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ESPEN GUIDELINES

ESPEN Guidelines on Enteral Nutrition: Geriatrics ☆

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Summary Nutritional intake is often compromised in elderly, multimorbid patients. Enteral nutrition (EN) by means of oral nutritional supplements (ONS) and tube feeding (TF) offers the possibility to increase or to insure nutrient intake in case of insufficient oral food intake.

The present guideline is intended to give evidence-based recommendations for the use of ONS and TF in geriatric patients. It was developed by an interdisciplinary expert group in accordance with officially accepted standards and is based on all

Abbreviations: ADL, activities of daily living; BCM, body cell mass; BMI, body-mass index; CI, confidence interval; EN, enteral nutrition; FFM, fat-free mass; IADL, instrumental activities of daily living; MAC, mid-arm circumference; MAMC, mid-arm muscle circumference; NGT, nasogastric tube; ONS, oral nutritional supplement; OR, odds ratio; PEG, percutaneous endoscopic gastrostomy; RR, relative risk; SD, standard deviation; TF, tube feeding; TSF, triceps skin fold

☆For further information on methodology see Schütz et al.[173] For further information on definition of terms see Lochs et al.[174]

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Enteral nutrition;
Oral nutritional supplements;
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Geriatric patients;
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Aged-80-and-over

relevant publications since 1985. The guideline was discussed and accepted in a consensus conference.

EN by means of ONS is recommended for geriatric patients at nutritional risk, in case of multimorbidity and frailty, and following orthopaedic-surgical procedures. In elderly people at risk of undernutrition ONS improve nutritional status and reduce mortality. After orthopaedic-surgery ONS reduce unfavourable outcome. TF is clearly indicated in patients with neurologic dysphagia. In contrast, TF is not indicated in final disease states, including final dementia, and in order to facilitate patient care. Altogether, it is strongly recommended not to wait until severe undernutrition has developed, but to start EN therapy early, as soon as a nutritional risk becomes apparent.

The full version of this article is available at www.espen.org.

Summary of statements: Geriatrics

Subject	Recommendations	Grade[173]	Number
Indications	In patients who are ***undernourished or at risk of undernutrition*** use oral nutritional supplementation to increase energy, protein and micronutrient intake, maintain or improve nutritional status, and improve survival.	A	2.1
	In frail elderly use oral nutritional supplements (ONS) to improve or maintain nutritional status.	A	2.2
	Frail elderly may benefit from TF as long as their general condition is stable (not in terminal phases of illness).	B	2.2
	In geriatric patients with ***severe neurological dysphagia*** use enteral nutrition (EN) to ensure energy and nutrient supply and, thus, to maintain or improve nutritional status.	A	2.3
	In geriatric patients ***after hip fracture and orthopaedic surgery*** use ONS to reduce complications.	A	2.4
	In ***depression*** use EN to overcome the phase of severe anorexia and loss of motivation.	C	2.6
	In ***demented patients*** ONS or tube feeding (TF) may lead to an improvement of nutritional status.		2.7
	In ***early and moderate dementia*** consider ONS—and occasionally TF—to ensure adequate energy and nutrient supply and to prevent undernutrition.	C	2.7
	In patients with ***terminal dementia***, tube feeding is not recommended.	C	2.7
	In patients with dysphagia the ***prevention of aspiration pneumonia*** with TF is not proven.		2.9
	ONS, particularly with high protein content, can reduce the risk of ***developing pressure ulcers***.	A	2.10
	Based on positive clinical experience, EN is also recommended in order to improve ***healing of pressure ulcers***.	C	2.10

Application	In case of ***nutritional risk*** (e.g. insufficient nutritional intake, unintended weight loss $>5\%$ in 3 months or $>10\%$ in 6 months, body-mass index (BMI) $<20\,kg/m^2$) initiate oral nutritional supplementation and/or TF early.	B	2.1
	In geriatric patients with ***severe neurological dysphagia*** EN has to be initiated as soon as possible.	C	2.3
	In geriatric patients with ***neurological dysphagia*** accompany EN by intensive swallowing therapy until safe and sufficient oral intake is possible.	C	2.3
	Initiate enteral nutrition 3 hours after PEG placement.	A	3.2
Route	In geriatric patients with ***neurological dysphagia*** prefer percutaneous endoscopic gastrostomy (PEG) to nasogastric tubes (NGT) for long-term nutritional support, since it is associated with less treatment failures and better nutritional status.	A	2.3
	Use a PEG tube if EN is anticipated for longer than 4 weeks.	A	3.1
Type of formula	Dietary fibre can contribute to the normalisation of bowel functions in tube-fed elderly subjects.	A	3.4

Grade: Grade of recommendation; Number: refers to statement number within the text.

Terminology

Geriatric patient—a biologically elderly patient who is at acute risk of loss of independence due to acute and/or chronic diseases (multiple pathology) with related limitations in physical, psychological, mental and/or social functions. The abilities to perform the basic activities of independent daily living are jeopardised, diminished or lost. The person is in increased need of rehabilitative, physical, psychological and/or social care to avoid partial or complete loss of independence.

Elderly—a term used to describe a particular age group, i.e. over 65 years.

Very old or very elderly—a term to describe those over 85 years of age.

Frail elderly—Frail elderly are limited in their activities of daily living due to physical, mental, psychological and/or social impairments as well as recurrent disease. They suffer from multiple pathologies which seriously impair their independence. They are therefore in particular need of help and/or care and are vulnerable to complications.

Reduced capacity for rehabilitation—This means that the older the patient, the more difficult it is to rehabilitate that patient back to normal or to his/her previous state. Specifically, the restoration of muscle mass after illness requires much greater effort in terms of exercise and nutrition in the elderly compared with the younger patient. It is also implicit that other functions, including mental, are similarly more resistant to rehabilitation.

Functional status—This term is being used in a general sense to describe global function, e.g. the ability to perform activities of daily living (ADL), or specific function, e.g. muscle strength or immune function.

Introduction

The risk of undernutrition is increased in elderly patients due to their decreased lean body mass and to many other factors that may compromise nutrient and fluid intake. Consequently, an adequate intake of energy, protein and micronutrients has to be ensured in each patient independently of his/her previous nutritional status. Since restoration of body cell mass (BCM) is more difficult than in younger persons, preventive nutritional support has to be considered.

Nutritional care should be integrated appropriately into the overall care plan, which takes into

account all aspects of the patient, personal, social, physical and psychological. A complete assessment of the patient should include that of nutritional status or risk, followed by a nutritional programme reflecting ethical as well as clinical considerations. In designing the programme, it should be remembered that the majority of sick elderly patients require at least 1 g protein/kg/day and around 30 kcal/kg/day of energy, depending on their activity. Many elderly people also suffer from specific micronutrient deficiencies, which should be corrected by supplementation.

Oral nutritional therapy via assisted feeding and dietary supplements is often difficult, time-consuming and demanding in elderly patients (due to multimorbidity and slow responses). However, assisted oral feeding and supplements are able to support the physical and psychological rehabilitation of most elderly patients. Therefore, even in times of declining financial and human resources, it is unacceptable to initiate tube feeding (TF) merely in order to facilitate care or save time.

Decision making concerning TF in the elderly is often difficult, and in many cases ethical questions arise (***see Guidelines "Ethical and legal aspects in enteral nutrition"***). In each case, the following questions should be asked:

- Does the patient suffer from a condition that is likely to benefit from enteral nutrition (EN)?
- Will nutritional support improve outcome and/or accelerate recovery?
- Does the patient suffer from an incurable disease, but one in which quality of life and wellbeing can be maintained or improved by EN?
- Does the anticipated benefit outweigh the potential risks?
- Does EN accord with the expressed or presumed will of the patient, or in the case of incompetent patients, of his/her legal representative?
- Are there sufficient resources available to manage EN properly? If long-term EN implies a different living situation (e.g. institution vs. home), will the change benefit the patient overall?

Sedation of the patient for acceptance of the nutritional treatment is not justified.

The present guidelines are based on studies in elderly subjects or in those in whom the average age of the study participants is 65 years or more.

1. What are the aims of EN therapy in geriatrics?

- ***Provision of sufficient amounts of energy, protein and micronutrients.***
- ***Maintenance or improvement of nutritional status.***
- ***Maintenance or improvement of function, activity and capacity for rehabilitation.***
- ***Maintenance or improvement of quality of life.***
- ***Reduction in morbidity and mortality.***

Therapeutic aims for geriatric patients do not generally differ from those in younger patients except in emphasis. While reducing morbidity and mortality is a priority in younger patients, in geriatric patients maintenance of function and quality of life is often the most important aim. Considering the reduced adaptive and regenerative capacity of the elderly, EN may be indicated earlier and for longer periods than in younger patients.

1.1. Can EN improve energy and nutrient intake in geriatric patients?

EN (oral nutritional supplement (ONS) and/or TF) increases energy and nutrient intake in geriatric patients (Ia). Percutaneous endoscopic gastrostomy (PEG) feeding is superior to nasogastric feeding in this respect (Ia).

Comment: In a recent Cochrane analysis, ONS led to an increase in energy and nutrient intake in 29 out of the 33 analysed trials which had reported intake. In three studies no difference in total intake was found, since patients reduced their voluntary food consumption[1] (Ia). The success of ONS is sometimes limited by poor compliance due to low palatability, side effects such as nausea and diarrhoea, and by cost.[2–10] Variety and alteration in taste (different flavours, temperature and consistency), encouragement and support by staff, as well as administration between the meals (and not at meal times) are all important in order to achieve increased energy and nutrient intake.

Randomised controlled trials of TF in patients with neurological dysphagia that compared nasogastric (NG) with PEG feeding have shown that 93–100% of the prescription was administered via the PEG, versus 55–70% via a NG tube.[11,12] In three studies with supplemental overnight NG TF, between 1000 and 1500 kcal were administered per night in addition to daily food intake. Total energy and nutrient intake was, therefore, markedly improved.[13–15]

1.2. Can EN maintain or improve the nutritional status of elderly patients?

ONS can maintain or improve nutritional status (Ia). Several studies have shown that TF also

maintains or improves nutritional paramenters irrespective of the underlying diagnosis. The metabolic consequences of ageing which can lead to sarcopenia and a severely reduced nutritional status at the time of tube placement can impair or even prevent successful nutritional therapy (III).

