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Palliative care in amyotrophic lateral sclerosis

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Abstract The poor prognosis of amyotrophic lateral sclerosis (ALS) makes palliative care a challenge for the neurologist. Most disabilities associated with progressive disease can be ameliorated by symptomatic treatment. Prognosis and treatment options should be openly discussed with the patient and his/her relatives. Nutritional deficiency due to pronounced dysphagia can be efficiently relieved by a percutaneous enterogastrostomy. Respiratory insufficiency can be treated by non-invasive ventilation at home, provided the familial environment is supportive. Adequate assistance and palliative treatment in the terminal phase is of paramount importance.

Introduction

Amyotrophic lateral sclerosis (ALS) is the most common degenerative motor neuron disorder occurring in adult life. Its prevalence has been estimated at around 6–8 per 100 000, with a slowly increasing incidence of 1.5–2 per 100 000 per year [5]. The clinical course is characterized by slowly progressing paresis of voluntary muscles, coupled with hyperreflexia and spasticity due to concomitant involvement of upper and lower motor neurons [4]. Extraocular movements and sphincter continence are usually spared; sensation is normal. Although subtle neuropsychological deficits can be detected after careful examination, frank dementia is a rare occurrence [1].

There is no satisfactory therapy available for ALS. However, the first small steps toward causative treatment have taken place [9]. In the current situation, ALS patients need adequate palliative treatment more than anything else. Unfortunately, they often hear from their physicians statements like “there is nothing I can do for you”. Nothing could be further from the truth: all signs and symptoms of ALS (Table 1) can be alleviated by appropriate palliative measures [17], the most important of which are briefly summarized in this article.

Breaking the news

Palliative care begins by the way the diagnosis is told. If the communication between physician and patient is inadequate, the patient will be left uncertain about the diagnosis, with a vague sense that he/she has got some serious and probably incurable disease, and without any reasonable hope for the future [18]. Often, such a situation leads to a pilgrimage from one doctor to another, from one hospital to another, until a physician manages to establish a good therapeutic relationship with the patient, based on mutual openness. Patients will try to gather information from the medical literature or the internet which can sometimes lead to gross misundertandings (many patients, at the beginning, believe that they have “some kind of multiple sclerosis” and ask for immunosuppressive drugs).

Breaking the news of ALS is not a standardizable procedure. Although the physician often feels a sense of frustration in communicating an incurable diagnosis, this should not lead to withholding information from the patient [13] or, worse still, providing information only to relatives and giving the patient “reassuring” statements. On the other hand, it is an undeniable right of the patient not to be informed about the condition if he/she so wishes.

Accordingly, it is the patient who should dictate the pace and depth of the information flow, while the doctor retains the difficult task of responding appropriately to the patient's cues [3].

Once the diagnosis has been confirmed beyond reasonable doubt, the patient should be told that he/she has a progressive disease of the motor nerves. The name of the disease should be mentioned and explained, to avoid misundertandings. Positive aspects of the disease (i.e., no pain, no disturbances in sensation, mentation, continence etc.) should be emphasized, as should current research efforts and forthcoming therapeutic studies. For subsequent clinic visits, it is important to keep in mind that patients often only remember a very selected portion of the information that has been discussed. Therefore, care should be taken at each visit to find out where the patient stands and move on from there [24].

The relentless progression of the disease is a heavy burden for patients and caregivers alike; the psychological burden of the caregivers sometimes even exceeds that of the patient. It is, therefore, mandatory to involve the patient's family in every step of palliative therapy, beginning with the disclosure of the diagnosis. If the patient and family express the wish for a second opinion, this should be encouraged.

As in every incurable disease, it is understandable that some patients will search for "alternative" medical treatments. There is nothing to be said against acupuncture or homeopathy, for example; however, it is the physician's duty to warn the patient at the outset from dubious and costly healing methods, even if they are administered by doctors. As a rule, the more expensive the drug and the higher the promised clinical effect, the greater is the caution that should be exercised.

