

# Evaluation of Preoperative Nutritional Status in Gastric Cancer Patients

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## Abstract

**Background:** Malnutrition is a common feature in gastric cancer patients and it is directly correlated with tumour stage. The goal of our study was the assessment of nutritional status in a large series of gastric cancer patients.

**Methods:** We performed a retrospective study which included all the patients newly diagnosed with gastric cancer which were submitted in our unit in a 2 year period. We performed a comparative analysis between the patient in which radical resection was performed and the patient in which a palliative procedure was made.

**Results:** There were 136 gastric cancer patients; radical resections were performed in 81 patients (34 total gastrectomies and 47 subtotal gastrectomies). Palliative procedures included 17 gastroenterostomy, 13 feeding jejunostomy and 25 exploratory laparoscopies. Patients in which radical resection was performed presented higher Karnofsky ( $P=0.006$ ) and Charlson ( $P=0.007$ ) indexes, higher BMI ( $P=0.017$ ), higher albumin ( $P=0.001$ ), lymphocytes ( $P=0.03$ ) and Onodera index ( $P=0.0032$ ).

**Conclusion:** An accurate clinical and biological nutritional assessment of newly diagnosed gastric cancer patients could identify the subgroup of patients with more advanced or metastatic lesions in which a thorough stadialisation should be performed.

**Keywords:** Gastric cancer; Nutritional status; Gastrectomy; Gastroenterostomy; Jejunostomy; Karnofsky index; Charlson score; Onodera index

## Introduction

Although the incidence have decreased in western world, gastric cancer represents a major health care problem worldwide and remains one of the leading causes of cancer related deaths. Prognosis of gastric cancer is relatively poor with 5-year survival rates around 27% [1] for all stages and 63% for localised disease. Surgery plays the major role in the multidisciplinary treatment of gastric cancer and gastric cancer surgery is regarded as one of the most demanding and high risk surgery. The main goals of gastric surgery are the complete resection of the disease with local lymphadenectomy in order to increase survival without the increase of postoperative morbidity and mortality. Gastric cancer patients are at high risk for malnutrition [2], the most common causes of malnutrition are tumour volume with early satiety or obstruction and metabolic alterations [3]. Malnutrition is associated with increase morbidity and mortality after major gastric surgery and a thorough nutritional screening of potentially surgical candidates for gastrectomy is mandatory as intervention prior to surgery can improve the nutritional status and surgical outcomes. An easy non-invasive method for nutritional status assessment is the questionnaire such as: The Short Nutritional Assessment Questionnaire (SNAQ) and Malnutrition Universal Screening Tool (MUST) which are mandatory in some western countries. Questionnaires are subjective methods to investigate nutritional status and methods that objectively measure patient's status are used: plasma serum markers and imaging studies. The aim of this study is the assessment of nutritional status of a large cohort of gastric cancer patients using objective markers and the correlation with the extent of the disease.

## Materials and Methods

We conducted a retrospective study using a prospective collected database of consecutive patients diagnosed with gastric cancer in a single institution (1<sup>st</sup> Surgical Unit, Regional Institute of Oncology Iași) between May 2012 and 2014. All the patients had histological confirmed disease. In all cases was performed preoperative staging which included:

upper gastrointestinal endoscopy with biopsy, abdominal computed tomography and staging laparoscopy (where indicated). Functional status of the patients was assessed in all patients by routine blood tests, electrocardiogram, chest radiography and cardiac ultrasound in patients with impaired cardiac function. Based on the results of preoperative staging all patients were suitable for surgical treatment in absence of distant metastases or peritoneal carcinomatosis. Types of surgery included: total or subtotal gastrectomy depending on the localisation of the tumour, reconstruction was performed in all cases using a Roux-en-Y anastomosis. Locally advanced tumours involving surrounding organs were not considered unresectable; in those cases a multiorgan resection was performed. In patients with total gastrectomy a D-2 lymphadenectomy was performed and in cases with subtotal gastrectomies a modified D-2 lymphadenectomy. For cases in which peritoneal carcinomatosis was found, or the tumour was locally advanced but non-resectable, a palliative procedure was performed: gastroenterostomy or feeding jejunostomy. In patients without tumour obstruction a laparoscopy/laparotomy was performed. We considered two groups of patients: patients in which resection was performed and patients in which a palliative procedures due to tumour extent or extensive carcinomatosis. Patient's functional status assessment included: ASA physical status [4], Charlson score [5] Karnofsky index. Indicators of immune and nutritional status of the patients were: body mass index (BMI), haemoglobin, white blood cells, lymphocyte counts, total proteins and albumin levels, Onodera index (prognostic

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nutritional index) calculated as  $10 \times \text{albumin (g/dl)} + 0.005 \times \text{total lymphocyte count (per mm}^3\text{)}$ . All nutritional factors were measured prior to surgery.

