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Original article

Do critically ill elderly patients show a different profile than younger patients in terms of prealbumin response to nutrition?

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Summary. Nutritional assessment is essential for the clinical nutrition practice.In critical care, prealbumin is still a useful marker for this purpose.Geriatric patient population is increasing in number in critical care and with accompanying comorbidities, they exert different treatment-response profiles.We analysed prealbumin response of critically ill elderly patients compared to younger patients. *Methods:* 1311 adult patients were included in the 5 years retrospective analysis in our tertiery medical-surgical ICU.Admission levels of prealbumin, albumin, C-reactive protein, as well as CRP/albumin and CRP/prealbumin ratios were compared between the young (<65 years) and elderly (≥65 years)groups of patients, and the relation with outcome was analysed . For the secondary part of the study, patients whose CRP levels persisting over 15mg/L were excluded and 704 patients whose inflammatory response subsided and who were equally fed were analysed for the prealbumin response in the following weeks. The difference between the admission and the outcome levels (died, discharged or the 28th day) of prealbumin were compared within and between the young and elderly groups and their subgroups(died or survived). *Results:* Prealbumin and albumin levels were significantly higher in young group compared to old group on admission. There were no difference in the admission prealbumin, albumin, CRP levels and CRP/albumin, CRP/prealbumin ratios in the died or survived subgroups of younger patients .Whereas in the older group, admission prealbumin, albumin levels were lower, CRP, CRP/albumin, CRP/prealbumin ratios were significantly higher in died subgroup in terms of the 28th day, and the hospital outcomes (p<0,05).Outcome levels of prealbumin were higher in both groups (p<0,05) but the younger group showed a more pronounced prealbumin response, although in comparison, the mean levels of increase were not statistically significant (p>0,05).In subgroup analysis, mean values of increase between the admission and outcome levels were higher in the survived subgroups (p<0,05). *Conclusion:* Under the similar protein intake (0,8-1gr/kg/day), geriatric patients showed a blunted response for prealbumin synthesis compared to younger patients.The failure in this response may be due to the chronic inflammatory state, comorbidities and age related physiological organ dysfunctions which make this nutritional marker even less reliable in this age group.

Key words: prealbumin, elderly, nutrition, critically ill

Introduction

As a result of global rising in the number of the aging population, increasing number of elderly patients are admitted to the intensive care units (ICU). These patients usually have multiple comorbidies presenting different pathophysiologic profiles as well as limited organ functions related with aging.

Along with the other physiologic limitation of the organ functions, nutrition is another important determinant of health in geriatric age group. Critically ill older patients has a high incidence of malnutrition and

sarcopenia that leads to increased morbidity and mortality compared to younger patients (1,2).

Critical illness is associated with hypermetabolism and marked protein catabolism (3,4). In the face of unabated protein catabolism patients can experience greater mortality, increased infections and worsened survival and that would be even more detrimental in older patients (5-8).

Therefore, it is important to appropriately identify who may be at risk for poorer clinical outcomes and who may benefit from an aggressive nutritional strategy, that makes assessment of nutritional status central to the clinical nutrition practice.

However, nutritional assessment is not easy in ICU patients.Andropometric measurements are generally unreliable, especially in older patients, due to the decreased ability to excreate water load, and prolonged overexpansion of extracellular water following resuscitation or sepsis (1,9).

Although the traditional serum protein markers (albumin, prealbumin, transferrin, retinol binding protein) are a reflection of the acute-phase response (increases in vascular permeability and reprioritization of hepatic protein synthesis) and may not accurately represent nutrition status in the ICU setting (10), as the other alternatives (calcitonin, C-reactive protein (CRP), interleukin-1, tumor necrosis factor (TNF), interleukin-6, and citrulline) are still investigational and measures like muscle mass ultrasound and computed tomography of skeletal muscles are not practical, an optimal assessment tool is still pending.

At present, the most useful biological marker of nutritional status still seems to be prealbumin.

Prealbumin is mainly synthetised and catabolised by the liver and excreated by the kidney and gastrointestinal tract with a half-life of 1.9 days (11). Although it is known that inflammation and critical illness render serum proteins including serum prealbumin concentration unreliable (12), during the recovery period of the acute illness where the inflammatory phase of the disease subsets, it still can be regarded as a marker of nutrition in critically ill patients.