At the onset of dyspneic symptoms, symptoms of chronic nocturnal hypoventilation (see Table 5), or whenever the vital capacity drops below 50%, the patient should be offered information about the terminal phase of the disease, since most patients, at this point, fear that they will "choke to death." Describing the mechanism of terminal hypercapnic coma and the resulting peaceful death during sleep will produce relief from this fear in most patients. Patients and relatives must be informed that the array of medication available in the terminal phase, if applied correctly, is sufficient to prevent "choking to death" in every patient [19]. This information needs to be reiterated on subsequent visits.

At the same time, the patient should be asked whether he/she would wish to be intubated and ventilated in the event of terminal respiratory insufficiency. Patients who have been informed about the possible subsequent clinical course which may end in a "locked-in" syndrome in an intensive care unit (ICU) [8], will usually deny permission to such a procedure. This denial must be documented in writing by the physician and should be incorporated into a living will. The consequences of such a decision must be discussed with the patient, the family and the home physician (e.g., concerning the use of opioids in the terminal phase, see below). If symptoms of nocturnal hypoventilation are present, then the option of non-invasive intermittent ventilation (NIV) should be discussed.

Table 1 Symptoms of ALS

Direct:
- Weakness and atrophy
- Fasciculations and muscle cramps
- Spasticity
- Dysarthria
- Dysphagia and drooling
- Dyspnea
- Pathological laughter/tearfulness

Indirect:
- Psychic disturbances
- Sleep disturbances
- Musculoskeletal pain
- Constipation

Symptoms due directly to ALS

Weakness

Progressive weakness is usually the major source of discomfort for ALS patients. Initially, patients find that their stamina undergoes greater-than-usual day-to-day fluctuations and they need to be reassured that this is a normal phenomenon and does not herald an increase in pace of the disease's progression. Active and passive physiotherapy is very important, especially for the prevention of muscle contractures and joint stiffness. The exercise load can vary greatly from one day to another; as a rule, patients should never exercise to the point of exhaustion. If the legs are severely affected and there is an increased risk of falling, exercising in a water pool can be helpful.

As the disease progresses, patients require additional devices to maintain mobility (from a cane to an ankle–foot–orthosis to a wheelchair) and to maintain independence in everyday life activities (special eating tools, higher toilet seats, bath-tub lift, etc.). It is important to discuss the forthcoming need for these devices somewhat ahead of time, so that the patient and his/her family will have time to adjust mentally to the new degree of disability and are ready to accept the new help when it becomes necessary. Reluctant patients can be helped with the sentence "better have it and not need it than need it and not have it". If available, home evaluation by an occupational therapist can help to pinpoint the exact needs of the patient.

Acetylcholinesterase inhibitors may lead to a short-term improvement in muscle strength, especially during

Table 2 Medication for fasciculation and cramps[a]

Quinine sulfate	200 mg b.i.d.
Carbamazepine	200 mg b.i.d.
Vitamin E	400 I.U. b.i.d.
Phenytoin	100 mg q.d.–t.i.d.
Magnesium	5 mmol q.d.–t.i.d.
Verapamil	120 mg q.d.

[a] In all medication tables, the usual range of adult daily dosage is indicated; some patients may require higher doses, e.g., of antispastic medication

Table 3 Medication for spasticity

Baclofen	10– 80 mg
Tizanidin	6– 24 mg
Memantine	10– 60 mg
Tetrazepam	100–200 mg

the early stages of the disease. This effect seems to be more pronounced in patients with bulbar symptoms. However, it is not seen in all patients and only lasts from a few days to a few weeks. We, therefore, only recommend the use of pyridostigmine (up to 40 mg t.i.d.) for special situations, such as a plane trip or a holiday; however, there is no rationale for long-term therapy with pyridostigmine in ALS.

Muscle fasciculations, cramps and spasticity

Fasciculations are often the first symptoms of the disease. They arise through degeneration of the intramuscular motor axons and can lead to painful muscle cramps. Spasticity of the extremities, which is due to degeneration of the upper motor neurons, can sometimes be clinically severe. These symptoms can be relieved effectively using appropriate medication (Tables 2 and 3). In the case of antispastic drugs, the patient has to titrate the dosage against the subjective clinical effect, since a moderate degree of spasticity is usually better for mobility than a fully flaccid paresis.