### Statistical Analysis

Continuous data were expressed as median and interquartile range. Categorical data were compared among the two groups using Fisher's exact test and continuous data using Mann-Whitney U test. A p-value less than 0.05 was considered significant. Statistical analysis was performed using MedCalc v.4.0.

### Results

During the study period there were 136 patients operated for gastric cancer (86 males (63.23%) and 49 females (36.02%)) with a mean age of 66.9 (65.24-68.69) years. Radical resections were performed in 81 patients (59.55%). There were performed 34 total gastrectomies and 47 subtotal gastrectomies. Palliative procedures included: gastroenterostomy in 17 cases, feeding gastrostomy/jejunostomy in 13 cases and laparoscopy / laparotomy in 25 cases. Patient's characteristics are described in Table I. According to the UICC TNM classification of malignant tumours 7<sup>th</sup> Edition, stage I tumours were present in 2.9% of cases, stage II was present in 18.38% of cases, stage III was present in 46.32% of cases and stage IV in 32.35% of all cases. Only 4 patients underwent preoperative chemotherapy, despite the fact that most of the patients were diagnosed with locally advanced tumours (stage III-IV). By performing a comparative analysis of the clinical and biological characteristics of the resected and unresected patients we observed no difference in terms of age ( $P=0.6$ ), preoperative haemoglobin ( $P=0.49$ ) and white blood cells counts ( $P=0.23$ ). Also there were no differences regarding the histological type (intestinal type vs. Signet ring cell,  $p=0.11$ ) and the localisation of the tumour ( $P=0.16$ ). The characteristics of those two subgroups of patients are summarised in Table II. By comparing the clinical and functional status of the patients there were statistical highly significant differences regarding the Charlson score ( $P=0.006$ ), Karnofsky score ( $P=0.007$ ) and the BMI ( $P=0.017$ ). Although there were no statistical significant differences regarding the blood total protein levels ( $P=0.09$ ), the patients in which resection was performed presented higher levels of albumin ( $P=0.0032$ ).

### Discussion

One of the most important predictor factors for postoperative morbidity or mortality and overall survival in cancer patients is represented by the nutritional status. Malnutrition is frequent encountered in gastric cancer patients, mainly due to the increased metabolic demands (especially after surgical intervention), insufficient nutrient intake (depression-associated anorexia, mechanical intake difficulties and the side effects of the chemotherapy). A significant weight loss (above 10% of the usual weight) is considered to be a indicator of severe malnutrition and it can be encountered in up to one third of the newly diagnosed gastric cancer patients [6]. In other studies, the significant weight loss varied was encountered in 21.6 and 50% [7,8]. We included in our study all the patients newly diagnosed with gastric cancer referred to our unit in which a form of surgical treatment was needed. Based on the results of our study, the respectability rate was 59.55%, lower than the reported radical resection rates for gastric cancer [9]. Surgery does not give any benefit in terms of survival for patients with metastatic disease (either peritoneal or in distant organs), therefore, it is important to evaluate the curability and to avoid an unnecessary exploratory surgery for those patients. Most of the patients diagnosed with gastric cancer presented locally advanced or metastatic tumours, due to the lack of screening programs and the late onset of diagnosis in a symptomatic patient. Based on the actual guidelines recommendations and the results of previous randomised studies in gastric cancer patients [10,11], most of the

