Malnutrition risk in obese geriatric patients?

A routine data based analysis for patients living in nursing homes

Fabian Graeb, Petra Reiber, Reinhold Wolke

Abstract

Weight loss and malnutrition represent significant problems for geriatric patients in hospital. Based on a secondary analysis of routine data from nursing homes, an investigation was carried out into the causes of ≥ 5% weight loss in obese geriatric patients during hospitalisation. The data came exclusively from patients living in nursing homes. Among patients with a BMI of ≥ 30 kg/m², 29.1% (n = 91; N = 281) lost at least 5% of their body weight, 28.4% (n = 98; N = 313) developed a new malnutrition risk in hospital. A logistic regression analysis showed that the risk of losing ≥ 5% body weight in hospital increased when in the previous three months there was no weight loss trend (OR 1.5; 95% CI 1.06–1.23), when there was a long period of hospitalisation (OR 1.10; 95% CI 1.06–1.15), with a secondary diagnosis of anaemia (OR 2.23; 95% CI 1.00–4.94) and with discharge diagnoses in the ICD-10 group of respiratory system diseases (OR 2.53; 95% CI 1.12–5.70).

Key words: weight loss, malnutrition, geriatrics, nursing home, obesity

Introduction

Malnutrition is still a common problem in hospitals. The latest data from the annual nutritionDay audit shows that 15.9% of patients in German hospitals are moderately and 21.5% severely malnourished [1]. Among geriatric patients in German-speaking areas, depending on the sample between 17% and 30% are malnourished and 38% to 65% display a risk of malnutrition [2]. This can sometimes be associated with extremely negative consequences. For instance, patients at risk of malnutrition suffer falls in hospital significantly more frequently [3], are hospitalised for longer [4], suffer more frequently from extreme fragility and functional impairments [5] and, regardless of age, die more often in hospital [6-8]. Despite this knowledge, the topics of nutrition and abnormalities in connection with eating habits and nutritional status are given little consideration in day-to-day hospital life [9, 10]. Consequently, there is chronic underestimation of the problem, those affected are not recognised and thus there is rarely nutritional intervention [1, 11].

At the same time, excess weight and obesity are also not uncommon in the older population. According to the general WHO definitions, in Germany 51.7% of men over 70 are overweight and 27.9% are obese. In women these proportions are 38.6% and 29.3% [12]. In nursing homes, on the other hand, 28.9% are overweight and 16.4% are obese [13]. It must be borne in mind that the main risk factors for malnutrition—reduced nutrient intake and unintended weight loss—can occur regardless of weight or body mass index (BMI). In fact, regardless of BMI, unintended weight loss is associated with a significantly increased mortality risk, so even with a BMI of > 30 kg/m² [14]. This is remarkable above all because, although excess weight and particularly obesity are generally associated with severe secondary

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conditions, in the hospital setting—so in conjunction with acute hospitalisation—they are associated with a lower risk of dying [7]. Most of the work on malnutrition risk in hospitals has focused on nutritional status upon admission and sometimes its effect on outcome. On the other hand, studies into changes of nutritional status in the course of a hospital stay are extremely rare. In a summary paper, Löser cites a proportion of 30–80% with considerable weight loss during hospitalisation [15]. The studies listed there were all published around the turn of the millennium and may therefore no longer represent the current situation, but there are very few up-to-date surveys. In one study in Switzerland nutritional status was measured ten days before a planned operation and 30 days afterwards. Between these two measuring dates an average significant weight loss of -4 kg was established [16].

Here, weight loss of > 5% of body weight is associated with an increased rate of complications, whilst an initially low lean mass and small upper arm circumference are described as significant risk factors for this weight loss [16]. In a secondary analysis of hospital data from patients with dysphagia, an average weight drop of -1.74 kg was recorded in older patients during a hospital stay. Possible causes or associations are not stated here, but the related development of malnutrition is associated with emergency admissions and smaller clinics [17]. Rinninella et al. showed no significant changes in average weight in the course of hospitalisation. However, significant fat-free mass was lost: the fat-free mass index and phase angle reduced, suggesting loss of muscle mass [18]. But no group was identified with considerable weight loss.

So if the problem of malnutrition is basically more or less ignored in the clinical setting, it is plausible to assume that less obviously affected individuals, namely those who are overweight or even obese, are recognised even more rarely as having a possible malnutrition risk. The causes and implications of deteriorating nutritional status are generally well researched even for older people. However, up to now there have been no studies focussing particularly on older, obese individuals and, as already stated, studies concentrating on changes in the course of hospitalisation are relatively rare.