Dysarthria

One of the most feared consequences of ALS is the loss of the ability to communicate due to progressive dysarthria. Logopedic training is especially helpful in cases with slow progression. When speech becomes unintelligible, electronic devices may be employed as communication aids. However, a simple alphabet chart can also be very effective. Modern computer technology offers several options that enable even patients with almost total paresis of voluntary muscles to communicate and surf the internet e.g., via myoelectrically controlled switches. Given the great variety of options, decisions about communication devices should be taken on an individual basis.

Dysphagia and drooling

Dysphagia associated with ALS results from disturbed motility of the tongue, pharynx and esophagus. It can lead to choking and aspiration, especially with fluids and crumbly foods, such as popcorn or pumpernickel. The first step is a change in diet consistency: food should be easy to chew and rich in calories. Recipe books for ALS patients are available in the US from the Muscular Dystrophy Association (MDA) and in Germany from the Deutsche Gesellschaft für Muskelkranke (DGM). Special swallowing techniques, such as supraglottic swallowing, can be taught by specialized logopedists or physiotherapists and can reduce the risk of aspiration. If, despite these actions, the caloric intake is still insufficient and the patient continues to lose weight (more than 20% of the normal body weight prior to diagnosis) and oral food intake becomes intolerable due to frequent choking, a percutaneous entero-gastrostomy (PEG) should be discussed [23] (Fig. 1). The placement of a PEG is a simple procedure, which can be performed under local anesthesia. However, if a PEG is postponed until a stage in which the patient is in severe respiratory distress, the procedure becomes dangerous because of the possible insurgence of basal atelectases through pressure of the air-inflated stomach against the weakened diaphragm [10]. Therefore, the patient and his/her family should be encouraged to make an early decision regarding PEG placement. Whether an early PEG placement may result in an increased life span has not yet been demonstrated convincingly [11]. However, as with all other palliative measures, the primary goal is improvement of the quality of life, rather than life prolongation. It is important to remember that a PEG does not prevent as-

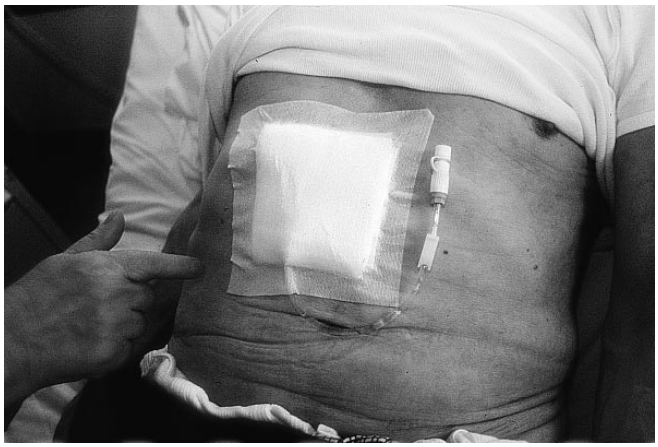

Fig. 1 Percutaneous entero-gastrostomy (PEG) (courtesy of Fresenius AG, Bad Homburg)

Table 4 Medication for drooling

Amitriptyline	10	–150	mg
Trihexyphenidyl	6	– 10	mg
Clonidine	0.15–	0.3	mg
Ipratropium bromide	0.5 –	1	mg
Butylsopolamine	10	– 60	mg

piration pneumonia, which indeed is especially frequent if overfeeding by PEG occurs.

Drooling is also a frequent complaint in ALS, due to a combination of facial muscle weakness and pseudo-hypersalivation stemming from a reduced swallowing ability. Medications reducing salivary output may be helpful (Table 4). If secretions are thick, *N*-acetylcysteine may be employed, provided that fluid intake is sufficient. Inhalators and suction measures may become necessary; beta-blockers might represent an alternative in severe cases [15]. Salivary-gland irradiation and transtympanic neurectomy have been successful in anecdotal reports, but have not yet been evaluated in controlled studies.

