

ORIGINAL ARTICLE

Nutritional assessment in patients with double malignant obstruction: Biliary and duodenal

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ABSTRACT

Background and aim: Biliary tract and pancreatic cancers are associated with poor prognosis due to rapid disease progression and frequent complications, including malignant biliary and duodenal obstruction. This study aimed to assess the nutritional status of patients presenting with simultaneous biliary and duodenal stenosis and to evaluate its impact on their overall condition and quality of life.

Methods: A retrospective study was conducted among 200 patients hospitalized at Ibn Sina University Hospital, Rabat, for malignant obstruction. Of these, 110 patients had isolated biliary stenosis (Group 1), while 90 had combined biliary and duodenal stenosis (Group 2). Clinical, anthropometric (weight, height, BMI), and biological parameters (albumin, bilirubin, CRP), as well as vomiting frequency and Nutritional Risk Index (NRI), were recorded. Data were analyzed using SPSS, with $p < 0.05$ considered statistically significant.

Results: The study population included 54.5% men and 45.5% women, with a mean age of 56.7 years. Compared with Group 1, patients in Group 2 had significantly lower weight (47.4 ± 5.4 kg vs 57.4 ± 9.3 kg, $p < 0.001$), BMI (15.9 ± 2.0 vs 20.0 ± 3.3 kg/m²), and serum albumin (26.1 g/L vs 29.3 g/L). Higher bilirubin and CRP levels were also observed in Group 2. Severe malnutrition was present in 100% of Group 2 versus 76.3% of Group 1. Daily vomiting occurred in 84.4% and 16.3% of cases, respectively ($p < 0.001$).

Conclusions: Double malignant obstruction has a profound negative impact on nutritional status and quality of life. Early nutritional assessment, timely intervention, and a coordinated multidisciplinary palliative approach are essential to improve clinical outcomes in this particularly vulnerable patient population.

Key words: duodenal strictures, biliary strictures, nutritional status, undernutrition, assessment.



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Introduction

Biliary and pancreatic neoplasia have an extremely poor prognosis, even when diagnosed at an early stage. Indeed, at initial presentation, 50% of patients already have liver or other distant metastases, and over 80% have locally advanced tumours (1). Patients with malignant obstructive jaundice and duodenal obstruction are in a poor condition or the tumor has already invaded the surrounding tissue or organs, thus tumor excision is no longer possible (2,3). These obstructive tumors translate to symptoms including severe obstructive jaundice, dark urine, itching, severe nausea, vomiting, intolerance to oral food and abdominal pain (4), all of which clearly alter the nutritional status of these patients and lead to progressive deterioration in quality of life and limited life expectancy.

Improving nutritional status in patients with malignant obstructive jaundice and duodenal obstruction requires a multidisciplinary approach that includes relieving obstructions via biliary drainage or duodenal stenting (5) and providing tailored nutritional support through enteral or parenteral nutrition, along with enzyme and micronutrient supplementation (6,7) Regular monitoring using validated tools like the CONUT score and Nutritional Risk Index helps guide interventions and predict outcomes (8).

The aim of our study was to analyze the nutritional status of patients with both biliary obstruction and duodenal malignant obstruction, and comparing it with patients with biliary stenosis only using Nutritional Risk Index (NRI).

Materials and Methods

This retrospective analysis included 200 adult patients with malignant stenosis who were hospitalized at Ibn Sina University Hospital in Rabat, Morocco. Among them, 110 patients had only biliary stenosis, while 90 had associated biliary and duodenal stenosis. Collected data included patient demographics (weight, height, BMI, and weight variation), biological parameters (albumin [ALB], bilirubin [BLT], and C-reactive protein [CRP]), frequency of vomiting, and Nutritional Risk Index (NRI) to assess the patients'

nutritional status. The frequency of vomiting is also recorded according to recurrence: Daily, Occasional or Absent. Malnutrition was defined by calculating the nutritional risk index (NRI) using the following equation:

$$NRI = (1.519 \times ALB (g/l) \times (0.417 \times (poids\ actuel \div poids\ normal))) \times 100$$

Statistical analyses were performed using SPSS version 26 software. The independent-samples t-test was used to compare the mean of nutritional status evaluation parameters. $P < 0.05$ was considered statistically significant.

