Malnutrition affects quality of life in gastroenterology patients

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INTRODUCTION

Malnutrition is common in chronic and acute gastrointestinal disease affecting both morbidity and mortality. Impairment of nutritional status frequently also decreases muscle function\(^1\)\(^-\)\(^3\), which lastly results in an impaired functional status.

Studies have shown a close relationship between malnutrition and decreased quality of life in some populations such as elderly institutionalized patients\(^4\)\(^-\)\(^6\), patients with cancer\(^7\)\(^-\)\(^9\), and patients on haemodialysis\(^10\)\(^-\)\(^11\). Quality of life is a subjective multidimensional construct reflecting functional status, emotional and social well being as well as general health. Its measurement is based on the patient’s perception of well being.

In order to evaluate patients’ situation or benefits of new treatment strategies, quality of life has become a new clinically relevant outcome parameter\(^12\)\(^-\)\(^18\). In chronic disease in particular, where recovery from disease is not always achievable, quality of life is essential and its measurement should be integrated as one main intervention target. It is therefore crucial to better understand the relationship between more objective measures such as disease parameters, nutritional status and subjective quality of life.

Studies investigating factors influencing quality of life in benign gastrointestinal (GI) disease have not looked at the impact of nutritional deficiency\(^19\)\(^-\)\(^21\). Hitherto, there are no data on quality of life in relation to nutritional status in patients with benign gastrointestinal disease. Since malnutrition frequently occurs in gastroenterological disease, we explored the impact of malnutrition as identified by the Subjective Global Assessment in patients with benign gastroenterological disease. We also focused the evaluation on subgroups of our study patients with chronic gastrointestinal disease like liver cirrhosis or chronic inflammatory bowel disease (Crohn’s disease or ulcerative colitis).

MATERIALS AND METHODS

Patients

A total of 200 patients with benign gastroenterological disease admitted to a gastroenterology ward at our university hospital were recruited for the study. Sixty one patients with liver cirrhosis (\(n = 33\) men and \(n = 28\) women), 69
patients with inflammatory bowel disease (n = 29 men and n = 40 women) as well as 70 patients with various acute and chronic gastroenterological diagnoses (n = 32 men, n = 38 women) were included in the study (Table 1). All patients were considered for inclusion if they had a non-neoplastic disease regardless of disease severity. Exclusion criteria were malignant comorbidity and terminal disease (life expectancy < 3 mo) in order not to bias interpretation of quality of life. Patients with neuro-muscular disease, hemplegia or rheumatoid arthritis were excluded in order to avoid potential confounders on muscle strength. Furthermore, patients with implanted defibrillator were excluded from the bioelectrical impedance analysis. All measurements were performed within 36 h of admission. Patient recruitment was consecutive until at least 100 well nourished patients with benign gastrointestinal disease were included. Then, only malnourished patients were consecutively included in order to obtain comparable patient groups.

All patients signed written informed consent and this study was approved by the local ethics committee.

Quality of life
Quality of life was assessed employing the validated Medical Outcomes Study 36-item Short-Form General Health Survey described in detail elsewhere[18,19]. The questionnaire consists of 36 questions forming 8 multi item scales and is self administered[18,19]. These scales range from 0-100 percent (absolute values), but norm values differ substantially across the scales. In order to facilitate interpretation and to compare the results with norm values obtained in 1998 (1998 SF-36 US population norms), all scales were therefore not only expressed as absolute values but also norm based scored, i.e. each scale was scored to have the same average and the same standard deviation. We employed the standard (US) scoring algorithms, as has been recommended by Ware et al.[19]. Results for the eight scales can then easily be compared directly since they are all standardized in relation to population norms.