In our retrospective analysis of critically ill patients, we aimed to compare the prealbumin responses of two different age groups. We planned to investigate if the older age group appropriately responds to the nutrition by increasing prealbumin levels when the amount of the calorie/protein intake is similar to the younger age group. We also compared two groups in terms of the prognostic value of nutritional indexes like CRP/albumin and CRP/prealbumin ratio.

Subjects and methods

The study is held in a university affliated teaching and research hospital. We performed a single center, retrospective observational study of the medical records of 21 bed ICU over a 5 -year period. Hospital management approval was obtained for the data collection from the hospital files. The nutritional assessments as well as the demographic and related parameters were recorded by the members of the nutrition team of the hospital; a dietitian and a nutrition nurse. They visited the patients admitted to ICU and followed up two times a week, but the prealbumin was checked once a week. The nutritional needs of the patients were generally estimated using a standardised amount of 25 kcal/kg/day. We analysed all patients admitted to our ICU, both diagnosed for surgical or medical reasons. As this is a retrospective study, if there was a missing data in this process, those patients were excluded.

Inclusion criterions:

Patients over 18 years old who stayed in ICU at least two weeks, and who has at least an admission and an outcome measurement of prealbumin/albumin/CRP levels.

Patients whose total weekly calorie intake after the first week was over 75% of the calculated needs.

Exclusion criterions:

For the prealbumin response, patients whose CRP levels over 15 mg/ L after the first week (Tto exclude the suppressive effect of inflammatory status on prealbumin production). Severe liver and kidney failure patients who need hemodialysis or hemodiafiltration. Patients who has known to have protein-losing nephropaties.

The patients who fulfilled the inclusion criterions were divided in two groups: patients between 18-64 years old and patients aged 65 years and over.

For the second part of the analysis, the groups were subdivided according to their outcome, dead or survived.

Data recordings and calculations:

Age, gender, body mass index (BMI), APACHE II, Nutritional Risk Screening (NRS 2002) scores (13), diagnosis on admission and comorbidities.

The amount of nutrients the patient needed and actually hand.

CRP, albumin, prealbumin levels, CRP/albumin and CRP/prealbumin ratios within the first 48 hours.

The last prealbumin, albumin and CRP levels on discharge, on death or on 28th day when the study ended; these values were taken as the level of outcome regardless of the lenght of stay in ICU (LOS ICU).

The difference between the prealbumin levels on admission and on outcome (Delta prealbumin levels)

Prealbumin, albumin and CRP results of patients who had the measurements in each consecutive week (n=113) were recorded until the patient discharged, died or up to the 28th day.

For the interpretation of the prealbumin levels, the hospitals laboratory reference value (prealbumin> 16 mg/dl; immunoturbimetric technique, Abbott lab.) was adjusted for the critically ill patient group: Low prealbumin<11 mg/dl; and normal prealbumin>11 mg/dl (14).

As the patients whose CRP levels were below 15mg/ L in the second week onwards were included in the study, and as the calorie-protein intakes were equal between younger and older groups, the prealbumin levels from the second week onwards were assumed to show the adequacy of, as well as the patients spesific response to the nutritional support.

Statistical analysis

Data were analysed using Statistical Package for Social (IBM SPSS Statistics). Whether or not the parameters were normally distributed was analysed with ShapiroWilks test. Student–t test was used for the comparison of the quantitative data and normally distributed variables as well as the complementery statistical methods (mean, SD, frequency). For the comparison of not normally distributed variables, Mann Whitney U test was used. For the comparison of normally distributed variables like admission-outcome data within the groups, Paired Samples t test was used. For the change of prealbumin in consecutive weeks, Repeated Measures Analysis of Variance (ANOVA) was used. For the comparison of the qualitative data, Chi square test and Yate's Correction for Continuity was used. The ROC curve was build to evaluate the cut-off points for outcome prealbumin levels. The correlation between the normally distributed parameters was assessed using Pearson Correlation Analysis, and the correlation between the not normally distributed parameters was evaluated using Spearman's rho Correlation Analysis.Two sided values of $p<0.05$ were considered as statistically significant.

