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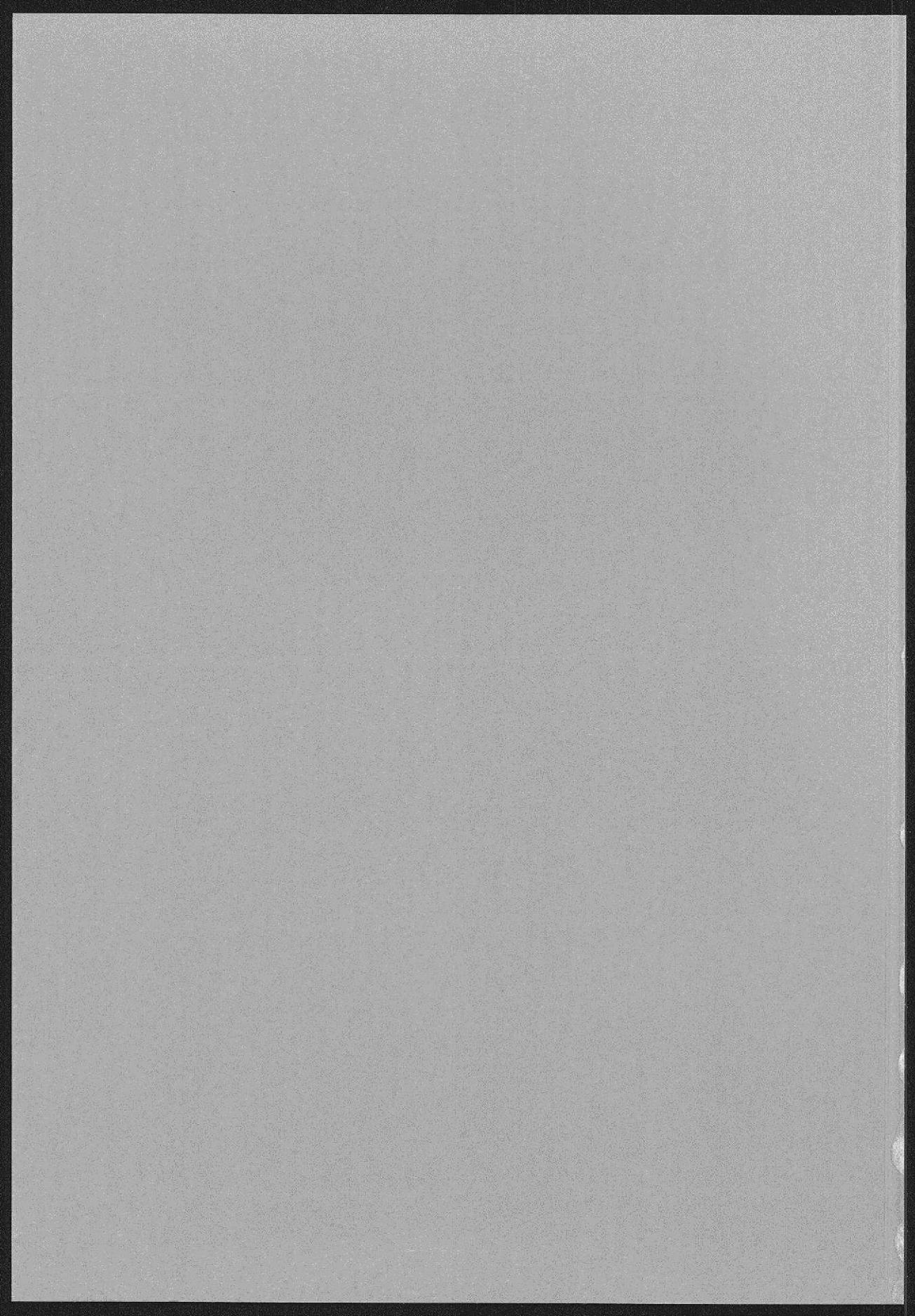


PHYSICAL AND PSYCHOSOCIAL  
ADAPTATION IN PATIENTS WITH  
A CONTINENT ILEOSTOMY



Björn Öjerskog

Göteborg 1988



**PHYSICAL AND PSYCHOSOCIAL ADAPTATION IN PATIENTS WITH A  
CONTINENT ILEOSTOMY**

AKADEMISK AVHANDLING

som för avläggande av doktorsexamen i medicinsk vetenskap  
vid Göteborgs Universitet kommer att offentligen  
försvaras i Aulan, Sahlgrenska sjukhuset,  
torsdagen den 24 november 1988, kl 13.00

av

Björn Öjerskog  
Leg. läk.

Avhandlingen baseras på följande arbeten:

- I LO Nilsson, HE Myrvold, B Swolin, B Öjerskog. Vitamin B<sub>12</sub> in plasma in patients with continent ileostomy and long observation time. Scand J Gastroenterol 1984;19:369-374.
- II B Öjerskog, H Andersson, I Bosaeus, H Brevinge, LO Nilsson. Total body water and total body potassium in ileostomy patients before and after conversion to the continent ileostomy. GUT 1988;29:1198-1201.
- III B Öjerskog, NG Kock, LO Nilsson, MB Philipson, C Åhrén. Long-term follow-up of patients with continent ileostomies. In manuscript.
- IV B Öjerskog, NG Kock, BM Philipson, M Philipson. Pregnancy and delivery in patients with a continent ileostomy. Surg Gynecol and Obstet 1988;167: 61-64.
- V B Öjerskog, T Hellström, NG Kock, HE Myrvold. Quality of life in ileostomy patients before and after conversion to the continent ileostomy. Int J Colorect Dis 1988;3:166-170.

**PHYSICAL AND PSYCHOSOCIAL ADAPTATION IN PATIENTS WITH A  
CONTINENT ILEOSTOMY**

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**ABSTRACT**

In the present investigation adjustment to life with the continent ileostomy was studied with special reference to vitamin B<sub>12</sub>, body composition, clinical outcome, pregnancy and delivery, and quality of life.

