Screening of malnutrition using Patient-Generated Subjective Global Assessment tool and hand muscle strength in subjects with pancreatitis

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Abstract

Background: Pancreatitis patients are at an increased risk of malnutrition due to impaired digestion, absorption, and metabolism. The degree of malnutrition is dependent on the duration, viz. acute or chronic. Studies on nutritional status in patients with pancreatitis are limited. Prevalence of nutritional status, physical functioning, and muscle strength among the subjects are scarce globally. The main aim of this study was to screen the status of malnutrition using appropriate screening tools and to assess hand muscle strength among subjects.

Method: A cross-sectional study was conducted on 64 subjects (18–80 years old, 59 males and 5 females) in Mysore city, Karnataka. The patients were screened for malnutrition using a standard tool Patient-Generated Subjective Global Assessment (PG-SGA) and handgrip strength on both dominant and nondominant hands.

Results: The majority of patients (n = 44) were categorized as moderately malnourished/suspected malnutrition (Stage B) according to PG-SGA. A significant difference (p < 0.005) in handgrip strength was seen in men aged 31–40 (t = −3.287) and 41–50 (t = −5.487) years compared to healthy adults.

Conclusion: This study was able to identify patients at risk of malnutrition when the PG-SGA tool was used along with handgrip strength and other anthropometric parameters.

KEYWORDS
handgrip strength, nutritional assessment, nutritional status, nutrition support, pancreatitis

Key points
- Fifty-eight percent of subjects belonged to the upper-lower socioeconomic class, with alcohol abuse in 80% of the subjects.
- The mean handgrip strength was lower compared to the normative mean in Indian adults.
- Patient-Generated Subjective Global Assessment score revealed Stage B of malnutrition.
- This study indicates the level of malnutrition among all the subjects irrespective of age or gender, leading to poor prognosis and increased length of stay among subjects; thus, early nutrition support may help in reducing the pain and reducing the length of stay in the hospital.

[Correction added on 21 October 2022, after first online publication: affiliation of second Author has been changed.]
1 | INTRODUCTION

Pancreatitis is defined as inflammation of the pancreas. The disease is broadly classified into acute pancreatitis (AP) and chronic pancreatitis (CP) based on the duration of the disease and the pathological and biochemical changes. The symptoms vary from mild abdomen pain to chronic malabsorption under a wide spectrum of reversible inflammation in AP and irreversible changes in CP, such as necrosis, calcification, fibrosis, and destruction of exocrine and endocrine functions of the pancreas.

The occurrence of malnutrition is a well-known fact among CP patients due to impaired digestion, absorption, and metabolism, which increases the further risk. National and international reports suggest that weight loss and malnutrition are the consequence of CP and can direct toward prognosis of the disease. The causative factor for malnutrition among patients are increased nutrient demands, increased metabolic activity, and reduced nutrient uptake and depletion along with stress and starvation. Malnutrition can also be seen in AP subjects as specific and nonspecific metabolic changes, even while the duration of the disease is short. The major reasons include pain in the abdomen, loss of appetite for more than a week, and vomiting/nausea in the initial days before admission, which leads to increased basal metabolic rate and higher nutrient demand. Nitrogen losses can increase up to 20–40 g/day, leading to decreased body storage of protein up to 20% within 5 days. In-hospital weight loss is most commonly seen among all patients due to various underlying causes, leading to increased mortality and morbidity. Alcohol intake being the major causative factor for pancreatitis can also hinder the absorption of nutrients and disturb the dietary patterns, leading to malnutrition even before the occurrence of disease in AP subjects. Early identification of malnutrition in the subjects can not only help in a better outcome but also reduces the length of stay (LOS), and reduces the recurrence and readmission. Prevalence of malnutrition status, physical functioning, and muscle strength among subjects is scarce; however, few studies conducted in various parts of India show the prevalence of malnutrition in both AP and CP patients.

