Augmentation

SIGMOID CYSTOPLASTY WITH ARGON BEAM WITHOUT MUCOSA

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ABSTRACT

Purpose: Intestinal bladder augmentations have well recognized complications, including mucus production, metabolic abnormalities and perforation. These complications may be avoided if the intestinal mucosa is not incorporated in the urinary tract. We report our experience with sigmoid cystoplasty without mucosa using argon beam, and describe the clinical, urodynamic, ultrasound and pathological results.

Materials and Methods: We performed sigmoid cystoplasty without mucosa in 26 patients and with argon beam over the mucosa before it was removed in 6 boys and 4 girls with a mean age of 8 years (range 3 to 14). All patients had neurogenic bladder as the initial disease. Indications for augmentation were poor bladder compliance, low bladder capacity, hydronephrosis and urinary incontinence. Mean followup was 18 months (range 8 to 40) and included ultrasound, urodynamic evaluation, renal function and clinical assessment. In all patients intraoperative biopsies were done. In 8 of the 10 patients endoscopic biopsies of the augmented segment were obtained between 6 months and 2 years postoperatively. The operation consisted of the Goodwin technique without mucosa, which was treated with argon beam before it was removed.

Results: The 10 patients are dry on intermittent clean catheterization with intervals of greater than 4 hours. There have been no clinical urinary tract infections. Two patients presented with peristaltic contractions and no symptoms. Bladder capacity increased from 80 (range 45 to 200) to 300 (220 to 400) ml., and mean postoperative compliance was 15 ml./cm. H2O (range 9 to 38). There were no significant changes in the urodynamic data between patients treated with sigmoid cystoplasty without mucosa only and with argon beam. Intraoperative biopsies after treatment with argon beam showed damaged mucosa and muscularis mucosa, and intact serosa, muscularis and submucosa layers. On the 8 argon beam postoperative biopsies the sigmoid submucosa was covered with a pseudostratified metaplasia of connective tissue with collagen fibers without scars (trichromic technique).

Conclusions: Sigmoid cystoplasty without mucosa with argon beam is easy to perform. The clinical and urodynamic results have been satisfactory, and use of argon beam prevents postoperative bleeding and residual glands.

KEY WORDS: bladder, sigmoid, urinary incontinence, argon, mucous membrane

Various techniques of bladder enlargement have been proposed for reconstruction of an inadequate lower urinary tract in patients with a small and/or inelastic bladder. Small and large bowel, megaureters and stomach augmentation are still the most commonly used. Autoaugmentation combined with seromuscular patch has been performed successfully in select cases. However, use of gastrointestinal segments for urinary tract reconstruction is associated with multiple complications, including infection with chronic bacteriuria, metabolic acidosis, mucus secretion, stone formation, calcium phosphate metabolism modification with potential bone growth retardation, gastrointestinal motility disorders and perforation.

To prevent the nonphysiological interface between urine and bowel mucosa, several techniques with de-epithelialized bowel patch have been assessed in experimental and clinical studies. Enteral mucosa regrowth or residual glands have been demonstrated after bladder augmentation using demucosalized gut segments. In our previous series of 16 patients treated with demucosalized sigmoid patch we reported residual disease and hematuria. To prevent these complications we used the argon beam in 10 patients treated with sigmoid cystoplasty without mucosa.

MATERIALS AND METHODS

We performed sigmoid cystoplasty without mucosa only in 26 patients and with argon beam over the mucosa before it was removed in 6 boys and 4 girls with a median age of 8 years (range 3 to 14). Neurogenic bladder was the initial disease in all cases, and indications for augmentation were poor bladder compliance, low bladder capacity, hydronephrosis and urinary incontinence.

The colon was cleaned with polyethylene glycol the day before surgery and prophylactic antibiotics were administered. The operation consisted of the Goodwin technique without mucosa. We isolated a vascularized segment of 20 to 25 cm. of sigmoid colon, and then used 80 to 120 power argon beam over the sigmoid colon mucosa before it was removed,
which was easier with use of the argon beam. Intraoperative specimens were obtained in all cases. In 6 of 10 patients we performed 9 simultaneous procedures, including artificial urinary sphincter (3), sling (1), ureteral reimplantation (2), Mitrofanoff (1) and Malone (2).

Most patients resumed oral intake after 3 days, and mean hospital stay was 5 days. Complete followup (mean 18 months, range 8 to 40) included ultrasound, urodynamic evaluation, and renal function and clinical assessment. In 8 of the 10 patients endoscopic biopsies of the augmented segment were obtained 8 months to 2 years postoperatively.

RESULTS

All patients are dry on clean intermittent catheterization every 4 hours or more. There were no clinical urinary tract infections and bladder irrigations were not necessary. Bladder capacity and compliance improved in all 10 patients. Two patients presented with peristaltic contractions with no symptoms. Bladder capacity increased from 80 (range 45 to 200) to 300 (range 220 to 400) ml postoperatively, and mean postoperative compliance was 15 ml/cc H2O (range 9 to 38). These urodynamic results were similar to those of patients treated with sigmoid cystoplasty without argon beam.1

We observed no technical difference in the anastomosis between the sigmoid patch and bladder after argon beam, although we did have some difficulty in the case with an associated Mitrofanoff procedure when performing the anastomosis between the appendix and sigmoid patch. Intraoperative biopsies of the sigmoid patch treated with argon beam showed damaged mucosa and muscularis mucosa and intact serosa, muscularis and submucosa layers. On the 8 argon beam postoperative biopsies the sigmoid submucosa was covered with a pseudostratified metaplasia with collagen fibers and no scars. We found no residual glands on these biopsies. There was no significant intraoperative or postoperative bleeding in any case.