A large series of patients with a continent ileostomy for 3-13 years had their plasma levels of vitamin B<sub>12</sub> evaluated. Total body water and total body potassium were investigated in ileostomy patients before and after conversion to the continent ileostomy by isotope dilution and whole body counter technique. A long-term follow-up of 36 patients, who were provided with a continent ileostomy in the time period 1967-1971, was carried out. Follow-up included a clinical examination, blood and urinary tests, cholecystographic studies and morphological studies of reservoir mucosal biopsies. The outcome of pregnancy and delivery was studied for 28 women with a continent ileostomy carrying 37 pregnancies to term. Quality of life was prospectively evaluated by structured interviews in a group of ileostomists undergoing conversion from a conventional to a continent ileostomy.

Plasma vitamin B<sub>12</sub> levels in patients with continent ileostomies and long observation time revealed subnormal values in 7 % and borderline values in another 7 %. No evidence was found of water or potassium depletion in ileostomy patients, neither before nor after construction of the continent ileostomy. The clinical long term follow-up revealed excellent general health, good functional results, full working capacity and no harmful effects expressed by morphological or biochemical indices. Leakage or intubation difficulties were reported by 18 % of the patients during pregnancy and delivery. Vaginal delivery seemed to be safe and was most common. Although there were 4 (11 %) premature babies, all newborns had a birth weight corresponding well with their gestational age. Quality of life was improved by conversion from a conventional to a continent ileostomy, the most obvious benefits being an improved sexual life and a better ability to take part in leisure activities.

From this study it is concluded that there is no need for general prophylactic treatment with vitamin B<sub>12</sub> in continent ileostomy patients, although regular control of plasma values is recommended. Ileostomy patients, conventional as well as continent, were found to have normal body composition. Patients with continent ileostomies for 16-20 years exhibit excellent general health, good functional results and good working capacity. Normal pregnancy and delivery can be expected in women with continent ileostomies. Quality of life is improved in patients who undergo conversion from a conventional to a continent ileostomy.

**Key words:** body potassium, body water, clinical outcome, continent ileostomy, ileostomy, pregnancy and delivery, quality of life, vitamin B<sub>12</sub>.

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This thesis is based on the following papers, which will be referred to in the text by their Roman numerals:

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## INTRODUCTION

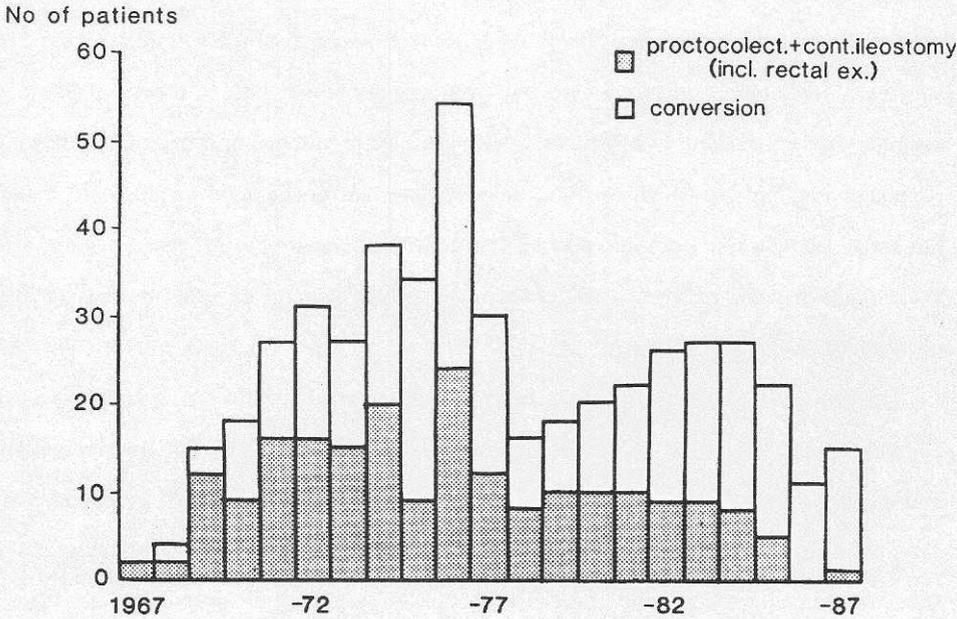
Surgical treatment of inflammatory bowel disease has evolved rapidly since World war II. Morbidity and mortality has gradually declined and today there is practically no mortality after proctocolectomy (1, 2), unless performed as an emergency procedure (3).

The introduction of primary mucocutaneous suture in ileostomy construction by Brooke in 1952 (4) greatly improved ileostomy care. Despite improvements in surgical technique, accompanied by the development of modern ileostomy appliances, the patient was still left with an uncontrolled emptying of the bowel. Although attempts with an ileoanal anastomosis had been made earlier (5), it was not until 1969, when Kock introduced the continent ileostomy (6), that patients and their doctors were offered an alternative that obviates an external appliance and permits controlled emptying.

The continent ileostomy soon attracted surgeons worldwide (7, 8, 9, 10, 11, 12, 13, 14, 15) and became an alternative in the surgical treatment of ulcerative colitis and polyposis coli. Parks in 1978 (16) and Utsunomiya in 1980 (17) independently developed the pelvic pouch procedure with an ileoanal anastomosis. Physiologically, the continent ileostomy and the pelvic pouch have the same properties (an intra-abdominal ileal reservoir with a controlled emptying mechanism) and much of the knowledge about the continent ileostomy is probably also valid for the pelvic pouch. Today the pelvic pouch has become increasingly popular among colorectal surgeons and seems to prevail among the reconstructive methods that are used in connection with proctocolectomy. However, there is still a place for the continent ileostomy; nowadays mainly as a conversion procedure for patients earlier operated with the Brooke ileostomy. The change in operative pattern in our institution during the 1980's illustrates this, as indicated in Fig. 1.