Results

Data were analyzed by comparing two patient cohorts: Group 1 comprised individuals with isolated biliary obstruction, whereas Group 2 included patients presenting with concurrent biliary and duodenal obstruction.

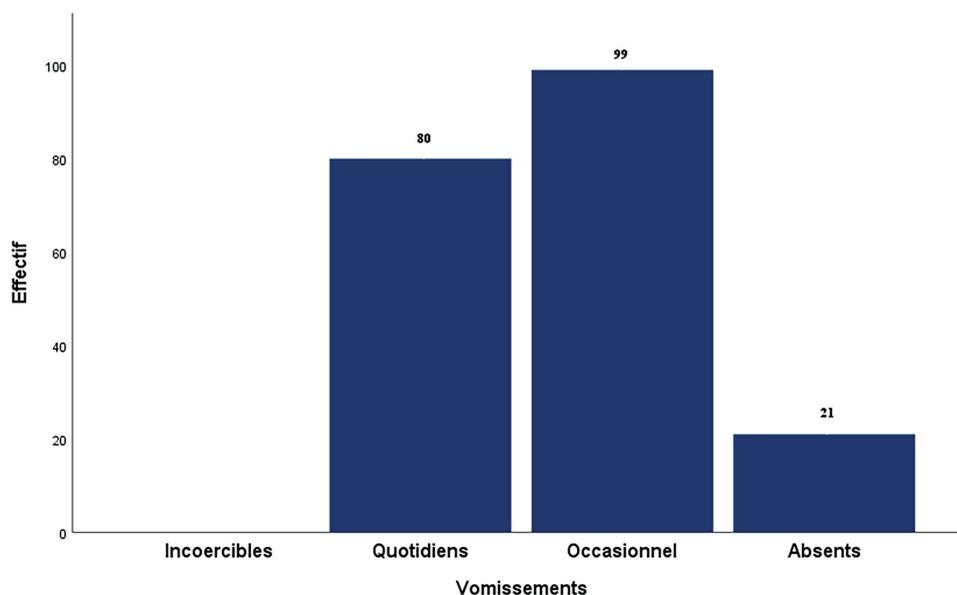
Patients characteristics

As shown in the Table 1 the median age of the patients was 59.7 years (range: 18–96 years); 109 (54.5%) were male and 91 (45.5%) were female. Among all patients included in the study, 45% presented with combined biliary and duodenal obstruction, while 55% had isolated biliary obstruction.

The mean body weight of patients was 53.20 ± 9.28 kg, with a mean body mass index (BMI) of 18.31 ± 3.46 kg/m². A total of 113 patients (56.6%) had a BMI < 18.5 kg/m², indicating undernutrition. All patients experienced significant disease-related weight loss, with a mean weight reduction of 27.66%; notably, 135 patients (67.5%) had a weight loss exceeding 20%. Laboratory investigations revealed hypoalbuminemia (serum albumin < 35 g/L) in 89% of patients, with a mean albumin level of 27.86 ± 4.01 g/L. Elevated C-reactive protein (CRP > 6 mg/L) was observed in 99% of patients, with a mean CRP value of 64.14 ± 9.9 mg/L. Total bilirubin levels were > 200 mg/L in 54.5% of patients and between 100 and 200 mg/L in 29.5%. Figure 1 show that 40% of patients