Classification of malnutrition
The Subjective Global Assessment (SGA) was carried out using the protocol developed by Detsky et al[20]. It relies on the patient’s history regarding weight loss, dietary intake, gastrointestinal symptoms, functional capacity, and physical signs of malnutrition (loss of subcuture fat or muscle mass, edema, ascites). Patients were classified as well nourished (A), moderately or suspected of being malnourished (B) or severely malnourished (C). Since subgroups of patients classified as SGA C were too small, comparative analyses were performed between well-nourished patients classified as SGA A and malnourished patients classified as either SGA B or C.

Anthropometry
Body weight was measured on light clothes with a portable electronic scale (seca 910, Hamburg Germany) to the nearest 0.1 kg and height was measured with a portable stadiometer (seca 220 telescopic measuring rod) to the nearest 0.1 cm. Weight and height were used to calculate BMI (weight (kg)/height (m)²). Mid upper arm circumference (of the nondominant arm) was measured to the nearest 0.1 cm with a nonelastic tape measure and triceps skinfold was measured to the nearest 0.1 mm with a Holtain caliper (Crymch, UK) on the non dominant relaxed arm midway between the tip of the acromion and the olecranon process. Arm muscle area (AMA) and arm fat area (AFA) were calculated applying the formula by Gurney[21].

Body composition
BIA was performed using a BIA 2000M (Data Input GmbH, Darmstadt, Germany) applying alternating electric currents of 800 μA at 50 kHz. Patients were measured in the morning after an overnight fast, in the supine position with arms and legs abducted from the body. Source and sensor electrodes were placed on the dorsum of both hand and foot of the dominant side of the body. Total body water and fat free mass (FFM) were then calculated according to the formula by Kushner and Schoeller, body cell mass (BCM) and extracellular mass (ECM) were calculated as described previously[22]. BCM was also expressed corrected for height (BCM/m²). ECM/BCM ratio was calculated to detect shifts between BCM and ECM.

Phase angle is a bioimpedance parameter that reflects the contribution between resistance, the pure opposition of a biological conductor to alternating electric current, and capacitance, which is the resisting effect produced by the tissue interfaces (arc tangent of this ratio transformed to degrees). It has been shown to be of clinical relevance in a number of disease settings[23,24].

Muscle function
Hand grip strength was measured both in the nondominant and in the dominant hand with a Digimax electronic dynamometer (Mechatronic GmbH, Germany). The patients performed the test while sitting comfortably with shoulder adducted and neutrally rotated, the elbow supported on a table and flexed to 90 degrees, forearm and wrist in neutral position. The patients were instructed to perform a maximal isometric contraction.

Table 1 Clinical diagnoses of the study population

| Diagnoses                        | n  | n  | n  |
|----------------------------------|----|----|----|
|Liver cirrhosis                   | 61 | Others | 70 |
|Alcoholic liver cirrhosis         | 51 | Biliary disease | 11 |
|Cryptogenic liver cirrhosis       | 4  | Gastritis / reflux disease | 11 |
|Biliary liver cirrhosis           | 4  | Chronic pancreatitis | 9 |
|Post hepatic liver cirrhosis      | 2  | Non infectious colitis | 7 |
|Inflammatory bowel disease        | 69 | Diverticulitis | 8 |
|Crohn’s disease                   | 46 | Fatty liver disease | 8 |
|Ulcerative colitis                | 23 |                | Total 200 |

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The test was repeated within 30 s and the highest value was recorded.

Peak expiratory flow was investigated by the Vitalograph® Peak Flow Meter. Patients were instructed to exhale as fast and as forcefully as possible. The test was repeated within 30 seconds and the highest value was recorded.

**Statistical analysis**

Statistical analysis was carried out using the software package SPSS® (version 11, SPSS Inc. Chicago, IL, USA). All data are given as mean ± SD. The Mann–Whitney U Test was used for comparison between groups. An acceptable level of statistical significance was established a priori at \( P < 0.05 \).

