Anorectal function after low anterior resection

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Most patients with rectal carcinoma can now be treated with sphincter-sparing procedures. The quality of life after sphincter-sparing procedures is better than after abdominoperineal excision. However, morphology and physiology of the neorectum/sphincter complex are challenged and enthusiasm towards restorative surgery in rectal cancer was tempered by concerns over functional deficits: after low anterior resection a substantial portion of patients experience impaired anorectal function, in particular fecal leakage and urgency of defecation and report disturbed sexual function. The aim of our work was to investigate functional outcome and anorectal physiologic function as measured by manometry after the three most commonly used reconstructions of intestinal continuity: anterior rectal resection, low anterior resection, and intersphincteric rectal resection.

Key words: adenocarcinoma, anterior, resection

PATIENTS AND METHODS

A total of 139 patients were available for the study. All had histologically confirmed rectal adenocarcinoma and had undergone anterior resection (in 23), low anterior resection (in 87), and intersphincteric resection (in 29).

In 137 patients resection was locally curative (R0). No patient had experienced anorectal dysfunction before manifestation of the tumour. Of the 139 patients, 45% underwent radiochemotherapy (RCT), neoadjuvant in 27, adjuvant in 36. In patients with anterior resection, intestinal continuity was restored by straight colorectal handsewn anastomosis. In those with low anterior resection, straight colorectal (n=62) or colonic J-pouch rectal anastomoses (n=25) were performed with a transanally inserted stapling device. All patients with intersphincteric resection underwent handsewn coloanal anastomosis. Colonic pouch reconstruction was performed in 29% of the patients, who underwent low anterior resection, in 38% of the cases with intersphincteric resection. A colonic J-pouch had a length of 6 cm and was created, if the anatomy permitted it.

A loop ileostomy was established in all patients after intersphincteric resection and in the others only with evidence of anastomotic leakage after intraoperative instillation of air or methylene blue. The ileostomy was closed on average 25±15 weeks postoperatively (range: 7-73 weeks).

Postoperative continence (in 122) and sexual function (in 115) were evaluated 108±46 weeks after rectal resection (range: 16-220 weeks) or 76±43 weeks after ileostomy resection (range: 15-209 weeks).

Functional outcome was assessed clinically with the Cleveland Clinic Continence Score questionnaire proposed by Jorge and Wexner. The value of 20 represents complete incontinence, 0 full continence.

To address aspects of the Anterior Resection Syndrome, the patients were also questioned in standardized, semiquantitative manner: The questions addressed their daily stool frequency (>5, 3-5, or 1-2 per day; 1-2 per week), duration of warning period (none, reduced, normal), discrimination of stool consistency (none, reduced, normal), evacuation disorders (always, sometimes, never), and general satisfaction with postoperative stool habits (dissatisfaction, partial satisfaction, satisfaction).

Additionally, sexual function after resection was compared by questionnaire with that before the operation in those patients who agreed to respond.

Anorectal physiology was obtained by manometry in 70 patients on an average of 26±15 weeks postoperatively. Anorectal manometry was recorded with a water-perfused 8-lumen PVC catheter: a stationary pullthrough technique was used. Both sphincteric function and neorectal function were measured: (maximal resting pressure, mean resting pressure), maximal squeeze pressure, and mean squeeze pressure. The perception of rectal filling and capacity of the neorectum were measured by placement of a balloon with its lower edge 5 cm from the anal verge and subsequent stepwise inflation with air in 10-cc incre-
ments. The thresholds of the patient’s first sensation of rectal filling, urge to defecate, and maximum tolerable volume were assessed.

**STATISTICS**

The Mann-Whitney U-test, the Wilcoxon test, and the Kruskal-Wallis Test for independent groups were applied. To establish the relationship between manometric findings and postoperative continence score, a Pearson correlation coefficient was calculated. All manometry values are given with the standard deviation. Significance was assumed at $p < 0.05$.

**RESULTS**

The following results were achieved. The average continence score was $7.5 \pm 5.9$. Continence function varied significantly ($p<0.0001$) among the three groups and depended on the type of resection: anterior resection $4.1 \pm 4.6$; low anterior resection $6.9 \pm 5.6$; intersphincteric resection $11.5 \pm 5.2$.

Subanalysis of the Cleveland Clinic Continence Score revealed significant differences among the three groups for the ability to control gas, liquid and solid stool, the need to wear pads, and subsequent alterations in lifestyle. In these groups, half and $90\%$, respectively, preferred to wear pads.

Almost all of the patients, who underwent intersphincteric resection described relevant changes in their lifestyle due to the operation.

The Continence Score was significantly poorer if patients had to undergo radiochemotherapy: in the low anterior resection group $9.0 \text{ vs } 5.7$ ($p=0.030$); i the intersphincteric resection group), $12.8 \text{ vs } 8.8$ ($p=0.048$).

The presence of a colonic pouch did not affect the continence score significantly, continence function was improved with pouch reconstruction in low anterior resection and intersphincteric resection.

Anastomotic leakage did not alter functional outcome: the continence score was $7.3$ in patients with leakage and $7.5$ in those without.

The frequency of bowel movements was increased in all three patient groups. About half of the patients experienced a daily stool frequency higher than 3. Changes in the ability to discriminate the consistency of bowel content and evacuation disorders occurred in all groups, but did not differ among the three forms of reconstruction.

The most prominent findings was a reduction of the warning period: It was reduced in all groups and varied significantly between the groups.

