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Palliative Care Issues in Amyotrophic Lateral Sclerosis: An Evidenced-Based Review

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Abstract

As palliative care physicians become increasingly involved in the care of patients with amyotrophic lateral sclerosis (ALS), they will be asked to provide guidance regarding the use of supplements, diet, exercise, and other common preventive medicine interventions. Moreover, palliative care physicians have a crucial role assisting patients with ALS in addressing health care decisions to maximize quality of life and cope with a rapidly disabling disease. It is therefore important for palliative care physicians to be familiar with commonly encountered palliative care issues in ALS. This article provides an evidenced-based review of palliative care options not usually addressed in national and international ALS guidelines.

Keywords

amyotrophic lateral sclerosis; palliative care; hospice; alternative medicine; quality of life

Introduction

Many evidence-based amyotrophic lateral sclerosis (ALS) care options are usually initiated and managed by a neuromuscular specialist with ALS expertise, oftentimes within the multidisciplinary ALS clinic care model. These evidence-based care options include

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riluzole, multidisciplinary team care, early use of noninvasive ventilation, timely use of gastrostomy tube, and symptom management, and they are well discussed in national and international ALS guidelines.[1–3] As the disease advances, palliative care physicians are becoming increasingly involved in caring for patients with ALS. Palliative care physicians can provide guidance regarding the use of supplements, diet, exercise, and other common preventive medicine interventions and can assist patients having ALS with health care decisions to maximize quality of life and help them cope with a rapidly disabling disease. Furthermore, palliative care physicians can be an important liaisons between ALS centers and local health care and community resources, which may be geographically distant. In order to provide useful evidence-based information, which may not be addressed in national and international ALS guidelines, we present these issues subsequently, addressing each using evidence-based medicine and, when not available, clinical experience.

Vitamins and Supplements

Vitamin A

Some authors suggest that retinoid signaling is altered in patients with ALS with an increase in nuclear retinoic acid receptors.[4] However, a recent study showed a harmful effect of retinoic acid supplementation in transgenic mice.[5] There have been no human clinical trials assessing the efficacy of retinoic acid. At this time, we do not recommend the use of vitamin A for patients with ALS.

Vitamin B Complex and Homocysteine

Homocysteine is involved in the formation of free radicals and cytosolic calcium accumulation, mitochondrial dysfunction, apoptotic pathway activation, and excitotoxic amino acid-mediated damage.[6] These pathological pathways have been implicated in ALS. A small clinical study found that plasma homocysteine levels are increased in patients with ALS compared to healthy controls. Patients with ALS having shorter time to diagnosis were found to have higher homocysteine levels. The authors concluded that a higher plasma homocysteine may be linked to faster progression of the disease.[7] Another small study showed that homocysteine level in the cerebrospinal fluid is also increased in patients with ALS compared to healthy controls. The authors hypothesized that homocysteine may be a biomarker of ALS and may be involved in the pathophysiology.[8] Folate and vitamin B12 (VitB12) are thought to reduce the level of homocysteine via remethylation. One study using SOD1 mouse models showed a beneficial effect of folate on reducing the levels of homocysteine, delaying onset of disease, and prolonging life span.[9] However, in another study, B12 alone did not show any effect on homocysteine levels, onset of disease, or survival. A more recent in vitro study had opposite results, showing better survival against homocysteine toxicity in vitro, in cells pretreated with B12 but not in those treated with folate.[10] Furthermore, in 1 small preclinical study, ALS mice were supplemented with galactooligosaccharides (GOSs), a prebiotic that is thought to improve the absorption and synthesis of B vitamins. Administration of GOS and prebiotics yogurt was shown to significantly delay the disease onset and prolong the life span in SOD1G93A mice. Also, these products increased the concentration of folate and VitB12 and reduced the level of

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homocysteine.[11] To date, there have been no clinical trials examining the role of B12, folate, or GOS supplementation in patients with ALS.