Dyspnea

Respiratory insufficiency is the most fearsome symptom of ALS. Patients often react to the first dyspneic bouts with strong feelings of anxiety. In all stages of respiratory insufficiency, it is important, first, to break the vicious circle of dyspnea–anxiety–dyspnea. The calm, reassuring presence of relatives, trunk elevation and chest physiotherapy may provide relief. In cases with a pronounced panic component, lorazepam given sublingually (0.5–1 mg) has been most helpful, in our experience.

With progressing respiratory insufficiency, symptoms of chronic nocturnal hypoventilation (summarized in Table 5) may develop. These symptoms can severely hamper the patients' quality of life. NIV via mask is an efficient and cost-effective means of alleviating these symptoms [6, 14]. As outlined above, this should be discussed with the patient and his/her family at the onset of symptoms of chronic hypoventilation. They should be informed about the temporary nature of the measure, which is primarily directed towards improving quality of life, rather than prolonging it (as opposed to tracheostomy). The problem with mechanical ventilation is usually not related to cost or technical difficulties, but to the increasing care needs of the ventilated patients. A slow progression, good communication skills, mild bulbar involvement and, above all, a highly motivated patient and a supportive family environment argue in favor of the initiation of NIV [21]. It is very important to reassure the patient that, whenever he/she may decide to stop NIV, all necessary care and appropriate medication [26] will be available to prevent death by choking. Collaboration with hospices can be very helpful in such cases.

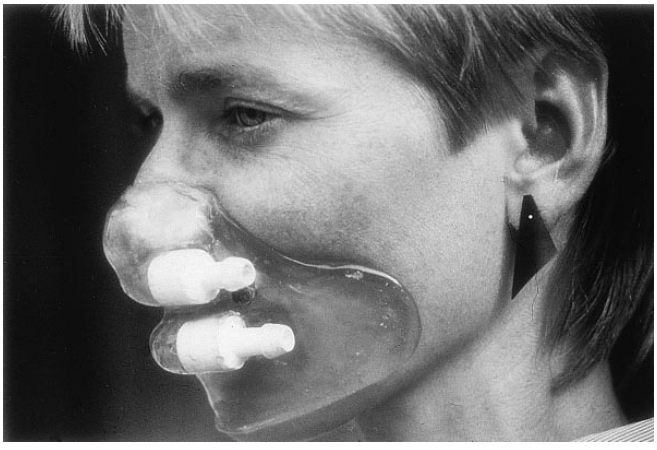

Fig. 2 The "Munich mask": an example of a nasofacial mask for non-invasive, intermittent ventilation at home (courtesy of Dr. A. Bockelbrink, Stiftung Pfennigparade, Munich)

Table 5 Symptoms of chronic respiratory insufficiency

- Daytime fatigue and sleepiness, concentration problems
- Difficulty falling asleep, disturbed sleep, nightmares
- Morning headache
- Nervousness, tremor, increased sweating, tachycardia
- Depression, anxiety
- Tachypnea, dyspnea, phonation difficulties
- Visible efforts of auxiliary respiratory muscles
- Reduced appetite, weight loss, recurrent gastritis
- Recurrent or chronic upper respiratory tract infections
- Cyanosis, edema
- Vision disturbances, dizziness, syncope
- Diffuse pain in head, neck and extremities

If the patient refuses NIV, intermittent oxygen administration may be attempted. However, oxygen is inferior to NIV, since it may only be administered during the day, when the patient is awake, because of the danger of respiratory depression in chronically hypercapnic patients receiving oxygen during sleep.