Again, deterioration of clinical function was higher, if the patient did undergo radiochemotherapy. With radiochemotherapy, the warning period and discrimination of stool consistency were altered in patients with low anterior resection and in those with intersphincteric resection (normal warning period in $52\%$ of the 19 patients with RCT vs. $63\%$ of the 9 without RCT; normal discrimination in $68\%$ of the 19 patients with RCT vs. $56\%$ of the 9 without RCT). If RCT was delivered, the frequency of bowel movements was greater: e.g., the number of patients with three or more bowel movements per day was greater than in those without RCT in the low anterior resection group (frequency $= 3 \text{ / day in } 66\%$ of the 29 patients with RCT vs. $45\%$ of the 40 without RCT) and in the intersphincteric resection group (frequency $= 3 \text{ / day in } 53\%$ of the 19 with RCT vs. $33\%$ of the 9 without RCT).

And with colonic pouch reconstruction the functional outcome was better, in part significantly improved. Colonic pouch reconstruction resulted in less frequent bowel movements, both in patients with low anterior resection (frequency $\geq 3 \text{ / day; colonic pouch vs. straight } = 35\% \text{ vs. } 60\%; p=0.035$) and in those with intersphincteric resection (frequency $\geq 3 \text{ / day; colonic pouch vs. straight } = 27\% \text{ vs. } 59\%; ns$). The warning period was significantly less in patients with low anterior and intersphincteric resection ($p=0.030$). The ability to discriminate the consistency of bowel content and evacuation disorders were more pronounced if no pouch was performed.

Sexual dysfunction secondary to the operation was observed in $50\%$ of the 115 patients who agreed to respond to this questioning; however, no correlation with the level of resection was evident. Disorders were significantly ($p<0.0001$) more frequent in men than in women: of the 69 male respondents, $71\%$ complained of absent (54%) or reduced (17%) sexual function; of the 46 female respondents, 35 (76%) reported unchanged sexual function.

Despite the changes in continence and sexual function and the impact on quality of life, overall $70\%$ of the patients reported satisfaction with their stool habits, $14\%$ reported partial satisfaction, and $16\%$ complained of dissatisfaction. Responses were comparable among the groups. On anorectal manometry the function of the internal sphincter differed significantly between the three groups: both maximal resting pressure and mean resting pressure were found to be significantly ($p<0.0001$) reduced in patients after intersphincteric resection.

Voluntary sphincter function did not differ among three groups Average maximal and mean squeeze pressures in all three groups were within or close to the normal range of 120 mm Hg and $>100 \text{ mm Hg}$, respectively.

The reduction in the threshold for urge volume was significant ($p=0.019$) among the three groups. It was also significantly lower than our normal values.

Appreciably reduced figures were found for the other parameters reflecting neorectal reservoir function: threshold for first sensation and maximum tolerable volume after low anterior and intersphincteric resection (both $83 \text{ mmHg (normal range, >200 ml)}$).

Radiochemotherapy was detrimental to smooth anal sphincter muscle function in intersphincteric resection. With regard to neorectal sensitivity and capacity, function was less with RCT in the low anterior resection group, but no significant differences were found.

The presence of a colonic pouch affected maximal neorectal capacity positively without reaching significance both in patients with low anterior resection and in those with intersphincteric resection. Volume of first sensation
was significantly increased if a colonic pouch was constructed after low anterior resection. The creation of a colonic pouch did not affect sphincteric function.

**CORRELATION OF ANORECTAL MANOMETRY WITH CONTINENCE SCORE**

An overall significant correlation with the continence score was found for maximal resting pressure ($r = -0.345$, $p = 0.014$), mean resting pressure ($r = -0.415$, $p = 0.002$), urge volume ($r = -0.320$, $p = 0.037$), and neorectal compliance ($r = -0.355$, $p = 0.0018$). When correlation was analysed by individual groups, patients with low anterior resection showed a significant correlation for maximum tolerable volume ($r = -0.504$, $p = 0.028$) and neorectal compliance ($r = -0.606$, $p = 0.006$). Analysis in the intersphincteric group failed to achieve significance.

**CONCLUSION**

For patients undergoing surgery for rectal carcinoma, freedom from recurrent disease and quality of life are foremost. The latter is largely defined by acceptable continence. Sphincteric preservation can only be beneficial if the residual continence organ provides adequate function.

In our study the functional results are worse the lower the anastomosis. This applies to gas, liquid and solid bowel contents. Continence scores were worse if radiochemotherapy was delivered.

Recently published data point out that various functions contributing to adequate postoperative bowel habits, such as frequency of bowel movements and continence for gas, liquid and solid stool are significantly diminished after preoperative and postoperative radiation and postoperative radiochemotherapy.

The functional superiority of colonic pouch creation, was significant in our study with regard to the frequency of daily bowel movements and was obvious with regard to continence score, warning period, and the ability to discriminate stool consistency. The functional advantages of the colonic pouch have already been demonstrated in randomized trials.

Various anatomic structures and physiologic functions contribute to the maintenance of fecal continence. The physiological changes in continence organ function measured by anorectal manometry are multiple and depend on the operative trauma: two changes were most prominent. The reduced sphincter function in the intersphincteric resection group was not surprising because part of the internal anal sphincter is resected. RCT resulted in further deterioration of this function. Parameters reflecting neorectal capacity and elasticity were clearly influenced by the extent of resection and the way colorectal or coloanal continuity was reestablished.

Published data draw a heterogeneous picture of the physiologic sequelae of rectal resection. The most common finding is a reduction of neorectal capacity.

Parameters reflecting neorectal function are improved if the colonic pouch is established. Neorectal capacity correlates well with functional outcome. Our findings sugge-