Thiamin–thiamin monophosphate ratio has been shown to be reduced in the CSF of patients with ALS in 2 small studies. There have been no studies evaluating supplementation with thiamin (vitamin B1) in patients with ALS.[12,13]

Riboflavin or vitamin B2 supplementation was evaluated in 1 preclinical study using the SOD1 transgenic mouse model. There was no significant effect of riboflavin on either survival or motor performance.[14] Given the limited available data, we cannot make recommendations regarding administration of vitamin B complex for patients with ALS.

Vitamin C

Vitamin C is considered an antioxidant, but several studies have failed to show an association between vitamin C intake and ALS progression.[15] There are no trials addressing vitamin C supplementation in patients with ALS. Given the current data, we cannot make recommendations regarding vitamin C administration for patients with ALS.

Vitamin D

Vitamin D is a fat-soluble secosteroid. It can be found in certain foods but most vitamin D is synthesized in the skin from cholesterol when sun exposure is adequate. Vitamin D can influence several distinct pathways that are potentially important in physiopathology of ALS.[16] Supplementation with vitamin D in ALS mouse models has yielded mixed results.[17–19] A small clinical study showed that patients with ALS tended to have low vitamin D levels and that oral vitamin D supplementation with 2000 IU/d was safe and may be of benefit.[20] At this time, there is evidence that patients with ALS, like many patients with other chronic illnesses, are at increased risk of vitamin D deficiency, possibly secondary to limited sun exposure due to impaired mobility. Screening patients with ALS for 25-OH vitamin D deficiency and providing vitamin D3 supplementation for patients with ALS who are deficient are reasonable.[21] At this time, there is not enough evidence to support vitamin D treatment for patients with ALS who have normal vitamin D levels.[21]

Vitamin E

Vitamin E is a fat-soluble antioxidant comprised of tocopherols and tocotrienols. Studies on transgenic mice have shown that vitamin E can delay the onset of ALS but does not affect survival.[22] However, in randomized trials, vitamin E supplementation was found to be ineffective in patients with ALS.[23–25] Interestingly, vitamin E intake may reduce the risk of developing ALS.[25] With the current evidence, we do offer children of patients suspected of having familial ALS vitamin E supplementation at 200 IU/d. We caution that hypervitaminosis E can increase the risk of bleeding.

Omega 3

Omega 3 polyunsaturated fatty acids have been associated with significant health benefits.[26] Omega 3 is thought to reduce neuroexcitotoxicity and neuroinflammation and activate antiapoptotic pathways.[27] These cellular mechanisms are implicated in ALS; however, no

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clinical trials have evaluated the role of omega 3 supplementation in patients with ALS. One study was designed to evaluate the role of omega 3 in SOD1 mice.[28] In that study, omega 3 had no or negative effect on the SOD1 mice. Omega 3 did not affect the course of motor deficit nor the length of survival if administered at disease onset or if given during the symptomatic stage of the disease. However, omega 3 intake during the presymptomatic stage of ALS accelerated disease progression, increased vacuolization ofthe anterior horncell, and was associated with abnormalities of glial cells.[28] In their conclusion, the authors advised against the use of omega 3 supplementation in patients with ALS.

L-Carnitine

An essential cofactor for the β-oxidation of long-chain fatty acids, L-carnitine inhibits various types of mitochondrial injury and apoptosis both in vitro and in vivo. In transgenic mice carrying a human SOD1 gene, oral L-carnitine significantly delayed the onset of signs of disease, delayed deterioration of motor activity, and extended life span.[29] A small randomized double-blind, placebo-controlled pilot study of acetyl-L-carnitine showed an increase in median survival and slower ALS functional rating revised scores (ALSFRS-R) and forced vital capacity (FVC) decline in the patients taking L-carnitine 3 g/d. No significant side effects were reported, and the authors concluded that a phase III trial is needed to confirm these preliminary findings.[30]

Coenzyme Q10

Coenzyme Q10 (CoQ10), an antioxidant and mitochondrial cofactor, has shown promise in ALS transgenic mice, but although well tolerated[31] is expensive and did not show a benefit in patients with ALS.[32]