Table 1. Results of nutritional status assessment for all patients

Parameters	Average \pm SD or percentage % of average	Reference value	Number of patients N
Size (cm)	168.54 \pm 6.72 cm		
Weight (kg)	53.20 \pm 9.28 kg		
BMI (kg/m ²)	18.31 \pm 3.46 kg/m ²	BMI<18.5 kg/m ² BMI<25 kg/m ²	N=113 N=82
Weight variation (%)	27.66%	Weight variation >20	N=135
CRP (mg/l)	64.14 \pm 9.9 mg/l	CRP>6 mg	N=198
ALB (g/l)	27.86 \pm 4.01 g/l	ALB<35 g/l	N=178
BLT (mg/l)	203.34 \pm 108.1 mg/l	BLT<50mg/l 50mg/l<BLT<100mg/l 100mg/l<BLT<200mg/l BL>200 mg/l	N=14 N=18 N=59 N=109

**Figure 1.** Frequency of vomiting according to recurrence

vomited daily, 49.5% occasionally and 10.5% did not. Calculation of the nutritional risk index showed a percentage of 80.5% of patients with severe undernutrition and 19.5% with moderate undernutrition (Figure 2).

Assessment of nutritional status according to type of obstruction

ASSESSMENT OF ANTHROPOMETRIC PARAMETERS

As presented in Table 2, the mean body weight of patients with isolated biliary obstruction (Group 1)

was 57.39 \pm 9.31 kg, whereas patients with concurrent biliary and duodenal obstruction (Group 2) had a significantly lower mean weight of 47.38 \pm 5.39 kg ($p = 0.000$). A similar trend was observed for body mass index (BMI), with Group 1 exhibiting a mean BMI of 20.04 \pm 3.27 kg/m² compared to 15.95 \pm 2.05 kg/m² in Group 2; this difference was also statistically significant ($p = 0.000$). Comparative analysis according to tumor location (perihilar vs. periampullary) showed no significant difference in terms of weight, BMI, albuminemia and CRP ($p > 0.05$) (Table 3).

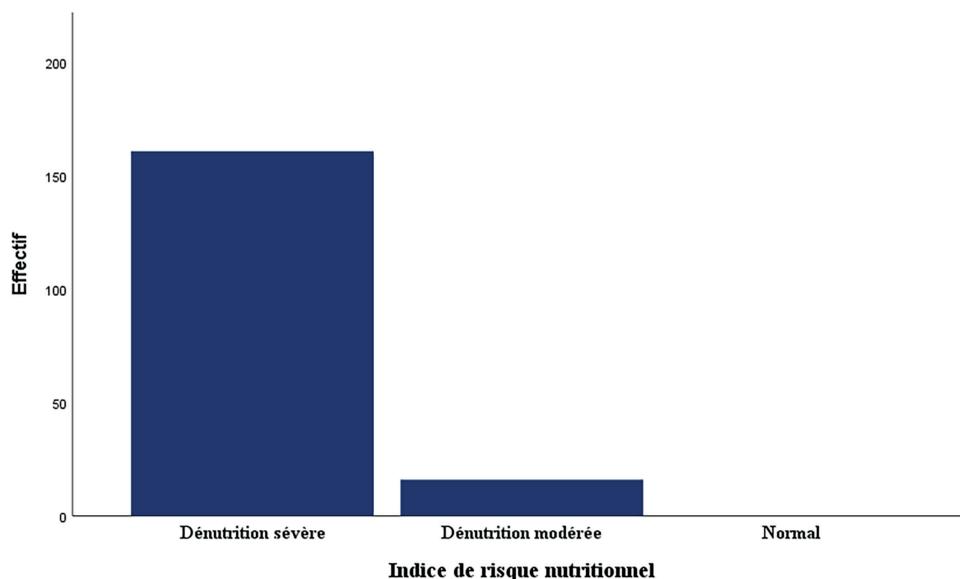


Figure 2. Nutritional status of patients according to the NRI nutritional risk index

Table 2. Assessment of anthropometric and biological parameters in both groups

	Biliary obstruction Average (\pmSD)	Biliary and duodenal obstruction Average (\pmSD)	P
Weight (kg)	57.39 \pm 9.31 kg	47.38 \pm 5.39 kg	0.000
BMI (kg/m ²)	20.04 \pm 3.27 kg/m ²	15.95 \pm 2.05 kg/m ²	0.000
Total bilirubin (mg/l)	197.75 \pm 76.5mg/	207.75 \pm 11.5 mg/l	0.5
Albumin (g/l)	29.27 \pm 4.17g/l	26.07 \pm 3.01g/l	0.000
C-reactive protein (mg/l)	60.96 \pm 6.09mg/l	66.51 \pm 12.5mg/l	0.7