The development of the continent ileostomy has included considerable laboratory and clinical work. Bacteriology, morphology and absorptive capacity was studied

by Philipson, resulting in his thesis on the ileostomy reservoir in 1975 (18). Further studies on long-term effects in the same field were presented by Nilsson in 1980 (19). A clinical and experimental study on volume and pressure characteristics of various types of intestinal reservoirs including the continent ileostomy was presented by Berglund in 1986 (20). Furthermore, the clinical material has continuously been presented (21, 22, 23, 24, 25).



**Fig. 1.** Distribution of primary (proctocolectomy + continent ileostomy) and secondary (conversion) procedures in 484 patients.

Previous investigations of vitamin B<sub>12</sub>-absorption in patients with continent ileostomies have shown varying results with the Schilling test (26, 27, 28, 29, 30). Since the Schilling test has been questioned (27, 31), it was decided to measure the plasma concentration of vitamin B<sub>12</sub> in patients with continent ileostomies and long observation times in order to elucidate their risk for vitamin B<sub>12</sub> deficiency (I).

The intestinal loss of about 500-600 ml of water/24 hours and subsequent chronic dehydration has been reported by Hill et al (32) in conventional ileostomy patients.

However, dehydration was not reported in a study by Nilsson (33) in a limited number of patients with continent ileostomies and these conflicting results prompted us to perform a comparative study (II).

One important question has remained unanswered: What will happen in the long run? Since more than 20 years have elapsed after the first continent ileal reservoir was created, a clinical follow-up of patients with a continent ileostomy and an observation time of 16-20 years was carried out (III).

In young women treated surgically with proctocolectomy and continent ileostomy, an important factor is the impact of the treatment on subsequent pregnancy and delivery. Only sporadic case reports on this issue have been presented earlier (23, 34) and this urged us to study the outcome of pregnancy and delivery in these patients (IV).

A wish for a better quality of life has been claimed to be the main reason for patients wanting the continent ileostomy. In several retrospective studies this has been affirmed (35, 36, 37, 38, 39, 40) but no prospective study has been presented earlier (V).

## AIMS OF THE PRESENT STUDY

1. To study the vitamin B<sub>12</sub> concentration in the plasma of patients with continent ileostomies and long observation times.
2. To compare total body water and total body potassium values between conventional and continent ileostomy patients and with reference values.
3. To investigate the clinical outcome in patients having 16-20 years of experience with a continent ileostomy.
4. To study the outcome of pregnancy and delivery in women with a continent ileostomy.
5. To evaluate the quality of life before (with a conventional ileostomy) and after conversion to a continent ileostomy.

## PATIENTS

Two hundred and thirty-five of a total number of 280 patients, who had been provided with a continent ileal reservoir in the time period 1967-1977, were investigated concerning concentration of vitamin B<sub>12</sub> in plasma (paper I).

Total body water and total body potassium was studied in 40 ileostomy patients, 18 women and 22 men, before (with a continent ileostomy) and one year after conversion to a continent ileostomy (paper II).

A long-term follow up was conducted in 36 patients who had been provided with a continent ileostomy during the time period 1967-1971. The diagnoses were ulcerative colitis in 29 patients, Crohn's disease in 4, familial polyposis in 2 and multiple colonic carcinoma in 1 (paper III).

The outcome of pregnancy and delivery in patients with a continent ileostomy was studied in 28 women carrying 37 pregnancies to term (paper IV).

Thirty-one consecutive patients, 16 women and 15 men, scheduled for conversion of their conventional (Brooke) ileostomy to a continent (Kock) ileostomy were evaluated for their quality of life with both types of ileostomy (paper V).

## METHODS

### Vitamin B<sub>12</sub> in plasma (paper I)

All patients with a continent ileostomy and an observation time of at least 3 years were requested to take part in a follow-up study of vitamin B<sub>12</sub> plasma concentration levels. Serum cobalamines (vitamin B<sub>12</sub>) and folates in blood or plasma were determined by microbiological assays using *Euglena gracilis* (strain Z) and *Lactobacillus casei* (ATCC 7469), respectively. Coefficients of variation were estimated to be 8 % for cobalamines and 9 % for folates.

### Total body water and total body potassium (paper II)

Forty ileostomy patients were all studied twice; the first occasion when having a conventional ileostomy and one or two days before construction of the continent ileostomy, and the second time one year after construction of the continent ileostomy. Thus each patient acted as his own control. Total body water (TBW) was determined by an isotope dilution technique. Total body potassium (TBK) was determined by measuring the gamma radiation from the naturally present radionucleid  $^{40}\text{K}$ . The measurements were performed in a whole body counter. Due to technical problems it was only possible to obtain correct values of TBK in the first 20 patients measured. Reference values were derived by multiple regression analyses of data from 476 healthy subjects obtained in the same laboratory and by the same technique as in the present study (41).

### Long-term follow-up (paper III)

Thirty-six patients with 16-20 years experience of the continent ileostomy and living in the vicinity of Göteborg, were selected as the study group for practical reasons. The medical records from these patients were studied and all patients were interviewed and received a general health examination, including a history of gall bladder and renal stone disease, medication, ileostomy function, occupational status and leisure time activities. Routine blood samples and a 24-hour urine sample were collected and analysed. A cholecystogram or ultrasonography of the gall bladder was performed in all patients who had not been operated for gall bladder disease. Biopsies from the reservoir mucosa for morphological studies were also taken from 15 patients, most of whom had been investigated previously (42), and a comparison was made with earlier results.