Creatine

Creatine, which stabilizes mitochondrial creatine kinase and inhibits opening of the mitochondrial transition pore, reducing oxidative damage to cells, was found to improve motor performance and extend survival in G93A transgenic mice.[33] A randomized double-blind, placebo-controlled trial in humans, however, did not show significant benefits.[34,35] A recent Cochrane review on creatine in ALS by Bedlack et al concluded that “in patients already diagnosed with clinically probable or definite ALS, creatine at doses ranging from 5 to 10 g/d did not have a statistically significant effect on survival, ALSFRS-R progression, or percent predicted FVC progression.”[36] However, it is unknown whether, at higher doses, creatine may be beneficial to patients with ALS.[37] Interestingly, a recent phase II study showed that high-dose creatine supplementation is safe, tolerable, and may have some positive effects in Huntington disease. At this time, and although creatine supplementation is safe, we cannot recommend for or against it for patients with ALS. We await further studies with high-dose creatine in patients with ALS to determine whether it is beneficial.

Diet

Weight and diet are 2 of the most important aspects of care in ALS. Body mass index (BMI) of less than 18.5 kg/m^2 is associated with shorter survival.[38–41] Interestingly, in data obtained from ALS clinical trial databases, patients with higher BMI at trial enrollment were

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found to have longer survival.[42] Furthermore, a recent small clinical study suggested that a high-carbohydrate, hypercaloric enteral diet was safe and tolerable in patients with ALS.[43] A larger study is needed to determine whether a hypercaloric diet affects survival. Maintaining a healthy weight and meeting calorie requirements is a challenge, especially in patients with ALS with impaired swallow from bulbar involvement or in patients with paralysis of the dominant upper limb who require help with feeding. Enteral tube feeding should be discussed early in the course of ALS and plans for gastrostomy placement encouraged before breathing is compromised (FVC around 50% predicted) or when patients lose 10% of their premorbid weight.[44] We frequently prescribe liquid nutritional supplements such as Boost or Ensure early in the course of the disease to assure maintenance of adequate nutritional intake and prevent weight loss.

Cannabis

Preclinical data indicate that cannabis has powerful antioxidative, anti-inflammatory, and neuroprotective effects, which to a certain extent have a role in ALS pathophysiology.[45] In the G93A-SOD1 ALS mouse, cannabis administration has translated to prolonged neuronal cell survival, delayed onset, and slower progression of the disease.[46] Results from a survey among 13 patients with ALS who used cannabis suggested that cannabis may be effective at reducing symptoms of appetite loss, depression, pain, spasticity, and drooling.[47] There are no clinical trials on cannabis in patients with ALS but such studies are warranted.

Statins

There are few, conflicting studies on the use of statins in patients with ALS.[48–50] One study showed an association between statin medications and an increased rate of functional decline and muscle cramping in patients with ALS.[49] Another clinical observation suggested that statins may rarely be associated with ALS in vulnerable individuals in whom prooxidant effects of statins predominate.[51] Statins may lower CoQ10 production and thus impair mitochondrial energy efficiency, which can play a role in a subtype of ALS. Furthermore, there is an apparent link between serum lipid levels and survival in patients with ALS.[52] However, other studies found no association between statin use and incidence and progression of ALS.[48,50,53] At this time, there is no definite evidence to link the use of statins to ALS development or progression. Therefore, we do not routinely discontinue statin therapy in patients with ALS.

Vaccination

Vaccinations against influenza (Flu Shots), pneumonia (Pneumococcal polysaccharide vaccine [Pneumovax]), and Shingles (Zoster vaccination) may be an important aspect of preventive care in patients with ALS to avoid potentially lethal infections in this already compromised population. There are no studies that have examined the issue of vaccination against infectious agents in patients with ALS. However, we do recommend vaccination in patients with ALS according to national vaccination guidelines.

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Antibiotics

A few clinical trials have evaluated the potential neuroprotective role of select antibiotics (eg, ceftriaxone, minocycline, and rifampicin) in patients with ALS. The results of these studies were negative, with no beneficial effect on survival. Actually, a phase 3 clinical trial of high-dose minocycline showed that patients taking minocycline progressed significantly faster than those on placebo. For this reason, we do not recommend using minocycline in patients with ALS.[54,55] Based on our experience, we do not have additional warning regarding the use of antibiotics in patients with ALS.