Assessment of biological parameters

The mean total bilirubin level was 197.75 \pm 76.5 mg/L in Group 1 and 207.75 \pm 11.5 mg/L in Group 2; this difference was not statistically significant ($p = 0.5$). In contrast, serum albumin levels differed significantly between the two groups, with a mean of 29.27 \pm 4.17 g/L in Group 1 and 26.07 \pm 3.01 g/L in Group 2 ($p = 0.000$). Regarding C-reactive protein (CRP), Group 1 had a mean level of 60.96 \pm 6.09 mg/L compared to 66.51 \pm 12.5 mg/L in Group 2, a difference that was not statistically significant ($p = 0.7$). Patients with perihilar tumors exhibited significantly higher mean total bilirubin levels compared to those with periampullary tumors (223.66 \pm 103.32 mg/L vs. 187.10 \pm 98.45 mg/L; $p = 0.01$). This difference is

likely attributable to the anatomical location of perihilar obstructions, which more severely compromise bile drainage (Table 3).

Assessment of nutritional parameters

The results of this assessment are summarized in Table 4. Based on the Nutritional Risk Index (NRI), 76.3% of patients in Group 1 were classified as severely undernourished, while 23.6% were moderately undernourished. In contrast, 100% of patients in Group 2 were severely undernourished, with the difference in nutritional status between the two groups reaching statistical significance ($p = 0,000$). Regarding vomiting frequency, 16.3% of patients in Group 1 experienced daily vomiting compared to 84.4% in Group 2.

Table 3. Assessment of anthropometric and biological parameters in both groups

	Perihilar Average (±SD)	Periampullary Average (±SD)	P
Weight (kg)	53.29 ± 8.59 kg	53.36 ± 9.79 kg	0.9
BMI (kg/m ²)	18.36 ±3.31 kg/m ²	18.28 ± 3.36 kg/m ²	0.8
Total bilirubin (mg/l)	223.66 ± 103.32 mg/l	187.10 ± 98.45 mg/l	0.01
Albumin (g/l)	27.66 ± 3.87 g/l	27.96 ± 4.12g/l	0.6
C-reactive protein (mg/l)	58.19 ±6.09mg/l	66.51 ± 12.5mg/l	0.5

Table 4. Assessment of nutritional parameters

	Biliary obstruction	Biliary and duodenal obstruction	P
NRI			0.000
-Severe undernutrition	84 (76.3%)	90 (100%)	
-Moderate undernutrition	26 (23.6%)	0 (0%)	
Normal	0 (0%)	0 (0%)	
Vomiting			0.000
-Dailies	18 (16.3%)	76 (84.4%)	
-Occasional	71 (64.5%)	14 (15.5%)	
-Absent	21(19.09%)	0 (0%)	

Table 5. Assessment of nutritional parameters

	Perihilar	Periampullary	P
NRI			0.3
-Severe undernutrition	86 (93.4%)	99 (91.6%)	
-Moderate undernutrition	6 (6.5%)	9 (8.3%)	
Normal	0 (0%)	0 (0%)	
Vomiting			0.8
-Dailies	36 (39.1%)	45 (41.6%)	
-Occasional	47 (51.08%)	51 (47.2%)	
-Absent	9 (9.78%)	12 (11.1%)	

Occasional vomiting was reported by 64.5% of Group 1 and 15.5% of Group 2 patients, while 19.1% of patients in Group 1 reported no vomiting. As shown in Table 5, comparison between patients with perihilar and periampullary tumors revealed no statistically significant difference in nutritional status based on the Nutritional Risk Index (NRI) (p = 0.3). Severe undernutrition was predominant in both subgroups, affecting 93.4% of patients with perihilar tumors and 91.6% of those with periampullary tumors. Similarly, vomiting frequency did not differ significantly between the groups, with daily vomiting reported in 39.1%

of perihilar cases and 41.6% of periampullary cases (p = 0.8); rates of occasional and absent vomiting were also comparable.