Results

In the five years period a total of 6045 patients were admitted to the ICU. In those, 1311 were eligible for the study. After excluding the patients whose CRP levels were over 15 mg/dl from the second week onwards, 704 patients were included in the final analysis (211 patients <65years, 493 patients≥ 65 years old).
Patients characteristics were summarised in Table 1,Table 2, Table 3.
The ICU lenght of stay (<65 years:20.1±13.3 (15)days vs ≥ 65years:21.1±12.9 (17) days; p>0.05) and 28th days mortality rates (30.3% vs 35%; p>0.05) were not found to be significant between two groups, hospital mortality was higher in older patient group (37.4% vs 47.5% ; p<0.05)

Table 1. BMI, NRS, APACHE II and gender of the groups

	<65 years (n=211)≥65 years (n=493)		
	mean±SD (median)	**mean±SD (median)**	**p**
BMI	25.9±6.4 (25)	26.5±5,9 (25,8)	[1]0.072
NRS	4.74±1.2 (5)	5±0.9 (5)	[1]0.013*
APACHE II	22±7.2 (21)	22.6±7 (22)	[1]0.367
Gender n(%)			
Female	85 (40.3%)	256 (51.9%)	[2]0.005*
Male	126 (59.7%)	237 (48 %)	

*[1]Mann Whitney U; [2]Ki-kare; *p<0.05*

Prealbumin and albumin levels on admission were significantly higher in the young group compared to the old group (Table 4).

There were no differences in the admission prealbumin, albumin, CRP levels and CRP/albumin, CRP/prealbumin ratios in the died or survived subgroups of younger patients. Whereas all measured and calculated parameters were significantly different in the died subgroup compared to the survived subgroup of the older patents (Table 5), and the hospital mortality. Elderly patients who died had a longer ICU stay compared to both the survived ones and the subgroups of younger age group ($p<0.05$).

Significant increases on outcome levels of prealbumin were detected compared to admission values in each group ($p<0.05$). In comparison between the mean levels of delta prealbumin levels of younger and older patient groups, the amount of increases in both groups were found to be statistically similar ($p>0.05$) (Table 6).

Comparing the mean delta prealbumin levels of dead and survived subgroups, mean increases in the surviving patients in both groups were significant, whereas the patients with bad prognosis showed almost no increase in prealbumin levels compared to the ones who survive (<65 years: 0.56±6.76 (0)mg/dl vs 3.13±6.98 (2)mg/dl; ≥ 65 years: 0.5±4.99 (0)mg/dl vs 1.71±4.87 (1.6) mg/dl, p= 0.000) (Table 7).The prealbumin levels had a slightly increasing trend in both groups, but the level of increase per consecutive week was not statistically significant ($p>0.05$).

From the first week to the study end point that was the 28th day, the prealbumin levels were always higher in the younger age group and the differences with the elderly group were statistically significant ($p<0.05$) (Figure 1).

To define prealbumin cut-off value for the 28th day outcome in both groups, ROC curves were analysed (Figure 2 and 3).

Table 2. Diagnosis on admission

	<65years(n=211)	≥65 years(n=493)
Diagnosis on admision	**n (%)**	**n (%)**
Neurological Disease	13 (6.2%)	36 (7.3%)
Respiratory Disease	79 (37.4%)	243 (49.3%)
Cardiovascular Disease	19 (9%)	23 (4,7%)
Metabolic Disease	27 (12.8%)	122(24.7%)
Trama/Postoperative	73 (34.6%)	69 (14%)

*[1]Ki-kare test; *p<0.05*

Table 3. Number of comorbidities the patients have: Most of the patients in the elderly group had at least two or more comorbidities, whereas the majority had one comorbidity in younger group (Comorbidities: Hypertension, Diabetes Mellitus, Alzheimers Disease, Chronic Obstructive Airway Disease, Coronary Artery Disease, Cerebrovascular Disease, Chronic Renal Failure, Chronic Heart Failure, Malignities and Others)

Comorbidies (n)	**< 65years (%) n=211**	**≥ 65 years(%) n=493**
0	44 (20.8%)	18 (3.6%)
1	89 (42.1%)	96 (19.4%)
2	32 (15.1%)	154 (31.2%)
3	35 (16.5%)	134 (27.1%)
4	11 (5.2%)	72 (14.6%)
5	0	17 (3.4%)
6	0	2 (0.4%)

Table 4. Prealbumin and albumin values were significantly lower in elderly patients on admission

	<65 years	**≥65 years**	
	mean±SD	**mean±SD**	**p**
Prealbumin	12.58±6.66	9.86±4.69	[1]0.000*
CRP	11.27±8.18	10.39±7.36	[1]0.165
Albumin	2.6±0.7	2.5±0.68	[1]0.03*
CRP/Albumin (median)	4.9±4.5 (3.7)	4.6±3.8 (3.8)	[2]0.899
CRP/Prealbumin (median)	1.5±1.9 (0.86)	1.5±1.6 (0.99)	[2]0.234

*[1]Student t; [2] Mann Whitney U *p<0.05*

Discussion

The prevalence of malnutrition in older adults admitted to medical or surgical ICU reported from 25% up to 68% (15-20).