Exercise

Skeletal muscle weakness is the sine qua non of ALS, causing the majority of the clinical and functional decline for which palliative interventions are often necessary. Contrary to popular dogma, which espouses “use it or lose it,” when it comes to exercise for patients with ALS, there remains a lack of sufficient data to determine whether exercise is beneficial or harmful. Controversy still exists as to whether exercise plays a role in the development of disease. The most recently published large epidemiologic study, by Pupillo et al, compared 652 patients with ALS, from European population-based registries, to 1166 sex- and aged-matched controls, reporting an overall reduced odds ratio (OR) of ALS in those with increased physical activity (Adj OR = 0.65, 95% confidence interval = 0.48–0.89). They also reported an inverse correlation between sports participation and ALS in women, but not in men, or those with repeated trauma. They concluded that increased physical activity may eventually be proved preventative.[55]

The literature regarding the safety and efficacy of exercise after diagnosis of ALS is scant. A Cochrane review, published in 2013 by Bello-Haas et al, identified only 2 randomized control trials comparing resistance training to standard therapy. Their search did not identify any randomized trials assessing aerobic exercise. When the authors combined the data of these 2 small randomized clinical trials, they found evidence of beneficial effect from mild to moderate resistance exercise in patients with ALS as measured by improved mean ALSFRS scores; no adverse events were reported. Unfortunately, these studies had methodological flaws, included very small numbers of patients with ALS, and had short follow-up time, making the results difficult to interpret.[56–58]

Three exercise strategies should be considered when making recommendations for patients with ALS: (1) range of motion, (2) resistance, and (3) aerobic exercises.

1. Range of motion exercise for patients with ALS has been considered first-line treatment for spasticity and painful muscle spasms. A small randomized clinical trial, including a group performing a standard range of motion program, described no adverse events associated with stretching.[58] A home stretching program should be considered safe and appropriate for patients with ALS. An independent stretching program, designed by a knowledgeable therapist, can be transitioned to caregiver-assisted exercises when the patient is no longer capable of performing stretches independently.

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2. Physicians caring for patients with ALS have traditionally been reluctant to recommend strengthening exercises. However, this philosophy may promote the development of disuse weakness, compounding the disability produced by ALS itself. The literature supporting the development of overwork weakness in patients with ALS is anecdotal and was not evident in the above-mentioned prospective studies. Supportive pre-clinical evidence for strength training was recently published by Nalbandian et al who evaluated the effects of resisted exercise on transgenic mice carrying the valosin-containing protein genetic mutation associated with ALS and Paget disease. The exercised cohort worked against an uphill gradient and showed significant improvement in muscle strength when compared to mice exercised on either a downhill gradient or those not exercised at all. In addition, the resistance-trained mice showed reduced levels of autophagy markers commonly associated with ALS.[59] In the early stages of ALS, patients often inquire about the role of exercise in reversing or preventing the development of weakness. Interested patients with ALS can be encouraged to begin or to continue a resistance program to maximize the strength of unaffected or mildly affected muscles with the goal of prolonging function. Based on the currently available literature, mild to moderate resistance training appears to be safe and possibly beneficial for patients with ALS. There are no hard and fast guidelines for the design of a resistance program; however, common sense would suggest that if an exercise routine consistently produces immediate, severe, or prolonged delayed muscle soreness, it is too strenuous. In addition, postexercise exhaustion should last no more than 5 to 15 minutes. Prolonged exercise-related fatigue should be considered an impairment to overall function and mobility. Assessment of postexercise pain and fatigue should be included during regular follow-up appointments and any evidence of such should trigger recommendations to modifying either or both exercise intensity and duration.

3. Aerobic exercise helps maintain cardiorespiratory fitness. Given the lack of any apparent contraindication, aerobic exercise training is recommended for patients with ALS as long as it can be performed safely without risk of falls or injury. In addition to the physical benefits, strengthening and aerobic exercise may have a beneficial effect on mood, psychological well-being, bone health, appetite, and sleep. Further studies are needed to assess the impact of regular exercise and varying exercise intensities on patients with ALS.