### Pregnancy and delivery (paper IV)

Among 241 women, who had a continent ileostomy constructed in the time period 1967-1985, there were 38 pregnancies recorded in 29 patients. Pregnancies were

reported by patients themselves as well as by their obstetricians. Twenty-eight patients, carrying 37 pregnancies to term responded to a questionnaire concerning ileostomy function during pregnancy and delivery. Moreover, medical files were studied including detailed records on pregnancy and delivery.

#### Quality of life (paper V)

Thirty-one consecutive patients, scheduled for conversion of their conventional ileostomy to a continent ileostomy, were all interviewed twice by an experienced psychiatrist. The first interview, depicting the patients life-style with the conventional ileostomy, took place immediately before the conversion operation. The second interview occurred one year after the conversion and thus reflected the same patients perspective with a one-year experience of life with the continent ileostomy. The interviews were structured and comprised a total of 104 questions. The answers were recorded in detail but assessments were also accomplished by using preformed answers according to ordinal scales. The topics mainly concerned aspects on work, leisure time activities, social and sexual life. Distribution-free statistical methods were used and the difference between the two groups (conventional versus continent ileostomy) was tested by paired Wilcoxon test and Sign test.

#### RESULTS AND COMMENTS

##### Vitamin B<sub>12</sub> in plasma (paper I)

Vitamin B<sub>12</sub> in plasma could not be evaluated in 22 out of 235 patients (9.4 %) since they had been substituted for prophylactic reasons or because of factors not related to the reservoir. Three different reasons were given for substitution:

- a. Patients receiving vitamin B<sub>12</sub> as prophylaxis (14 patients). Half of these patients had been put on medication in conjunction with distal ileal resections varying between 15 and 50 cm.

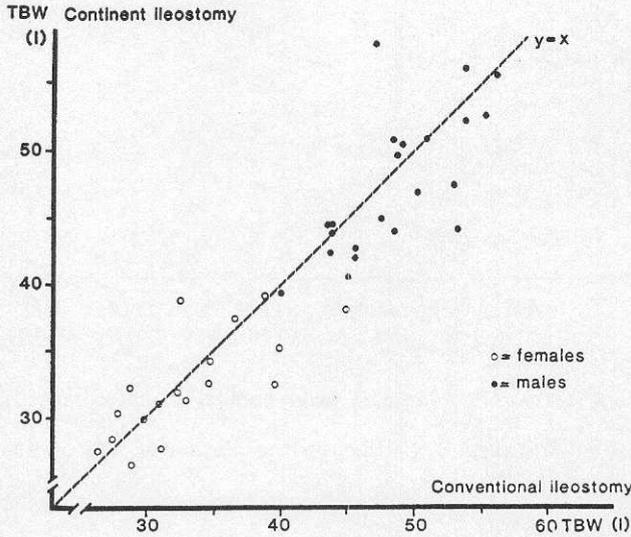
- b. Patients with unrelated neurological symptoms (5 patients). All these patients had normal values of vitamin B<sub>12</sub> in plasma when the substitution had been started and their neurological symptoms were unchanged after the treatment.
  
- c. Patients with subnormal values of vitamin B<sub>12</sub> in plasma before construction of the continent ileostomy (3 patients). In all three the reason for subnormal values was unknown and they displayed neither anemia nor neurological symptoms.

Among 213 patients whose values of vitamin B<sub>12</sub> levels in plasma could be evaluated, there were eight patients who had developed subnormal values during the follow-up period. They were all receiving vitamin B<sub>12</sub> substitution at the time of the survey. Five of these patients had been treated surgically with a resection of the terminal ileum varying between 15-70 cm. Moreover, repeated episodes of ileitis was found in four patients.

There were six additional patients in whom subnormal values of vitamin B<sub>12</sub> were found during the investigation. The clinical and laboratory data for these patients are summarized in Table I. All patients in this group, in addition to proctocolectomy, had undergone an ileal resection varying between 10 - 50 cm. Furthermore, three patients had signs of recurrent episodes of ileitis. No patient had anaemia (Table I), nor were there any neurological symptoms present. Values of vitamin B<sub>12</sub> in plasma between 130 - 200 pmol/l was considered to be border-line and such values were found in 14 patients. Eight of these patients had undergone a resection of more than 10 cm of the terminal ileum. There were three patients displaying anaemia in this group, but all had low values of serum iron and transferrin saturation compatible with iron deficiency anaemia. Patients with border-line values had their plasma vitamin B<sub>12</sub> levels measured once more one year later and at that time two of the 14 patients (14.3 %) had developed subnormal values.

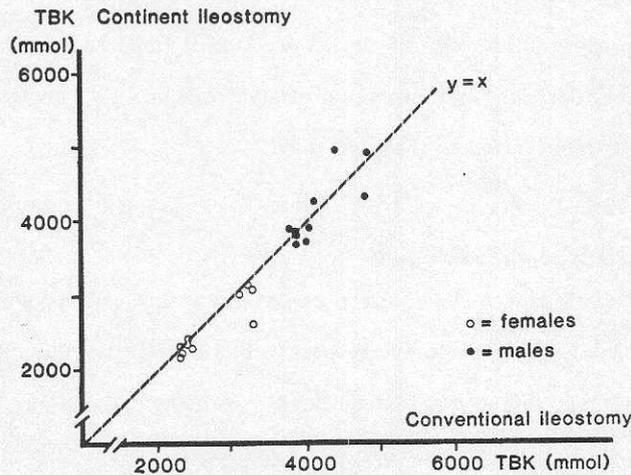


- 0.3 to 1.9 l. A comparison was also made with normal (predicted) values. The mean difference between measured and predicted values for conventional ileostomies was  $3.0 \pm 1.4$  (SEM) % and for continent ileostomies  $2.2 \pm 1.5$  (SEM) %. The resulting 95 % confidence limits being 0.3 to 5.7 % and - 0.8 to 5.2 %, for conventional and continent ileostomies, respectively.



**Fig. 2.** Observed values of total body water (TBW) for each individual when first having a conventional and later a continent ileostomy.