Comment: The administration of ONS has been reported to have positive effects on nutritional status irrespective of the main diagnosis. Weight loss, during acute illness and hospitalisation, can be prevented by the provision of food of high energy and protein density, combined with between meal snacks, and by the use of ONS, when normal intake is insufficient. Sometimes weight gain can even be achieved. Milne et al.[1] analysed the percentage weight change in 34 randomised controlled trials with 2484 elderly patients and showed a mean weight increase of 2.3% (pooled weighted mean difference; 95% confidence interval (CI) 1.9–2.7%)[1] (Ia). Changes to anthropometric parameters are less consistent, but may reflect improvement of nutritional status in general[1] (Ia). Effects on body composition have only occasionally been investigated. Increases in fat-free mass (FFM) (Ib)[16,17] (IIa)[18] and BCM (Ib)[19] in supplemented patients have been reported by some investigators whereas others could not detect any change (Ib)[20–22] (IIa)[23].

Several observational studies exploring the effect of TF in multimorbid geriatric patients have shown improvements in nutritional status, e.g. maintenance of body weight[24–27] (III) and either maintenance[25,27] (III) or increase in albumin levels[24,26,28] (III). It should be emphasised, however, that changes in albumin more usually reflect changes in disease rather than nutritional status.[29,30] In two studies of frail, mainly demented nursing home residents, weight gain has been reported.[31,32] Improvements in nutritional status have also been described in patients with neurological dysphagia, in whom PEG feeding proved superior to nasogastric feeding (NGT)[11,12] (Ib). The effects of nocturnal TF supplementary to daily food intake in elderly patients with hip fracture or fractured neck of femur, are inconsistent.[13–15] Bastow et al.[13] have reported the greatest benefit in undernourished patients (***Compare 2.4***).

The effectiveness of TF on nutritional status may be limited by compliance with the tubes, and by side effects. The nutritional status of the frail elderly is often very reduced at the time of tube placement,[24–26,33–38] and is accompanied by sarcopenia which is more difficult to reverse in the old compared with the young.[39–41] Resistance training, if tolerated, may add to the effectiveness of nutritional support.[9,42] Many tube fed patients are bedridden, and consequent immobility further enhances muscle wasting and prevents gain in lean mass. Weighing is also problematic in these patients.

1.3. Does EN maintain or improve functional status or rehabilitative capacity?

Adequate nutrition is a prerequisite for any functional improvement, although studies are too few and diverse to allow a general statement. Some studies have been positive and some negative in this respect.

Comment: Available data concerning the effect of ONS on the functional capacity of elderly patients are inconsistent, although several studies report functional improvements. Thus, Gray-Donald et al.[7] (Ib), observed a significantly lower *frequency of falls* in supplemented free-living frail elderly compared with non-supplemented and Unosson et al.[43] (Ib) describe a higher *activity level* in long-term care residents after 8 weeks of ONS. Improvements in the ability to perform basic *activities of daily living (ADL)* are reported in a group of female patients after hip fracture by Tidermark et al.[44] (Ib), in a subgroup of severely undernourished geriatric patients by Potter[45] (Ib) and in a subgroup of patients with good acceptance of a 6 months supplementation by Volkert et al.[2] (Ib). Woo et al.[46] (Ib) describe a significantly improved ADL status in patients during recovery from chest infection after 3-months intervention compared with the control group. Several studies, however, detected no difference between intervention and control groups with respect to independence in ADL (Ib)[19,20,47–49] (IIa)[6,50]. *Mobility* was also unchanged in several studies (Ib)[3,43,47] (IIa)[6]. Similarly, *hand grip strength* was unaltered in most studies (Ib)[3,6,7,17,21,51–53] (IIa)[18] but this may be of limited relevance as it only tests muscle function of the upper body. One randomised trial[54] (IIa) as well as two non-randomised[23,55] and one uncontrolled trial[56] (IIb) report an improved hand grip strength in supplemented patients. In four trials, the effects on *mental capacity* were assessed and again no changes were observed (Ib)[20,43,52] (IIa)[50].

At the time of tube placement, geriatric patients are often in a significantly compromised general condition as well as severely functionally impaired.[24,27,36,57–59] Trials in nursing homes also describe a high degree of frailty and dependence in PEG-fed residents[32,36,60–63] (III).

Apart from the fractured femur studies with supplementary overnight TF (**Compare 2.4**) only a few, uncontrolled trials have reported the effects of TF on either functional status or

rehabilitative capacity in other groups of elderly patients.[24,33,36,64,65] Callahan et al.[24] evaluated 72 PEG-fed patients with severe physical and mental impairments before and after PEG placement using several ADL scales. Improvements in functional status were only rarely observed (improvement of instrumental activities of daily living (IADL) in 6%, ADL 10%, upper body functions 18%, lower body functions 29%) (IIb). Kaw and Sekas,[36] using the Functional Independence Measure Scale (FIM), also failed to show significant improvements after 18 months in functional status in tube-fed nursing home residents who were in reduced general condition (52% demented, 48% completely ADL dependent) (III). Weaver et al.[65] used a Quality of Life Scale adapted from Spitzer, in which orientation, communicative capacity, ability to self-care, and continence were assessed. In a mixed population of PEG-fed patients (median age 76 years), no significant change was detected after long-term EN. Relatives of the patients with the lowest value on the scale tended to answer "no" to the question whether they would wish TF in a similar situation for themselves (IIb). Nair et al.[33] observed no changes in function measured by the Karnovsky Performance Scale after 6 months of PEG feeding in 31 surviving patients aged 84±8 years (IIa). Only Sanders et al.[64] describe an improvement in ADL in 25 stroke patients (mean age 80 years) with EN via PEG. At the time of PEG placement 84% of the patients had a Barthel index (0–100 points) of 0 points (completely dependent; mean 0.5 points). After 6 months of EN a mean increase of 4.8 points was observed. Six patients (24%) showed a clear improvement (Barthel index increase from 0.5 to 9 points), in 10 patients (40%), however, no or only a minimal improvement was observed (IIa).

1.4. Does EN reduce length of hospital stay?

In geriatric patients, length of hospital stay is determined not only by nutritional status but also by other factors. Available results concerning the effect of EN on length of hospital stay are conflicting.

Comment: Undernutrition increases the risk of complications thereby increasing the length of hospital stay in geriatric patients.[66–69] Consequently, improvement in nutritional status using EN should result in a reduced length of hospital stay. In geriatric patients, however, length of hospital stay is not only determined by nutritional status but also by other factors, e.g. the assurance of adequate care after discharge. In addition, in times of declining financial resources, length of hospital stay is only a poor reflection of the effects of EN.

Available study results about the impact of EN on length of stay are conflicting. In 2002 Milne et al.[70] analysed seven studies with 658 participants and reported a statistically significant benefit of ONS with respect to hospital stay. Mean length of stay was 3.4 days shorter in the supplemented compared with the unsupplemented group (95% CI 6.1–0.7 days) (Ia). The addition of three new trials to the meta-analysis, however, shifted the results to non-significant effects.[1] If patients with hip or femoral neck fracture are regarded separately, several studies report significantly shorter length of stay in supplemented patients[71–74]; this could not however be confirmed by others[75] (***Compare 2.4***)

The effects of TF on length of hospital stay have only occasionally been measured[11,13,15] and require further study.

1.5. Does EN improve quality of life?

The effect of ONS and TF on quality of life is uncertain.

Comment: Although quality of life is crucial in the evaluation of therapeutic benefit in geriatrics, only a few studies have examined the effect of EN upon it. Studies investigating the effect of ONS have employed different parameters, e.g: general well-being, subjective health, SF 36, EQ-5D, Hospital Anxiety and Depression Scale (HADS). Some report improvements (IIa)[3,54,76], whereas others observe no changes[7,22,51] (IIa). These few available data do not allow any firm conclusion about the effects of ONS on quality of life.

In patients requiring TF, impairments of cognition, vigilance and speech can make assessing quality of life difficult. About 60% of the patients in the trial of Callahan et al.[24] were unable to communicate at the time of PEG placement, and the majority of patients with preserved ability to communicate were cognitively impaired (IIb). In the cohort of 215 patients investigated by Bannerman et al.[77] data on quality of life could only be gathered in 30 patients (IIb). Verhoef and van Rosendaal[78] used semi-structured interviews (with either patients or their relatives), the Karnovsky Performance Scale as well as the Quality of Life Index, in order to measure subjective quality of life in patients after PEG placement (mean age 66±18 years). About 85% of the patients who were still alive after one year and still fed via PEG ($n = 23$) were not able to run a household, 67% were dependent in personal care and 19% were feeling very ill. However, the majority of patients and caregivers felt that it had been the right decision to agree to the PEG. All 10 patients who were alive after one year and could be asked, stated that they

would decide in favour of PEG again. The Karnovsky index deteriorated in three of these 10 surviving patients and improved in six (IIb). According to the authors, these results do not necessarily imply a clear improvement in quality of life.[78] Weaver et al.[65] evaluated subjective quality of life by interview and observed a correlation between subjective and objective quality of life (***Compare 1.3***). Significant changes in subjective quality of life were not detected (IIb). Abitbol et al.[26] used both a behaviour scale and a depression scale in order to assess quality of life in 59 institutionalised patients (mean age 85 years) who received EN via a PEG. The patients were bedridden, their health status was reduced, and infections were present in 25%. After 3 months of EN via a PEG, quality of life scores were unchanged, although the depression scale tended to improve. However, 16 of the surviving patients (27%) resumed full oral nutrition and six patients (10%), returned to their own home with a functioning PEG tube (IIb). In a cohort of 38 long-term home EN patients, quality of life was poorer in elderly than in younger patients.[79]

All in all, these studies do not allow for any general conclusions about effects of EN on quality of life. TF may also have side effects that may adversely affect quality of life, e.g. gastrointestinal symptoms, aspiration, the discomfort of the tube, or the need to use restraints.

1.6. Does EN improve survival in geriatric patients?

ONS improve average survival (Ia). In patients who need TF due to the severity of disease, an increase in survival is not proven.

Comment: Meta-analysis of the data from 32 randomised controlled trials with 3017 participants revealed a lower mortality risk in supplemented elderly subjects than in controls (relative risk (RR) 0.74; 95% CI 0.59–0.92)[1] (Ia). Participants were supplemented for at least 1 week and observed for at least 2 weeks. A further meta-analysis from 12 randomised controlled trials ($n = 1146$) and five non-randomised studies on the effect of ONS in hospitalised geriatric patients with mixed diagnoses reached similar conclusions (RR 0.58; 95% CI 0.4–0.83)[80] (Ia). In contrast, a meta-analysis from five studies on the effect of protein and energy supplementation, mainly in hip fracture patients, showed no effect on mortality risk.[75] Studies on supplementary overnight TF in hip fracture patients have produced similar results (***Compare 2.4***).