Use of appropriate screening tools to identify malnutrition among patients is essential to prevent and manage malnutrition. Handgrip strength is one such tool that is used in a clinical setup to evaluate the musculoskeletal system for its functional integrity. A cross-sectional study reported a moderate to severe decline in muscle strength and physical endurance among AP outpatients. Also, these patients had decreased Mini Nutrition Assessment (MNA) scores and significantly lower scores on Short Form-36 domains (SF-36, a self-reported measure of health). There are no similar studies reporting the use of handgrip strength in pancreatitis patients in India.

An exploratory hospital-based study (n = 22) undertaken to assess the extent of malnutrition using body-weight and 24 h dietary recall revealed the presence of malnutrition as indicated by low body mass index (BMI) and low-calorie intake. This prompted us to use specific and sensitive tools to assess the degree of malnutrition along with clinical symptoms and biochemical status.

The objective of the study was to screen hospitalized patients for the presence of malnutrition and physical endurance using specific tools such as Patient-Generated Subjective Global Assessment (PG-SGA) and handgrip strength.

2 | METHODS

2.1 | Recruitment of subjects

The cross-sectional study was conducted in three multispecialty hospitals in Mysore city, Karnataka, India. Clearance from the respective Institutional Human Ethics committee and informed written consent were taken before collecting the data from patients.

Patients who were admitted to the gastroenterology and surgical ward with a diagnosis of pancreatitis (n = 64) within the age group of 18–80 years of both genders, with or without comorbidities and willing to participate were included during the study period (November 2020 to October 2021). Pregnant women and patients requiring surgical intervention were excluded from the study.

2.2 | Nutritional assessment

A standard screening tool PG-SGA was used. This tool is an interdisciplinary patient assessment tool with four components, such as weight history, food intake, symptoms, and activities and function. This also includes metabolic stress and nutritional physical examination and gives a global assessment score (A: well nourished; B: moderately malnourished/suspected malnutrition; C: severely malnourished).

Each patient was interviewed to obtain information on personal and medical history, clinical signs and symptoms, universal pain score, and lifestyle. Anthropometric information, including height, weight, BMI, mid-upper arm circumference (MUAC), triceps skin fold (TSF), and mid-upper arm muscle circumference (MUAMC), was measured using standard methods.

Muscle strength was measured using a handgrip dynamometer (Camray) in both dominant and non-dominant hands. Patients were made to sit on the chair
without an armrest, with a straight back, elbow flexed at 90°, and a neutral wrist position. Three readings were taken on both hands at 1 min interval to avoid muscle fatigue. The readings were taken in kilogram (kg) and grip strength was compared with the published data on healthy Indian subjects (n = 600) to identify muscle strength.

**Biochemical parameters:** Disease-specific parameters like amylase, lipase, alkaline phosphatase, liver function tests like aspartate aminotransferase (AST), alanine aminotransferase (ALT), albumin, globulin, total protein, total bilirubin, direct and indirect bilirubin, kidney function tests like urea and creatinine, hemoglobin, hematocrit, total leucocyte count, platelet count, and random blood glucose were recorded.

### 2.3 Statistical analysis

Descriptive statistics such as mean, standard deviation, and median were obtained. The data were subjected to the Shapiro–Wilks test for normality. The LOS showed normal distribution (p > 0.05) with respect to PG-SGA. Therefore, the parametric one-way analysis of variance was carried out to assess the influence of LOS on PG-SGA. One-sample t-test was carried out to see the significant difference between the normative mean and the sample mean of dominant and nondominant hand grip scores with respect to different age groups. Since the biochemical parameters were significantly deviating from a normal distribution (p < 0.05), the nonparametric Mann–Whitney U-test was carried out to assess the significant influence of diagnosis on biochemical parameters. A χ² test for association was performed to study the association between types of diagnosis and PG-SGA. The statistically significant values were compared with a 0.05 level of significance. The whole statistical analysis was done by using SPSS software (version 16.0; SPSS Inc.).