The goal of this data analysis is therefore to establish the risk factors for considerable weight loss during hospital treatment in the case of geriatric patients suffering from obesity. In addition, the study is intended to investigate the extent to which the risk factors of this group differ from patients with normal to (slightly) excess weight.

Methodology

A secondary analysis was conducted on an existing data set from the research project "Silqua 2016 prevention and treatment of malnutrition in geriatric patients in hospital" sponsored by the German Federal Ministry for Education and Research (sponsorship reference 13FH011SX6). This data set contains routine data collected from residents of residential nursing homes. Firstly, all the residents in the participating facilities with hospitalisation of 3 days or more were identified and then the following data collected from the relevant residents' records: demographic data (age, gender), level of nursing care, secondary diagnoses including chronic diseases, discharge diagnoses and length of hospitalisation, progression of weight and BMI for up to 6 months before and after hospitalisation and, if applicable, death. Weight before hospitalisation was established from the last weight measurement before admission, but only if this was no more than 14 days before. After discharge all residents in the facilities were weighed within 24 hours. Discharge diagnoses were allocated to the relevant main groups in line with the current ICD-10 list. Clinical data was taken from the relevant hospital discharge report. For calculation of general morbidity the Charlson comorbidity index was used [19].

Establishment of nutritional status

BMI classification was done in line with the general WHO criteria for adults (◆ Table 1), which defines obesity from a BMI of 30 kg/m^2 [20]. This group was compared to the group with normal to slightly excess weight, so with a BMI of 18.5–29.9 kg/m^2.

Possible malnutrition risk was identified using the criteria of the valid MUST (Malnutrition Universal Screening Tool) and applied to the weight and BMI data available. With this instrument a point is given for low BMI (< 20 kg/m^2), unintended weight loss in the last three to six months (> 5%) and no nutritional intake for five or more days [21]. In this evaluation a malnutrition risk was assumed from 1 point. No further sub-classification into moderate and high risk was done, since the criterion of no nutritional intake could not be evaluated on the basis of the data available. The consensus criteria of the Global Leadership Initiative on Malnutrition (GLIM) published in 2019 on differentiation of manifest malnutrition [22] could not be considered on account of the data situation.

Considerable weight loss during hospitalisation was defined as a weight loss of ≥ 5% body weight. This ensured that the results were comparable to previous studies, which also used this cut-off value [16].

Data analysis

The data was analysed only after anonymisation in conjunction with the relevant data protection officers. The data set included a total of 2,721 cases from 19 nursing homes over three years (01/2015–12/2016 and 11/2018–10/2019). After adjustment for cases without a medical report on hospital discharge and where there were no weight measurements

BMI	Classification
< 18.5 kg/m²	underweight
18.5–24.9 kg/m²	normal weight
25.0–29.9 kg/m²	pre-obese/obese
30.0–34.9 kg/m²	obese class I
35.0–39.9 kg/m²	obese class II
≥ 40 kg/m²	obese class III

Tab. 1: **BMI classification in line with WHO** (own representation in acc. with [20])

before hospital admission, 2,102 cases were included in this analysis. Of the 2,102 cases, 348 (16.6%) showed a BMI ≥ 30 kg/m^2 and 1,571 (74.7%) a BMI of between 18.5 and 29.9 kg/m^2. Only a small proportion was under 18.5 kg/m^2 (n = 183; 8.7%). These too were omitted, which left a total of 1,919 cases. These were evaluated using the software SPSS 24®, the calculations made were chi-squared test, t-test and logistic regression analysis.
The whole research project has a positive ethical vote by the Ethics Committee of the German Society for Nursing Science (Application No. 17-005).

Results

◆ Table 2 describes the general characteristics of the groups obese (BMI ≥ 30 kg/m^2) and normal/overweight (BMI 18.5–29.9 kg/m^2) in comparison. There are few significant differences. However, the patients with obesity are somewhat younger (82.0 vs. 84.2 years), have higher morbidity (7.6 vs. 7.3), but are more rarely in need of a high level of nursing care (41.5% vs. 47.7%). Gender distribution, length of hospitalisation and mortality are comparable. There are some significant differences in the frequency of secondary and discharge diagnoses, but the effect size (r) is quite small. In the obese group the following are significantly more common: hypertension (70.6% vs. 62.8%; p 0.006), diabetes mellitus (46.1% vs. 26.8%; $p < 0.001$), cardiac insufficiency (25.1% vs. 17.0%; $p < 0.001$) and affective disorders (21.9% vs. 13.4%; $p < 0.001$),

