US detected 86% compared to IVP 100%. <i>Pyelonephritis</i> : US detected only 25% compared to IVP 100%. <i>Calculi</i> : US detected 78% compared to IVP 87%.
Scher 1975	II	100	***	Observational	IVP	Hydronephrosis, pyelonephritis	***	20% had hydronephrosis and 12% had chronic pyelonephritis.
Tins 2005	II	100	2	Observational	KUB compared to US	Urinary tract stones	Multiple	KUB radiograph identified five subjects with renal stones. In two subjects, these stones were also identified on US. KUB and US are poor at detecting urinary tract stones
Tempkin 1985	II	52	***	Observational	Renal scan, IVP, VCUG, ERPF	Upper tract damage, renal obstruction	Indwelling catheter	Of the 42 subjects with abnormal renal scans, 22 with acute SCI had normal IVP, ERPF and creatinine clearance. The other subjects with chronic SCI & renal deterioration, had abnormal renal scans, with abnormal IVP, ERPF and creatinine.
Tsai 2001	II	109	19	Observational	US, renal scan	Hydronephrosis	***	US sensitivity 96% and specificity 90%. Sensitivity of renal scan 91%, and specificity 84%.
Tseng 2004	II	51	***	Observational	US and renal scan	Hydronephrosis, renal function, renal vascular resistive index	***	Resistive indices are increased (0.58±0.7 vs. 0.65± 0.08) in SCI subjects with obstructive uropathy.
Vaidyanathan 2006	Level III	108	25	Observational	US, patient symptoms	Abnormalities in the urinary tract	***	Ultrasound detected abnormalities in 20 of 21 participants with symptoms; all 20 required intervention.

\*\*\* indicates that this was not stated in the article  
 CIC= clean intermittent catheterization, CT= computed tomography, ERPF= effective renal plasma flow, IVP= intravenous pyelogram, KUB= kidney+ureter+bladder X-ray  
 SCI= spinal cord injury, US= ultrasound, VCUG= voiding cystourethrogram