The effect of *TF* on the survival of elderly patients without a hip fracture was investigated in nine non-randomised controlled studies (non-randomised for ethical reasons) (Table 1) and several uncontrolled observational studies (Table 2).

Four of the *controlled studies* were carried out in hospitals,[33,81,82,84] five in nursing homes.[60–63,83] Two of the studies were prospective,[33,81] and the others were retrospective comparisons of EN vs. no EN. In five studies, participants with advanced dementia were investigated.[33,61,62,81,84] The most recent of these studies was retrospective and describes a mean survival of 59 and 60 days in 23 severely demented dysphagic patients with PEG and in 18 patients without PEG.[84] A database analysis from Mitchell et al.[62] in 1386 nursing home residents with severe cognitive impairment—where 135 were enterally fed—showed no increase in survival (III). Mortality rate after one year was surprisingly low (15%). Meier et al.[81] prospectively studied 99 acutely ill patients with advanced dementia, seventeen of whom were already being fed by PEG at the time of hospital admission, 51 had a PEG inserted in hospital, and the remaining 31 consumed regular food orally. Half of all patients died during the following 6 months irrespective of the nutritional regimen. Nair et al.[33] observed a higher mortality rate in 55 severely demented patients with PEG after 6 months compared with a control group without a PEG (44% vs. 26%). According to the authors, the groups were comparable regarding age, gender and comorbidity. PEG patients, however, suffered more often from severe hypoalbuminaemia (mean albumin concentration 28.6 ± 5 vs. 33.2 ± 4 g/l in the control group) suggesting more severe underlying inflammatory disease. The only trial that detected a significantly reduced mortality in nursing home residents with severe cognitive impairment is the data base analysis from Rudberg et al.[61] After 30 days, 15% had died in the group of enterally fed patients compared with 30% in the control group. After 1 year, the difference was less distinct, but still statistically significant (50% vs. 61%). The control group was comparable regarding dementia, comorbidity, functional status and BMI (III).

Two further non-randomised controlled studies in nursing home patients with various diagnoses and a low percentage of demented patients also failed to show prolonged survival in the enterally fed patients.[60,63] In the databank analysis from Mitchell et al.[63] mortality in 551 tube-fed nursing home residents with chewing and swallowing difficulties was even higher than in 4715 residents without nutritional therapy (III). Approximately half of the participants showed severe cognitive impairments (66% of tube-fed patients vs. 46% of the control

Table 1 Mortality in tube-fed elderly subjects (controlled, non-randomised studies).

Article	Study		Type of EN	Patients			Diagnosis					Mortality (%)		
First author	Type	Place		*n*	Age (years)		Dementia (%)	CVE (%)	CA (%)	Dysphagia (%)	Other characteristics	30 day	6 mon	1 year
					M±SD	Range								
Mitchell[62]	R (database)	NH	TF	135	87 (Md)	(65–107)	100 severe	47	6	—	63% instable condition, 30% decubitus, 33% severe ADL-dependent, 84% chewing or swallowing problems	<5		ca. 15
			No	1251	87 (Md)	(65–107)	100 severe	27	7	—	52% instable condition, 15% decubitus, 45% severe ADL-dependent, 61% chewing or swallowing problems	<5		ca. 15
Meier[81]	P	H	68 PEG, 31 no	99	84.8	(63–100)	100 advanced	0	0	—	All acutely ill, 56% decubitus, 62% infections	ca. 20	50	65
Nair[33]	P	H	PEG	55	83±10		100 advanced	0	0	—	No CA, CVE, severe disease, EN due to low oral intake		44	
			No	33	80±8		100 advanced	0	0	—	No CA, CVE, severe disease		26	
Rudberg[61]	R (database)	NH	NG	353	85±7	⩾65	93 cog. imp. (63 severe)	—	—	100	100% dysphagia & eating dependence, 96% dependent in 6 ADL	15		50
			No	1192	86±7	⩾65	93 cog. imp. (64 severe)	—	—	100	100% dysphagia & eating dependence, 96% dependent in 6 ADL	30		61

Table 1 (*continued*)

Article	Study		Type of EN	Patients			Diagnosis					Mortality (%)		
First author	Type	Place		*n*	Age (years)		Dementia (%)	CVE (%)	CA (%)	Dysphagia (%)	Other characteristics	30 day	6 mon	1 year
					M±SD	Range								
Mitchell[63]	R (database)	NH	TF	551	87 (Md)	⩾65	31 (66 severe cog. imp.)	59	7	—	100% chewing or swallowing difficulties, 47% instable condition, 12% decubitus, 83% severely ADL-dependent			22
			No	4715	87 (Md)	⩾65	50 (46 severe cog. imp.)	30	6		100% chewing or swallowing difficulties, 40% instable condition, 9% decubitus, 46% severely ADL-dependent			12
Bourdel-Marchasson[60]	R	NH	PEG	58	74±9		n.a. (NH 55%)	n.a. (NH 19%)	n.a.	53	36% anorexia, 10% unconscious, all severely dependent, 66% decubitus	14		
			No	50	82±8		n.a. (NH 55%)	n.a. (NH 19%)	n.a.	44	56% anorexia, 0% unconscious, all severely dependent, 14% decubitus	10		
Cowen[82]	R	H	All	149	76±12		20	56	0	100	Serious comorbidity, 42% hemiplegia, 32% CHF, 20% decubitus, 70% alert, 85% urine-incontinent	27		62
			PEG	80										60
			No	18							Spontaneous improvement			10
			No/NG	51										78
Croghan[83]	R	NH	All	40	69	(31–96)	25	90	5	83	55% aspiration, 20% mobile			
			Tube	15										53
			No	7										43

ADL = Activities of daily living, CA = cancer, CHF = congestive heart failure, cog.imp. = cognitive impairment, CVE = cerebrovascular event, EN = enteral nutrition, H = Hospital, ONS: oral nutritional supplements, TF = tube feeding, EN = enteral nutrition (= ONS & TF) Md = Median, M±SD = Mean±standard deviation, mon = months, n.a. = not available, NG = nasogastric tube, NH = nursing home, PEG = percutaneous endoscopic gastrostomy, P = prospective, R = retrospective.

Table 2 Mortality in tube-fed elderly subjects (observational studies without control group).

Article	Study type	Type of EN	Patients			Diagnosis					Mortality			
First author			*n*	Age (yr) M±SD	(Range)	Dementia (%)	CVE (%)	CA (%)	Dysphagia (%)	Other characteristics	30 day (%)	3 mon (%)	6 mon (%)	1 year (%)
Nursing home residents														
Golden[32]	R	PEG	102	89±6	(71–104)	89 severe	20	0	100	Persistent dysphagia, low intake, 75% compl. ADL-dependent, stable condition, no terminal stage, LE at least 1 mon		12	24	38
Abuksis[57]	R	PEG	47	84±11	(44–100)	87	49	0	—	94% desoriented, 96% bedridden	4			
Kaw[36]	R	PEG	46	74	(19–96) 70%>70	52	24	7	—	48% completely ADL-dependent, only 4% could decide in favour of PEG themselves, poor general condition	20			50
Geriatric patients (all >65 yr or mean age >65 yr)														
Lindemann[85]	P	PEG	36	83	(⩾65)	100	0	0	11	84% low intake (53% chron, 31% acute), 6% behavioural disorder	25		42	
Sanders[59]	R	PEG	103	77	—	100	0	0	100	all severely ADL-dependent (BI 0-5 P)	54	78	81	90
Dwolatzky[86]	P	PEG	32	85±6	(⩾65)	84	53	3	28	72% refusal to eat	5			45
		NG	90	82±9	(⩾65)	68	43	2	37	63% refusal to eat	20			80
Abuksis[57]	R	PEG	67	80±16	(26–103)	52	30	10	31	79% bedridden, 11% unconscious	29			
Paillaud[35]	R	PEG	73	83±9	(⩾65)	45	—	4	45	49% anorexia, 30% infection 44% reduced mobility, 44% decubitus	32		52	63
Fay[27]	R	PEG	80	70.2	—	32	52	23	79	31% decubitus, 91% in need of assistance in ADL, 76% faecal-, 90% urine-incontinent	17		55	70
		NG	29	69.8	—	13	41	28	41	21% decubitus, 86% in need of assistance in ADL, 66% faecal-, 82% urine-incontinent	28		45	70
Callahan[24]	P	PEG	99	79±9	(60–98)	35	41	13	—	35% neuro-degenerative disorder, severe physical and mental impairment	22			50
Ciocon[25]	P	NG	70	82	(65–95)	34	—	—	47	50% refusal to eat, 3% oesophagus-obstruction, multiple & advanced disease	5		41	
Quill[87]	R	NG/G	55	>70	(⩾70)	31	49	27	—	69% incompetent				
Abitbol[26]	P	PEG	59	83±7	50%>85	30	—	2	42	31% MN without dys, 25% refusal to eat 54% decubitus, 49% pulmonary infection	25			
Bussone[88]	R	PEG	155	84	(70–98)	24	—	3	—	35% neurol, 38% depression	16			
Bussone[89]	P	PEG	101	83.6	(70–98)	22	36	4	—	38% depression	14			
Markgraf[90]	R/P	PEG	54	87	(65–94)	—	—	24	—	72% neurol, multimorbid	33			
Raha[91]	?	PEG	161	79	(53–99)	—	81	—	88	12% MN	20	39		
Finucane[92]	P	PEG	28	82	(68–99)	—	93	—	100	7% Parkinson; NG-intolerant	8			

Table 2 (*continued*)

