

The Impact of Chemotherapy on Nutritional Status

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Article History: | Received: 08.03.2024 | Accepted: 21.04.2024 | Published: 26.04.2024 |

Abstract: Introduction: A state of malnutrition is so commonly associated with tumor disease that it is often considered an integral part of the evolution of cancers. **Materials and Methods:** This is a prospective monocentric study carried out in the Medical Oncology department of the PHE of Laghouat. Patients with cancer and followed in this service between October 4, 2020 and November 26, 2020 have been included. The main objective was to study the impact of chemotherapy on the nutritional status of cancer patients by assessing the nutritional status and quantifying its anthropometric and biological parameters. Malnutrition is defined as weight loss $> 5\%$ in one month or $> 10\%$ in six months and/or body mass index $\leq 18,5 \text{ kg/m}^2$ and/or albuminemia 30 g/L in adult patients aged < 70 and by weight loss 5% in one month or 10% in six months and/or body mass index $\leq 21 \text{ kg/m}^2$ and/or albuminemia 35 g/L in patients aged ≥ 70 . **Results:** This study included 123 patients with a sex ratio of 0.6 and an average age of 51.81 ± 14.33 years who were sectioned into 2 groups: undernutrition with a weight loss greater than 5% of usual weight and or $\text{BMI } 18,5 \text{ kg/m}^2$ and or albuminemia 30 g/L (in 70-year-old patients) and or $\text{BMI } 21 \text{ kg/m}^2$ and or albuminemia 35 g/L (in 70-year-old patients) ($n=16, 13\%$) and those without malnutrition ($n=107, 87\%$). Men accounted for 34.6% of the not undernourished population and 56.3% of the malnourished population. The weight change in the undernourished group was on average $-1.12\% \pm 5.4$ with 30.1% of undernourished people have $\text{PDP} > 5\%$ and 81.26% were on chemotherapy. The mean BMI of the undernourished population is 18.63 kg/m^2 3.98 and the mean albumin is 35.65 g/L 3.68 in the undernourished population. **Discussion and Conclusion:** The undernutrition of cancer patients is common and associated with less benefit from chemotherapy and a derogatory prognosis.

Keywords: Cancer, Nutrition, Chemotherapy, Weight loss, BMI, Albumin.

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INTRODUCTION

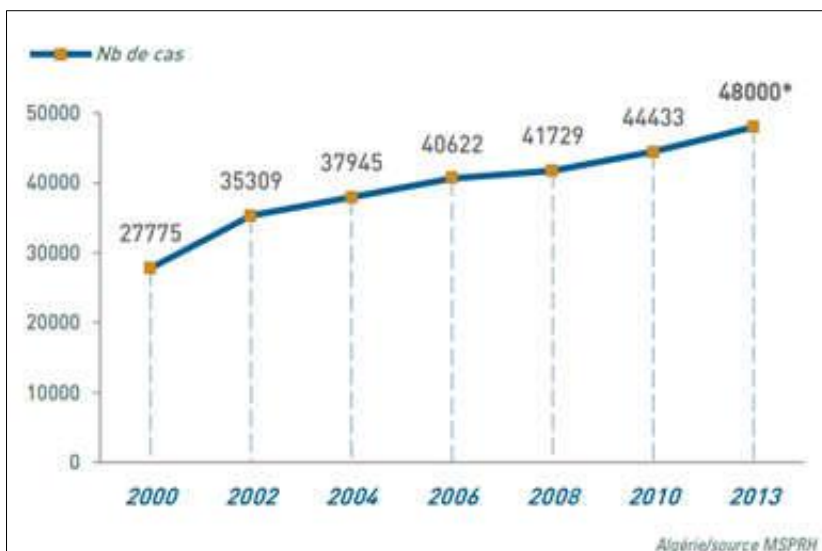
According to the WHO, nutrition is the intake of food that meets the body's needs. Good nutrition - meaning a suitable and balanced diet - and regular physical exercise are both guarantees of good health [1].

EPIDEMIOLOGY

Epidemiological Profile of Cancer in the Algerian Context

There is an increase of the incidence of cancer, which has risen from 80 new cases per 100,000 inhabitants in 1990 to over 130 new cases per 100,000 inhabitants in 2010, which is significant and it probably will continue to rise, potentially reaching 50,000 cases per year (Pic 1) [2].