	BMI ≥ 30 kg/m² (N = 348)		BMI 18.5–29.9 kg/m² (N = 1,571)		p	r
	MW	(± SD)	MW	(± SD)		
Age[1]	82.0	(± 6.9)	84.2	(± 7.5)	< 0.001	0.116
Length of hospitalisation (days)[1]	11.7	(± 11.1)	10.6	(± 8.3)	0.082	
Morbidity index Charlson[1]	7.6	(± 2.2)	7.3	(± 2.2)	0.045	0.046
	n	(%)	n	(%)	p	r
Gender female[2]	217	(62.5)	1015	(64.6)	0.466	
High level of nursing care (care level 4-5)[2]	144	(41.5)	749	(47.7)	0.037	0.048
Sd hypertension[2]	245	(70.6)	987	(62.8)	0.006	0.062
Sd dementia[2]	127	(36.6)	686	(43.7)	0.016	0.055
Sd renal insufficiency[2]	130	(37.5)	511	(32.5)	0.078	
Sd diabetes[2]	160	(46.1)	421	(26.8)	< 0.001	0.162
Sd thyroid disorders[2]	78	(22.5)	292	(18.6)	0.096	
Sd cardiac insufficiency[2]	87	(25.1)	267	(17.0)	< 0.001	0.080
Sd anaemias[2]	61	(17.6)	295	(18.8)	0.603	
Sd affective disorders[2]	76	(21.9)	210	(13.4)	< 0.001	0.092
Sd chronic lung diseases[2]	48	(13.8)	164	(10.4)	0.068	
Sd Parkinson's disease[2]	38	(11.0)	157	(10)	0.593	
DD respiratory system diseases[2]	46	(13.3)	257	(16.4)	0.152	
DD injury, poisoning[2]	35	(10.1)	262	(16.7)	0.002	0.070
DD circulatory system diseases[2]	54	(15.6)	203	(12.9)	0.191	
DD digestive system diseases[2]	48	(13.8)	207	(13.2)	0.744	
DD symptoms and abnormal clinical findings[2]	37	(10.7)	180	(11.5)	0.672	
Mortality H[2]	22	(6.4)	136	(8.7)	0.159	

Tab. 2: **Description of sample**
[1] t-test; [2] Chi-squared; DD = discharge diagnosis; H = hospital; MV = mean value; p < 0.05 = significant; r = effect size; SD = standard deviation; Sd = secondary diagnosis

but dementia is less common (36.6% vs. 43.7%; p 0.016) and this group were admitted to hospital less frequently for injury or poisoning (10.1% vs. 16.7%; p 0.002).

Weight changes before and during hospitalisation

◆ Table 3 shows nutritional status upon admission and changes in the course of hospitalisation. It is noticeable that the group of patients with obesity actually gained weight slightly on average in the three months before hospital admission, whilst the group with normal weight tended to lose weight (0.6% vs. -1.2%). Correspondingly, the number of obese patients with a risk of malnutrition upon hospital admission is significantly lower. However, in the course of hospitalisation these patients lost significantly more weight (-3.2 kg/-3.6% vs. -1.7 kg/-2.6%) and this meant that they more frequently developed a risk of malnutrition (28.4% vs. 20.1%). On the other hand, the proportions with a weight loss of ≥ 5% were almost equal at 29.1% and 27.2%.

Influence factors for weight loss ≥ 5%

The logistic regression model for weight loss ≥ 5% was prepared exploratively for both groups through step-by-step inclusion of the variables (◆ Table 4). These include chronic diseases, discharge diagnoses, gender, age, level of nursing care, malnutrition risk and weight progression before hospitalisation. Results were significant in each case with slight differences between the groups. The patients in the group BMI ≥ 30 kg/m² lost at least 5% of their body weight more frequently (odds ratio [OR] > 1) in conjunction with:

- weight gain in the previous three months (OR 1.15),
- longer hospitalisation (OR 1.10),
- secondary diagnosis of anaemia (OR 2.23) and
- discharge diagnoses in the ICD-10 group of respiratory system diseases (OR 2.53).

The patients with normal weight also lost over 5% of their body weight more frequently in conjunction with longer hospitalisation (OR 1.07) and discharge diagnoses of respiratory system diseases (OR 1.63). Other significant risk factors were advanced age (OR 1.02), discharge diagnoses in the group endocrine, nutritional and metabolic diseases (OR 2.40) and circulatory system diseases (OR 1.86). The risk reduced significantly in the case of renal insufficiency (OR 0.69).