Discussion

Patients diagnosed with malignancies of the hepatobiliary and pancreatic systems often present at advanced stages of disease, with up to 80% showing locally advanced tumors and 50% exhibiting distant metastases at the time of diagnosis (9,10). In this context,

the development of double malignant obstruction; comprising both biliary and duodenal stenosis is a severe complication that profoundly affects patient survival, symptom burden, and most critically, nutritional status. The study conducted at Ibn Sina University Hospital in Rabat highlights the alarming prevalence and severity of undernutrition in patients with malignant biliary and duodenal obstruction. The Nutritional Risk Index (NRI), a validated and widely adopted tool for nutritional assessment in oncology, has been shown to predict malnutrition and poor outcomes in cancer patients (11–13). The study found that 100% of patients with double obstruction were severely malnourished, as compared to 76.3% of those with isolated biliary stenosis ($p = 0.000$). This observation underscores the exacerbated catabolic state induced by gastrointestinal obstruction, chronic inflammation, and tumor-induced metabolic demand.

The significant decrease in BMI ($15.95 \pm 2.05 \text{ kg/m}^2$ vs. $20.04 \pm 3.27 \text{ kg/m}^2$) and serum albumin ($26.07 \pm 3.01 \text{ g/L}$ vs. $29.27 \pm 4.17 \text{ g/L}$) observed in patients with both malignant biliary and duodenal obstructions reflects a severe deterioration in nutritional status. These findings are consistent with studies on advanced pancreatic and periampullary cancers, in which hypoalbuminemia ($< 3.5 \text{ g/dL}$) is associated with reduced overall survival, and low BMI ($< 18.5 \text{ kg/m}^2$) correlates with poor prognosis and decreased treatment efficacy (14–16). Additionally, vomiting, a major contributor to reduced oral intake and nutrient absorption, was markedly more frequent in patients with double obstruction (daily in 84.4% vs. 16.3% in isolated biliary stenosis), highlighting the mechanical and functional impact of duodenal narrowing. This further explains the poor nutritional indicators observed in this group. Combined biliary and duodenal obstruction commonly occurs in locally advanced pancreatic head, ampullary, or perihilar cholangiocarcinomas, which anatomically invade both the bile ducts and the duodenum. This dual obstruction leads to cholestasis, pancreatic enzyme insufficiency, nausea, vomiting, and severe anorexia, markedly impairing nutrient absorption (17,18). Elevated CRP levels and hypoalbuminemia in our cohort reflect the systemic inflammatory response induced by malignancy and obstruction, which contributes to protein-energy wasting and

hypoalbuminemia (19,20). These findings emphasize the importance of early and appropriate nutritional support in patients with malignant gastrointestinal obstruction. According to ESPEN guidelines, enteral nutrition should be initiated when feasible, while parenteral nutrition is recommended when oral or enteral routes are not possible due to obstruction (21,22). Additionally, biliary stenting and endoscopic duodenal stenting, particularly using a double stenting approach, should be considered to relieve both biliary and duodenal obstruction, facilitate oral intake, and thereby improve nutritional outcomes and quality of life (23,24). Given the severity of undernutrition in patients with double obstruction, routine nutritional screening using tools like the Nutritional Risk Index (NRI) or similar should be integrated into management protocols to allow for timely interventions (25). Additionally, supplementation with pancreatic enzyme replacement therapy (PERT) as well as trace elements and micronutrients is recommended to address malabsorption and deficiency states frequently seen in these patients (26,27). Interestingly, the study did not find significant differences in nutritional parameters when comparing perihilar and periampullary tumors, except for bilirubin levels, which were higher in perihilar cases ($223.66 \pm 103.32 \text{ mg/L}$ vs. $187.10 \pm 98.45 \text{ mg/L}$; $p = 0.01$). This can be attributed to the more proximal nature of perihilar obstructions, which tend to cause complete bile flow blockage, leading to more severe jaundice. However, the nutritional consequences remained severe across both groups, further emphasizing the need for uniform nutritional strategies regardless of tumor origin.