Citation: Zakia Batoul Benlahrech, Kamel Hail, Mouna Khireddine, Sabrina Insaf Garadi (2024). The Impact of Chemotherapy on Nutritional Status; *SAR J Med Case Rep*, 5(2), 30-34.



Pic 1: Estimated evolution of the number of cancer cases [2]

Epidemiology of cancer in Laghouat:

Size of the population at risk estimated as of December 31, 2016:

650,644 inhabitants

Coverage area: 25,052 km²

New cancer cases recorded in the Wilaya of Laghouat in 2018 [3]

- 310 new cancer cases were recorded.
- 118 cases in men: 38.98% of recorded malignant tumors.
- 192 cases in women: 61.02% of recorded malignant tumors.
- The sex ratio is 0.6

The Impact of Chemotherapy on Nutritional Status

Malnutrition in adult oncology is a major prognostic factor. Once again, BMI and weight loss are the most studied clinical parameters. There are no specific criteria for malnutrition in this context, but a prognostic use of clinical data adapted to oncology and based on survival. In this particular context, the combination of BMI and weight loss (without any duration) allows for the most accurate prognosis. In patients without weight loss, the risk of death increases once the BMI is below 25 and increases further in patients with a BMI below 20. Moreover, regardless of BMI, the risk of death increases once weight loss exceeds 2.5%. The following thresholds are at 6, 11, and 15%. By combining quintiles of weight loss and BMI, we obtain 25 different situations with severity scores ranging from 0 (BMI > 25 without weight loss) to 4 [4].

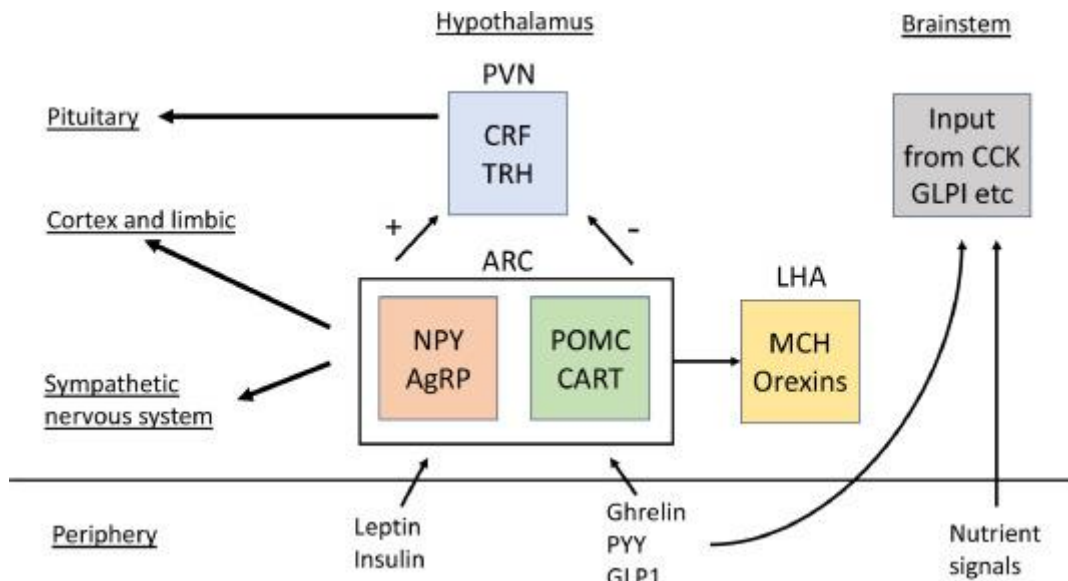
Incidence of Protein-Energy Malnutrition during Cancer

Approximately 40 to 80% of patients, depending on the type of cancer, develop malnutrition that can progress to cachexia. Among cancers, digestive cancers and cancers of the upper aerodigestive tract are