Regarding the elderly patient in the intensive care unit, the rate and the risks of the malnutrition combining the acute critical illness considerably increases the morbidity and mortality of the patients who already has limited organ functions as a result of the increasing age.That makes nutritional assessment of the geriatric ICU patients even more important.

Table 5. All measured parameters were significantly different in elderly group who died within 28 days

		28th day outcome		
		Died	Survived	p
		Mean±SD	Mean±SD	
<65 years	Prealbumin	12±7	12.8±6.49	[1]0.403
	CRP	11.77±7.9	11±8.3	[1]0.560
	Albumin	2.5±0.77	2.67±0.66	[1]0.204
	CRP/Albumin (median)	5.86±5.7 (4)	4.5±3.78 (3.4)	[2]0.142
	CRP/Prealbumin (median)	1.6±1.7 (1.2)	1.47±2 (0.8)	[2]0.184
≥65 years	Prealbumin	9±4.56	10.3±4.7	[1]0.007*
	CRP	11.68±7.67	9.7±7	[1]0.005*
	Albumin	2.3±0.57	2.6±0.71	[1]0.000*
	CRP/Albumin (median)	5.55±4.3 (4.7)	4.1±3.4 (3)	[2]0.000*
	CRP/Prealbumin (median)	1.86±2 (1.2)	1.34±1.4 (0.9)	[2]0.001*

*[1]Student t test; [2] Mann Whitney U Test; *p<0.05*

Table 6: Increase in outcome prealbumin levels were significant within groups, the delta prealbumin levels (median) were found to be similar between groups.

	<65 years	≥65 years	
Prealbumin(mg/dl)	**Mean±SD**	**Mean±SD**	**p**
Admission	12.58±6.66	9.86±4.69	[1]0.000*
Outcome	14.9±8.18	11.15±5.4	[1]0.000*
Delta prealbumin(median)	2.35±7 (1)	1.3±4.9 (1)	[2]0.184
Admission-outcome [3]p	0.000*	0.000*	

*[1]Student t test; [2] Mann Whitney U Test; [3]Paired Samples t test; *p<0.05*

Prealbumin still an acceptable nutritional marker in ICU, so it is important to define its use in detail for different patients and circumstances.

Related with aging, there are some physiological changes in the gastrointestinal tract like prolonged transit time, declined pancreatic secretions and insulin action (Insulin resistance) (21,22)

The composition of microbiota significantly corraletes with fraility, co-morbidity, nutritional status, and markers of inflammation in the elderly (23). The permeability appears to remain intact (24-25).Proteo-

Table 7. Surviving patients in both groups had increasing levels of prealbumin, whereas the patients with bad prognosis showed almost no increase

		28th day outcome		
		Died	Survived	p
Age	**Prealbumin(mg/dl)**	**Mean±SD**	**Mean±SD**	
<65 years	Admission	12±7	12.84±6.49	[1]0.403
	Outcome	12.56±7.8	15.96±8.15	[1]0.005*
	Delta prealbumin(median)	0.56±6.76 (0)	3.13±6.98 (2)	[2]0.010*
	Admission-Outcome[3]p	0.507	0.000*	
≥65 years	Admission	9±4.56	10.29±4.7	[1]0.007*
	Outcome	9.59±4.72	12±5.6	[1]0.000*
	Delta prealbumin(median)	0.5±4.99 (0)	1.7±4.87 (1.6)	[2]0.010*
	Admission-Outcome[3]p	0.194	0.000*	