Article	Study type	Type of EN	Patients			Diagnosis					Mortality			
First author			*n*	Age (yr) M±SD	(Range)	Dementia (%)	CVE (%)	CA (%)	Dysphagia (%)	Other characteristics	30 day (%)	3 mon (%)	6 mon (%)	1 year (%)
James[93]	R	PEG	126	80 (Md)	(53–94)	—	100	—	100	aspiration risk	23	38	46	53
Wanklyn[94]	R	PEG	37	74	(48–89)	—	100	—	—	92% hemiplegia		68		
Wijdicks[95]	R	PEG	63	74 (Md)	(41–98)	0 advanced	100	0	—	no terminal stages; 63% hemiplegia, 21% aphasia, 35% reduced consciousness	14 (2 wks)			
Mixed cohorts with high percentage of elderly														
Clarkston[96]	R	PEG	42	71.4	(33–99)	—	—	24	—	67% neurol, 9% MN	26	48		
Friedenberg[97]	P	PEG	64	76	(39–97)	—	—	20	—	80% severe neurol. dysfunction, 38% respiratory problems, severe cognitive impairment	33			
Horton[98]	R	PEG	224	75	(20–103)	6	70	15	—	—	8			
Kohli[99]	R	PEG	100	82	(47–102)	4	—	2	38	48% MN	16			
Larson[100]	R	PEG	314	n.a.	(3–92) 66%>60	—	—	1	—	75% neurol, 13% oropharyngeal	16			
Light[101]	R	PEG	416	75	(18–103)	11	30	9	—	19% MN; -	23			
Llaneza[102]	R	PEG	73	67	(30–96)	—	—	19	—	34% neurol, 18% AP	26			
Markgraf[103]	R	PEG	84	69±14	(35–98) 65%≥65	—	—	39	—	59% neurol, polymorbid	31			
Nicholson[104]	R	PEG	168	70	(16–96)	—	58	—	18	15% neurol, 9% obstruction	9.5			
Rabeneck[105]	R	PEG	7368	68.1	(18–102) 26%>75	—	19	30	—	29% neurol				59
Rimon[106]	P	PEG	339	71.3	(14–96)	—	—	11	—	82% neurol	19.5			
Sali[107]	R	PEG	32	75	(38–88)	—	53	13	100	16% pseudobulbar paralysis	16			
Sanders[59]	R	PEG	361	68.5	—	29	33	18	100	20% miscellaneous diagnoses	28	44	52	63
Skelly[58]	P	PEG	74	69 (Md)	(28–90)	—	42	26		23% chron. neurol; severe functionally impaired (38% BI 0, Md 1 point)	19	35	42	
Stuart[108]	R	PEG	48	70 (Md)	—	—	—	17	—	66% neurol, 13% COPD	31			
Stuart[108]	R	op.G.	55	65 (Md)	—	—	—	29	—	64% neurol, 7% COPD	24			
Tan[109]	R	PEG	44	65	(14–94)	—	39	36	100	59% neurol, 7% Parkinson				
Taylor[110]	R	PEG	97	76.5	(<1–97)	—	55	5		25% other CNS-diseases, 55% impaired vigilance, 87% assistance in toilet & transfer	22			53
Wolfsen[111]	R/P	PEG/PEJ	201	66±16	(≥18)	—	—	36	—	64% benign disease, esp. neurol			50	
Home enteral nutrition patients														
Elia[112]	BANS	HEN	1230	—	(65–75)	—	100		—	41% bedridden, 31% house-bound				25
			2970	—	(≥75)	—	100		—	47% bedridden, 30% house-bound				36
Howard[113]	R	HEN	787	79±8	(≥65)				100	neuromuscular dysphagia				53
Sanders[114]	P	PEG	87	74	(35–88)	—	—	—		PEG-complications at home			17	
Schneider[115]	P	HEN	54	86 (Md)	(60–101)	100	0	0	0	100% low intake	46			80
			148	75 (Md)	(1–97)	0	**57**	0	97	3% low intake (as indication), 20% ALS	17			59
			64	65 (Md)	(40–92)	0	0	100	100	0% low intake (as indication)	12			63
			32	75 (Md)	(1–94)	0	0	0	0	100% low intake due to depression or disease related stress	19			44

ADL = activities of daily living, ALS = amyotrophic lateral sclerosis, AP = aspiration pneumonia, BANS = British Artificial Nutrition Survey, BI = Barthel Index, CA = cancer, chron = chronic, compl. = completely, COPD = chronic obstructive pulmonary disease, CVE = cerebrovascular event, Dys = Dysphagia, EN = enteral nutrition, G = Gastrostomy, HEN = home enteral nutrition, LE = life expectancy, Md = median, MN = malnutrition, M±SD = mean±standard deviation, mon = months, n.a. = not available, NG = nasogastric tube, neurol = neurological, op.G. = operative gastrostomy, P = prospective, PEG = percutaneous endoscopic gastrostomy, PEJ = percutaneous endoscopic jejunostomy, R = retrospective.

group) and 83% and 46%, respectively, were severely dependent in basic ADLs. The mortality rate after one year was comparably low in both groups (22% and 12%, respectively). Bourdel-Marchasson et al.[60] (III) reported in a mixed population of 108 severely dependent nursing home residents a mortality rate of 14% in the PEG group vs. 10% in the group without nutritional support. Gastrointestinal and pulmonary complications were also not significantly different. The prevalence of dementia in the nursing home was reported to be 55% and of stroke 19%. Specific prevalence data for the study group, however, are not given.

Two trials in dysphagic patients reach different conclusions. Croghan et al.[83] report no difference in mortality between 15 tube-fed and seven orally fed nursing home residents suffering from aspiration, who underwent videofluoroscopic swallowing evaluation mainly because of stroke. Cowen et al.[82] (III) recruited 149 severely ill hospital patients with dysphagia and compared the mortality of three subgroups after one year: Death had occurred in 60% of 80 patients who had received a PEG, in 10% of 18 patients who did not receive a PEG because their clinical situation had improved in hospital, and in 78% of 51 patients who did not receive a PEG for other reasons (28 had refused EN, 12 had died before PEG placement, one patient was transferred to another hospital and 10 patients were fed via a NGT).

The study by Cowen et al.[82] is an example of the difficulty of all non-randomised controlled studies, i.e. there is a lack of comparability between the intervention and control group. The enterally fed patients from almost all studies described above are probably not comparable with the patients in the control group. The only exception is the study from Rudberg et al.[61] In the studies from Meier et al.[81] and Murphy and Lipman[84] the groups are not properly described. In the non-randomised studies, the enterally fed patients obviously differed from those patients who did not receive EN—for a variety of reasons. The decision not to use EN is probably linked to the status of the patients in some respects. Moreover, the heterogeneity of geriatric patient populations provides a multitude of factors which may influence outcome, e.g. main diagnosis, comorbidity, nutritional status and general condition, mood, various functional parameters including cognition, vigilance, self-care ability, mobility and continence which are present at the same time in different combinations and to a varying extent.

Observational studies reporting mortality of enterally fed elderly subjects focus on mortality after 30 days or after 1 year (Table 2). However, comparisons between studies are generally difficult due to the heterogeneous populations involved that are often not properly characterised. In most of the studies, between 10% and 30% of the participants died after 30 days. Lower mortality rates are reported by Abuksis et al.[57] and Dwolatzky et al.[86] mainly in the demented elderly, by Finucane et al.[92] and Horton et al.[98] in geriatric patients with predominantly cerebrovascular events, and by Ciocon et al.[25] in a mixed population of elderly patients. Extremely high 30 day mortality rates of 46% and 54% are described by Schneider et al.[115] and Sanders et al.[59] in the demented elderly. One year after initiation of EN, mortality rates between 15% and 90% are reported (Table 2). The highest as well as the lowest mortality rate is reported in demented patients[59,62] (***Compare 2.7***).

Mitchell et al. who performed a meta-analysis of seven controlled studies on mortality with or without PEG, draw the conclusion that the impact of TF on survival "is not known because the level of evidence is limited".[116] Further studies are needed in groups in whom nutrition may further reasonably be expected to influence mortality.

2. EN in specific diagnostic groups

2.1. Is EN indicated in patients with undernutrition?

Undernutrition and risk of undernutrition represent essential and independent indications for EN in geriatric patients. ONS is recommended in order to increase energy, protein and micronutrient intake, maintain or improve nutritional status, and improve survival in patients who are undernourished or at risk of undernutrition (A). ONS and/or TF are recommended early in patients at nutritional risk (e.g. insufficient nutritional intake, unintended weight loss $>$5% in 3 months or $>$10% in 6 months, BMI $<$ 20 kg/m^2) (B).

Comment: Undernutrition in geriatric patients is associated with poor outcome. Essential signs of undernutrition in the elderly are unintended weight loss $>$5% in 3 months or $>$10% in 6 months as well as a BMI below 20 kg/m^2. Risk of undernutrition is indicated by loss of appetite, reduced oral intake and stress (physical as well as psychological).

In a Cochrane analysis of 49 studies including 4790 randomised elderly patients with manifest undernutrition or risk of undernutrition, positive effects of ONS have been shown: there is increase in energy and nutrient intake, maintenance or improvement of nutritional status and reduction of

mortality risk[1] (Ia) (***Compare 1.1, 1.2 and 1.6***). ONS are, therefore, clearly recommended (A). Effects on functionality and quality of life are, however, uncertain (***Compare 1.3 and 1.5***).

The effects of TF in undernourished elderly patients are unclear due to limited data. Very often TF is not initiated until advanced undernutrition has developed, which is a clear impediment to the success of nutritional therapy (***Compare 1.2***). Results from several studies however, indicate maintenance or improvement of nutritional parameters in undernourished elderly patients after TF[24–26] (III). Effects on functional status and quality of life are uncertain (***Compare 1.3 and 1.5***).

It is highly recommended to initiate nutritional support, not only in manifest undernutrition, but as soon as there are indications of nutritional risk, and as long as physical activity is possible, EN—together with rehabilitative exercise—can help to maintain muscle mass (C). Early routine nutritional screening is mandatory. Several tools (e.g. ESPEN guidelines,[117] MNA[118]) are available for this purpose.

2.2. Is EN indicated in frail elderly?

In frail elderly, ONS are recommended in order to improve or maintain nutritional status (A).

Frail elderly may benefit from TF as long as their general condition is stable (not in terminal phases of illness). TF is therefore recommended early in case of nutritional risk (B), where normal food intake is insufficient.

Comment: Frail elderly are limited in their ADL due to physical, mental, psychological and/or social impairments a well as recurrent disease. They suffer from multiple pathology which seriously impairs their independence. Therefore they are in particular need of help and care and are vulnerable to complications. An inadequate intake of fluids and nutrients is a common problem in these subjects. Frail elderly therefore are at high risk of undernutrition and its serious consequences. Experience has shown that the ability to eat sufficient amounts orally is inversely associated with the extent of frailty. Decreasing oral intake may therefore be an indication of the progress or severity of disease or frailty.

ONS lead to a significant increase in energy and nutrient intake as well as to a stabilisation or improvement of nutritional status in mixed samples of multimorbid elderly with acute and/or chronic diseases, at home as well as in nursing homes and hospitals (Table 3). Effects on functional status and quality of life are uncertain due to limited data. Effects on length of hospital stay and mortality have been investigated only occasionally. Potter et al.[127] found a reduced length of hospital stay only in a subgroup of patients with adequate initial nutritional status. Data on mortality are controversial in frail elderly.[8,127]

Clinical experience shows that frail elderly, at nutritional risk, may benefit from TF as long as their general condition is stable. Observational studies indicate a relatively good prognosis in tube-fed frail elderly nursing home residents with good health status[32,57] (III) (Table 2). Although data are scarce, it is recommended that nutritional support be initiated early, as soon as there are indications of nutritional risk and as long as physical activity is possible since EN—together with rehabilitative exercise—can help to maintain muscle mass (C). Nutritional screening has to be implemented as a matter of routine for early detection of risk of undernutrition. Several tools (e.g. ESPEN guidelines,[117] MNA[118]) are available for this purpose.