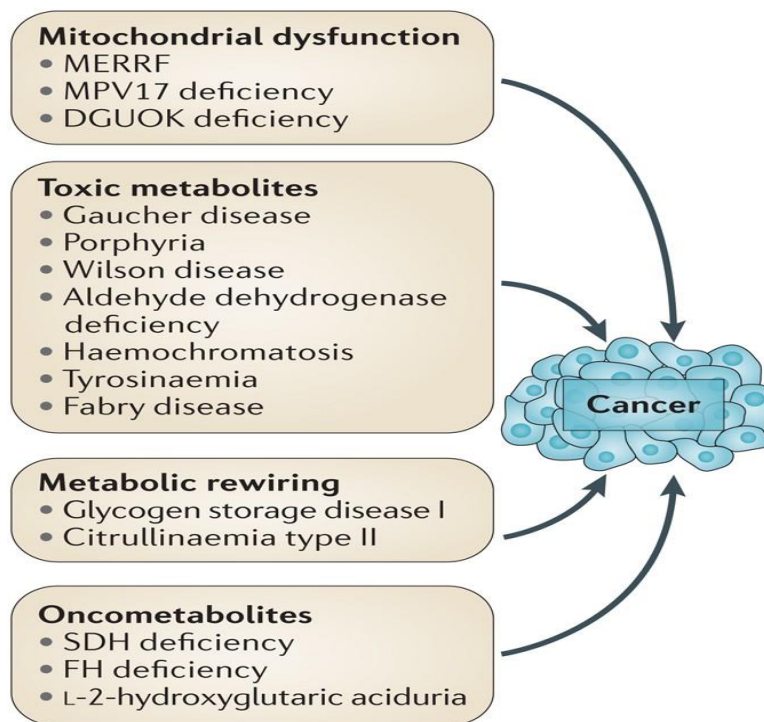
most likely to lead to malnutrition. In gastric cancers, the prevalence of malnutrition is over 80%. It is identical in pancreatic cancers. In the latter condition, weight loss is 14% at the time of diagnosis and 24.5% at the time of death. Peritoneal carcinomatosis, regardless of its origin, leads to constant severe malnutrition due to the inability to eat as a result of the chronic intestinal obstruction it induces. Head and neck cancers, on the other hand, can cause a sometimes total decrease in food intake due to swallowing difficulties they induce. The essential factor explaining malnutrition during cancer is certainly the reduction in food intake. Thirty to 75% of cancer patients are anorexic depending on the site of the primary cancer location. This reduction can be directly linked to the tumor through a mechanical phenomenon (Pic. 2) [5].

However, the reduction in food intake does not explain all the nutritional problems encountered during neoplastic conditions. Indeed, complex metabolic disorders are often associated, for example, the difficulties observed during the renutrition of these patients. Cytokines secreted by activated macrophages promote anorexia and generally have a lipolytic and proteolytic effect (Pic. 3) [6].

During cancer, energy expenditure may increase. This increase, however, is inconsistent, often modest (around 15%), and mainly found in patients with fever and/or infectious conditions. On the other hand, there are significant disturbances in carbohydrate, lipid, and protein metabolism. Glucose metabolism is characterized by an increase in gluconeogenesis from lactate (Cori cycle) and alanine, and insulin resistance. Lipolysis is constant, leading to depletion of fat stores, increased plasma concentrations of glycerol, and free fatty acids. Protein metabolism abnormalities include an increase in protein turnover, a decrease in muscle protein synthesis.



Pic 1 : Mechanisme of appetite control [5]



Nature Reviews | Cancer

Pic 2: Metabolism dysregulation in cancer [6]

This is a prospective monocentric study carried out in the Medical Oncology department of the PHE of Laghouat. Patients with cancer and followed in this service between October 4, 2020 and November 26, 2020 have been included. The main objective was to study the impact of chemotherapy on the nutritional status of cancer patients by assessing the nutritional status and quantifying its anthropometric and biological parameters. Malnutrition is defined as weight loss > 5% in one month or > 10% in six months and/or body mass index $\leq 18,5 \text{ kg/m}^2$ and/or albuminemia 30 g/L in adult

patients aged < 70 and by weight loss 5% in one month or 10% in six months and/or body mass index $\leq 21 \text{ kg/m}^2$ and/or albuminemia 35 g/L in patients aged ≥ 70 [7].