*[1]Student t test; [2] Mann Whitney U Test; [3]Paired Samples t test; *p<0.05*

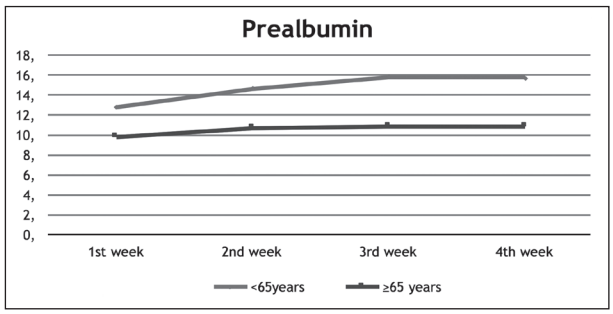

Figure 1: Prealbumin trends in consecutive weeks: Increase in the young group was more prominent than the elderly group

lytic activity in the small intestine appears to be sufficient to ensure a proper digestion of proteins. Absorption of the amino acids in the small intestine are not limited in the elderly but the peripheral availibility of amino acids could be strongly affected by an increased metabolic use of dietery amino acids in the gastrointestinal tract and the liver (26). The net balance of these effects of aging on plasma protein sythesis are not clearly understood.

Protein energy malnutrition leads to a reduction of both somatic proteins of fat-free mass and of visceral proteins.

Sergi et all studied on underweight elderly patients (BMI<20 kg/m2). Along with the low muscle mass, underweight subjects presented reduced mean values of albumin and other visceral proteins. He concluded that the underweight condition and low plasma proteins are both indexes of poor nutritional status enhanced in old people with sarcopenia (27).Our patients body mass indexes were similar, 18% patients in young and 20% patients in elderly group had BMI of <20%.But the admission levels of both albumin and prealbumin were lower in geriatric group.This is again the problem with the elderly and the criticaly ill, we did not know the actual fat and edema-free mass of the patients to confirm that the BMIs were actually true, especially in the geriatric group.

Although nutrition has been considered a very important factor regulating the albumin synthesis (28), in elderly, the presence of comorbid conditions has been considered as the most frequent cause of hypoalbuminemia (29). This is actually an unresolved issue, how much the relationship between hypoalbuminemia and mortality could depend either on malnutrition or on a condition of severe illness and comorbidities. Our elderly group has a high incidence of comorbidities (Table 2) The lower levels of albumin and prealbumin in this group when they accepted to ICU can be explained by malnutrition, sarcopenia, accompanying comorbidities and high inflammatory state associated with acute critical illness. The 28th day mortality and the lenght of stay in ICU were similar, but the long term hospital mortality was higher, this again undoubtly is the result

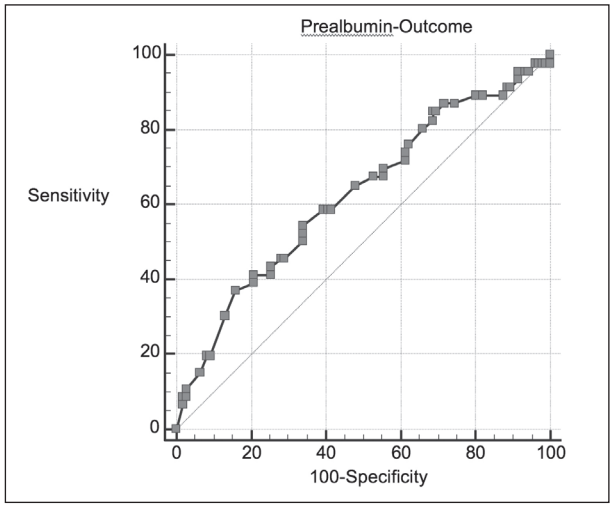

Figure 2: Prealbumin cut-off value for the 28th day outcome in group <65 years:The area under curve is calculated as 0.624, SD:0.05(p=0.015; p<0.05) .Prealbumin cut-off value for 28th day outcome is ≤8 mg/dl.(sensitivity:36.9%,specificity:: 83.9%)