Spasticity

Spasticity is a common issue in patients with ALS, especially in those where upper motor involvement is predominant. Spasticity can interfere with voluntary movement affecting gait and cause falls, sudden twitching in a limb, contractures, and so forth. Physical therapy, range of motion, and stretching as mentioned previously can be helpful. In addition, medication such as baclofen or tizanidine can be tried. Physicians must be careful when prescribing these medications since weakness can be an important side effect. Intrathecal baclofen is usually avoided because of the progressive nature of the disease. However, it may be used in selected patients with slow progression and predominantly upper motor

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neuron signs. There are no clinical trials comparing the efficacy of different muscle relaxants in patients with ALS. A recent Cochrane database identified only 1 randomized controlled trial of moderate intensity, endurance-type exercise versus “usual activities” in 25 patients with ALS. The authors concluded that “the study too small to determine whether individualized moderate intensity endurance-type exercises for the trunk and limbs are beneficial or harmful.”[56]

Hypersialorrhea

Hypersialorrhea is a frustrating and embarrassing issue for patients with ALS and bulbar involvement. Furthermore, hypersialorrhea can result in choking and aspiration pneumonia. Because of cost and accessibility, oral medications are the first line of therapy, although there are no clinical trials that studied their efficacy. We first try amitriptyline 10 mg 3 times a day by mouth or per percutaneous endoscopic gastrostomy. Apart from its anticholinergic effect and reduction in drooling, amitriptyline is also effective for depression, emotional lability seen in pseudobulbar affect, and chronic pain. However, constipation may be an issue. Atropine drops, 0.5% or 1%, administered sublingually 3 or 4 times a day can be tried. Another option is glycopyrrolate solution taken 1 mg 2 to 3 times a day. Transdermal hyoscine (scopolamine), 1.5 mg every third day, is also an option, although it can frequently cause confusion or loss of bladder control. When those medications are not enough or side effects are not tolerable, botulinium toxin injection or salivary gland radiation can be tried. Botulinium toxin can be injected in the parotid gland, submandibular gland, or both. Different types and doses of complete botulinium toxin have been tried. The location of the gland to be injected was identified by either anatomical markers, electromyography, or ultrasound guidance. The use of ultrasound guidance may improve the precision of the procedure. Side effects are uncommon, although case of rapid worsening of bulbar patients with ALS has been reported. Radiation therapy to the submandibular glands and two-thirds of both parotid glands has been shown to be effective.[57,58] Radiation therapy may be used as a last resort when other intervention did not work. Short-term side effects that are commonly reversible include loss of taste, thrush and pain, mouth sores, and worsening of the dysphagia or dysarthria. Long-term side effects on patient with ALS are still not known.

Communication

Augmentative and alternative communication devices (AAC) are essential for patients with impaired speech. AAC can improve quality of life by optimizing function, allowing the patient with loss of speech to continue to express their needs, communicate with caregivers and loved ones, and continue to direct their own medical care. There are more options than ever before, from cell phone and iPad applications to the more traditional Tobii or Dynavox AAC systems. While the Tobii and Dynavox systems are not as easily portable, they Currently offer the greatest longevity with eye-gaze tracking technology that allows continued use for the patient who loses hand function.[59,60]

Surgical Risks

The literature regarding perioperative complications in patients with ALS is limited. However, we recommend that patients with ALS undergo thorough medical evaluation prior

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to any surgery to reduce perioperative risk. Cardiac function should be assessed formally, as patients with ALS often have limited physical activity and may not present with classic cardiac symptoms. A careful evaluation of pulmonary function is required, with strategies developed in advance of the procedure for patients with ALS with respiratory compromise. Successful postoperative extubation may be complicated, especially in patients with low FVC. The possibility of extubation failure and its consequences should be discussed with the patient. Simple interventions, such as extubation to noninvasive ventilation, even in patients with ALS with no evidence of respiratory compromise, can prevent postoperative pulmonary complications.[61]

Anesthesia

Surgical risks in patients with ALS are mainly related to anesthesia. Risks with general anesthesia requiring intubation are high, especially in patients with ALS with respiratory compromise, which is why, if possible, regional anesthesia is preferred. Literature pertaining to the anesthetic management of ALS is limited.