Calculation of Data:

After data collection, calculations are performed using the NUTRILOG and SECRETFAT software to determine the total energy intake and the qualitative intake in calories (proteins, carbohydrates, and lipids).

Equipment: Electronic height meter SOEHNLE 5003, ref. 100QCA (Pic 4).

It features an integrated electronic automatic level, ensuring extremely rapid and accurate measurements at any location.

The operation does not require careful monitoring due to the emission of a sound signal and fixed value recording at the end of the measurement.



Pic 4: Electronic height meter SOEHNLE 5003, ref. 100QCA

Description of the Nutritional Status of the Overall Population

Total Energy Intake:

The average total energy intake is 2027.04±115.63 Kcal, categorized as low in 65% of patients and high in the remaining 35%.

Table 1: Summary table of qualitative intake in calories of proteins, carbohydrates, and lipids

	Proteins	Carbohydrates	Lipids
Low	5.7%	15.4%	69.9%
High	94.7%	84.6%	30.1%

The table above shows the percentage distribution of qualitative intake in proteins, carbohydrates, and lipids.

Initial Weight

When patients were asked how you qualified your weight before the start of treatment 56.1% responded that they were Normal Weight, 27.6% were Overweight, 13% were Obese and 3.3% were Skinny [8].

Type of Cancer

Breast cancer is the most common type of cancer with 39% of cases. The Digestive cancers come in 2nd position with 22% of patients. The Other cancers represent 39% the results correspond to the literature [2, 8, 9].

The Nutritional Scores

The ideal method for assessing nutritional status does not exist. Thus, a certain number of prognostic clinico-biological scores have been developed [10].

These predict with greater or lesser sensitivity and specificity, complications linked to malnutrition. Among the many scores offered, the Nutritional Risk Index (NRI) is currently recommended under the national program [10] nutrition and health (PNNS). Its prognostic value has been perfectly validated [11].

Chemotherapy Interference with Diet

In the study by Cusodio *et al.*, [12]; chemotherapy interferes with the diet of patients, which has a negative impact on the quality and consumption of micronutrients and macronutrients, as well as an impact on the values of nutritional status, with a increase in anthropometric measurements.

After a course of chemotherapy, the frequency of malnutrition increased to 46.4% (P=0.001). The groups of patients who had high rates of weakness were those who have a diagnosis of biliary, hepatic and colorectal cancer (33.3%, 27.3% and 20%, respectively). Weakness increased significantly after a series of CT in

patients who received chemotherapy before ($P = 0.039$) according to Bikacli *et al.*, [13].

In a 2011 study, involving 47 patients aged 63 ± 12 years with gastroesophageal cancer, the rate of sarcopenia was studied before and after the implementation in place of neoadjuvant chemotherapy. The measurements were taken at 107 ± 27 days apart. The rate of sarcopenia increased from 57% to 79% [14]. a poor prognosis according to the study by Vandenhove [15].

In our study, the patients were sectioned into 2 groups: undernutrition with a weight loss greater than 5% of usual weight and or BMI $18, 5 \text{ kg/m}^2$ and or albuminemia 30 g/L (in 70-year-old patients) and or BMI 21 kg/m^2 and or albuminemia 35 g/L (in 70-year-old patients) ($n=16, 13\%$) and those without malnutrition ($n=107, 87\%$). Men accounted for 34.6% of the not undernourished population and 56.3% of the malnourished population. The weight change in the undernourished group was on average $-1.12\% \pm 5.4$ with 30.1% of undernourished people have $\text{PDP} > 5\%$ and 81.26% were on chemotherapy. The mean BMI of the undernourished population is 18.63 kg/m^2 3.98 and the mean albumin is 35.65 g/L 3.68 in the undernourished population.

CONCLUSION

Nutrition is at the heart of our daily lives. She is the pillar of every human being, allowing him to live more healthily and limit any risk of developing pathologies induced by poor diet.

Cancer is a common, serious pathology in which undernutrition has a major impact. pejorative way on overall survival, progression-free survival, quality of life.

However, although new data have been published in the last decade, many unknowns remain regarding the physiopathological factors and the management Therapeutic burden of malnutrition in cancer.

Our study do not prove a significative the impact of chemotherapy on nutritional status.

Conflicts of Interest: The authors declare no conflicts of interest.

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