**RESULTS**

Patients’ characteristics are given in Table 2. Patients classified moderately or severely malnourished (\( n = 96 \)) by the Subjective Global Assessment were not significantly older than well nourished patients were. As anticipated however, they exhibited lower blood albumin levels, a significantly reduced body cell mass corrected for height and a significantly increased ECM/BCM ratio when compared to the well nourished patients. Body mass index and arm muscle area were also reduced. Moreover, muscle function as assessed by hand grip strength was significantly lower in the malnourished patients (Table 2). Peak flow was not different between well and malnourished patients.

All patients suffered impaired quality of life in all scales when compared with norm values from the US adult population (Figure 1). Characteristics of the liver cirrhosis and IBD patients are given in Table 3. IBD patients were significantly younger than liver cirrhosis patients and had higher serum albumin level. BCM did not differ between the two groups. IBD patients exhibited lower body

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**Table 2  Study population and differences between well and malnourished patients**

| Characteristics          | Overall study population \( (n = 200) \) | Well nourished (SGA A) \( (n = 104) \) | Malnourished (SGA B C) \( (n = 96) \) | \( P \) |
|--------------------------|------------------------------------------|----------------------------------------|--------------------------------------|-------|
| Gender (M/F)             | 94/106                                   | 44/60                                  | 50/46                                | NS    |
| Age (yr)                 | 54.9 ± 17.1                              | 56.7 ± 16.7                            | 52.9 ± 17.3                          | NS    |
| Albumin (g/L)            | 37 ± 7.1                                 | 39 ± 7.0                               | 35 ± 7.0                             | 0.001 |
| Body mass index (kg/m²)  | 23.7 ± 4.9                               | 25.7 ± 4.6                             | 21.6 ± 4.2                           | <0.000|
| Phase angle (°)          | 4.9 ± 1.1                                | 5.2 ± 1.0                              | 4.5 ± 1.1                            | <0.000|
| BCM/height (kg/m²)       | 8.1 ± 1.8                                | 8.6 ± 1.7                              | 7.4 ± 1.8                            | <0.000|
| ECM/BCM                  | 1.3 ± 0.6                                | 1.2 ± 0.4                              | 1.4 ± 0.7                            | <0.000|
| Arm muscle area (mm²)    | 4327.5 ± 1261.8                          | 4713.2 ± 1200.3                        | 3916.1 ± 1200.1                      | <0.000|
| Hand grip strength (kg)  | 29.1 ± 11.0                              | 30.6 ± 10.5                            | 27.3 ± 11.4                          | 0.030 |
| Peak flow (L/min)        | 346.0 ± 118.4                            | 353.4 ± 113.2                          | 337.6 ± 124.2                        | NS    |

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**Table 3  Study population and differences between liver cirrhosis and IBD patients**

| Differences                     | Liver cirrhosis | Inflammatory bowel disease | \( P \) |
|---------------------------------|-----------------|-----------------------------|-------|
| SGA A vs BC                     | 34/27           | 33/36                       | NS    |
| Gender (M/F)                    | 33/28           | 29/40                       | NS    |
| Age (yr)                        | 56.8 ± 12.2     | 38.5 ± 13.4                 | <0.000|
| Albumin (g/L)                   | 33.0 ± 6.0      | 38.0 ± 7.0                  | <0.000|
| Body mass index (kg/m²)         | 26.1 ± 4.9      | 21.2 ± 3.6                  | <0.000|
| Phase angle (°)                 | 4.7 ± 1.0       | 5.4 ± 1.2                   | <0.000|
| BCM/height (kg/m²)              | 8.4 ± 1.9       | 7.9 ± 1.8                   | NS    |
| ECM/BCM                         | 1.4 ± 0.5       | 1.2 ± 0.8                   | <0.000|
| Arm muscle area (mm²)           | 4606.3 ± 1485.9 | 3921.9 ± 1069.8             | 0.009 |
| Hand grip strength (kg)         | 30.9 ± 11.6     | 31.5 ± 11.4                 | NS    |
| Peak flow (L/min)               | 328.2 ± 116.9   | 375.8 ± 112.5               | 0.048 |
mass index, higher phase angle but reduced arm muscle area. ECM/BCM ratio was significantly also lower in IBD patients than liver cirrhosis patients. Hand grip strength was not different between the two groups but peak flow was higher in IBD patients. When evaluating their quality of life, IBD patients exhibited slightly lower quality of life values than liver cirrhosis patients did. This was significant in the scales concerning bodily pain \((P < 0.00001)\), general health \((P < 0.00001)\), mental health \((P = 0.031)\) and social functioning \((P = 0.016)\) (Figure 2).