In a study of 51 patients with ALS undergoing general anesthesia,[62] Onders et al argued that general anesthesia in patients with ALS can be safely performed. However, these results should be interpreted with caution since those patients were undergoing elective diaphragm pacing system placement, which may have a different risk profile than other more commonly performed surgeries. The strategy used by the authors relied on the use of rapid reversible short-acting analgesic and amnestic agents. For premedication, they used midazolam. Induction was attained using propofol and remifentanil infusion. Propofol is an intravenous amnestic agent, and remifentanil, an intravenous ultrashortacting narcotic, is used for both induction and maintenance of anesthesia.[62] Anesthesia was deepened using an inhalational agent, sevoflurane or desflurane, which has low lipid solubility allowing rapid on and off capabilities.[62] Although this anesthetic technique is logical, there was no control or comparison data to verify its superiority over other techniques. Inhalational agents can cause postoperative respiratory depression; and thus, extubation should be done when the patient is fully awake.[63]

Depolarizing neuromuscular blockers, such as succinylcholine, are contraindicated in patients with ALS because of the risk of profound potassium release.[64] Other nondepolarizing muscle relaxants should also be avoided since prolonged activity has been described.[65] However, there are case reports of patients with ALS who underwent neuromuscular blockade and recovered quickly with the use of suggamadex.[66,67] Increased risk of malignant hyperthermia or rhabdomyolysis has not been reported in patients with ALS.[64]

When local anesthesia is used in patients with impaired respiratory function, NIV may be helpful in reducing respiratory complications during or following surgery.[39] There is no evidence that peripheral nerve block is harmful for patients with ALS.[68]

Effect of Surgery on ALS Progression

One study suggested that major surgery, necessitating either regional or generalized anesthesia, may result in a more rapid ALS progression.[69] Unfortunately, that study was

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retrospective and did not include long-term follow-up. Regardless, careful consideration of risks versus benefits of surgery is warranted on a case-by-case basis.

Pulmonary Issues

Respiratory failure is the leading cause of death in ALS. In the absence of underlying intrinsic pulmonary disease, the respiratory failure in ALS is purely mechanical; due to respiratory muscle weakness, the lungs do not fully inflate during inspiration. Discussion concerning respiratory failure should be initiated soon after the diagnosis of ALS is confirmed, giving patients and their families time to learn about their choices and, ideally, make decisions in a noncrisis situation. These discussions should include both the benefits and the limitations of all forms of assistive ventilation.

Most patients with ALS remain asymptomatic until their FVC is less than 50% of predicted. Pulmonary function tests, particularly the FVC, should be monitored every few months, depending on the rate of disease progression. Nocturnal hypoventilation is typically the earliest manifestation of respiratory insufficiency; symptoms include poor sleep with frequent awakening, nightmares, early morning headaches, and excessive daytime fatigue with sleepiness.[1,70] Another early sign of respiratory muscle weakness is a weak cough and difficulty in clearing secretions. The management of respiratory failure in ALS involves prevention of infection and provision of noninvasive or invasive mechanical ventilatory assistance. Patients with an inadequate cough, as determined by a peak cough flow measurement of 270 L/min or less, can be helped by manually assisted coughing or an in-exsufflator device that mechanically augments the cough.[71] Providing patients with supplemental oxygen should typically be avoided, as it may suppress respiratory drive, exacerbate alveolar hypoventilation, and ultimately lead to carbon dioxide retention and respiratory arrest.[71,72] Supplemental oxygen is recommended only for patients with concomitant pulmonary disease or as a comfort measure for those who decline assisted ventilation in the terminal stage of disease.