A full, 24-h mechanical ventilation via tracheostomy is an option that is only rarely chosen by fully informed patients, although single instances of patients with good quality of life over a period of 10 years and longer have been reported [23]. On the other hand, unwanted intubation by the emergency physician because of terminal respiratory failure is not infrequent when the patient and his/her family are poorly informed about the disease. Such patients may survive for years in ICU and progress to a total "locked-in" syndrome [8], where any possibility of communication with the outside world is rendered impossible by a complete tetraplegia including extraocular muscles. The understandable wish for discontinuation of life support that arises in such cases is fraught with med-

Table 6 Medication for pathological laughter/tearfulness

Amitriptyline	10– 150 mg
Fluoxetine	20– 60 mg
Sertraline	50– 150 mg
Lithium carbonate	400– 800 mg
L-Dopa	600–1000 mg

ical, ethical and juridical problems [7]. Therefore, one important aim of a good patient–physician relationship in ALS must be to prevent such a situation through early discussion and the installment of advance directives.

Pathological laughter/tearfulness

A typical symptom of ALS, which needs to be differentiated from a depressed mood state, is the insurgence of uncontrollable bouts of laughter and/or tearfulness, which is also referred to as "pseudobulbar affect". Since this symptom can be very disturbing for the patient in social situations, physicians should should ask about it and point out that it responds well to medication (Table 6). The drug of first choice is amitriptyline, but positive effects have also been reported for dopamine [22] and lithium [17].

Symptoms due indirectly to ALS

Psychological problems

All patients with ALS undergo a phase of reactive depression after being diagnosed. Counseling is very important at this stage, but is unfortunately not widely available. In severe cases, supportive psychotherapy (which is usually best administered as family therapy) and antidepressants may be indicated. Although suicidal thoughts are common in ALS, suicide attempts are rare in our experience. One of the most frequent reasons for suicidal thoughts is the fear to become a burden on one's own family. This issue should be explicitly discussed with the patient and his/her relatives. Clinically significant depression should be looked out for and treated at all disease stages, particularly since the psychological status of the patients strongly correlates with survival [12].

Table 7 Causes of sleep disturbances in ALS

- Psychic disturbances, anxiety depression, nightmares
- Inability to change position during sleep due to weakness
- Fasciculations and muscle cramps
- Dysphagia with aspiration of saliva
- Respiratory insufficiency with hypoxia and dyspnea

Table 8 Sedatives

	Dosage nocté
Chloral hydrate	250–1000 mg
Diphenhydramine	25– 50 mg
Flurazepam (beware of respiratory depression)	15– 30 mg

Sleep disturbances

The most common causes of sleep disturbances in ALS are shown in Table 7. They should be carefully looked for and treated accordingly. Sleep medication should be administered sparingly (Table 8).

Musculoskeletal pain

Although ALS itself does not usually involve sensory fibers at the clinical level, musculoskeletal pain may arise in the later stages of the disease, as a result of unphysiological stress on the bones and joints which have lost their protective muscular sheath due to atrophy. In addition, muscle contractures and joint stiffness (e.g., frozen shoulder) may be painful. These symptoms are usually best treated with non-steroidal anti-inflammatory drugs and physiotherapy. Special attention must be given to nursing care, which requires frequent changes in the patient's position, both at night and during the daytime [16].

Constipation

Although the autonomic fibers innervating the intestine are not overtly affected by the disease, lack of exercise can promote the development of constipation in ALS patients. The first steps are dietary measures (foods with high fiber content). Care should also be taken to ensure adequate fluid intake, since dysphagia-induced dehydration may worsen constipation. The next step is a review of current medication, since muscle relaxants, sedatives and anticholinergics reduce bowel mobility. Mild laxative therapy should be prophylactically initiated in bed-ridden ALS patients and in all patients receiving opiates. If bowel pain arises, ileus or subileus should be suspected.

Terminal phase

If ALS patients are not ventilated, they will almost invariably die in their sleep due to the insurgence of hypercapnic coma. The only aim of medical intervention in the terminal phase is to ensure that the patient is comfortable [25]. If the patient shows signs of dyspnea or discomfort (e.g., restlessness), appropriate medication should be administered (e.g., morphine, starting with 5 mg s.c. or i.v.).