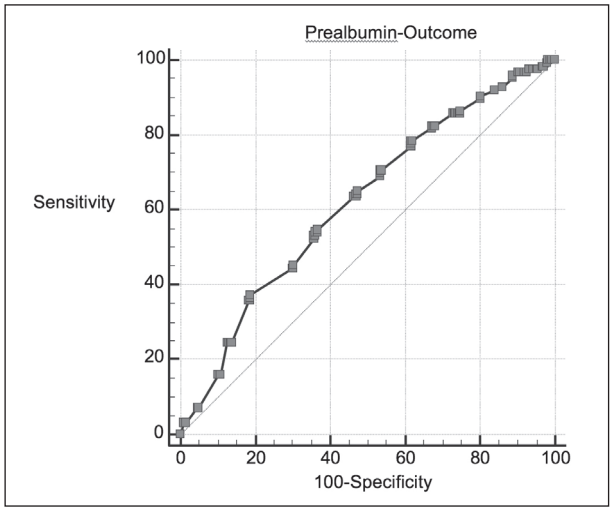

Figure 3: Prealbumin cut-off value for the 28th day outcome in group≥65 years:The area under curve is 0.619, SD:0.03(p=0.0005. p<0,05) and prealbumin cut-off value is ≤7.4 mg/dl for the old age group(sensitivity:37.3%, specificity: 81.3%)

of not recovering the whole complexity of the chronic inflammation and organ dysfunctions in the elderly.

In the mortality prediction, CRP/albumin and CRP/prealbumin ratios both were significant only in the geriatric group. The patients who died within the 28th days and after had higher CRP/albumin and CRP/prealbumin ratios together with lower albumin and prealbumin levels in the elderly group but not in the younger group. With these findings, it is possible to say that if malnutrition and high inflammation is together in an elderly patient, a worse outcome can be expected. Similarly, in critically ill trauma patients, the combination of low albumin level and increased age was found to be the most predictive of infection and mortality (30).

The prognostic and inflammatory nutritional index (PINI= Orosomucoid * C-reactive protein / albumin*prealbumin) was used to predict mortality in ICU patients (31,32). In the study of Gharsallah et all, this score was found to be correlated with the organ failure but not with the mortality. In their study, age again was the only significant parameter between the died and survived patients (32).

The positive relation with the CRP/albumin and CRP/prealbumin inflammation-based prognostic scores and morbidity-mortality is also shown in patients treated with parenteral nutrition. CRP/albumin is found to be relevant with mortality and major morbidities, with CRP/prealbumin, it is also significantly related with lenght of ICU stay and lenght of mechanical ventilation (33).

In a recent review on outcome prediction by nutrition indicators in the critically ill reported that 6 studies out of 12 found an association between improved outcome and serum prealbumin levels when measured in the following days of ICU stay (34). Another study reported that slightly low concentration of prealbumin (<16 mg/dl) at admission is associated with increased lenght of stay and mortality (35). It is also stressed that the estimate of initial value is needed to assess prognosis.

In their review, Delliere et al, proposed an algorithm to help clinicians as a reference on how to use prealbumin as a useful parameter (14). As the inflammatory process causes liver synthesis priority to favor inflammatory proteins such as C-reactive protein and alpha 2 macroglobulin at the expense of prealbumin, it is suggested that prealbumin should be interpreted only if the CRP level is below 15 mg/ L and there is no inflammatory syndrome.

For a patient accepted to ICU, CRP levels above this level is a common finding, but as the acute inflammatory state subsides, CRP levels is expected to decrease and the interpretation of prealbumin levels can become acceptable.We therefore have included all the suitable patients regardless of the CRP levels on admission, but after the first week, the ones with CRP values over 15mg/L were excluded.

According to the latest recommendations, the level of 11 mg/dl is suggested to be the treshold for the the good prognosis of the ICU patient and an increase of 4 mg /dl or more in prealbumin concentration per week reflects a metabolic switch to anabolism (14,36,37).

In our two groups of patients, the young group had a mean prealbumin value that is over the ICU treshold (12.6±6.66 mg/dl) but the geriatric group had lower levels (9.86±4.69 mg/dl) checked in the first 48 hours of admission.On outcome, both groups showed some increase in levels (14.9±8.18 mg/dl and 11.15±5.43 mg /dl). The differences in dead and survived subgroups were more remarkable. Similarly, the prealbumin increase in young and survived patients was reached almost the anabolic level, but the elderly and survived patients showed a modest increase, (3.13±6.98 (2) vs 1.7±4.87 (1.6), p= 0.000) (Table 6), that may suggest an inadequate response of the geriatric patient to nutrition.

We finally sub-analysed the patients who could be followed up for four weeks and who had prealbumin levels checked every consecutive week. The mean value of young patients on the 28th day was 15.77±6.6 mg/dl, the value in the elderly group could reach only 10.86±5 mg/dl (p=0,000).