Conclusions

This study highlights the severe nutritional deterioration in patients with concurrent malignant biliary and duodenal obstruction. Compared to those with isolated biliary stenosis, these patients exhibit significantly lower body weight, BMI, and serum albumin levels. The frequency of daily vomiting is markedly higher in the double obstruction group, further exacerbating nutritional decline. All patients with double obstruction were classified as severely undernourished using the Nutritional Risk Index. These findings emphasize

that malnutrition is not merely a consequence of cancer but a critical comorbidity that influences prognosis and treatment outcomes. Effective management must include early nutritional screening and individualized interventions. Endoscopic or surgical decompression, combined with tailored enteral or parenteral nutrition, is essential to restore and maintain nutritional balance. Multidisciplinary collaboration is crucial in delivering comprehensive care to these patients. The anatomical location of the tumor (perihilar vs. periampullary) appears less relevant than the functional impact of obstruction on nutritional status.

Ethic Approval: This is a retrospective non-interventional study exempt from the requirement for ethics approval

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Declaration on the Use of AI: None.

References

1. Abraham NS, Barkun JS, Barkun AN. Palliation of malignant biliary obstruction: a prospective trial examining impact on quality of life. *Gastrointest Endosc.* 2002;56(6):835-41. doi: 10.1067/mge.2002.129868.
2. Fábán A, Bor R, Gede N et al. Double Stenting for Malignant Biliary and Duodenal Obstruction: A Systematic Review and Meta-Analysis. *Clin Transl Gastroenterol.* 2020;11(4):e00161. doi: 10.14309/ctg.000000000000161.
3. Zhao L, Xu H, Zhang Y. Palliation double stenting for malignant biliary and duodenal obstruction. *Exp Ther Med.* 2016;11(1):348-352. doi: 10.3892/etm.2015.2875.
4. Yu J, Hao J, Wu D, Lang H. Retrospective evaluation of endoscopic stenting of combined malignant common bile duct and gastric outlet-duodenum obstructions. *Exp Ther Med.* 2014;8(4):1173-1177. doi: 10.3892/etm.2014.1899.
5. Mutignani M, Tringali A, Shah SG, et al. Combined endoscopic stent insertion in malignant biliary and duodenal obstruction. *Endoscopy.* 2007;39(5):440-7. doi: 10.1055/s-2007-966327.
6. Bozzetti F. Nutritional Support in Oncologic Patients: Where We Are and Where We Are Going. *Clinical Nutrition.* 2011;30:714-717. <http://dx.doi.org/10.1016/j.clnu.2011.06.011>
7. Cotogni P, Stragliotto S, Ossola M, Collo A, Riso S, On Behalf Of The Intersociety Italian Working Group For Nutritional Support In Cancer. The Role of Nutritional Support for Cancer Patients in Palliative Care. *Nutrients.* 2021;13(2):306. doi: 10.3390/nu13020306.
8. Yu M, Li X, Chen M, et al. Prognostic potential of nutritional risk screening and assessment tools in predicting survival of patients with pancreatic neoplasms: a systematic review. *Nutr J.* 23,17(2024). <https://doi.org/10.1186/s12937-024-00920-w>
9. Tempero MA, Malafa MP, Al-Hawary M, et al. Pancreatic Adenocarcinoma, Version 2.2021, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw.* 2021;19(4):439-457. doi: 10.6004/jnccn.2021.0017.
10. Huang L, Wang F, Wang F, et al. Anatomical classification of advanced biliary tract cancer predicts programmed cell death protein 1 blockade efficacy. *Front Pharmacol.* 2024;15:1375769. doi: 10.3389/fphar.2024.1375769.
11. Lin F, Xia W, Chen M, et al. A prognostic model based on nutritional risk index in operative breast cancer. *Nutrients.* 2022;14(18):3783.
12. Jiao Z, Liang C, Luo G, et al. Prognostic utility of nutritional risk index in patients with head and neck soft tissue sarcoma. *Nutrients.* 2023;15(3):641.
13. Zhang L, Chen S, Huang M, et al. Prognostic value of the nutritional risk index in patients with newly diagnosed multiple myeloma. *Ann Hematol.* 2023;102(1):125-32.
14. Cui L, Yu H, Sun Q, Miao Y, Jiang K, Fang X. Effects of body mass index and serum albumin on overall survival in patients with cancer undergoing pancreaticoduodenectomy: a single-center retrospective cohort study. *World J Surg Oncol.* 2022;20(1):221. doi: 10.1186/s12957-022-02678-z.
15. Fu N, Jiang Y, Qin K, Chen H, Deng X, Shen B. Higher body mass index indicated better overall survival in pancreatic ductal adenocarcinoma patients: a real-world study of 2010 patients. *BMC Cancer.* 2021;21(1):1318. doi: 10.1186/s12885-021-09056-0.
16. Jachnis A, Słodkowski MT. The Relationship between Nutritional Status and Body Composition with Clinical Parameters, Tumor Stage, CA19-9, CEA Levels in Patients with Pancreatic and Periampullary Tumors. *Curr Oncol.* 2021;28(6):4805-4820. doi: 10.3390/curroncol28060406.
17. Mutignani M, Tringali A, Shah SG, et al. Combined endoscopic stent insertion in malignant biliary and duodenal obstruction. *Endoscopy.* 2007;39(5):440-7. doi: 10.1055/s-2007-966327.
18. Gupta D, Lis CG. Pretreatment serum albumin as a predictor of cancer survival: a systematic review of the epidemiological literature. *Nutr J.* 2010;9:69. doi: 10.1186/1475-2891-9-69.
19. Fearon K, Strasser F, Anker SD, et al. Definition and classification of cancer cachexia: an international consensus.