Noninvasive positive pressure ventilation (NIPPV) is considered standard of care for patients with ALS. The American Academy of Neurology’s practice parameter on ALS recommends that NIPPV be introduced when the FVC falls to 50% of predicted or earlier if the patient is symptomatic.[2] However, others have suggested that earlier introduction of NIPPV may further improve survival and quality of life.[72,73] With good patient acceptance, NIPPV can extend the life of a patient with ALS well beyond that of available disease-modifying medications.[73,74]

Noninvasive positive pressure ventilation can be delivered through a variety of oral or nasal mask interfaces with use of bi-level positive airway pressure machines or portable volume-cycled ventilators. Bi-level positive airway pressure is currently the most commonly used form of NIPPV. Gaining popularity are newer technologies that offer volume-assured pressure support and provide automatic inspiratory and expiratory pressure adjustments to meet the tidal volume or alveolar ventilation needs of patients with progressive restrictive lung disease. Initially, NIPPV is used at night. As FVC continues to decline, ventilator use

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can be extended into the day and eventually become continuous. Patients wishing to prolong their life to the fullest extent possible may consider invasive mechanical ventilation.

Pain, Quality of Life, and Immobility

Although not frequently characterized as a major component of ALS, the majority of patients with ALS experience significant pain as a complication of the disease. Moreover, a higher risk of depression and a negative effect on quality of life (QoL) have been reported in patients with ALS having pain.[75] Recent studies reported that the vast majority of patients with ALS report some problems with pain.[75,76] Clinicians should pay attention to both pain and depressive symptoms in patients with ALS and consider their negative effect on their QoL. Pain in ALS is likely primarily due to immobility, which can cause adhesive capsulitis, mechanical back pain, pressure areas on the skin, and, more rarely, neuropathic pain although this is not well studied.[1] Frequently, severe weakness in the neck flexors and extensors will cause a “floppy head” often associated with severe neck pain and tightness. This may be helped by a hard cervical (Philadelphia type), a Freeman or Headmaster type collar—which is a wire frame collar with padding over the pressure points. Wheelchairs should provide adequate lumbar support and good cushioning (gel-foam). The chair should be properly fitted to avoid pressure ulcers and inadequate support for the spine. Simply giving the patient a prescription for a wheelchair often ends up with the patient getting a standard manual chair that does not fit properly. A power wheelchair, although expensive, can be justified since it will help prolong independent mobility and thus markedly improve quality of life.[1]

A good pressure-relieving mattress (air or dense foam) should be used on the bed at home, along with foam wedges to facilitate proper positioning. This will help prevent pressure ulcers and contractures. Daily passive and active-assisted range of motion is critical. Maintaining mobility and functional independence as long as possible will have positive physical as well as psychological benefits. Ankle-foot orthoses molded in the neutral position may prolong ambulation and avoid injury if there is uni- or bilateral foot drop. Wheeled walkers (Gran Tour in particular) or quad (4 point) canes may also help, depending on the pattern of weakness. Other useful equipment includes hand-held showers, bath tub benches, grab bars, raised toilet seat, hospital bed, commode chair, ADL aids (sock aid, grabbers, etc), and wheel chair ramps. An occupational therapist will help define which, if any, of these devices will be useful to the patient. Other simple suggestions such as moving the patient’s bedroom to the first floor, removing any loose rugs or covering slippery floors, and so forth are helpful and can be done during an in-home evaluation by the therapist.

Conclusion

Amyotrophic lateral sclerosis is a progressive neurodegenerative disease for which there is no cure. Much can be done to mitigate the disease burden of patients with ALS through the use of palliative interventions. The care of patients with ALS is complex with evidence suggesting it is best done by a multi-disciplinary team led by a neuromuscular-trained ALS specialist. However, as disease burden increases, access to these specialty clinics may become difficult or impossible for the patient. Extending the current multidisciplinary team

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paradigm to include collaborations with local providers, including local palliative care physicians and allied health care providers, can assure that the patient's needs are met throughout the disease course, particularly during terminal illness. We hope that this article becomes a useful resource to palliative care physicians, in addition to available national and international guidelines. Ultimately, we believe a team approach that relies on close communication among ALS specialists, palliative care physicians, and allied health care professionals is the care model that results in best outcomes.

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