patients with locally advanced tumours are candidates for preoperative chemotherapy. Beginning from 2015 all the patients with locally advanced gastric tumours (diagnosed on preoperative imaging or on staging laparoscopy) are submitted to neoadjuvant chemotherapy. One of the main purposes of our study was to see if there are any differences in the clinical and biological nutritional status in patients with resectable tumours and those with unresectable or metastatic gastric tumours. In our study the patients in which resection was not suitable presented lower Karnofsky indexes and lower Charlson comorbidities indexes, this was mainly caused by the effect of the advanced tumour on body biology (including the effects of malnutrition). Those patients presented lower albumin plasmatic levels, one of the most accurate tools to investigate the nutritional status. Moreover, the immune response was altered in those patients, they presented lower lymphocyte levels. The combination of albumin and lymphocytes formula (Onodera Index or Prognostic Nutritional Index) was, as expected, statistically significant different in the two subgroups of patients. This nutritional index was directly correlated with greater tumour depth, lymph node metastases, lymphatic permeation and venous invasion for gastric cancer patients [12]. Moreover, this index could be a novel indicator of the malignant potential of human tumours [13]. The fact that there were no differences of the nutritional status between those two subgroups regarding the tumour localisation on gastric wall, could be an indicator that the nutritional impairment mechanism in gastric cancer is more complex and it is not correlated with the possible mechanical effect of the tumour localised in the proximity of the cardia or the pylorus. Our study presents several limitations. We included in our study all the patients which were referred to our unit with a specific indication for surgery, and we excluded the patients diagnosed with gastric cancer which were not suitable for surgery (patients with metastatic disease or patient unfitted for surgery). The effect of those patients, with a probable impaired nutritional status could sustain the results of our study. Another limitation is represented by the indication of surgical treatment in patients with locally advanced tumours; those patients, based on the current recommendations, should have been submitted to neoadjuvant chemotherapy. The effect of the neoadjuvant chemotherapy on the nutritional status of those patients previous to surgery could be investigated in a future study with standardized and uniform procedures. Nonetheless, the present study gives an insight regarding some indicators of nutritional status in a relative large subgroup of patients. In conclusion, preoperative serum albumin levels and the prognostic nutritional index are significant predictors of unresectability in gastric cancer patients. This could be an indicator of a more advanced disease, such as local involvement or peritoneal/hepatic metastases which were not suspected on the initial staging of the patient. In our opinion, for a gastric cancer patient with an impaired nutritional status, in which the initial imaging examination do not reveal a locally advanced tumour or a metastatic disease, the

**Table I:** Patient's characteristics.

|                          |                          |
|--------------------------|--------------------------|
| <b>Age</b>               | <b>66.9(65.24-68.69)</b> |
| Gender(male /female)     | 86 / 49                  |
| Charlson score           | 4                        |
| Stage I                  | 4 pts                    |
| Stage II                 | 25 pts                   |
| Stage III                | 63 pts                   |
| Stage IV                 | 44 pts                   |
| <b>Type of resection</b> |                          |
| Total gastrectomy        | 34 pts                   |
| Subtotal gastrectomy     | 47 pts                   |
| <b>Tumour location</b>   |                          |
| Distal stomach           | 57 pts                   |
| Body                     | 80 pts                   |
| Upper stomach            | 26 pts                   |

**Table II:** Comparative analysis of the resected and unresected patients.

|                          | Resected patients (N=81 pts) | Unresected patients (N=55) | P value |
|--------------------------|------------------------------|----------------------------|---------|
| Age                      | 65.5 (63.45-67.7)            | 69 (66.1-71.8)             | 0.6     |
| Charlson score           | 3                            | 4                          | 0.006   |
| Karnofsky score          | 90 (80-90)                   | 80 (70-80)                 | 0.007   |
| BMI                      | 25.16 (24.06-26.25)          | 22.61(21.55-23.66)         | 0.017   |
| Hb                       | 10 (9.39-10.66)              | 10.9 (10.1-11.7)           | 0.49    |
| WBC                      | 7853 (7365-8340)             | 7363 (6675-8050)           | 0.23    |
| Lymphocytes              | 1647 (1502-1791)             | 1271 (1116-1426)           | 0.001   |
| Total proteins           | 66.7 (65.02-68.38)           | 63 (60.7-65.3)             | 0.09    |
| Albumine levels          | 37.76 (36.40-39.06)          | 36.17 (34.7-37.55)         | 0.03    |
| Onodera index            | 45.9 (44.29-47.64)           | 42.53 (40.9-44.15)         | 0.0032  |
| <b>Hystological type</b> |                              |                            |         |
| Intestinal               | 60                           | 38                         | 0.11    |
| Signet ring cells        | 12                           | 10                         |         |
| Undifferentiated         | 9                            | 7                          |         |
| <b>Tumour location</b>   |                              |                            |         |
| Distal stomach           | 33                           | 17                         | 0.16    |
| Body                     | 35                           | 25                         |         |
| Upper stomach            | 13                           | 13                         |         |

staging procedures should include a PET/CT or a echoendoscopy for a more accurate diagnosis.

#### Conflict of Interest

The authors report no conflict of interest. All the authors had a significant contribution to this paperwork.

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