TF is not recommended in frail elderly who have progressed to an irreversible final stage, e.g. with extreme frailty and advanced disease (irreversibly dependent in ADL, immobile, unable to communicate, as well as high risk of death) (IV).

2.3. Is EN indicated in geriatric patients with neurological dysphagia?

In geriatric patients with severe neurological dysphagia, EN is recommended in order to ensure energy and nutrient supply and, thus, to maintain or improve nutritional status (A). For long-term nutritional support PEG should be preferred to NGT, since it is associated with less treatment failures, better nutritional status (A), and it may also be more convenient for the patient. In patients with severe neurological dysphagia TF has to be initiated as soon as possible (C). EN should accompany intensive swallowing therapy until safe and sufficient oral intake from a normal diet is possible (C).

Comment: In neurological dysphagia, nutritional therapy depends on the type and extent of the swallowing disorder. Nutritional therapy may range from normal food, to mushy meals (modified consistency), thickened liquids of different consistencies or total EN delivered via NGT or PEG. Nutritional therapy and swallowing therapy have to be closely coordinated. Typical complications of neurological dysphagia are aspiration with bronchopulmonary infections[136–139] and undernutrition, causing extended length of hospital stay and recurrent hospitalisations.[139–141] Mortality due to dysphagia is significantly enhanced.[139] Patients

Table 3 Oral supplementation in mixed cohorts of frail elderly.

Article	Study type	Patients				Supplements			Results				
First author		*n*	Age (yr) *M*±SD (range)	Nutritional status	Place	Energy (kcal/d)	Protein (g/d)	Duration	Intake		Nutritional status	Functional status	Quality of life
									E	Prot			
Chandra[119]	RCT	30	(70–84)	MN	At home	Individ.	n.a.	4 wks	n.a.	n.a.	Weight+ TSF+ Alb, PA + immune response+	n.a.	n.a.
Gray-Donald[7]	RCT	50	78 (>60)	BMI 19±3	At home	500–700	17–26	12 wks	(+)	n.a.	Weight+ skinfolds = AMC, CC =	Hand grip = falls+	Well-being = subjective health =
Payette[3]	RCT	83	80±7 (>65)	BMI 20±3	At home	500–700	17–26	16 wks	+	(+)	Weight+ skinfolds = AMC, CC =	Hand grip = mobility = days in bed+	''Emotional role functioning''+
Volkert[2]	RCT	46	85 (75–98)	MN BMI 19±2	At home	250	15.0	6 mon	n.a.	n.a.	Weight =	ADL+(in compliant subgroup)	n.a.
Woo[46]	RCT	81	73 (>65)	BMI 20±5	At home	500	17.0	1 mon	+	+	Weight+(m) fat mass + FFM+(m)	ADL+ activity+ mental function = appetite = sleep+	n.a.
Wouters[22]	RCT	68	82 (⩾65)	BMI 24±2	Nursing home	250	8.8	6 mon	+	+	weight + FFM, FM, CC = Alb, PA =	Hand grip = ADL = mobility = sleep+	=
Wouters[120]	RCT	55	83 (⩾65)	BMI 24±2	Nursing home	250	8.8	6 mon	n.a.	n.a.	Vit. C, E, Cysteine+ Antiox. capacity+	n.a.	n.a.
Banerjee[121,122]	RCT	63	81 (60–98)	n.a.	Nursing home	265	18.6	14 wks	=	+	TSF+ Alb, Trf, PA = % T-Lymphocytes = Complement C3 =	Skin problems+	n.a.
Beck[123]	RCT	16	85 (65–96)	BMI 20 (M) MNA 17–23,5	Nursing home	380	5.0	2 mon	=	n.a.	weight =	n.a.	n.a.
Ek[124]	RCT	482	80	28.5% MN	Nursing home	400	16.0	26 wks	n.a.	n.a.	Skin test+	n.a.	n.a.
Fiatarone[20]	RCT	50	88±1 (>70)	BMI 25.5 (M)	Nursing home	360	15.0	10 wks	=	n.a.	Weight+ FFM = FM (+) Alb, Fe, HDL = Vit. D, E, Folate =	ADL = depression = mental function =	n.a.
Hankey[125]	RCT	14	81±2 (>75)	weight 45 kg, Alb 33 g/L	Nursing home	680	n.a.	8 wks	+	n.a.	weight (+) TSF, AMC +Albumin =	n.a.	n.a.

Table 3 (*continued*)

Article	Study type	Patients				Supplements			Results				
First author		*n*	Age (yr) $M \pm SD$ (range)	Nutritional status	Place	Energy (kcal/d)	Protein (g/d)	Duration	Intake		Nutritional status	Functional status	Quality of life
									E	Prot			
Larsson[8]	RCT	435	80	29% MN	Nursing home	400	16.0	26 wks	n.a.	n.a.		n.a.	n.a.
Lauque[53]	RCT	35	85 (>65)	BMI 22±1 MNA 17-23.5	Nursing home	300–500	20–30	60 days	+	+	Weight+	Hand grip = MNA+	n.a.
Unosson[43]	RCT	430	80	26% MN	Nursing home	400	16.0	26 wks	n.a.	n.a.	n.a.	Activity+, mobility = mental function = general well-being =	n.a.
Hübsch[19]	RCT	72	86 (75–99)	MN	Hospital	500	30.0	3 wks	+	+	Weight = FFM = BCM+ Alb, Trf, RBP = Vit. B1, C+	ADL (+)	n.a.
McEvoy[126]	RCT	51	n.a.	MN	Hospital	644	36.4	4 wks	n.a.	n.a.	Weight+ TSF+, AMC = Alb =	n.a.	n.a.
Potter[127]	RCT	381	83 (Md) (61–99)	Non-obese	hospital	540	22.5	Hospital (Md 17 days)	+	n.a.	Weight+ AMC (+)	ADL+(MN)	n.a.
Bunker[128]	NRT	58	80 (70–85)	BMI 24.4 (M); 19%<20	At home	200 (in under-weight patients 300)	20.0	12 wks	n.a.	n.a.	Alb, PA = , RBP+ Fe, Zn, Se+ lymphocyte-populations = skin test (+)	n.a.	n.a.
Cederholm[55]	NRT	23	74±1	MN BMI 17 (M)	At home	400	40.0	3 mon	n.a.	n.a.	Weight+ TSF, AMC+ Alb, Orosomucoid = skin test+	Hand grip+ peak flow =	n.a.
Bos[18]	NRT	23	79 (69–90)	MN BMI 21±3	Hospital	400	30.0	10 days	+	+	Weight+ FFM + Alb, Trf, PA = CRP, IGF-I = Immunglobulin = Complement C3 =	Hand grip (+)	n.a.
Bourdel-M.[129]	NRT	672	83 (>65)	Alb 32±5	Hospital	400	30.0	15 days	+	+	n.a.	Decubitus (+)	n.a.

Chandra[130]	UCT	21	>60	MN	At home	500	17.5	8 wks	n.a.	n.a.	Alb, PA, Trf, RBP+ Zn+, Ferritin = skin test+ lymphocyte populations+	n.a.	n.a.
Gray-Donald[131]	UCT	14	79±6 (>60)	MN	At home	500	KA	12 wks	+	+	Alb (+), RBP, Hb = lymphocyte count+	Hand grip =	Well-being+
Lipschitz[132]	UCT	12	75	"High risk"	At home	1050	39.0	16 wks	+	+	Weight+ Alb, TIBC, Vit. + Hb, metals = lymphocyte count = skin test =	n.a.	n.a.
Harrill[133]	UCT	18	89 (Md)	n.a.	Nursing home	355	13,0	30 days	(+)	(+)	Vit. A, C, B1, B2+ Alb, Hb, Ht, Fe =	n.a.	n.a.
Welch[134]	UCT	15	81	Alb 32 g/L	Nursing home	n.a.	n.a.	6 mon	+	+	Weight+ Alb, Hb, Ht+ Fe, TIBC, Trf =	Decubitus+	n.a.
Bourdel-M.[23]	UCT	11	87	MN BMI 18±3	Hospital	400	30.0	4 wks	=	=	Weight+ muscle mass = Alb+	Hand grip+	n.a.
Joosten[135]	UCT	50	83±6	BMI 24.5±4 Alb 36±6 g/L	Hospital	600	19.0	13±6 days	+	n.a.	n.a.	n.a.	n.a.
Katakity[56]	UCT	12	(71–84)	n.a.	n.a.	204	9.0	12 wks	n.a.	n.a.	Hb = Vit. C, D, B1	Hand grip+ mental function = dark adaption =	n.a.

ADL = activities of daily living, Alb = albumin, AMC = arm muscle circumference, Antiox. = antioxidative, BCM = body cell mass, BMI = body-mass index [Kg/m^2], CC = calf circumference, CRP = C-reactive protein, E = energy, Fe = iron, FFM = fat free mass, FM = fat mass, Hb = hemoglobin, Ht = hematocrit, n.a. = not available, M = Mean, (m) = male participants, Md = median, MN = malnutrition, MNA = Mini Nutritional Assessment, mon = months, NRT = non-randomised trial, PA = prealbumin, Prot = protein, RCT = randomised controlled trial, RBP = Retinol binding protein, Ref. = reference, SD = standard deviation, Se = Selen, TIBC = total iron binding capacity, TSF = Triceps skinfold, Trf = Transferrin, UCT = uncontrolled trial, Vit. = vitamin, wks = weeks, Zn = Zinc.
+improvement in supplemented group (SG) compared to control group (CG).
(+) trend towards improvement, not significant; = no difference SG–CG.

with acute stroke and dysphagia often already exhibit a poor nutritional status on hospital admission, which negatively impacts on outcome and costs: length of hospital stay is extended, rehabilitation is delayed and survival is reduced.[141–143] These results are confirmed by the current international FOOD study.[144]

Controlled trials studying the effects of EN after dysphagic stroke are not available, since control groups without nutritional support would be unethical. It is common sense, however, that energy and nutrient supply has to be ensured in these patients in order to maintain nutritional status and to avoid the development of undernutrition. Due to the strong physiological plausibility based on the fact that patients with *severe* neurological dysphygia are not able to sustain their life without nutritional support, this recommendation was rated at the highest level.