DISCUSSION

Early attempts using seromuscular graft in laboratory experiments have been reported in search of a bladder augmentation technique free of mucus production and electrolyte disturbances.9,11 Oesch used demucosalized cecum for bladder augmentation in rats, and found that uroepithelial cells grew onto the demucosalized bowel segment.11 Pippi Salle et al repeated similar experiments in dogs, and showed that there was viable urothelial growth but also significant fibrosis and scarring of the graft, which were possibly due to contact between urine and the intestinal surface.10 We believe that the demucosalized patch left the muscular surface in contact with urine, which caused the retraction. To prevent this complication, Dewan et al performed a combined procedure with autoaugmentation in a sheep model.13 Mitchell performed bladder augmentation with a demucosalized gastric patch and bladder diverticula14 in 11 patients.15

In 1995 Gonzalez et al reported their clinical experience with grafting demucosalized sigmoid colon onto an autoaugmented bladder in an attempt to demonstrate that bladder diverticula prevented the graft from retraction.6 Despite this clinical application the uroepithelium of the autoaugmentation did not prevent urine from contacting the muscular tissue of the seromuscular graft. Instead the patch conserved the submucosal layer. We believe that the submucosa does not allow retraction of the graft and contact with urine or without diverticula. All surgeons who combine autoaugmentation with seromuscular graft report perforations of the diverticula, and some left catheters between the patch and autoaugmented bladder. As we described previously, when the graft includes the seromuscular, submucosal and muscularis mucosa layers, it was an excellent matrix for growth of a pseudostratified metaplasia.1 Based on these results, we believe that bladder diverticula are unnecessary. The urodynamic results in our cases were excellent and no scars or shrinkage was present on biopsies.

In our previous series biopsies showed residual glands and the most common complication was gross hematuria. In the current series we used argon beam in 10 patients to prevent gross hematuria and residual disease. The argon beam produced a 2 mm. deep burn, which resulted in complete damage of the mucosa and severe alteration of the muscularis mucosa structure. The results were satisfactory, with no residual glands on the 8 postoperative biopsies, and hematuria was minimal. Although we do not know the exact significance of a pseudostratified metaplasia with collagen fibers, we do know that the growth tissue over the submucosal layer was not an epithelium and there was no fibrosis or retraction with the new tissue.

CONCLUSIONS

We believe that autoaugmentation is unnecessary, as clinical and urodynamic results without it have been satisfactory. Use of argon beam prevents postoperative bleeding and residual glands. The submucosa is a good matrix for nonsecreting tissue growth, and is our first choice in patients with a normal superior urinary system without hydronephrosis.

REFERENCES

13. Dewan, P., Close, C., Byard, R. et al: Enteral mucosa regrowth associated Mitrofanoff procedure when performing the anastomosis between the appendix and sigmoid patch. Intraoperative biopsies of the appendix and sigmoid patch treated with argon beam showed damaged mucosa and muscularis mucosa and intact serosa, muscularis and submucosa layers. On the 8 argon beam postoperative biopsies the sigmoid submucosa was covered with a pseudostratified metaplasia with collagen fibers and no scars. We found no residual glands on these biopsies. There was no significant intraoperative or postoperative bleeding in any case.

DISCUSSION

Dr. Yuri Reinberg. How are you planning to follow your patients with biopsies because now I follow patients through muscular augmentation without mucosa with auto-augmentation. I think all of them have colonic
mucosa in the future and my followup is now 10 years. You biopsy them for various reasons, for instance 1 patient just had a perforation. Colonic mucosa has redeveloped in all of them. How are you going to follow them?

Dr. F. de Badiola. In our series biopsies were performed at a mean of 18 months. If you ask me about how they will be followed in the future, I will check the mucus. You could probably measure the mucus in the urine of the patients.

Doctor Reinberg. You do not need to measure. If you ask the parents, they say that in the first couple of years there is no mucus, and progressively they get more and more mucus in the urine.

Dr. David Thomas. It may be that there is a fourth approach, which is a combination of demucosalized intestine and tissue engineering. That is the work we have been doing for the last 8 years. I suspect that is going to find its way into clinical practice first. What I would say to everyone is that we need to be sure that what lines the segments is urothelium. With light microscopy it is difficult to be sure of that. And I would caution everyone in this field that we should be using immunohistochemistry to characterize the tissue lining these segments.

Dr. Paddy Dewan. How certain are you that you had actually taken the submucosa? This is what John Blandy back in the 1960s had said we needed to do to prevent the problem of mucus. If you have managed to do that, that is obviously a big step forward. How certain are you that you have actually removed all the elements that will produce the mucosal regrowth from the colonic segment.

Doctor de Badiola. The point is that you need to damage the submucosa and not only strip out the mucosa. If you leave the submucosa, you probably have residual glands or regrowth of the glands. That is exactly the point. The submucosa is also a good matrix for the new in-growth of urothelium. I repeat, we do not want to say that we have new urothelium. It is not urothelium. It is colonic metaplasia with connective tissue. We do not have scars and we do not have retractions, but it is a good method to destroy the submucosa.

Doctor Dewan. Is it uniform in its effect over the bowel?

Doctor de Badiola. All parts of the intraoperative biopsies had the same appearance. I do not recommend use in the small bowel because it would probably risk perforation.