Discussion

The analysis in both groups shows a clear deterioration of weight status during hospitalisation. However, the patients with obesity lost more weight on average, both in absolute terms and also as a percentage of body weight. It could not be ascertained from the data whether and in what way the body composition of these patients changed. This gap represents a basic limitation for studies that determine changes in nutritional status primarily by way of weight changes. It remains unclear to what extent loss of water could have contributed to this or to what extent muscle or fat mass was lost.

The significant risk increase shown in the regression analysis when in the previous three months there was a tendency towards weight gain ("obese group") could be seen as an indication that water previously retained was lost during hospitalisation. On the other hand, this group showed no significant risk factors in terms of circulatory system diseases in the discharge diagnoses or, in particular, cardiac insufficiency as a secondary diagnosis

	BMI ≥ 30 kg/m²		BMI 18.5–29.9 kg/m²		p	r
	MW	(± SD)	MW	(± SD)		
Weight changes in the 3 months before H (in %)	0.6	(± 4.8)	-1.2	(± 6.1)	< 0.001	0.230
Weight before H (in kg)[1]	90.7	(± 16.3)	62.8	(± 11.8)	< 0.001	0.828
BMI before H (in kg/m²)[1]	33.9	(± 3.9)	23.4	(± 3.5)	< 0.001	0.908
Weight changes in H (in kg)[2]	-3.2	(± 5.3)	-1.7	(± 4.0)	< 0.001	0.230
Weight changes in H (in %)[2]	-3.6	(± 5.7)	-2.6	(± 6.1)	< 0.001	0.064
	n	(%)	n	(%)	p	r
Risk of malnutrition before admission[3]	35	(10.1)	496	(31.6)	< 0.001	0.185
Risk of malnutrition after discharge[2]	117	(37.4)	633	(46.9)	0.002	0.075
Risk of malnutrition acquired in H[2]	98	(28.4)	314	(20.1)	0.001	0.078
Weight loss ≥ 5% in H[2]	91	(29.1)	367	(27.2)	0.505	
N for BMI ≥ 30/BMI 18.5–29.9: [1]N = 281/1199; [2]N = 313/1349; [3]N = 348/1571						

Tab. 3: **Nutritional status of the sample**
H = hospitalisation; MV = mean value; p < 0.05 = significant; r = effect size; SD = standard deviation

	BMI ≥ 30 kg/m²			BMI 18.5–29.9 kg/m²		
	OR	95% CI	p	OR	95% CI	p
Malnutrition risk (MUST) before H	3.21	0.98–10.57	0.055			
Weight changes in the 3 months before H in %	**1.15**	**1.06–1.23**	**< 0.001**			
Length of hospitalisation	**1.10**	**1.06–1.15**	**< 0.001**	**1.07**	**1.05–1.09**	**< 0.001**
DD respiratory system diseases	**2.53**	**1.12–5.70**	**0.025**	**1.63**	**1.11–2.4**	**0.012**
Sd anaemias	**2.23**	**1.00–4.94**	**0.049**			
Sd affective disorders	0.42	0.17–1.01	0.053			
Age				**1.02**	**1.00–1.04**	**0.025**
DD endocrine. nutritional and metabolic disorders				**2.40**	**1.10–5.20**	**0.027**
DD circulatory system diseases				**1.86**	**1.23–2.81**	**0.003**
Sd renal insufficiency				**0.69**	**0.50–0.95**	**0.023**
Constants	0.08		< 0.001	0.02		< 0.001
	N = 251; R^2 = 0.312; p < 0.001; f = 0.673			N = 1018; R^2 = 0.095; p < 0.001; f = 0.324		

Tab. 4: **Logistic regression for weight loss ≥ 5%**
(significant variables in bold type)
95% CI = 95% confidence interval; DD = discharge diagnosis; f = effect size in line with Cohen; H = hospital; p < 0.05 = significant; R^2 = Nagelkerke's R squared; Sd = secondary diagnosis; OR = odds ratio

(causes oedema, also through water retention in the legs). This means that, at least in the obese group, it appears unlikely that the flushing out of oedema has a significant effect on weight loss as a result of cardiac insufficiency. A tendency to weight gain before hospital admission as a risk factor for losing more weight in hospital can alternatively be seen as an indication that acute hospitalisation plays a greater role for these individuals than, for instance, chronic processes. This is also supported by the fact that the proportion of residents with a risk of malnutrition increased significantly through hospital admission from 10.1% (n = 35) to 37.4% (n = 117), almost a quadruple rise.