Table 9 Patients' associations

UK	Motor Neuron Disease Association (MNDA) and International Alliance of ALS/MND associations	PO Box 246, Northampton NN1 2PR	Tel.: +44 1604 250505 Fax: +44 1604 24726 Website: www.alsmndalliance.org
Germany	Deutsche Gesellschaft für Muskelkranke (DGM)	Im Moos 4, D-79112 Freiburg	Tel.: +49 7665 94470 Fax: +49 7665 944720 E-mail: dgm_bgs@t-online.de Website: www.dgm.org
USA	Muscular Dystrophy Association (MDA)	3300 East Sunrise Dr. Tucson, AZ 85718	Tel.: +1 520 529 2000 Fax: +1 520 529 5300 E-mail: mda@mdausa.org Website: www.mdausa.org
USA	ALS Association (ALSA)	21021 Ventura Blvd. Suite #321 Woodland Hills, CA 91364	Tel.: +1 818 340 7500 Fax: +1 818 340 2060 E-mail: EAJC27B@Prodigy.com Website: www.alsa.org

Most patients wish to die at home, but this is not always easy to arrange. Hospice institutions can offer invaluable assistance in the patient's care at home during the terminal phase [20]. Alternatively, ALS patients may be admitted to hospice institutions for the last days of life, if care at home is no longer possible. It is hoped that availability of hospice care will increase in the near future.

Patients' associations

Home care of ALS patients is often limited by the amount of professional nursing care available during the advanced stages. A very important role is played by patients'associations, which provide voluntary helpers, information booklets and other educational material, and promote the exchange of information among ALS patients. A list of some of the main patients' association is given in Table 9; a full list of all ALS associations worldwide can be obtained from the International Alliance of ALS/Motor Neuron Disease (MND) associations [same address as the Motor Neuron Disease Association (MNDA), see Table 9].

Conclusion

ALS patients witness their progressing debilitation with a fully clear mind. This situation is regarded as extremely difficult by most neurologists. However, the intact mentation offers ALS patients the possibility to develop coping mechanisms which can lead, more often than expected, to a surprisingly serene acceptance of the disease state. This is usually coupled with a wish for active involvement in the process of administering adequate symptomatic treatment. It is the physician's responsibility to establish a good working relationship with the patient and his/her family that may enable their active participation in all decision processes concerning palliative care.

Palliative care in ALS does not only involve physicians, but also a large number of other professionals: counsellors; dietitians; occupational therapists; physical therapists; logopedists; nurse practitioners; social workers; hospice personnel, etc.; not to mention the family members, for whom caring for the patient often becomes a full-time job. The physician's role is to coordinate the efforts and discuss the appropriate time point for each intervention with the patient and the family.

It is hoped that new developments in the search for etiology, pathogenesis and cure of ALS will lead to drugs which can promote a significant prolongation of life in the not-too-distant future. This will increase the prevalence of the disease and will undoubtedly be paralleled by an even stronger demand for optimal palliative therapy. Accordingly, quality-of-life measures are now becoming a standard feature of therapeutic trials in ALS [2]. Especially in patients with this condition, it is not sufficient to add months to life – we also need to learn how to add life to the remaining months.

