LEGENDS IN UROLOGY

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In urology it is difficult to imagine any aspect more basic or potentially more mundane than the transport of urine from the kidney to the bladder but this, ironically, became my passion throughout my career. It seemed to me that in normal function there is a combination of hydrostatic pressure difference between the two organs, at least when standing up, a pressure generated by the kidney which I like to refer as "vis a tergo" and finally there is peristalsis. Each, in turn, contributes in varying proportions according to a variety of secondary factors such as renal function, degree of hydration, width of the ureter and position of the person in question. If the kidney and ureter are wider than normal, usually discovered by investigative techniques such as ultrasound, CT scanning, or in my day, intravenous urography, then there was a tendency to declare the system "obstructed". Indeed, in the early urological textbooks it was clearly stated that "dilatation equals obstruction" and as a trainee in urology I found that this myth was still not fully exploded but it was indeed under suspicion.

So how did I get involved in this lifelong passion? My father was a radiologist and one of my childhood joys was to join him in visits to the numerous hospitals he visited in the Liverpool region. It was a time when screening for tuberculosis was pre-eminent using mass mini-x-rays and dozens of these tiny films were flashed up on the screen in rapid succession by my father for what seems like seconds during which he declared whether or not there was active disease. The wonders of radiology seemed magical to me as a small boy at a time when the specialty was still in its relative infancy. Indeed my father had been trained by one of the earliest radiologists in the UK – Thurston Holland, and in my father's practice he, or his assistant, processed the x-ray films by hand in enormous tanks of developer and fixer. I can recall the smell all to clearly!

I managed to achieve a place at Selwyn College at the University of Cambridge in 1957 but I often wonder how, when I see the extraordinary intelligence of the current medical students I now teach. After 3 years of basic science we all transferred to London to complete our clinical studies. After qualification I did house jobs at University College Hospital in London and the surgical appointment was with the only surgeon on the staff who spent much of his time in urology. He was amongst a group of general surgeons throughout the country who were beginning to develop urology as an accepted specialty. The principles of urological reconstruction were little understood and most of the operations were ablative or designed to control cancer. Prostatectomy was an open operation and often a bloody business but I have to admit both fun and challenging!

Following all this and after further surgical training I decided that a spell in the USA would be useful and interesting. Such trips were often called "getting your BTA degree" – BTA meaning "Been to America", an experience that was usually advantageous when applying for further posts back in the UK. I went into the research year at The Brady Institute at The Johns Hopkins Hospital in Baltimore where, amongst other topics, I wrote a chapter on the undescended testicle for WW Scott but spent most of my time investigating the dynamics of fluid transport in rubber tubes and dogs' urinary tracts.

On return to the UK I was appointed as a Resident Surgical Officer to the "3 Ps" – St Peter's, St Paul's and St Philip's urological hospitals in London, working for a variety of surgeons but, without doubt for me the best part of the rotation was working for Mr. David Innes Williams (later Sir David). Sitting at his weekly patient review

session with intravenous urograms and micturating cystograms up on the screen it soon became clear to me, and almost certainly perfectly clear to Innes Williams, that we really did not know how to diagnose obstruction at kidney, ureteric or bladder neck level. Undoubtedly this was most obvious in boys with dilated urinary tracts after ablation of a posterior urethral valve. Was the residual dilatation indicating obstruction at a higher level than the valve – bladder neck or vesicoureteric junction or just a result of overstretched tissues? This really mattered as the former might possibly be helped by surgery whereas the latter almost certainly will not be and would probably make matters worse. The temptation to try to improve the appearances of the radiographs as opposed to making a firm diagnosis of obstruction was too tempting for many surgeons.

So with the help and encouragement of Innes Williams and an expert nephrologist, Dr. Martin Barrett, I commenced my analysis of the meaning of obstruction. But try as hard as I could with the analysis of radiographs and renography the answer was not forthcoming. We needed to define obstruction and I became convinced that it could only be defined accurately in terms of dynamic study of the parameters of pressure and flow. This led finally to my favorite definition of obstruction which is "an increased pressure in the pelvicaliceal system of the kidney at normal physiological flow rates such that the renal function is adversely affected". Renography was never going to give a definitive answer as both the flow and the pressure are neither controlled or known.

Thus we had no choice but to measure the pressure in the renal pelvis whilst controlling the flow artificially through placement of a percutaneous nephrostomy cannula. Contrast was used as the perfusion fluid so that radiographic evidence could also be usefully obtained. After some 250 such studies, some with patients under general anesthetic and some without, we were able to determine that normal or slightly dilated upper urinary tracts could tolerate a flow of 10 mL/minute with no more pressure rise than 10 cm-15 cm water. Clearly, perfusion must be continued until a steady state is reached. It was to our satisfaction that some of the boys after valve ablation with gross dilatation were found not to have obstructed systems and I like to think that we saved many of these children from unnecessary and possibly harmful operations.