Measurements of total body potassium (TBK) before and one year after conversion to the continent ileostomy are illustrated in Fig. 3. The mean difference



**Fig. 3.** Observed values of total body potassium (TBK) for each individual when first having a conventional and later a continent ileostomy.

between the observed values at the two occasions (conventional - continent ileostomy) was  $83 \pm 55$  (SEM) mmol for 20 subjects. The resulting 95 % confidence interval was - 25 to 191 mmol. When comparing observed and predicted values, the mean difference for conventional ileostomies was  $1.0 \pm 2.3$  (SEM) % and for continent ileostomies -  $0.8 \pm 2.3$  (SEM) %. The 95 % confidence limits for the mean percentage difference from the predicted value for continent ileostomies was -3.5 to 5.5 % and for continent ileostomies -5.3 to 3.7 %.

**Comments:** By comparing measurements of total body water and total body potassium for the same individual when first having a conventional and later a continent ileostomy, the significance of the type of ileostomy could be evaluated. No evidence of water or potassium depletion in ileostomy patients was found, neither before, nor after construction of the continent ileostomy.

#### Long-term follow-up (paper III)

Excellent general health was exhibited by all but two patients, one with sclerosing cholangitis and the other with Crohn's disease. Only one patient had lost weight compared to pre-illness values, nine had noted no change and 26 had gained weight. Blood analyses revealed anaemia in one patients and iron deficiency in two others. There were five patients who had low sodium output in urine, in one case it was probably due to high ileostomy output, while in the four others it was a result of low sodium intake, values being normalized by an increased dietary supplement. The plasma levels of vitamin B<sub>12</sub> were normal in all patients but 10 were on substitution, three because of true deficiency and seven as prophylaxis. Cholecystectomy had been performed in six patients, although only one had had surgery after construction of the continent ileostomy. Cholecystographic studies revealed silent gallstones in another two patients, giving a total frequency of 22 % for gall bladder diseases. However, only three patients (8 %) had developed gallstones after construction of their continent ileostomy. Urolithiasis was found in six patients (17 %) all men, and they had all developed symptoms of renal stone disease after

construction of the continent ileostomy.

All 36 patients at the initial reservoir operation had a continent ileostomy constructed without an intussusception valve. Later a valve was created in 25 (70 %) of these patients but at follow-up, there were 11 (30 %) who still did not have a reservoir provided with a nipple valve. Valve revisions were performed in about 50 % of the patients, in most cases within the first postoperative year. The ileostomy function at follow-up is summarized in Table II. Of 36 patients 33 (92 %) had a good to excellent function of their continent ileostomy. Major leak problems necessitating an ileostomy bag were observed in three patients only, although there were 11 patients who had just a strait outlet without a valve. Dietary restriction was practiced by 3 patients who mainly avoided vegetables like peas and corn because of evacuation difficulties. Repeated episodes of ileitis (pouchitis) were recorded in two patients while seven others had occasionally experienced ileostomy diarrhea, which had resolved spontaneously or after a short period of antibiotic treatment. Medication related to the continent ileostomy was seen in three patients, two taking Metronidazol intermittently and one taking Loperamid.

**Table II.** Functional results in 36 patients 16-20 years after construction of the ileostomy reservoir

| Function       | Result                     | Number of patients   |                   | Total (%) |
|----------------|----------------------------|----------------------|-------------------|-----------|
|                |                            | without valve (n=11) | with valve (n=25) |           |
| Emptying freq. | 1-2 times/24 h             | 1                    | 3                 | 11        |
|                | 3-4 times/24 h             | 9                    | 19                | 78        |
|                | > 5 times/24 h             | 1                    | 3                 | 11        |
| Continence     | perfect                    | 5                    | 19                | 67        |
|                | occasional leak (gas)      | 4                    | 5                 | 25        |
|                | major leak (ileostomy bag) | 2                    | 1                 | 8         |

Most patients (n = 18) still practiced their original profession and a normal working capacity was admitted by all but one patient, the one with sclerosing

cholangitis. There were six patients who had retired because of age and one because of disability, the one with sclerosing cholangitis. The majority of patients (n = 29) considered their life-style to be normal, while minor restrictions were noted by seven patients.

Mucosal biopsies from the reservoir showed minor morphological changes in terms of shorter and broader villi, and an increased crypt depth compared with normal ileal mucosa. An inflammatory reaction, although slight in the majority of specimens, was noted in all patients. The surface epithelium was intact in all biopsies and the enterocytes appeared normal with a preserved brush border layer. The mucus storing goblet cells were increased in number and in one third of the specimens the goblet cells contained more sulfo- than sialomucins, indicating an adaptive change towards colon-like mucosa. Areas of focal fibrosis were noted in half of the patients. Cellular dysplasia was not observed in any of the specimens. The results of morphometric measurements are shown in Fig. 4. When the reservoir mucosa was compared with normal ileum, the villous height was significantly reduced, the number of crypt cells increased and the number of mitosis normal.

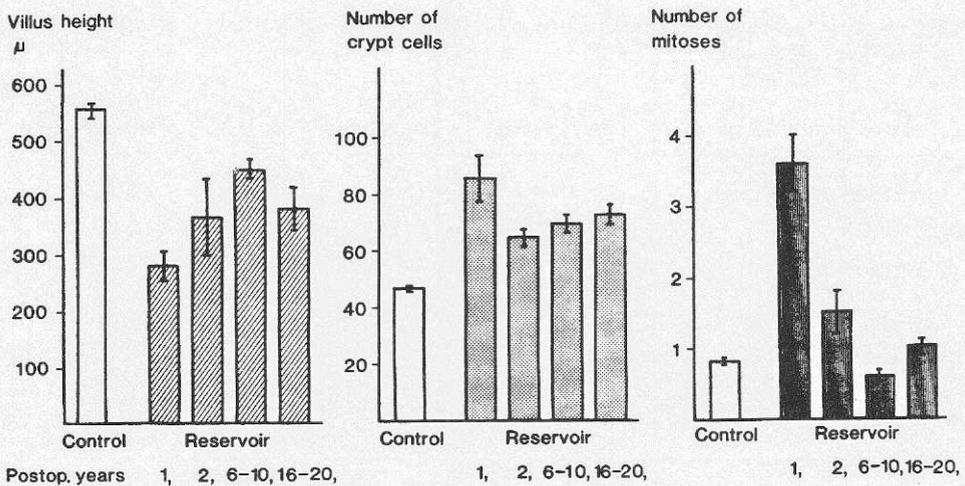


Fig. 4. Morphometric data from normal ileum and from ileal reservoirs with increasing observation time. Mean  $\pm$  SE.

