Indiana pouch in female patients with spinal cord injury

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Objective: We assessed the results of a continent urinary diversion (Indiana pouch) in seven women with severe neurogenic urinary incontinence.

Patients and methods: There were seven patients (mean follow-up 28 months), in five of whom a complete Indiana pouch was created. In two the bladder was augmented with the Indiana pouch, the bladder neck was closed and an umbilical stoma was created. In three cases the appendix served as outlet whereas in the other patients a continent catheterisable stoma was created by means of a tapered terminal ileum.

Results: All the patients were dry (the stoma was continent) and could catheterise themselves while sitting in a wheelchair. There was one complication (bleeding) immediately post-operatively that needed reintervention. The late complications were acceptable: in one patient a stone had to be removed from the pouch and there was a stenosis of the stoma in two others. There was no hyperchloraemic acidosis.

Conclusion: The Indiana pouch is a safe and effective method for neurogenic incontinence when all available pharmacological treatments and clean intermittent catheterisation have failed. It has little impact on the body image, and the independence and social reintegration of the woman is improved.

Keywords: neurogenic bladder dysfunction; urinary incontinence; Indiana pouch; spinal cord injury

Introduction

The treatment of the neurogenic bladder has evolved in the past years. The introduction of clean intermittent catheterisation, bladder augmentation and also the implantation of bladder stimulators have decreased the need for a supravescical urinary diversion. Nevertheless, there is still a group of female patients who are wheelchair-bound with a hyperreflexic detrusor that has no reaction to anticholinergics. They suffer from incontinence with formation of residual urine which needs intermittent bladder catheterisation, but this is made very difficult because of the need to transfer the patient out of the wheelchair and because of the spasticity of the lower extremities.

Patients and methods

A series of seven women (median age 35 years, range 20–57) with a neurogenic bladder were selected for a continent urinary diversion. Four had thoracic lesions and three cervical lesions. All patients were wheelchair users. The levels of the spinal cord lesions are shown in Table 1. The cause of the cord lesion was traumatic in

five patients but was of vascular origin (Spinalis anterior Syndrome) in two. Urodynamic investigation showed a hyperreflexic detrusor (Upper Motor Neuron Lesion) in all patients, and three also had a sphincter-dyssynergia. The bladder capacity was small in every patient despite anticholinergic medication. Filling cystometry showed high detrusor pressures during the reflectory contractions. The mean bladder capacity was 200 ml. There was severe incontinence with residual urine needing intermittent catheterisation. Because of the difficult transfer from wheelchair to bed and because of spasticity of the lower extremities catheterisation could usually not be carried out by the patient herself. Intravenous Urography (IVU) preoperatively showed no abnormalities, and serum creatinine was normal in every patient.

The reasons for creating a continent urinary diversion were as follows: firstly, there was severe, socially disturbing incontinence despite intermittent catheterisation. Secondly there were the difficult transfers for catheterisation and nursing. In four of the seven patients catheterisation had to be done by attending persons, which made the patients dependent. In five patients an Indiana pouch was created: the ascending colon was detubularised and a pouch was created, both ureters being implanted according to the method of Leduc. The bladder was left *in situ*. In two

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Table 1 Details of the patients

	<i>Pt 1</i>	<i>Pt 2</i>	<i>Pt 3</i>	<i>Pt 4</i>	<i>Pt 5</i>	<i>Pt 6</i>	<i>Pt 7</i>
Age (years)	48	35	31	29	28	57	20
Level	T5	C6	C4	T3	C8	T10	T10
Origin	trauma	trauma	trauma	trauma	vascular	vascular	trauma
Urodynamics	UMN	UMN	UMN	UMN	UMN	UMN	UMN
			DSD	DSD	DSD		
Bladder capacity (ml)	150	200	250	300	130	200	150
Follow-up (months)	50	43	29	24	21	17	12
Operation	IP + App	IPAug	IPAug + App	IP	IP	IP + App	IP
Pouch-capacity (ml)	800	700	600	500	500	400	600
Complications	stoma stenosis	kidney stone			stoma stenosis		postoperative haemorrhage

DSD=Detrusor Sphincter Dyssynergia; UMN=Upper motor neuron; IP=Indiana pouch; IPAug=Augmentation with Indiana pouch; App=Appendix as outlet

women the bladder was augmented with the pouch, the bladder neck was closed and an umbilical stoma was created. In three cases the appendix served as an outlet whereas in the other patients the outlet was created by means of a tapered terminal ileum. In all the patients a 'hidden stoma' was created in the umbilicus. The continence mechanism of the ileocaecal valve was reinforced with the invagination of the distal part of the ileum in the caecum.