Nutritional status: In a Cochrane analysis of interventions for dysphagia in acute stroke EN delivered via PEG was associated with a greater improvement of nutritional status when compared to EN delivered via NGT.[145] These results are based on a randomised controlled trial conducted by Norton et al.[11] (Ib) in 30 patients and on unpublished data from the authors of the Cochrane analysis from 19 further patients. In another randomised controlled trial in 40 patients with neurological dysphagia (mean age 60 years), the group receiving PEG also exhibited weight gain as well as an increase in mean serum albumin and transferrin. Due to a high drop out rate no evaluation was undertaken in the NGT group[12] (Ib).

Functional status: Sanders et al.[64] reported an improvement in ADL in 25 stroke patients (mean age 80 years) with EN via PEG (PEG placement on average 14 days after stroke). At the time of PEG placement Barthel index was 0 points (completely dependent) in 84% of patients (mean 0.5 points). After 6 months of EN a mean increase of 4.8 points was observed. Six patients (24%) showed a clear improvement (Barthel index increase from 0.5 to 9 points). In 10 patients (40%), however, no or only a minimal improvement was observed (IIa).

Resuming oral nutrition: Dysphagia may be reversible in stroke patients.[146] In various studies between 4% and 29% of patients resumed full oral nutrition after 4–31 months[11,92,93,95,112,115] (III) (Table 4). In the British Artificial Nutrition Survey (BANS) no difference between 65- and 75-year old elderly people and younger adults (16–64 years) was found, although resumption of oral nutrition was slightly reduced in the elderly above the age of 75 years[112] (Table 4). Schneider et al.[115] report the rate of resuming oral nutrition in different diagnostic groups of tube-fed patients at home. Among 148 neurological patients with dysphagia (mean age 75 years), 24% regained the ability to eat sufficient amounts orally within the study period of 242 ± 494 days.

Mortality: Clear statements about the effect of EN on overall mortality after dysphagic stroke are not possible since the investigated groups are too heterogeneous, and control groups without nutritional support would be unethical (***Compare 1.6***). In the study of Norton et al.[11] mortality after 6 weeks was significantly lower in the PEG group than in the group fed by NGT (12% vs. 57%), due probably to the lower percentage of the prescribed intake reached in the latter. In the recent multicentre FOOD trial[147] no difference in 6-month mortality was found between 162 dysphagic stroke patients with PEG and 159 patients with NGT. However, these results are of limited value since only those patients were enrolled in whom the responsible clinician was uncertain of the best feeding practice. Furthermore the duration of the intervention is unclear and there was a greater delay to first TF in the PEG group than in the nasogastic group. Because of these methodological problems, results of the FOOD trial have to be interpreted with caution.

Timing of tube placement: In patients with severe neurological dysphagia, TF has to be ensured immediately unless there are compelling reasons against it. Studies investigating the role of early TF after acute cerebrovascular events in age-mixed samples have shown that early TF is feasible also in elderly patients[148,149] and has a positive impact on survival[148] and length of hospital stay[144] (III). In a retrospective analysis of stroke patients (19% of patients >65 years) by Nyswonger and Helmchen,[149] the group receiving TF within 72 h after the cerebrovascular event had a reduced hospital stay compared to patients that received TF after 72 h (III). Taylor[148] found that patients, who had spent less than 5 days without nutrient supply, had a lower mortality than patients who had more than 5 days without nutrition. Interestingly, this difference was statistically significant only in patients aged >65 years and was less distinct in younger patients. The authors conclude that older patients react more sensitively to food deprivation than younger patients and that TF should be initiated as early as possible in this group (III).

In the recent multicentre FOOD trial[147] no difference in outcome was found between dysphagic stroke patients who received EN via a PEG within 7 days of hospital admission and another group in whom TF was avoided for at least 7 days. Again, these results are of limited value because of methodological problems (see above).

Table 4 Resuming oral nutrition after enteral nutrition in elderly patients.

Article	Study		Patients				Type of EN	Proportion resuming full oral nutrition (%)	Time period
First author	Type	Place	*n*	Age (yr)		Proportion of elderly			
				M ± SD	(Range)				
Neurologic dysphagia									
Finucane[92]	P	Hospital	28	82	(68–99)		PEG	4%	6 months
Elia[112]	P	At home	2970	—	(⩾75)		EN	10%	12 months
Elia[112]	P	At home	1230	—	(65–75)		EN	15%	12 months
Norton[11]	P	Hospital	16	76	—		PEG	19%	6 months
Schneider[115]	P	At home	148	75 (Md)	(1–97)		EN	24%	4 months (M)
Wijdicks[95]	R	Hospital	63	74 (Md)	(41–98)		PEG	28%	2–36 months (Md 4 months)
James[93]	R	Hospital	126	80 (Md)	(53–94)		PEG	29%	4–71 months (Md 31 months)
Mixed cohorts									
Quill[87]	R	Hospital	55	>70	(⩾70)	51% > 80 yr	NG	4%	—
Clarkston[96]	R	Hospital	42	71.4	(33–99)		PEG	7%	2 months
Dwolatzky[86]	P	Hospital	122	—	(⩾65)		PEG/NG	8%	3 months
Markgraf[103]	R	Hospital	84	69 ± 14	(35–98)	65% ⩾ 65 yr	PEG	12%	14–229 days (M 108 days)
Markgraf[90]	R/P	Hospital	54	87	(65–94)		PEG	13%	14–229 days (M 133 days)
Bussone[88]	R	Hospital	155	84	(70–98)		PEG	14%	—
Larson[100]	R	Hospital	314	—	(3–92)	66% > 60 yr	PEG	14%	—
Skelly[58]	P	Hospital	74	69 (Md)	(28–90)		PEG	15%	6 months
Tan[109]	R	Hospital	44	65	(14–94)		PEG	16%	1–44 months
Howard[113]	R	At home	887	79 ± 8	(⩾65)		EN	17%	12 months
Nicholson[104]	R	Hospital	168	70 (Md)	(16–96)		PEG	21%	4 months (Md)
Wolfsen[111]	R/P	Hospital	201	66 ± 16	—		PEG/PEJ	21%	275 ± 353 days (Md 144 days)
Sali[107]	R	Hospital	32	75	(38–88)		PEG	22%	2–8 months
Mitchell[63]	R	At home	551	87 (Md)	(65–107)		TF	25%	12 months
Taylor[110]	P	Hospital	97	76.5	(<1–97)		PEG	25%	1 day–7 yr (Md 327 days)
Abitbol[26]	P	Hospital	59	83 ± 7	—	50% > 85 yr	PEG	27%	12 months
Verhoef[78]	P	Hospital	71	66 ± 18	(17–89)		PEG	28%	12 months

EN = enteral nutrition, M = mean, Md = Median, NG = nasogastric tube, P = prospective, PEG = percutaneous endoscopic gastrostomy, PEJ = percutaneous endoscopic jejunostomy, R = retrospective, SD = standard deviation, TF = tube feeding, yr = years.

Table 5 Supplementary overnight tube feeding in elderly fracture patients.

Article	Patients			Supplement		Results		
First author	*n*	Age* (yr)	Diagnosis	Energy and protein/day	Duration	Intake	Nutritional status	Clinical course
Bastow[13]	58 CG 64 SG	80 81	Femur neck fracture & malnutrition	+1000 kcal +28 g prot	16–39 days Md 26 days	Total intake ↑ Food intake =	Anthropometry ↑ Proteins ↑	ADL = LOR ↓ LOS ↓ Mortality (↓)
Hartgrink[14]	67 CG 62 SG	83±8 84±7	Hip fracture & risk of pressure sores	+1500 kcal +60 g prot	7 and 14 days, resp.	↑ Despite low tolerance	Intended to feed: Alb, TP = Actually fed: Alb ↑, TP ↑	Pressure sores = only 40% tolerated tube >1 wk
Sullivan[15]	10 CG 8 SG	77±6 75±2	Hip fracture & good nutritional status	+1383 kcal +86 g prot	16±6 days	↑	Alb, transferrin =	Complications = ADL = LOS = In-hospital mortality = 6-months mortality↓

ADL = activities of daily living, Alb = albumin, CG = control group, LOR = length of rehabilitation, LOS = length of stay, Md = median, prot = protein, SG = Supplemented group, TP = total protein, yr = years.
↑ increase, ↓ decrease (or improvement in the supplmented group compared to the control group); = no difference between the groups.
*Mean or mean±standard deviation.

In earlier studies, long periods of 44–63 days between the acute event and PEG placement are noticeable.[91,93,107] Three studies on the natural course of dysphagia after stroke show that spontaneous remission of the swallowing difficulty occurs 7–14 days after the acute event in 73–86%.[150–152] Based on clinical experience, prognosis of dysphagia seems to be better in medial cerebral infarct than in brain stem infarct (IV). If severe dysphagia persists longer than 14 days after the acute event, a PEG should be placed immediately. Controlled trials on the ideal timing and length of TF in neurological dysphagia, that also consider the varying kinds and extents of swallowing disorders, are still not available.

2.4. Is EN indicated after orthopaedic surgery in geriatric patients?

ONS are recommended in geriatric patients after hip fracture and orthopaedic surgery in order to reduce complications (A).

Comment: Voluntary oral intake is often insufficient to meet the enhanced requirements of energy, protein and micronutrients after orthopaedic surgery. Rapid deterioration in nutritional status, and impaired recovery and rehabilitation are common.

The results of several randomised studies of EN after hip fracture are summarised in a Cochrane analysis[75] that includes eight trials testing supplementary overnight TF, five trials with ONS and three studies regarding the effects of supplementary oral protein. The quality of most of the studies and the availability of outcome data were considered poor by the authors of the Cochrane analysis.[75] In addition, a recent randomised controlled study[153] and two non-randomised trials with ONS are available.[4,6,154]

Energy and nutrient intake: Administration of *ONS* leads to a significant increase in energy and nutrient intake.[75] However, several trials[71,74,155] have shown that the daily requirements for energy and protein are still not met. This may be due to poor compliance of less than 20%,[7] to intolerance of supplements by some patients,[155] and to requirements being markedly increased.

Supplementary overnight TF enables the administration of larger amounts of enteral formulae,[13–15] but is of limited tolerance in practice. In the trial of Hartgrink et al.[14] only 40% tolerated this intervention longer than 1 week and only one-quarter for the whole study period of 2 weeks.