**Comments:** This clinical follow-up of patients with experience of continent ileostomies for 16-20 years revealed no harmful effects on the basis of morphological or biochemical indices. Functional results were good and the majority of patients enjoy an excellent working capacity and good possibilities for taking part in leisure activities.

Pregnancy and delivery (paper IV)

An increased urge to empty the ileostomy reservoir was the most frequent problem encountered by patients during pregnancy. Ileostomy problems are summarized in Table III. In most patients, the problems were small but to overcome the intubation difficulties, a plugged catheter was continuously kept in the reservoir in two patients during the last month of pregnancy. There was no need for operative correction of leakage or intubation difficulties during pregnancy or in connection with delivery. One patient had surgery during pregnancy because of small bowel obstruction. In five patients revisional surgery treatment was performed after childbirth and one was awaiting surgery due to recurrent Crohn's disease.

**Table III.** Ileostomy problems during pregnancy and delivery in 28 patients with a continent ileostomy

| Ileostomy problems           | Before pregnancy | During pregnancy | After delivery | Need for reoperation |
|------------------------------|------------------|------------------|----------------|----------------------|
| Increased emptying frequency | 0                | 23               | 0              | 0                    |
| Leakage of gas               | 6                | 6                | 2              | 0                    |
| Leakage of feces             | 0                | 5                | 3              | 3                    |
| Intubation difficulties      | 0                | 8                | 2              | 2                    |
| High ileostomy output        | 0                | 2                | 1              | 1*                   |