**Impact of malnutrition on parameters of quality of life**

Malnourished patients from the overall study group suffered significantly impaired quality of life in both the mental and physical dimension of the quality of life. All subscales except bodily pain were reduced (Figure 3).

Evaluating the two chronic disease groups, malnourished liver cirrhosis patients experienced significantly lower quality of life in six out of the eight scales compared to well nourished liver cirrhosis patients. Malnourished IBD patients showed reduced quality of life in four out of the eight scales (Table 4).

**DISCUSSION**

In this study we investigated the quality of life of 200 patients with benign acute and chronic gastrointestinal disease in relation to their nutritional status. Quality of life in relation to nutritional status has been investigated in patients on haemodialysis, in institutionalized elderly and in patients with cancer\(^{3-9,25,26}\). At present however, there is not sufficient information on quality of life in relation to nutritional status in chronic benign gastroenterological disease, although malnutrition is frequently observed in these patients\(^{27,28}\) and has well known adverse effects on clinical outcome\(^{29-31}\). In order to use quality of life as a clinical outcome parameter in these patients, it is therefore essential to enhance the understanding of quality of life and its association with nutritional status. We employed the SF 36 questionnaire which has been validated in various settings\(^{32-34}\) and has the advantage of being disease unspecific. We moreover compared the results with values gathered in the 1998 US National Survey of Functional Status. Quality of life was generally impaired in our study population when compared to the norm values. Similar to the findings in other disease settings we also found that quality of life appeared to be compromised in malnutrition. Patients from the overall study group classified as malnourished experienced a significantly lower quality of life than the well nourished patients in all scales except the perception of pain, leading to impairment of both the mental and the physical dimension of quality of life.

Among our study patients, the largest subgroups were patients with liver cirrhosis or IBD. Since health related quality of life obviously depends on underlying disease we also focused the evaluation on these patients. Malnourished liver cirrhosis patients suffered statistically significant reductions in all scales except the...
Table 4  Quality of life in malnourished vs wellnourished patients with either liver cirrhosis or inflammatory bowel disease (absolute percentage)

| QOL scales            | Liver cirrhosis | Inflammatory bowel disease |
|-----------------------|-----------------|----------------------------|
|                       | Wellnourished   | Malnourished               | P     | Wellnourished | Malnourished | P     |
| Physical functioning  | 74.0 ± 23.8     | 44.6 ± 22.1                | 0.000 | 66.6 ± 31.6  | 52.1 ± 28.4  | 0.036 |
| Role physical         | 52.3 ± 42.6     | 22.2 ± 36.9                | 0.003 | 49.2 ± 45.1  | 24.4 ± 34.6  | 0.024 |
| Bodily pain           | 88.9 ± 28.5     | 59.3 ± 47.4                | 0.007 | 67.7 ± 41.9  | 59.1 ± 46.5  | NS    |
| General health        | 82.6 ± 27.4     | 81.0 ± 28.7                | NS    | 71.9 ± 31.6  | 51.1 ± 33.1  | 0.012 |
| Vitality              | 73.2 ± 38.2     | 59.0 ± 39.4                | NS    | 35.4 ± 33.5  | 37.7 ± 33.7  | NS    |
| Social functioning    | 51.8 ± 19.8     | 41.3 ± 16.1                | 0.041 | 42.1 ± 20.2  | 37.6 ± 13.5  | NS    |
| Role emotional        | 46.8 ± 21.3     | 31.7 ± 20.0                | 0.007 | 39.1 ± 23.7  | 26.9 ± 18.8  | 0.027 |
| Mental health         | 78.1 ± 17.6     | 56.9 ± 25.9                | 0.001 | 64.9 ± 18.9  | 56.1 ± 21.8  | NS    |

perception of social functioning and bodily pain whereas malnourished IBD patients were compromised in social functioning but mainly in the physical scales such as physical functioning, role physical and vitality.