### 3 Results

#### 3.1 Demographic data

The total number of patients recruited for this study was 66, out of which 2 patients were excluded due to complications like sepsis and multiple organ failure. Out of 64 subjects, only 5 were women. A majority of the patients were from rural areas (64%) and hailed from villages around Mysore District, while the rest belonged to urban areas. The majority of the subjects were illiterate or had school education only. Fifty-eight percent belonged to the upper-lower socioeconomic class, while 34% were lower-middle class and only 8% belonged to the upper-middle class. χ² analysis of socioeconomic status and area of stay revealed a significant association (χ² = 17.80, p = 0.000) between low socioeconomic status and rural background (Table 1).

#### 3.2 Medical history and personal habits

Among the 64 patients, 44 were diagnosed with AP and 20 with CP. A small number of patients had comorbidities such as diabetes and hypertension (Figure 1). The majority of patients were <40 years (36 males). The etiology was alcohol abuse in 51 (80%) of all pancreatitis patients, and in the remaining, it was gallstone induced (6%). The majority of them were exposed to country liquor at a young age (16–18 years), continuing to consume liquor on a daily basis, the minimum quantity being 180 ml/day. About 28% of the patients were also reported to be chronic smokers. Fifty-two patients were reported to consume mixed types of diet, while only 12 were consuming a lacto-vegetarian diet. The majority were in the habit of skipping dinner due to the consumption of alcohol accompanied by fried foods. The majority reported having poor appetite (n = 46). None of the patients had consulted a dietitian nor were they on any oral pancreatic enzyme supplements.

#### 3.3 Clinical signs and symptoms

The major reason for hospital admission was abdominal pain (n = 61) and vomiting (n = 49) (Figure 2). As per the pain abdomen score, 22 had severe pain, while 34 could be categorized as having moderate pain score. Bilious and nonbilious vomiting was reported by 12 and 19 subjects, respectively.

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**Table 1**  Demographic profile of the 64 patients

| Demographic Profile | Frequency | χ² | p Value |
|---------------------|-----------|----|---------|
| **Gender**          |           |    |         |
| Female              | 5 (8)     |    |         |
| Male                | 59 (92)   |    |         |
| **Area**            |           |    |         |
| Urban               | 23 (36)   |    |         |
| Rural               | 41 (64)   |    |         |
| **Socioeconomic status score** | Urban | Rural | χ²       | p Value |
| Upper lower (5–10)  | 7         | 29 | 17.808 | 0.000* |
| Lower middle (11–15)| 10        | 12 |        |         |
| Upper middle (16–25)| 6         | 0  |        |         |

*Note: Data are shown as n (%). p < 0.01
SCREENING OF MALNUTRITION IN PANCREATITIS

**FIGURE 1** Medical history and personal habits

**FIGURE 2** Clinical signs and symptoms
3.4 | Anthropometric data

The anthropometric and hand muscle strength data are summarized in Table 2. Although the mean weight was similar in both groups of subjects, the mean BMI in men (21.98 ± 3.53) was lower than that in women (25.48 ± 6.50), indicating the overweight category. The TSF thickness in women was less than normal, which showed mild malnutrition (8.64 ± 5.41 mm), while the MUAC and MUAMC of both genders were in the normal cut-off range. The average handgrip strength in males was 28.99 ± 8.01 kg, while that in females was 24.30 ± 12.19 kg. The average nondominant hand in males was 28.80 ± 8.00 kg and that in females was 23.46 ± 12.41 kg.

3.5 | Handgrip strength

The mean handgrip strength, irrespective of age group (Tables 3 and 4), was lower compared to the normative mean in Indian adults10 in the dominant and nondominant hand, thus indicating the presence of chronic malnutrition.

3.6 | PG-SGA tool

Figure 3 and Table 5 show the classification of subjects according to PG-SGA scores, which revealed the presence of moderate malnutrition (Stage B) in the majority (n = 44) of the subjects irrespective of the duration of the disease.

More than 72% of subjects with AP exhibited moderate malnutrition. Although the average weight of both genders was similar, weight loss during the hospital stay was significantly (p = 0.000) higher among men (3.13 ± 2.48 kg) compared to that of women (1.79 ± 2.46 kg).