The test was inevitably applied to such conditions as megaureter and equivocal pelviureteric obstruction (primary or secondary to vesicoureteric reflux) with great clinical advantage. I believe that we have progressed a long way from earlier misunderstanding of the meaning of urinary tract dilatation to an ability to analyze the situation more fully and to make clinical decisions more rationally. I continue to hold the view that, although helpful and non-invasive, renography cannot and will not be able to define accurately the dynamics of obstruction. We were criticized for offering an invasive technique but if it is performed carefully the complications are minimal and are balanced by an accurate assessment that allows a rational clinical decision.

In 1984 we compared the results of renography with the pressure/flow studies in a series of patients with varying degrees of urinary tract dilatation and although the results agreed to a degree as to whether or not there was obstruction, there were two situations where they failed to show the same results. In the children with greatly dilated systems and relatively poor renal function we were able to exclude obstruction but the renograms suggested that obstruction was present. Perhaps not surprising as in a large system with sluggish flow and poor renal function the isotope is simply not moved along fast enough and the poor kidney not able to respond to a diuretic. The second, more unusual situation was when there was a solitary kidney with a degree of dilatation where the renogram showed good transit and hence no obstruction, but the pressure/flow study showed an abnormal rise in pressure associated with the whole urinary output placed on a single kidney – a possibly dangerous situation in terms of future further renal deterioration.

There are still challenges to address. To some I think I know the answer but cannot prove it. For instance I am convinced that some types of pelviureteric obstruction and megaureter are the result of abnormal peristalsis.[1] Please can someone prove me right or wrong!

So what other urological challenges caught my attention and imagination? At a time when the manufacture of small resectoscopes was in its infancy we designed a tiny hook that could be passed easily in an infant boy to ablate a posterior valve without an anesthetic. At first we used diathermy but later resorted to a tiny concealed blade designed in such a way that no other tissue than valve tissue could be snagged.

Intersex surgery came my way in relative abundance and the challenge of a high concealed vagina in congenital adrenal hyperplasia was a challenge indeed. I had the privilege of working with a wonderfully dedicated colleague – Dr. Gillian Hunt who looked after and followed up the survivors of 117 children with spina bifida for over some 40 years. The interest from a urological view point is the fate of the renal function is accurately predictable by the assessment of the sensory level at first examination.

Finally my career story would not be complete without the mention of my most valued colleague – Professor Thomas Sherwood, Emeritus Professor of Radiology in Cambridge. Together we researched and expressed opinions on a variety of pediatric urological topics which included the diagnosis of obstruction, the management of children with urinary tract infection, with and without vesicoureteric reflux, and many more joint ventures.

After some 25 years in urology spinal problems overtook me and I was unable to continue in practice. I retired and joined the Department of Anatomy here in Cambridge. This was in 1990 and I have spent the intervening 27 years teaching anatomy to medical students and also surgeons and radiologists preparing for higher degrees. I can honestly say that I have enjoyed this teaching as much as I enjoyed my urological practice and research and it has the very real advantage that any telephone call after 9.00 pm is no longer a call to hospital duty.

I have had an enduring hobby of water color painting which started bizarrely with little sketches of hypospadias operations in the patients' notes so that the nurses on the wards and the parents could see what had been done to poor Willie's willie. Landscapes are far more fun and of course the illustration of anatomy has proved irresistible (www.instantanatomy.net and www.instantanatomy.co.uk).

This year Katharine and I will celebrate our 50 years of marriage. How she has put up with me all that time I shall never know but without her support and sacrifices I would never have achieved the little I have contributed to urology. Probably not very practical but I believe that my grave stone should have on it "Dilatation does not Equal Obstruction" as that is the message I will leave behind me.

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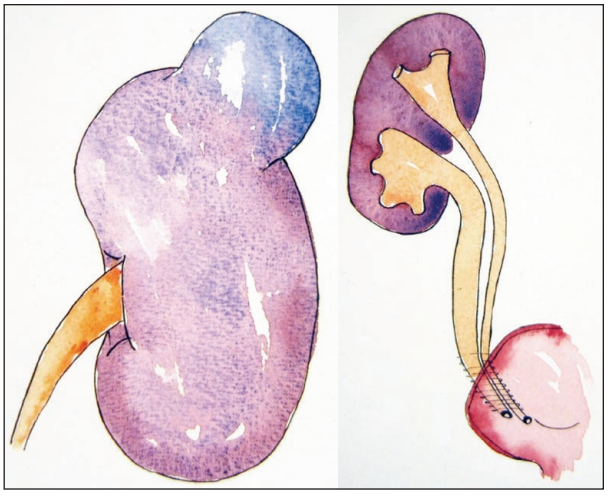
EDITOR'S NOTE: The "Whitaker Test", credited to Dr. Whitaker is used to differentiate upper tract obstruction from simple dilation.

References

1. Whitaker RH. Some observations and theories on the wide ureter and hydronephrosis. *Br J Urol* 1975;47(4):377-385.

Buccaneer Beach, Antigua Village, W.I.



Simple, solitary renal cyst and ureteric duplication with reflux into lower pole. Images from "Congenital Anomalies of the Urinary Tract. Churchill Livingstone 1990. (Out of print).