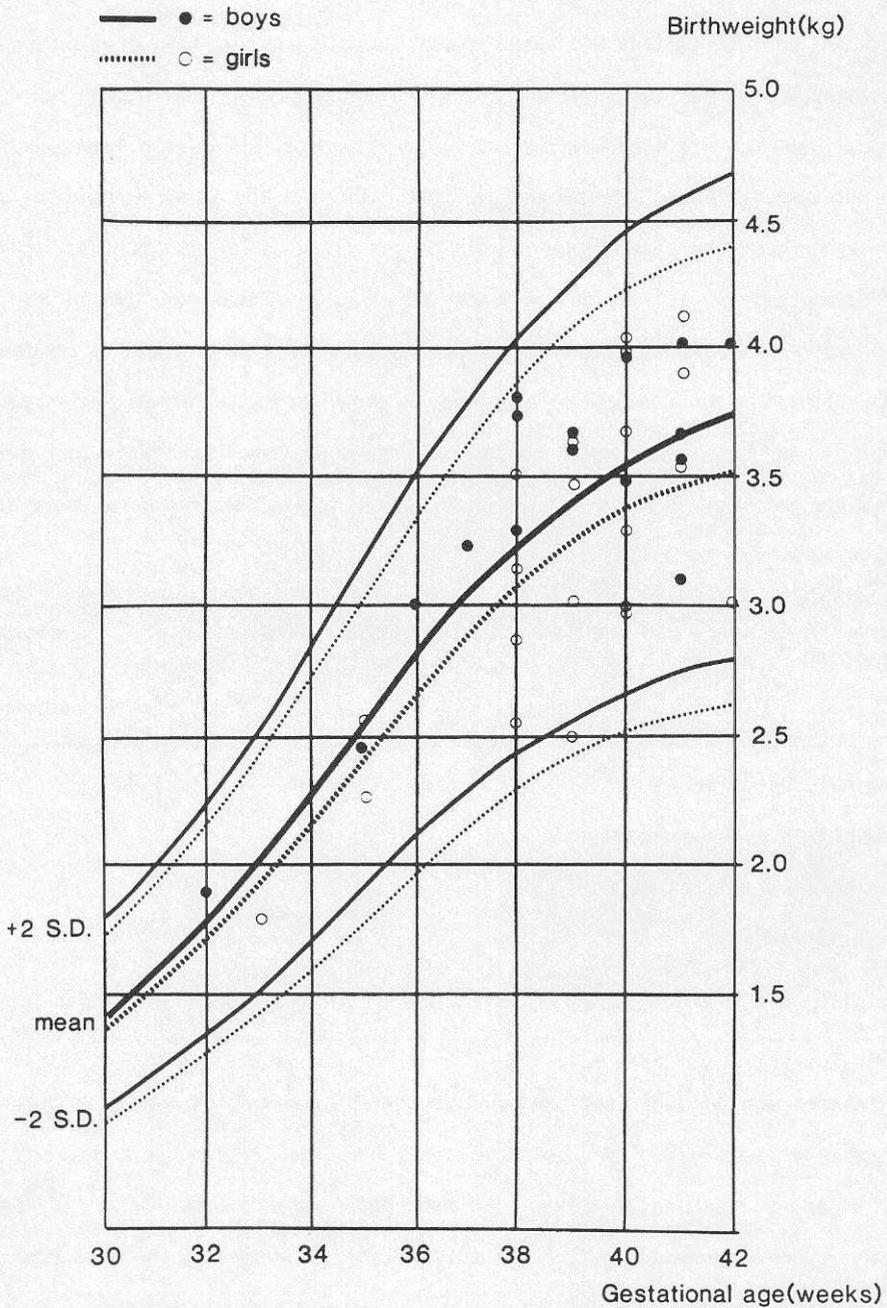
\* recurrent Crohn's disease

There were 37 pregnancies recorded in 28 patients, 20 patients had one, seven had two and one patient had three childbirths. Miscarriage was not observed and parturition, in the majority of patients, took place in their local hospitals. Gestational age was normal in all but five pregnancies. In one case, high ileostomy output contributed to the premature birth, while in the other four cases pure obstetrical factors were involved. Delivery presentations are summarized in Table IV. About 25 % of the babies were delivered by Caesarean section and the indications were purely obstetrical in all but one case. All pregnancies resulted in live births. The birth weight of each baby is shown in Fig. 5, which also shows the limits of normal birth weights for babies born in Sweden. There were four infants weighing less than 2.500 g but the birth weight of the four newborns were all in accordance with the gestational age.

**Table IV.** Delivery presentations in 37 childbirths of 28 patients with a continent ileostomy

|                               | Number of deliveries |
|-------------------------------|----------------------|
| Vaginal (uncompl.)            | 17                   |
| Vaginal (breech-presentation) | 2                    |
| Vaginal (Vacuum-extraction)   | 9                    |
| Cesarean section              | 9                    |
| Total                         | 37                   |

**Comments:** An increased emptying frequency, especially in the late period of pregnancy, was noted by most patients. However, only a few patients had disturbances resulting in a need for revisional surgery after delivery. Vaginal delivery was successful in the majority of the patients and the presence of a continent ileostomy should not, in general, influence the obstetric conduct of labor. All pregnancies resulted in live births and no deliterious effects were recorded affecting the fetus.



**Fig. 5.** Birthweight and gestational age in 37 childbirths of 28 patients with a continent ileostomy.

### Quality of life (paper V)

For patients requesting a conversion of their conventional (Brooke) ileostomy to a continent (Kock) ileostomy, expectations of a better quality of life was the main reason for their choice. To facilitate physical activity and to improve work performance were the reasons most frequently mentioned by men. Among women, the avoidance of a protruding stoma and the ability to dress more freely were the most common reasons. Emotional reactions toward the stoma were more positive with regard to the continent ileostomy. The data on expectations towards the conventional ileostomy, however, were collected retrospectively as proctocolectomy had been performed several years earlier (mean 4.4, range 1-16). The present attitude towards the stoma was more positive regarding the continent ileostomy than the conventional ileostomy. Of the seven patients indicating indifferent or mainly negative reactions towards the continent ileostomy one month after discharge from the hospital, all but one were satisfied after one year of experience, the remaining patient having suffered from repeated episodes of ileitis.

Working capacity was influenced positively by the continent ileostomy. At the second interview, when patients were asked whether the continent ileostomy increased, made no change, or decreased their working capacity, nearly 50 % responded that they felt more capable. With the exception of four patients, two students and two house-wives, all were fully employed at the time of both interviews. When the patients were specifically asked about a change in their ability to partake in leisure activities, 18 patients (60 %) reported an increased opportunity to do so after conversion to the continent ileostomy.

There was not much influence recorded on family and social relations by either type of ileostomy. Although six patients stated that they felt inhibited in social relations when they had a conventional ileostomy, while none reported this after conversion, there was no statistical difference between the two groups. The most significant positive result of the continent ileostomy was noted in sexual relations. Eight patients reported that they had established a new sexual relationship after

construction of the continent ileostomy. Inconvenience at sexual intercourse was more frequently noticed by conventional ileostomists and precautions before intercourse were also undertaken significantly more often when having a conventional ileostomy. Among those, having an established sexual relationship, their coital frequency was recorded. Although many patients stated that they had coitus more frequently after conversion to the continent ileostomy, the difference was not statistically significant.

**Comments:** The present investigation was aimed at prospectively evaluating the quality of life in patients requesting a conversion from a conventional to a continent ileostomy. The results indicate that the positive expectations of each patient were fulfilled to a great extent. The most obvious benefits were an improved sexual life and fewer restrictions in sports and leisure activities.

#### GENERAL DISCUSSION

About 25 % of patients with ulcerative colitis will eventually require a proctocolectomy because of their disease (43, 44). To prevent the development of cancer, all patients suffering from familial polyposis coli will have a (procto)colectomy performed (45). Until 1969, all these patients requiring proctocolectomy were provided with a conventional (Brooke) ileostomy. Although the physical adaptation to life with a conventional ileostomy in most patients is excellent (46), it leaves the patient with a situation which may create significant problems (47, 48). In order to obviate the problems with a conventional ileostomy, Kock (6) developed the continent ileostomy, the basic principle being the creation of a low pressure, intra-abdominal reservoir provided with a biological closing mechanism, and thus eliminating the need of an external appliance. Initially the method was accompanied by a high frequency of early as well as late complications (7), the latter mainly consisting of a malfunctioning valve. Today, however, complications have been reduced to an acceptable level (25, 49). At present the pelvic pouch procedure,

introduced by Parks (16) and Utsunomiya (17), seems to prevail among colorectal surgeons but there is still a place for the continent ileostomy in the following situations:

- a/ as a conversion procedure from a conventional ileostomy
- b/ as a conversion from an unsuccessful pelvic pouch
- c/ as a primary procedure when the patient has a disturbed anal sphincter
- d/ when it is impossible to reach the anus with a newly constructed pouch.

Since the basic physiological principles are the same (a reservoir at the end of the small bowel accompanied by a closing mechanism), much of the knowledge about the continent ileostomy is also valid for the pelvic pouch. The biological consequences of an intestinal reservoir at the end of the small bowel mainly embrace the following subjects: intestinal bacterial flora, mucosal morphology and absorptive function.

