	Mean CIS		
	Pre-treatment	Post-treatment	p-value
Group 1	7.35	1.79	<0.001
Group 2	9.22	0.57	<0.001
Group 3	9.52	2.14	<0.001

Table 1

After the completion of treatment, significant improvement in quality of life could be achieved in all children. No patient continued to suffer from severe psychosocial and behavioral problem. The psychosocial aspect of patient were more noticeably improved than their behavioral aspect. Children with double incontinence suffered from more psychosocial and behavioral problems before and after treatment compared to children with single incontinence. The CIS and CBCL had a positive relationship among the children (Pearson correlation = 0.47, $p<0.01$).
Conclusion: Incontinence will lead to significant psychological problems in children. Their quality of life can be remarkably improve by a multidisciplinary Incontinence Care Programme.

16

M.J. Drake, G. Wyatt, G. McMurray, J.G. Noble, A.F. Brading

Oxford Continence Group, University Department of Pharmacology, and Department of Urology, Churchill Hospital, Oxford, U.K.

ANALYSIS OF COMMUNICATION BETWEEN MUSCLE BUNDLES USING 3-D IMAGE RECONSTRUCTION OF SERIAL SECTIONS OF HUMAN BLADDER

Aims of study: Bladder emptying requires the synchronous contraction of the detrusor musculature, necessitating communication between adjacent muscle bundles. Potential routes of coordination are through excitable tissues (nerve or muscle), interstitial cells, or direct mechanical stretch. However, current knowledge about spatial relationships of these tissues in the bladder wall is limited. While 2-D sections yield some information about tissue structure, extrapolation of 3-D properties stereologically requires stringent criteria that are not often satisfied in biological tissues. Nevertheless, it is possible to generate a simulated 3-D reconstruction by integrating serial sections. This technique has been applied to macroscopic structures, for example urethra and fetal penis [1], and microscopic features including sebaceous glands [2] and neurons. The aims of the present study were firstly to adapt serial sectioning techniques to study 3-D attributes of the bladder wall in controls and secondly to elaborate possible routes of communication between muscle bundles. The work is part of an ongoing study of the structural effects of outflow obstruction on the bladder wall.
Methods: 1cm cubic bladder specimens were taken from 6 cadaveric organ donors and frozen in O.C.T. compound using liquid nitrogen-cooled isopentane. Serial sections of the full thickness of bladder wall were cut with a cryostat (15μM, -23°C). Sequential sections were stained with Masson trichrome/acetyl-cholinesterase techniques, methods for elastin, or immuno-histochemically for vimentin. Slides were video scanned (JVC KY-F30 on Leica microscope) to a Macintosh computer for image capture (Neotech Imagegrabber 2.04). Tissue preparation, histochemical methods and microscope/condenser focus were kept constant throughout. Binary images were generated (Adobe Photoshop 4.0), aligned with internal referencing and imported to a stereology programme (MacStereology 2.8) for 3-D surface/wireframe modelling.
Results: Serial sectioning established that the musculature of the human bladder consists of contractile units that are structurally independent, except where they affix through connective tissue attachments. Within muscle bundles, a subpopulation of fascicles was identified, which were typically smaller and orientated in a different direction from other fascicles of the bundle. Ten of these fascicles were studied in detail; their course was related to large neurovascular structures in six. Seven fascicles had

connective tissue bindings to a different muscle bundle at one end, in two of which there was an accretion of elastin fibres. The remaining three fascicles merged into separate muscle bundles at each end. Cholinergic nerves were observed crossing the connective tissue endings of these fascicles, but were not seen crossing other connective tissue planes between bundles. Interstitial cells were present at the connective tissue endings and their processes were seen to cross to either side of the attachment.

Conclusions: The semi-automated technique of 3-D reconstruction described successfully facilitates comparison of muscle bundle arrangement and stereological parameters at a microscopic level. Detrusor muscle bundles are structurally independent, but attached through connective tissue elements which may contain elastin accretions. Subpopulations of fascicles are present which appear potentially to subserve a communication function, since nerve fibres and interstitial cells are present, and presumably the fascicle is able to exert physical force. Putatively, such an arrangement is consistent with the facility to generate asynchronous, non-propagated "micro-motions" [3] along with the general synchronous contractions of voiding. The findings are of interest in the study of detrusor instability: the myogenic hypothesis suggests abnormal dissemination of excitation as a result of changes in smooth muscle properties. Presence of nerves and interstitial cells at the interface between bundles suggests means by which activity might spread.

References:
1 Neuroanatomical ontogeny of human fetal penis. *Br J Urol* 1997; 79:628-40
2 Automated image segmentation and serial section reconstruction in microscopy. *J Microsc* 1990; 158: 187-96.
3 New concepts in relation to urge and detrusor activity. *Neurourol Urodyn* 1993; 12: 463-71.

17

R. Kozlowski, M. B. Siroky , R. J. Krane and K. M. Azadzoi.

Boston University School of Medicine and Boston VA Medical Center, Boston, Massachusetts, USA.

REGIONAL DIFFERENCES IN BLADDER BLOOD FLOW AND MICROCIRCULATION RESISTANCE AT REST AND DURING FILLING

Aims of Study: Most studies have suggested that increased intravesical pressure during distention produces compressive forces on the bladder microcirculation that lead to decreased bladder blood flow. In the rabbit model, we found that the normally compliant bladder acts as a low pressure reservoir allowing little increase in intravesical pressure during filling. Intravesical pressure during filling was 20 mm Hg or less and thus always less than the mean arteriolar pressure in bladder wall (25-30 mm Hg). This would suggest the role of factors other than intravesical pressure in regulating the hemodynamics of bladder wall circulation. In this study we examined the hypothesis that changes in bladder microcirculation resistance independent of intravesical pressure play a role in regulating bladder blood flow during filling.

Methods: In surgically exposed bladders of anesthetized male New Zealand white rabbits (3.5-4 kg, n=16), bladder blood flow was measured with a laser Doppler flowmeter. The laser Doppler probes were placed directly into the bladder wall at the dome and at the base. An 18 gauge angiocatheter was inserted through the bladder wall for measurement of intravesical pressure. A 3 F catheter placed through the urethra was used to fill with normal saline. Simultaneous measurements of arterial pressure, bladder wall blood flow at the bladder dome and base and intravesical pressure were obtained at rest and at intravesical volumes of 25 and 50 ml. Changes in bladder microcirculation resistance (MCR, mm Hg/ml/min) were calculated from the ratio of mean arterial blood pressure (BP, mm Hg) to blood flow (Q, ml/min/100 g tissue) (MCR = BP/Q).

Results: With the bladder empty, bladder wall blood flow was significantly greater at the base (11.5 ± 0.4) than at the dome (8.6 ± 0.2). Filling caused an initial increase in blood flow at the base (12.5 ± 0.3), which