3.7 | Biochemical parameters

By comparing the mean biochemical parameters in both groups of subjects, it was observed that patients with CP had a lower range of parameters compared to patients with AP. This can be due to sustained adaptability to inflammation and repeated episodes of aggravation. Significant differences were observed in case of AST (p = 0.024), serum creatinine (p = 0.007), serum lipase (p = 0.014), and serum amylase (p = 0.029).

4 | DISCUSSION

The present study attempted to identify “at risk” patients who were diagnosed with pancreatitis. The data available on the nutritional status of Indian subjects are scarce. Nutrition assessment and intervention are the most neglected treatment for pancreatitis and can...
increase the risk of malnutrition among patients.\textsuperscript{8,9} Using the right assessment tool and technique is most important to identify patients at risk of malnutrition, intervene nutritionally, and determine a better prognosis.\textsuperscript{2,3,6,11} Catabolism of skeletal muscle is increased up to 80\% and nitrogen losses to as much as 20–40 g/day, thus leading to decreased stores of amino acid concentration to as much as 40\%.\textsuperscript{5,6,9} Our pilot study indicated that the presence of malnutrition among all patients with pancreatitis, most of whom were on a hypocaloric liquid diet or in a fasting state for more than 48 h, led to further weight loss during the hospital stay, which increased LOS.\textsuperscript{9} A similar outcome of malnutrition leading to the increase in LOS was reported in a review of the studies in AP subjects.\textsuperscript{12} Thus, the current study was designed based on the pilot study outcome and the requirement for a better assessment tool for early detection of malnutrition and intervention.\textsuperscript{13} Use of handgrip strength and PG-SGA tool thus were included in the present study to assess the hand muscle strength and the extent of malnutrition present.

The current study revealed that most of the subjects came from rural areas and had the least education or no education. Studies have shown positive results when nutritional status was assessed with simple measurements, and could predict the prognosis of pancreatitis irrespective of the types.\textsuperscript{6} The majority of the patients were categorized as an upper lower class of socioeconomic status according to the modified Kuppuswamy score.\textsuperscript{8} Alcohol consumption and gallstone obstruction were the major etiology identified in this study, similar to two other Indian studies conducted in eastern Indian and in rural Indian populations.\textsuperscript{1,4} Even though subjects were from the lower economic group, daily consumption of alcohol was observed. It was also observed that subjects from rural backgrounds had higher consumption of alcohol and smoking compared to the urban group. This can be attributed to lower education qualifications, less knowledge of the ill effects of alcohol, and easy access to alcohol at local outlets selling local brands at cheaper prices compared to branded liquor. One of the studies reported a mean age group of 40.9 years, with the highest incidence among 36–45 years old,\textsuperscript{5} another study reported a similar mean age group of 34.5 years,\textsuperscript{4} and the current study also showed similar reports of the mean age group of 39.56 ± 13.76 years among men. Indulgence in alcohol in the younger age group of men is seen across the globe. Introduction to alcohol in age as less as 16–18 years has been observed among subjects, leading to addiction and daily consumption. Men were more involved in these exposures compared to women. Women who were diagnosed were with other etiology like gall stones and idiopathic causes.

Since the majority of the patients were in the younger age group, comorbidities like diabetes, hypertension, and

![FIGURE 3 Patient-Generated Subjective Global Assessment tool (PG-SGA)](image)

**TABLE 5** PG-SGA score in acute and chronic pancreatitis group

| Variables               | Male          | Female        |
|-------------------------|---------------|---------------|
| Weight on admission (kg)| 61.24 ± 1.04  | 61.15 ± 1.36  |
| Weight on discharge (kg)| 57.79 ± 1.05  | 56.2 ± 1.17   |
| Weight loss (kg)        | 3.13 ± 2.48   | 1.79 ± 2.46   |
| t (df)                  | 8.20 (58)     | 1.623 (4)     |
| p Value                 | 0.000*        | 0.180         |