Results

In the postoperative period one patient suffered from a haemorrhage in the pouch, requiring reintervention on the second day. The mean postoperative follow-up was 28 months (12–50 months). All the patients have been dry since the operation, the umbilical stoma remaining continent. The patients were no longer dependent on bladder catheterisation and because the catheterisation of the umbilical stoma could be done sitting in the wheelchair, no longer was any transfer to a bed or any undressing needed. The mean capacity of the neobladder was 600 ml (range 400–800 ml). One patient had a stone removed from the pouch 9 months after the operation, and one other needed a dilation of the outlet (appendix) because of difficulties in catheterisation. In another patient a surgical correction of the stoma had to be performed because of stenosis. The postoperative IVU was normal in all patients. No reflux was seen on the pouchogram and the kidney function remained stable after the operation. No patient developed a hyperchloraemic acidosis. The quality of life of all the patients improved, so that three of them were able to return to work.

Discussion

The aims in the treatment of the neurogenic bladder in women with detrusor hyperreflexia are to improve continence, to achieve controlled bladder emptying and to prevent damage to the upper urinary tract. In the

majority of the patients it is possible to achieve this with anticholinergics, intermittent catheterisation or suprapubic tapping. Despite these therapies there is a group of patients, mostly women with severe incontinence and recurrent infections, who need other treatment modalities.^{1,2,3}

Theoretically there are various different possibilities. In patients with a complete cord lesion a bladder stimulator can be indicated. The results with this technique have been reported in the literature as being good.⁴ An advantage of a bladder stimulator is the possibility in some cases of improving defaecation and in male patients erection can be helped with the stimulator. The limited availability of this technique up to now, also its high cost, are both obstacles. A continent urinary diversion is a far better known technique because of its wide-spread use after cystectomy for malignancy.

All these possibilities were considered in our patients. The facts that even with a bladder stimulator the patient still needed transferring from the wheelchair and that there was still a slight chance of incontinence during day-time made our patients choose a continent stoma. Also the fact that implantation of a stimulator meant deafferentiation (cutting of the dorsal roots to the bladder) was a problem for some patients. Another possibility is to perform only a bladder augmentation but here too there is still a chance that the patient remains incontinent.² The combination of an augmentation ileocystoplasty and a sling procedure has good results for incontinence, but was also not a useful alternative for our patients, because the difficult transfer from wheelchair to bed was still necessary.⁵ Another therapeutic option is the combination of an augmentation with a continent stoma and closure of the bladder neck.⁷ This was done in two patients. The umbilical location of the stoma is an important advantage as it obviates the need for difficult catheterisation per urethram. The Mitrofanoff procedure is a possibility, allowing even quadriplegic patients with severely impaired hand function to catheterise themselves.⁶

The appendix was used as an outlet in three of the patients, in combination with a pouch or a bladder augmentation.

The incorporation of an intestinal segment in the urinary tract can have important implications for nutritional and gastro-intestinal but especially for metabolic functions.^{8,9} Osmotic diarrhoea, Vitamin B12 deficiency and cholelithiasis have been reported, but occur very rarely after the creation of an Indiana pouch.⁹ The metabolic changes after incorporation of a bowel segment in the urinary tract are described in the literature but the exact mechanisms remain unclear.⁸ The reabsorption of ammonium and the exchange of chloride and bicarbonate are the most important causes of the development of hyperchloraemic metabolic acidosis. In practice, it seems that the patients who already have impaired kidney function before operation are those who run the greatest risk of developing clinically significant acidosis.

Several authors report different incidences of metabolic complications in patients with ileocolic enterocystoplasties. Sullivan *et al.* found no metabolic changes in a group of 40 patients.¹⁰ In the series of Thüroff all the patients needed oral bicarbonate supplementation but after a while this treatment could be stopped in most of them.¹¹ There was still a group of patients with mild metabolic acidosis, but the significance and consequences in the long run have yet to be established.

The exact risk for developing malignancy in bowel segments incorporated in the urinary tract is not yet really known. There have been 14 cases of malignancy reported in literature after bladder augmentation for a benign reason.¹² In the case of continent urine diversion there was only one case of malignancy in a group of 2000 patients with a maximum follow-up of 22 years.¹³

The bladder was left intact in five of the seven women in the present series. In the literature, there are several possible complications described of leaving a nonfunctioning bladder behind, including pyocystitis, pain and haematuria. In chronic infection caused by a vesical fistula or obstruction and with severe interstitial cystitis an immediate cystectomy is recommended. In other cases the risk of complications is too low to justify performing a cystectomy together with the diversion procedure. The risk of developing malignancy in a nonfunctional bladder is very low but follow-up is recommended.¹⁴ Another important argument in the discussion regarding the treatment is the effect on the body-image and sexuality of the patient. From the reports in the literature it seems that the creation of a umbilical continent stoma results in an improved body image, a better quality of life and even a better sex-life.^{15,16}

Conclusion

Although the number of patients is small and the period of observation is short, we believe that with careful patient selection, the Indiana pouch can be used in the treatment of incontinence caused by neurogenic bladder dysfunction in female patients. It is our opinion that an augmentation alone is not a sufficient solution for women in contrast to male patients. The Indiana pouch provides the patient the possibility of becoming more self-supporting without a significant impact on the body-image. Difficulties in catheterisation are solved by the umbilical location of the stoma and the incontinence is improved by the pouch or the augmentation.

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