Nutritional status: Information about the effects of ONS on nutritional status is sparse and inconsistent. Delmi et al.[71] observed a larger increase in albumin and transferrin levels in supplemented patients than in the unsupplemented control group (Ib), whereas Lawson et al.[154] and Williams et al.[6] detected no difference with respect to serum albumin (IIa). In the study of Lawson et al.[154] BMI and mid-arm muscle circumference (MAMC) were also unaffected, however transferrin and haemoglobin decreased less than in the unsupplemented group. Williams et al.[6] reported a positive effect on triceps skinfold thickness (TSF) and MAMC in the supplemented group. In contrast Tidermark et al.[44] registered weight loss, and Brown and Seabrock[74] observed decreases in body weight, mid-arm circumference (MAC) and TSF in the supplemented as well as in the control group.

Positive effects of *protein supplementation* on bone density and parameters of bone metabolism were described by Tkatch et al.[72] and Schürch et al.[73] (Ib). A 6-month administration of protein-enriched supplements led to a significant attenuation of loss of bone mineral density when compared to the control group. Even short-term supplementation (<40 days) was accompanied by a smaller decrease in proximal femur bone mineral density than in the unsupplemented group. However, other skeletal sites were unaffected. Moreover, protein repletion was shown to be associated with an increase in serum osteocalcin[72] and insulin-like growth factor-I,[73] both of which are important mediators of bone metabolism.

The effect of *supplementary overnight TF* on nutritional status of elderly patients with either hip or femoral neck fracture was investigated in three randomised controlled studies[13–15] (Ia) (Table 5). Initial nutritional status as well as results were inconsistent. Clear improvements were reported by Bastow et al.[13] who divided their patients into "thin" and "very thin" according to anthropometric measurements. In both intervention groups ("thin" and "very thin"), anthropometric parameters (body weight, TSF, MAC) and postoperative prealbumin increased during 16–39 days. "Very thin" patients had the greatest benefit from the nutritional therapy. No change in serum albumin was observed in the study of Hartgrink et al.[14] in 62 patients intended to receive supplementary TF. An evaluation of the actually tube-fed patients however ($n = 25$ after 1 week, $n = 16$ after 2 weeks), revealed increased serum concentrations of albumin and total protein. No effects on plasma proteins were reported in the study of Sullivan et al.[15] who examined patients with a relatively good nutritional status (BMI 24.1 kg/m^2, albumin 32 and 35 g/l, respectively), with respect to albumin, transferrin and cholesterol values.

Length of hospital stay: Data concerning the length of hospital stay are inconsistent. Delmi et al.[71] found a significantly shorter length of hospital stay (including rehabilitation) in patients receiving ONS (median 24 days) compared to control patients (median 40 days) (Ib). Protein administration in the trials of Tkatch et al.[72] and Schürch et al.[73] was also associated with a significantly reduced length of stay (30 and 21 days, respectively). In five other studies, however, the observed differences were not significant.[44,75]

A positive impact of *supplementary overnight TF* on the length of hospital stay of geriatric patients after hip or femur neck fracture cannot be firmly concluded from the data available.[13–15]

Functional status: Data regarding functional status are heterogeneous and unsatisfactory. The Cochrane analysis of Avenell and Handoll[75] refers to four studies investigating this aspect. Only one of them showed positive effects of *ONS* on ADL-functions after 6 months.[44] The non-randomised trial of Williams et al.[6] showed a trend towards improved mobility and greater independence at hospital discharge in supplemented patients. Oral supplementation of calcium, protein and vitamins in the study of Espaulella et al.[47] showed no significant changes in mobilisation, ADL status and use of walking aids when compared to the control group receiving an isocaloric placebo as well.

Bastow et al.[13] assessed the time between the patient's operation and the achievement of physiotherapy goals (e.g. recovering independent mobility). Thin patients (according to anthropometric measurements; see above) receiving *supplementary overnight TF*, achieved independent mobility in 10 days, while thin control patients did so in 12 days. Very thin patients from the intervention group reached this goal after 16 days whereas very thin control patients needed 23 days to regain independent mobility ($P < 0.05$) (IIa). ADL status at discharge, however, was not affected by the intervention.[13]

Postoperative complications and mortality: *ONS* have a positive impact on the rate of postoperative complications. Thus, Lawson et al.[154] in their recent non-randomised study found a significantly lower rate of complications in post-operatively supplemented orthopaedic patients than in those unsupplemented (IIa). In the study of Tkatch et al.[72] the complication rate in protein supplemented patients was significantly lower during hospital stay, as well as 7 months later, compared to the control group with isocaloric placebo. The pooled analysis of five randomised studies in the meta-analysis of Avenell and Handoll[75] revealed a borderline reduction of the risk of complications in supplemented patients (RR 0.61, 95% CI 0.36–1.03). When risks for mortality and complications were combined in these five studies, the chances of an unfavourable outcome were reduced in supplemented patients (RR 0.52, 95% CI 0.32–0.84)[72] (Ia).

If mortality was considered separately in the meta-analysis of five studies with ONS, no reduction in mortality risk was found.[75] The same was true in the study of Espaulella et al.[47] Combining mortality outcome of all the studies with *supplementary overnight TF* did not produce a significant risk reduction either (RR 0.99; 95% CI 0.5–1.97).[75] The pooled analysis of studies using ONS or overnight TF in geriatric patients with either hip or femoral neck fracture also did not show a significant reduction of mortality risk in the enterally fed patients when compared to controls (RR 0.94; 95% CI 0.59–1.50).[75]

2.5. Is EN indicated in the perioperative phase of major surgery in geriatric patients?

There is no evidence that nutritional therapy in elderly patients undergoing major surgery (e.g. pancreatic surgery, head and neck surgery) should be different from that in younger patients. We therefore refer to the Guidelines. "Surgery and transplantation".

It is generally recognised, however, that elderly are at higher risk of being undernourished than younger patients and restoration of BCM is more difficult. Therefore, preventive nutritional support has to be considered.

2.6. Is EN indicated in elderly patients with depression?

EN is recommended in depression in order to overcome the phase of severe anorexia and loss of motivation (C).

Comment: Depression is common in elderly patients, but often not recognised due to the difficulty of discriminating it from other symptoms of old age. Anorexia and refusal to eat are integral symptoms of this disease, and depression is therefore regarded as a major cause of undernutrition in the elderly.[156] Undernutrition may itself contribute to the depressive states often seen in the elderly.[157] Depression can be treated by several methods, especially by drugs, although this may take some time to be effective. Based on positive clinical experience and expert opinion, EN is recommended in the elderly suffering from depression in order to support the patient during the early phase of severe anorexia and loss of motivation, thereby preventing the development of undernutrition with its serious consequences (C).

Table 6 Prevalence of aspiration pneumonia in tube-fed elderly patients.

First author	Study type	Patients			Aspiration pneumonia (AP)		
		n	Age* (years)	Diagnoses	Before	After	Time period
Patel[160]	P	24	72	CVE, CA, dementia	58%	14/24 (58%) (all) 12/14 (86%) (with AP)	Until AP or death
Paillaud[35]	R	73	83 ± 9	Mixed	15%	53%	2, 6, 12 months
Sali[107]	P	32	75	Mixed	9%	— 3/5 (60%) deaths due to AP	2–488 days 30 days
Abitbol[26]	P	59	83 ± 7	Nursing home residents	49%	51%	12 months
Baeten[161]	P	90	72	CA, neurological disease	—	6%	Hospital stay
Wijdicks[95]	P	63	74	Apoplex	—	16%	2–36 months
Peschl[151]	P	33	76	Cerebral dysfunctions	—	18%	6 months
Kaw[36]	R	46	74	Neurological disease, dementia	—	22%	12, 18 months
Stuart[108]	R	125	70	CA, dementia, cachexia	—	28%	30 days
Bourdel-Marchasson[60]	R	46	81 ± 9	Mixed	—	39%	14/192 days
Fay[27]	R	80	70	Apoplex, dementia, PEG	—	6%/32%	14/141 days
		29	70	Parkinson NG	—	24%/46%	6 months
Golden[32]	R	102	89 ± 6	dementia	—	51%	

AP = aspiration pneumonia, CA = carcinoma, CVE = cerebrovascular event, NG = nasogastric tube, P = prospective, R = retrospective.
*Mean or mean ± standard deviation.

2.7. Is EN indicated in dementia?

ONS or TF may lead to an improvement in nutritional status in demented patients. In early and moderate dementia ONS—and occasionally TF—may contribute to ensuring an adequate energy and nutrient supply and to preventing undernutrition from developing; they are therefore recommended (C). In those with terminal dementia, TF is not recommended (C). The decision in each case must be made on an individual basis.

Comment: An indequate intake of energy and nutrients is a common problem in demented patients. Undernutrition may be caused by several factors including anorexia (common cause: polypharmaco-therapy), insufficient oral intake (forgetting to eat), depression, apraxia of eating or, less often, enhanced energy requirement due to hyperactivity (constant pacing).[158] In advanced stages of dementia, dysphagia may develop and might be an indication for EN in a few cases.

Some studies with ONS have shown improvements in body weight (Ib)[49,159] (IIa)[50]. In tube-fed demented elderly patients, two studies reported weight gain[31,32] (III), but two others reported no change (III)[24] (IIb)[86]. Available trials regarding the effects of ONS (Ib)[49] (IIa)[50] or TF[24,33,36] on functional status, report no improvement (***Compare 1.5***). In terms of survival most studies show no benefit.[33,81,84,94] On the other hand, Rudberg et al.[61] described lower mortality, compared to controls, at 30 days and 1 year in enterally fed patients with severe cognitive impairment (IIb). Very low mortality rates have been reported in PEG-fed demented nursing home residents.[32,57,62] On the other hand, in one retrospective study comparing mortality rates in different diagnostic groups, outcome was worst among the demented[59] (III).

In conclusion, tube-fed demented patients vary considerably with respect to their prognosis. Outcome and also the success of nutritional therapy in demented patients are strongly influenced by the severity of disease, the kind and extent of comorbidities and by their general condition. It is therefore recommended that adequate and high quality nutrition is ensured, especially in the early and middle stages of dementia, in order to prevent undernutrition developing and to help maintain a stable general condition (C).

TF may be useful in some demented patients. The following aspects have to be considered in decision-making:

- presumed or previously expressed wishes of the patient with respect to TF;
- severity of the disease;
- the individual prognosis and life expectancy of the demented patient;
- the anticipated quality of life of the patient with or without TF;
- the anticipated complications and impairments due to TF;
- the mobility of the patient.

The decision for or against TF has *always* to be made individually and together with relatives and care givers, legal custodian, family doctor and therapists, and in case of doubt, with legal advice.