Note: Data are shown as mean ± SD.
Abbreviation: PG-SGA, Patient-Generated Subjective Global Assessment.
*p < 0.01.
cardiovascular diseases were uncommon. It was observed that the majority of the patients were admitted for the first time and were diagnosed with AP. Clinical signs and symptoms like pain abdomen, nausea, vomiting, occasionally diarrhea, dyspnea, and fever were common among subjects, which are similar to most of the studies reported on pancreatitis.\textsuperscript{1,4,6,14} Selection of proper assessment tool is important for early detection of malnutrition, but studies that have used MNA and Malnutrition Universal Screening Tool (MUST) could not identify percent weight loss and reduction in food intake in past months, as well as the severity of disease; thus, the PG-SGA tool was used for assessment and it showed that most of the patients were suspected to have malnutrition (Stage B) and the occurrence of malnutrition was even before the disease sets in. This is due to the major etiological factor being alcohol and decreased nutrient absorption and deficiencies, along with probable disturbances in the meal due to alcohol intake.\textsuperscript{1,3,5,15} Other anthropometric assessments of MUAC and TSF also showed lower values compared to the normal cut-off for Indians. Similar results were obtained in one of the studies conducted on nutritional assessment of CP versus tropical pancreatitis.\textsuperscript{16} Weight loss that occurred recently during the course of the disease was higher among men compared to women and the BMI of men was categorized under normal cut-off, while women were under the overweight category. This might be attributed to the common etiology of gall stone among women. Weight loss during the hospital stay is mainly due to hypocaloric liquids prescribed initially during hospitalization and starvation due to symptoms. No studies have assessed food intake during the hospital stay or after the onset of pancreatitis. Malnutrition during hospital stay was higher among men compared to women. This may be attributed to decreased absorption due to alcohol consumption among men. Handgrip strength helps identify muscle strength related to good nutritional status.\textsuperscript{4} The mean value of handgrip strength on dominant and nondominant hands was lower in patients compared to that in the healthy population taken from published data.\textsuperscript{7} The study showed significance among the 31–40 and 41–50 years age group.

Another study reported similar observations of decreased muscle strength in chronic pancreatitis subjects when compared to healthy adults.\textsuperscript{5} Irrespective of the type of pancreatitis, it was evident that malnutrition was present among all the subjects.

This study also showed that chronic pancreatitis patients had lower ranges of biochemical parameters when compared to AP subjects, even though both of them were elevated. Significance was seen in serum amylase, lipase, AST, and creatinine values. These observations revealed that patients with CP had repetitive episodes, less severe pain, and physiological adaptability when compared to AP patients with sudden onset and higher levels of pain scale and biochemical parameters.

In conclusion, the study showed similar results in various aspects when compared to other Indian studies and could identify patients “at risk” of malnutrition. PG-SGA can be a better tool in identifying malnutrition when used along with other anthropometric data and hand grip strength. Irrespective of the type of pancreatitis, malnourishment was seen among all patients. Malnourished patients had poor outcomes, increased LOS, and increased risk of mortality and morbidity.\textsuperscript{17} This can be reduced with early nutrition support either via oral, enteral, or parenteral route.\textsuperscript{14,17,18}

**AUTHOR CONTRIBUTIONS**

Akshatha Nagaraj Thantry: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; validation; visualization; roles/writing–original draft; writing–review & editing. Asna Urooj: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; roles/writing–original draft; writing–review and editing. Dinesh Halumathigatta Nagappa: Acquisition of data; validation; review of the original draft.

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**CONFLICT OF INTEREST**

The authors declare no conflict of interest.

**DATA AVAILABILITY STATEMENT**

To maintain the confidentiality of the patients, data are not available.

**ETHICS STATEMENT**

Clearance from the respective Institutional Human Ethics committee (University of Mysore, three hospitals) was obtained (IEC-JSS Medical College-JSSMC/IEC/0503/12NCT/2019-20-11.03.2020; IEC-Columbia Asia hospital Mysore dated 30.04.2019; IEC/IRB MMC& RI dated 18.09.2020 and IHEC-UOM No. 159/PhD/2018-19). Informed written consent was taken before collecting the data from patients.

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