The relationship between hepatic proteins like albumin and prealbumin and protein intake was assumed with the observation of the increasing levels after the acute illness subsets and when the patients nutritional intake improved, but determining the nutritional status may not be as easy as reviewing serum protein levels because it does not reflect the complexity of hepatic protein syhthesis, especially in the old (38).

Non-nutritional conditions as inflammatory states have an increased prevalance with advancing age, and these states may not always be clinically overt. Low values of albumin can be related to protein–vasting syndromes, hepatic disease or alterations of hydration state (28).

In a previous study, albumin synthesis was evaluated in young and elderly subjects who received an adequate protein intake (1.5 g /kg for 7 days) or a low protein intake (0.4 g/kg for 14 days). The fractional synthesis rate of the whole body albumin pool with adequate intake of protein was 4%/day in the young and 3.4%/day in the elderly. This fractional rate reduced significantly by giving the low-protein diet to the young subjects, but not reduced in the elderly. Serum albumin concentration was lower in the elderly at both levels of protein intake; the rate of albumin synthesis in the young, but not in the elderly was tought to be sensitive to changes in protein intake. It was suggested that albumin synthesis in the elderly had been controlled at a lower set point, which prevented its response to higher protein intakes (39).

We have choosen only the patients whose total calorie/protein intake was over 75% of the needs. Mean protein intake of both groups were calculated between 0.8-1 gr/kg/day.This amount is actually below the recommended limits of the critically ill patient group ; as the current clinical practice recommendations are to give patients with mild to moderate illness 0.8–1.2 g/kg protein per day, and to prescribe critically ill patients higher protein diets of 1.2–1.5 g/kg protein per day, that may go up to 2.5 g protein/kg/ day in the guidelines for critical illnesses (39-43).

However, it is currently being discussed that solutions have a nonprotein energy/nitrogen ratio too high to provide adequate 'protein' without overfeeding energy in critically ill patients. Protein prescription failed to meet most guidelines in >50% of ICU patients receiving full enteral nutrition, when constrained to not overfeed (45). Our study patients usually had standart formulas which do not adequately account for protein needs . Unless protein requirements are independently estimated and protein supplements are used, it is hard to meet the protein requirements without giving excess energy that may itself increase net protein catabolism (44,45).

Older patients have a higher prevalence of renal dysfunction and renal failure at admission to the ICU. This provides an additional challenge to providing adequate protein nutrition. If the patient is undergoing dialysis protein needs are increased (14). For those patients with moderately impaired renal function, the protein amount of 0.8 g/kg/ day is usually recommended in stable conditions, while during illness, it is recommended to increase protein intake to 1 g/kg/ day to meet the higher demand (46,47).

We excluded the patients with acute renal failure requiring renal replacement therapies. But the patients with mild to moderate degree of renal dysfunction who did not need dialysis were included. Regarding the geriatric patient, in the other hand, unless renal functions and the renal risk of the acute critical disease are closely monitorised, protein load may impose an extra renal risk. This may be a confounding factor for not to achieve the target level of anabolic state of these group of patients in ICU, also limiting the establishment of specific protein recommendations for the various stages of critical illness in geriatric patients.

In conclusion, under the similar energy/protein intake, geriatric patients showed a blunted response for prealbumin synthesis compared to younger patients. With the same APACHE II scores and similar BMIs, they had a higher risk of malnutrition, lower prealbumin-albumin levels and higher inflammatory indexes which may show worse prognosis.

On the other hand, when we focus on the non-survival subgroups of the both elderly and young patients, the low prealbumin-albumin levels and the finding of no increase in prealbumin values especially in these subgroups bring the discussion of these markers being indicators of morbidity and mortality, rather than being nutritional markers. In fact, this statement was currently expressed; according to the Academy of Nutrition's analysis, serum proteins such as albumin and prealbumin are not included as defining characteristics of malnutrition because evidence analysis shows that serum levels of these proteins do not change in response to changes in nutrient intake, they are more likely to have prognostic value like morbidity-mortality or recovery from acute and chronic disease (48-50).

Our study was a retrospective search of the five years recordings. The measurements were taken once

a week, not twice as recommended for a marker with short half life. In the light of the current suggestions on protein dosage for critically ill patients, our study may be repeated with a higher protein intake, with carefull follow up of the elderly group in terms of the renal functions.

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