- Lancet Oncol. 2011;12(5):489-95. doi: 10.1016/S1470-2045(10)70218-7.
20. Gray S, Axelsson B. The prevalence of deranged C-reactive protein and albumin in patients with incurable cancer approaching death. *PLoS One*. 2018;13(3):e0193693. doi: 10.1371/journal.pone.0193693.
 21. Muscaritoli M, Arends J, Bachmann P, et al. ESPEN practical guideline: Clinical nutrition in cancer. *Clin Nutr*. 2021;40(5):2898-2913.
 22. Bozzetti F, Arends J, Lundholm K, et al. ESPEN guidelines on parenteral nutrition: non-surgical oncology. *Clin Nutr*. 2009;28(4):445-54
 23. Mutignani M, Tringali A, Shah SG, et al. Combined endoscopic stent insertion in malignant biliary and duodenal obstruction. *Endoscopy*. 2007;39(5):440-447.
 24. Tonozuka R, Itoi T, Baron TH, et al. Endoscopic double stenting for malignant biliary and duodenal obstruction due to pancreatic cancer. *Dig Endosc*. 2013;25(3):241-248.
 25. Dominguez-Muñoz JE, Vujasinovic M, De La Iglesia D, et al. European guidelines for the diagnosis and treatment of pancreatic exocrine insufficiency: UEG, EPC, EDS, ESPEN, ESPGHAN, ESDO, and ESPCG evidence-based recommendations. *United European Gastroenterol J*. 2025;13(1):125-172. doi: 10.1002/ueg2.12674.
 26. Rasmussen HH, Irtun O, Olesen SS, Drewes AM, Holst M. Nutrition in chronic pancreatitis. *World J Gastroenterol*. 2013;19(42):7267-75. doi: 10.3748/wjg.v19.i42.7267.
 27. Peery AF, Crockett SD, Murphy CC, et al. Nutrition management in acute and chronic pancreatic disease: importance of enzyme replacement and micronutrient correction. *World Gastroenterol Org Expert Views*. 2022;162(2):621-644.

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