For patients with terminal dementia (irreversible, immobile, unable to communicate, completely dependent, lack of physical resources) TF is not recommended (C).

2.8. Is EN indicated in geriatric patients with cancer?

In principal, nutritional therapy in geriatric patients with cancer does not differ from younger cancer patients (***see Guidelines on "Non-surgical oncology"***).

Comment: It is generally recognised, however, that elderly are at higher risk of being undernourished than younger patients and restoration of BCM is more difficult. Therefore, preventive nutritional support has to be considered.

2.9. In patients with dysphagia does TF prevent aspiration pneumonia by improving functional status?

Due to the heterogeneity of the studies, and lack of data on prevalence before the TF, firm conclusions can not be drawn.

Comment: Dysphagia may enhance aspiration from pharyngeal contents, but, on the other hand, TF may enhance reflux and aspiration of gastric contents. Several studies have reported the prevalence of aspiration pneumonia in tube-fed elderly patients (Table 6). Due to the heterogeneity of patient groups and lack of data on the prevalence of aspiration before TF, it is difficult to draw any firm conclusion whether bypassing dysphagia, using a NG tube or PEG helps to reduce the incidence of pneumonia. It certainly has the potential to increase reflux and aspiration. Data about the incidence of aspiration pneumonia during nutritional support via PEG compared to NGT are controversial.[12,27,86,161] It is also not proven that surgical or endoscopic jejunostomy prevents this complication.

Table 7 PEG versus nasogastric tube feeding in elderly patients.

First author	Study type	*n*	Age* (years)	Diagnoses (place)	Duration	Treatment failure	Intake	Nutritional status	Aspiration	Other complications	Mortality	LOS
Baeten[161]	P RCT	44 PEG 46 NG	72±10	Mixed (hospital)	18±20 days	↓	n.a.	n.a.	=	n.a.	n.a.	n.a.
Norton[11]	P RCT	16 PEG 14 NG	76 79	Apoplexia (hospital)	6 wks	↓	↑	↑	n.a.	n.a.	↓	↓
Park[12]	P RCT	20 PEG 20 NG	56±5 65±3	Neurolog. dysphagia (hospital)	4 wks	↓	↑	↑	= / ↑	= / ↑	n.a.	n.a.
Dwolatzky[86]	P NRT	32 PEG 90 NG	85 82	Chronic, mixed (home)	4 wks/12 wks	↓	n.a.	= / ↑	↓	=	↓	n.a.
Fay[27]	R NRT	80 PEG 29 NG	70.2 68.8	Mixed (hospital)	142±192 days	↓	n.a.	=	↓	=	=	n.a.

LOS = length of stay, n.a. = not available, NG = nasogastric tube, NRT = non-randomised trial, PEG = percutaneous endoscopic gastrostomy, P = prospective, R = retrospective, RCT = randomised controlled trial, Ref. = reference, wks = weeks
↑ increase, ↓ decrease (improvement in the PEG-group compared to the NG-group); = no difference between PEG and NG.
*Mean or mean±standard deviation.

2.10. Can EN prevent or improve pressure ulcers in geriatric patients?

ONS, particular high protein ONS, can reduce the risk of developing pressure ulcers (A). Based on positive clinical experience, EN is also recommended in order to improve healing of pressure ulcers (C).

Comment: Adequate nutrition is a prerequisite for preventing and healing pressure ulcers. Studies addressing this topic are difficult to conduct because of the multifactorial origin of pressure ulcers, various uncontrollable factors affecting the development of pressure ulcers and the necessarily long observational periods. Only few trials are available examining the effects of EN on prevention or healing of decubitus ulcers. These trials vary greatly with respect to study design, patient population and reported outcome variables.

A recent meta-analysis of four randomised controlled trials showed that *oral nutritional supplementation* was associated with a significantly lower incidence of pressure ulcer development in at-risk patients compared to routine care (odds ratio (OR) 0.75; 95% CI 0.62–0.89)[162] (Ia). Three of the four studies used high protein ONS (30 energy percent). Three other studies, which were not meta-analysable, showed a trend towards improved healing of existing pressure ulcers in patients receiving ONS.[162]

Available studies on the effect of TF do not show significant effects, neither on healing nor on prevention of decubitus ulcers,[14,26,31,60,62] however, overall quality of the studies is poor.

The importance of protein in pressure sore healing was suggested in an 8-week non-randomised study in 28 undernourished nursing home residents with decubitus ulcers.[163] The administration of a TF formula with 61 g protein per litre (24 energy percent) was more successful in decreasing total pressure ulcer surface area than a TF formula with 37 g protein per litre (14 energy percent).

Clinical experience suggests that wound healing in elderly patients may be improved by the administration of supplements containing protein and micronutrients that are involved in wound healing (zinc, arginine, carotenoids, vitamins A, C and E). Crucial for the effect of these nutrients is the local circulation in the pressure ulcer area, which determines effective nutrient transport and local metabolism as well as removal of toxic cell products. Besides the correction of nutrient deficiencies, the correct positioning of the patient to allow optimal blood circulation to the pressure area and to minimise further tissue damage is crucial.

3. Special practical aspects of EN in geriatric patients

3.1. How should EN be delivered: by PEG or by NGT?

In elderly patients in whom EN is anticipated for longer than 4 weeks, placement of a PEG tube is recommended (A).

Comment: Five studies (four prospective, three randomised) comparing PEG with NGT, show the superiority of PEG (Table 7) in allowing the administration of greater amounts of energy and nutrients over longer periods, resulting in better nutritional status (Ib)[11,12] (IIa)[86] The use of NGT is associated with more tube displacements[86] (IIa) and more reinsertions (Ib)[12,161] (III)[27]. Less treatment failures with PEG are reported in all studies (Ib)[11,12,161] (IIa)[86] (III)[27]. Moreover, fewer fixations are necessary in PEG patients, and the management is easier both for patients and nursing staff[161] (Ib).

Improved survival in PEG-fed patients was observed in one randomised controlled trial and one non-randomised trial (Ib)[11] (IIa)[86]. In their retrospective study, however, Fay et al.[27] found no difference in mortality between PEG- and NGT-fed patients. Dwolatzky et al.[86] (IIa) and Fay et al.[27] (III) reported a lower incidence of aspiration in patients fed by PEG than by NGT. However, Park et al.[12] and Baeten and Hoefnagels[161] found no difference in aspiration rates in their randomised studies. In geriatric patients the frequent combination of neurological swallowing difficulties with cognitive impairment (dementia, Parkinson's disease, recurrent cerebrovascular events) is associated with a higher risk of aspiration. In these situations, early PEG placement compared to NGT might be advantageous.

An important aspect of PEG in patients with neurological dysphagia is that it allows more effective swallowing therapy without interference by NGT. As swallowing improves, TF can be reduced as oral intake increases, and in many cases it can be completely abandoned.

3.2. When should TF be initiated after PEG placement?

TF can be initiated 3 h after PEG placement in geriatric patients (A).

Comment: In three randomised prospective studies that included elderly patients, early feeding (3–4 h after PEG placement) vs. delayed feeding (24 h after PEG placement) was studied[164–166] (Ib). Tolerance and safety were equal whether nutrition was initiated 3 or 24 h after PEG placement.[164,165]

Another study comparing initiation of nutrition 4 vs. 24 h after PEG placement, also found no significant differences between the two groups.[166] These results confirm early feeding after PEG placement as a safe and effective procedure in elderly patients.

3.3. Is EN in geriatric patients associated with specific complications?

Complications of EN are similar to those in other age groups. There is no information available about the prevalence of specific complications in different age groups.

3.4. Is dietary fibre beneficial for enterally fed geriatric patients?

Available studies suggest that dietary fibre can contribute to the normalisation of bowel functions in elderly tube-fed subjects (B).

With respect to ONS no studies are available.

Comment: Elderly patients often suffer from gastrointestinal problems, including constipation and diarrhoea. The effect of dietary fibre in *ONS* on bowel function has not been studied. Since dietary fibre intake from food is usually low in geriatric patients, fibre-containing products are generally recommended.

Few studies of the effects of fibre-containing enteral *formulae* on bowel function in elderly subjects are available.[167–172] Despite great differences in study populations, gastrointestinal problems and the type and amount of fibre used, these studies all report that fibre helps to normalise bowel functions during TF.

In a randomised cross-over study design with 10 long-term tube-fed elderly patients recovering from stroke ***without diarrhoea*** the administration of 28.8 g soy/oat fibre per day (14.4 g/l) significantly increased the number of bowel movements per day (0.9 ± 0.4 vs. 0.5 ± 0.2, $P < 0.05$) and faecal weights (57 ± 31 vs. 32 ± 25 g/d, $P < 0.05$)[167] (Ib). A randomised pilot study with seven immobile long-term care residents on long-term TF also reported more stools with a softer consistency[168] (III).

In long-term care patients ***with diarrhoea*** EN with 12.8 g soy fibre/1000 kcal resulted in significantly fewer reports of diarrhoea (6 vs. 26, $P < 0.01$) and markedly improved bowel function compared with the control group without fibre[169] (Ib). In a prospective observational study with 20 elderly bedridden patients (mean age 79 ± 5 years) with diarrhoea, receiving EN due to cerebrovascular events, Nakao et al.[170] demonstrated that soluble fibre decreased the frequency of daily bowel movements significantly and simultaneously improved faecal features in the course of 4 weeks with gradually increasing fibre administration from 7 to 28 g/d (III). A retrospective chart review in 50 long-term care patients with mixed diagnoses (age 28–83 yr, median age 71 yr) who received EN with 14 g soy polysaccharides/l for at least 3 weeks also resulted in fewer loose stools and diarrhoea than in patients given a fibre-free solution[171] (III). Homann et al.[172] investigated the effects of 20 g partially hydrolised guar gum/l in a prospective, randomised controlled trial with 100 surgical and medical patients. About 30 patients (mean age 60 years, mainly gastric or oesophageal resection) received total EN and 70 patients (mean age 69 years, mainly metastatic malignancies) received supplementary EN. In patients receiving total EN with fibre and in the whole group receiving fibre the incidence of diarrhoea was significantly lower than in patients receiving the standard diet without fibre.

In order to increase tolerance and avoid gastrointestinal side-effects such as bloating and flatulence, the mode of administration (rate, temperature) is important. In subjects not used to dietary fibre intake, fibre fortified feedings should be added gradually.

Since different kinds of fibre may have dissimilar effects in different clinical situations, further studies are necessary to elucidate the role of specific types of dietary fibre in enterally fed geriatric patients.

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