The ileal flora from a conventional ileostomy is quantitatively and qualitatively a transition between the normal ileum and stools (50). In other words ileostomy excreta is more fecal and the addition of a reservoir reinforces this tendency (18, 51, 52). The change of milieu in the ileal reservoir results in an altered morphology, villous height is reduced and the form is changed from slender, finger-like to shorter and more club-like villi (18). Cell turnover is increased but the ultrastructure of the enterocytes, including the brush border, seems normal (42). As time passes there seems to be a normalization of the reservoir mucosa (42, 53) and this is confirmed by the present study with an observation time of 16-20 years.

The terminal ileum has an active absorptive function of two compounds of major physiological importance; bile acids and vitamin B<sub>12</sub>. Reabsorption of bile acids maintains the enterohepatic circulation and disturbances of this cycle could in the long run induce gallstone disease. An increased prevalence of gall bladder disease in patients having a conventional ileostomy, although confined to patients also being subjected to ileal resection, has been reported by Hill et al (54). In the present study no increased prevalence was found in patients with continent ileostomies over long-

term observation times. Active reabsorption of bile acids from the ileal pouch, which might explain a possible difference, has been demonstrated by Go et al in a recent study (55). However, other reports have indicated a malabsorption of bile acids in patients with ileal reservoirs (56, 57). Vitamin B<sub>12</sub> absorption has received much attention because its key role in the hematopoietic and nervus systems. The Schilling test enables the study of vitamin B<sub>12</sub> absorption but, unfortunately, the result of earlier studies have been conflicting (26, 27, 28, 29, 30) and, moreover, the reliability of the Schilling test has been questioned (27, 31). Therefore, a large survey of the serum cobalamin levels in patients with continent ileostomies and long observation time was undertaken. This study revealed that there is no general impairment in vitamin B<sub>12</sub> absorption in these patients but those who had an additional ileal resection and those suffering from repeated episodes of ileitis are susceptible to vitamin B<sub>12</sub> deficiency.

Absorption of water and electrolytes in ileal pouches has been shown to be in the same range as for the normal ileum (58) and essentially normal absorption of D-xylose and L-phenylalanine have been demonstrated in studies from Göteborg (26, 29). Salt and water depletion has been claimed to be present in conventional ileostomists (32) but this could not be confirmed in a study in patients with continent ileostomies (33). By measuring the body composition of the same individual before (with a conventional ileostomy) and after conversion to the continent ileostomy, an intraindividual comparison of total body water and total body potassium was made in a group of ileostomy patients who were, furthermore, compared with a large group of healthy controls. There were no signs of water or potassium depletion in ileostomy patients, neither before, nor after construction of the continent ileostomy.

Long-term effects on mucosal morphology and absorption have displayed no major adverse effects from the ileal reservoir (1, 19, 42). In the present study an excellent general health was found in patients with continent ileostomies followed for 16-20 years, and this suggests that there are no metabolically harmful effects

attributable to the reservoir construction itself. The long-term study also revealed that patients who have been provided with a continent ileostomy will have excellent working capacities and good opportunities to take part in leisure activities.

Inflammatory bowel disease mainly affects young people in their reproductive age and the question of whether or not subsequent childbearing will be possible is relevant and of great concern to the affected patient. Pregnancy and delivery in conventional ileostomy patients was first reported by Scudamore and coworkers (59). Two large collective series have been published from Great Britain (60) and United States (34) and both studies reported a successful pregnancy and delivery in these patients. Data collected in the present study confirms that when a woman has undergone proctocolectomy with construction of a continent ileostomy, it does not imply an increased risk for complications during pregnancy and delivery.

An improved quality of life was the main objective when Kock introduced the concept of the continent ileostomy (1, 6). The avoidance of a protruding stoma and an external appliance was accomplished by creating a low pressure intraabdominal reservoir provided with a biological closing mechanism. The surgical procedure has attracted patients chiefly by its positive impact on their quality of life and several retrospective reports have addressed this subject (35, 36, 37, 38, 39, 40). The patient undergoing a conversion from a conventional to a continent ileostomy seems to be an ideal judge since he has experienced both types of ileostomy. In the present study, an attempt was made to evaluate prospectively the quality of life in patients undergoing this surgical procedure and a better quality of life was recorded after conversion to the continent ileostomy, the most obvious benefits being those of improved sexual life and less restrictions in sports and leisure activities.

## SUMMARY AND CONCLUSIONS

The continent ileostomy has now been used in clinical practice for more than 20 years. In the present studies the adjustment to life with the continent ileostomy is outlined.

Plasma vitamin B<sub>12</sub> levels in 235 patients with continent ileostomies for 3 -13 years revealed subnormal values in 7% and borderline values in another 7%. Most patients displaying subnormal values had had an ileal resection and some also had repeated episodes of ileitis. General prophylaxis is not needed but patients should have their plasma levels of vitamin B<sub>12</sub> examined at yearly intervals.

Body composition was studied before and after conversion to the continent ileostomy and no evidence was found of water and potassium depletion, neither before, nor after construction of the continent ileostomy.

A long term follow-up of patients with a continent ileostomy for 16 -20 years revealed an excellent general health, good functional results, full working capacity and no harmful effects as expressed by morphology and biochemical indices.

The outcome of pregnancy and delivery in women with a continent ileostomy were evaluated. Most patients reported an increased urge to empty the reservoir during pregnancy. Severe leakage and intubation difficulties were noted in 5 patients (18 %), but none had to be operated during their pregnancy and delivery. Vaginal delivery was safe and used mostly. Although 4 newborns were premature, all babies had birth weights which correspond well with their gestational age.

Quality of life was prospectively evaluated in a group of patients requesting conversion of their conventional to a continent ileostomy. It was found that the patients' positive expectations to a great extent were fulfilled. The most obvious benefits were those of improved sexual life and fewer restrictions in leisure activities.

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