One difficulty in evaluating our study results was to reliably differentiate between the effects of disease and the effects of malnutrition on quality of life, since they obviously are closely interrelated. Severity of disease is likely to trigger a worsening of nutritional status and malnutrition has well known adverse effects on the clinical outcome. Studies investigating health related quality of life in relation to disease severity do not show consistent findings. Kalantar-Zadeh et al[8] observed that quality of life assessed by the SF 36 had a strong association with disease severity judged by prospective hospitalization and mortality in patients on haemodialysis. Bianchi et al[10] showed a relationship between the disease severity index Child Pugh Score and the Psychological General Wellbeing Index. In patients with hepatocellular carcinoma however, quality of life was not primarily related to tumour mass or hepatocellular failure, but sleep disorders were shown to be strongly associated with quality of life. Similarly, in primary biliary cirrhosis, no associations between scales of the Nottingham health profile and biochemical liver tests, histological stages or duration of the disease were found[17]. Moreover, Hauser et al found psychiatric or active medical comorbidity to be of a larger influence than disease severity in a population with various liver diseases[10].

In this study, reliable data on disease severity were only available in liver cirrhosis and Crohn’s Disease. In these groups, malnourished patients also experienced greater disease severity classified by the Child Pugh Score or the Crohn’s Disease Activity Index (data not shown). This clearly makes interpretation of the results more difficult and we consider it a limitation of the study. We cannot reliably conclude whether the observed impairments of quality of life in malnutrition are due exclusively to nutritional deprivation.

Malnutrition however is known to be associated with impaired functional status[12], worsened immune system[20], delayed recovery, higher mortality and morbidity[31]. The malnourished patients in our study population exhibited both lower muscle mass (as measured by body cell mass and arm muscle area) and muscle function and these changes were not attributable to age. It is therefore highly probable that malnutrition per se-defined mainly by weight loss in the preceding 6 months—has a measurable impact at least on the physical aspect of quality of life, which in the end is likely to affect the mental dimension as well.

Interestingly, overall quality of life was lower in the patients suffering from IBD than in liver cirrhosis patients, which was due to the perception of general health, mental health, vitality, social functioning and bodily pain. The physical scales physical functioning, role physical and vitality were not significantly higher in the IBD patients despite their younger age. There were no significant differences between patients with ulcerative colitis or Crohn’s disease (data not shown). Considering that IBD in general is associated with a better prognosis and longer survival time than liver cirrhosis, these results are somewhat alarming. Our findings indicate that acute disease specific aspects such as diarrhoea and abdominal pain occurring in IBD rather than survival associated disease severity lead to a greater impairment of health-related quality of life. Marchesini et al[18] who studied quality of life in an Italian cohort of liver cirrhotics found similar associations between non life threatening symptoms such as muscle cramps and quality of life.

It is evident that subjective perception of quality of life depends on more than nutritional status or disease severity. Cancer patients currently on remission might e.g. experience a better quality of life than their healthy but overworked physician. When deciding on optimal therapy, it must also be taken into account that patients with impaired quality of life must be considered in need of intensified attention and care.

In conclusion, quality of life is impaired in benign gastrointestinal disease and becomes further compromised in malnutrition. It appears that liver cirrhosis patients experience a higher quality of life than IBD patients do, but the impact of malnutrition seems to be greater in liver cirrhosis than in IBD. Further studies are required to investi-
gate and identify therapy strategies that improve quality of life in chronic benign gastrointestinal disease. Whether nutritional intervention is successful in enhancing quality of life in these patients remains to be studied.

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