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References

1. Abrahams S, Goldstein LH, Al-Chalabi A, Pickering A, Morris RG, Passingham RE, Brooks DJ, Leigh PN (1997) Relation between cognitive dysfunction and pseudobulbar palsy in amyotrophic lateral sclerosis. J Neurol Neurosurg Psychiatry 62:464–472
2. Borasio GD (1997) Amyotrophic lateral sclerosis: lessons in trial design from recent trials. J Neurol Sci [Suppl] (in press)
3. Borasio GD, Pongratz DE (1997) Breaking the news in ALS. Presented at the 8th International Symposium on ALS/MND, Glasgow 1997
4. Borasio GD, Appel SH, Büttner U (1996) Upper and lower motor neuron disorders. In: Brandt T, Caplan LR, Dichgans J, Diener HC, Kennard C (eds) Neurological disorders: course and treatment. Academic, San Diego, pp 811–817
5. Brooks BR (1996) Clinical epidemiology of amyotrophic lateral sclerosis. Neurol Clin 14:399–420
6. Cazzolli PA, Oppenheimer EA (1996) Home mechanical ventilation for amyotrophic lateral sclerosis: nasal compared to tracheostomy-intermittent positive pressure ventilation. J Neurol Sci 139 [Suppl]:123–128
7. Goldblatt D, Greenlaw J (1989) Starting and stopping the ventilator for patients with amyotrophic lateral sclerosis. Neurol Clin 7:789–806
8. Hayashi H, Shuuichi K, Kawada A (1991) Amyotrophic lateral sclerosis patients living beyond respiratory failure. J Neurol Sci 105:73–78
9. Lacomblez L, Bensimon G, Leigh PN, Guillet P, Meininger V (1996) Dose-ranging study of riluzole in amyotrophic lateral sclerosis. Lancet 347:1425–1431
10. Mathus-Vliegen LM, Louwerse LS, Merkus MP, Tytgat GN, de Jong J.M.B.V. (1994) Percutaneous endoscopic gastrostomy in patients with amyotrophic lateral sclerosis and impaired pulmonary function. Gastrointest Endosc 40:463–469
11. Mazzini L, Corra T, Zaccala M, Mora G, Del Piano M, Galante M (1995) Percutaneous endoscopic gastrostomy and enteral nutrition in amyotrophic lateral sclerosis. J Neurol 242:695–698
12. McDonald ER, Wiedenfeld SA, Hillel A, Carpenter CL, Walter RA (1994) Survival in amyotrophic lateral sclerosis: the role of psychological factors. Arch Neurol 51:17–23
13. Meininger V (1993) Breaking bad news in amyotrophic lateral sclerosis. Palliat Med 7 [Suppl 2]:37–40
14. Moss AH, Casey P, Stocking CB, Rooks RP, Brooks BR, Siegler M (1993) Home ventilation for amyotrophic lateral sclerosis patients: outcomes, costs, and patient, family, and physician attitudes. Neurology 43:438–443
15. Newall AR, Orser R, Hunt M (1996) The control of oral secretions in bulbar ALS/MND. J Neurol Sci 139 [Suppl]:43–44
16. Newrick PG, Langton-Hewer R (1985) Pain in motor neuron disease. J Neurol Neurosurg Psychiatry 48:838–840
17. Norris FH, Smith RA, Denis EH (1985) Motor neurone disease: towards better care. BMJ 291:259–262
18. O'Brien T (1993) Palliative care and taboos within motor neurone disease. Palliat Med 7 [Suppl 2]:69–72
19. O'Brien T, Kelly M, Saunders C (1992) Motor neuron disease: a hospice perspective. BMJ 304:471–473
20. Oliver D (1996) The quality of care and symptom control – the effects on the terminal phase of ALS/MND. J Neurol Sci 139 [Suppl]:134–136
21. Oppenheimer EA (1993) Decision-making in the respiratory care of amyotrophic lateral sclerosis patients: should home mechanical ventilation be used? Palliat Med 7 [Suppl 2]:49–64
22. Sieb JP, Jerusalem F, Fresmann J (1987) Symptomatische Therapie bei amyotrophischer Lateralsklerose. Dtsch Med Wochenschr 112:769–772
23. Smith RA, Gillie E, Licht J (1991) Palliative treatment of motor neuron disease. In: de Jong JMBV (ed) Diseases of the motor system. (Handbook of clinical neurology, vol 15) Elsevier, New York, pp 459–473
24. Volkenandt M, Borasio GD, Atzpodien J (1995) Überlegungen zur ärztlichen Aufklärung von Patienten mit unaufhaltsam progredienten Erkrankungen. Z Med Ethik 41:117–128
25. Voltz R, Borasio GD (1994) Palliative Therapie in der Neurologie. Nervenarzt 65:220–225
26. Voltz R, Borasio GD (1997) Palliative therapy in the terminal stage of neurologic disease. J Neurol (this issue)