Another limitation is the basis for the data. Since this was routine data, which was anonymised before analysis, it was not possible to fill in data gaps afterwards. Taking the individual weight parameters, e.g. weight changes in the three months before hospitalisation or BMI before hospital, it becomes clear that this data was not available in all cases. Weight before hospital admission was only considered if this was recorded a maximum of 14 days before hospital admission. In some cases however the last weight recorded was three to four weeks beforehand and so this could not be considered. Other reasons for lack of weight data could include admission to a care facility shortly before hospital admission, refusal to be weighed or defective weighing scales. However, this cannot be ascertained in retrospect. Furthermore, it was generally unclear to what extent the relevant chronic diseases were advanced, such as dementia, cardiac or renal insufficiency. These diagnoses were taken from the hospital discharge reports in which they were generally not described in detail—presumably because they were not relevant for the acute hospitalisation.

Patients who spent a longer period in hospital or had a discharge diagnosis in the group of respiratory system diseases were more likely to lose at least 5% of their body weight. This effect was significant in both groups, whilst on the other hand, e.g. chronic lung diseases had no effect. This means that it is presumably above all acute conditions, such as pneumonia, which tend to be relevant risk factors here. A longer stay in hospital can be interpreted as an indication of a more severe hospital progression, which in turn makes greater weight loss more likely. But the converse effect is also possible: that a deteriorating nutritional status induces a longer recovery process. However, the actual cause and effect in each case or indeed whether it was in fact a combination of the two cannot be ascertained from the data. The obese group spent on average somewhat longer in hospital, although not significantly (11.7 days vs. 10.6 days, p = 0.082). This, combined with the higher morbidity in line with the Charlson comorbidity index (7.6 points vs. 7.3; p = 0.045), could (partly) explain the more significant weight loss in conjunction with hospitalisation.

Anaemia has also already been investigated as a risk factor in other studies and is significant here only in the group BMI ≥ 30 kg/m², but not the group BMI 18.5–29.9 kg/m²—in this case the variable is not included in the regression model. Why this is different in two groups remains unclear. A study in German nursing homes on the other hand found no significant correlation [23]. It is also striking that more advanced age significantly increases the risk of weight loss only in the group with a BMI of 18.5–29.9 kg/m². The obese group is actually younger on average (82.0 years vs. 84.2 years; $p < 0.001$), but also has greater morbidity. This therefore suggests that the pathomechanisms of unintended weight loss are different in the two groups, perhaps with regard to the relevance of pre-existing conditions. Morbidity and level of nursing care are however not included in either of the two regression models. The Charlson comorbidity index varies little here, nearly 85% have a score of 5–8 points. This small variance may lead to the fact that the regression model shows no significant associations.

The fact that a higher level of nursing care shows no significant effect could have various reasons. On the one hand an increasing need for nursing care is associated with a higher risk of being underweight [2]. But those who already have a low weight or have lost considerable weight before being admitted to hospital will perhaps tend not to lose such a high proportion of their remaining body weight. At the same time level of nursing care is highly controversial as an objective parameter to describe the requirement for nursing care in terms of nursing science and has not been validated up to now [24]. Under the assumption that level of nursing care does not in the end describe the actual need for care, it seems less surprising that there was no significant association here.

Considerable weight loss and malnutrition risk are therefore certainly observed relatively commonly in the case of nursing home residents with obesity following hospitalisation. A greater emphasis should be placed on this in hospitals and long-term care. It would therefore also be desirable to conduct more research into the causes and consequences of the weight loss suffered in this group, which has been paid little attention up to now. Particularly with regard to possible differences in the pathomechanisms and resulting possibilities for prevention, new questions arise here. In addition, it has also been unclear up to now to what extent such weight loss as a result of acute hospitalisation with in-patient treatment can be avoided in a group of aged patients requiring a high level of nursing care. This also applies for the sub-group of residents with obesity studied here.

Further studies are required focussing on weight changes during hospitalisation with specific preventative interventions in the case of older, care-dependent persons with and without obesity in order to fill these knowledge gaps. At the same time it seems plausible that prevention in this area must start predominantly in advance, in nursing homes. In this respect it would also be important to ascertain whether and how well this has been working up to now.

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Conflict of Interest
The authors declare no conflict of interest.

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