TABLE 121-4 SYMPTOM MANAGEMENT FOR MOTOR NEURON DISEASES

RESPIRATORY INSUFFICIENCY	**SPASTICITY**
Noninvasive positive pressure ventilation Cough-assist devices	Baclofen 10-20 mg qid Dantrium 25-100 mg qid
DYSARTHRIA	**PSEUDOBULBAR AFFECT**
Augmentative speech device	Serotonin reuptake inhibitors Amitriptyline 25-75 mg qhs Dextromethorphan/Quinidine 20/10 mg bid
DYSPHAGIA	**WEAKNESS**
Percutaneous endoscopic gastrostomy placement Suction machine	Ankle foot orthosis Wheelchair Elevated toilet seat
SIALORRHEA	
Amitriptyline 25-75 mg qhs Glycopyrrolate 1-2 mg q8h Botulinum toxin	

TABLE 121-5 CLINICAL SPECTRUM OF MOTOR NEURON DISEASES*

UPPER AND LOWER MOTOR NEURON INVOLVEMENT	LOWER MOTOR NEURON INVOLVEMENT
Sporadic amyotrophic lateral sclerosis *Familial amyotrophic lateral sclerosis*	Motor neuronopathy related to malignancy or paraproteinemia Poliomyelitis West Nile virus Postpolio syndrome *Hexosaminidase deficiency* Progressive muscular atrophy *Spinal muscular atrophy* Type I: Infantile onset (Werdnig-Hoffmann disease) Type II: Late infantile onset Type III: Juvenile onset (Kugelberg-Welander disease)
UPPER MOTOR NEURON INVOLVEMENT	
Primary lateral sclerosis *Familial spastic paraparesis*	

*Italicized disorders are hereditary.

survival by 2 to 3 months (Level A). The mechanism of this effect is not known with certainty; however, riluzole may reduce excitotoxicity by diminishing presynaptic glutamate release. Initiation of noninvasive positive pressure ventilation (NPPV) on a spontaneous timed mode has also been shown to prolong survival up to 20 months, slow the rate of forced vital capacity (FVC) decline (Level B), and improve quality of life (Level C). NPPV should be initiated when the forced vital capacity (FVC) is less than 50%, the maximal inspiratory pressure is less than 60 cm, or when patients report symptoms that suggest nocturnal hypoventilation (e.g., daytime fatigue, frequent arousals, supine dyspnea, morning headaches). A cough-assist device can be used to assist with clearing upper airway secretions and has been shown to minimize the risk of pneumonia in clinical trials (Level C). A percutaneous gastrostomy (PEG) tube should be considered for prolonging survival and stabilizing body weight (Level B) in patients with impaired oral food intake. Symptomatic therapy for spasticity, pseudobulbar affect, muscle cramping, and sialorrhea is also essential in maintaining patient dignity and quality of life (Table 121-4). Augmentative speech devices can assist patients with communication and computer access.

Prognosis

Mean survival from onset of symptoms is 2 to 5 years, with 10% of patients surviving beyond 10 years. The majority of deaths are related to respiratory muscle failure and aspiration pneumonia.

Other Acquired Motor Neuron Diseases

Other motor neuron diseases involve only particular subsets of motor neurons (Table 121-5). Progressive muscular atrophy (PMA) is a pure lower motor neuron disease that accounts for 8% to 10% of patients with motor neuron disease. Weakness is typically distal and asymmetrical, and bulbar involvement is rare. Patients with PMA generally have a better prognosis than those with ALS, with a survival of 3 to 14 years. Primary lateral sclerosis (PLS) is a pure upper motor neuron syndrome in which patients demonstrate either a slowly progressive spastic paralysis or dysarthria. This is a rare disorder, accounting for 2% of all motor neuron cases. Survival is generally years to decades.

Spinal Muscular Atrophy

Spinal muscular atrophy (SMA) is a hereditary form of motor neuron disease in which only the lower motor neuron is affected. The SMAs may begin in utero, in infancy, in childhood, or in adult life and represent the first class of neurologic disorders in which a developmental defect in neuronal apoptosis most likely produces the disease. Two genes are involved in SMA types 1 to 3: the neuronal apoptosis inhibitor protein (NAIP) and survival motor neuron (SMN) genes.

Bulbospinal muscular atrophy (BSMA) or Kennedy's disease is an X-linked recessive disorder in which the mean age at onset is 30 years; the range is from 15 to 60 years. BSMA is a trinucleotide repeat disorder with a CAG expansion encoding for a polyglutamine tract in the first exon of the androgen receptor gene, on chromosome Xq11-12. The mechanism by which disruption of the androgen receptor gene alters the function of bulbar and spinal motor neurons is not known. An inverse correlation exists between the number of CAG repeats and the age of onset of the disease. Affected individuals exhibit chin fasciculations, midline furrowing and atrophy of the tongue, and proximal weakness. Dysphagia and dysarthria are common, and up to 90% of patients demonstrate gynecomastia and infertility. Two findings distinguishing this disorder from ALS are the absence of upper motor neuron signs and in some patients the presence of a subtle sensory neuropathy.

DISORDERS OF THE BRACHIAL AND LUMBOSACRAL PLEXUS

The roots within the cervical, lumbar, and sacral regions organize into the cervical, lumbar, and sacral plexuses before giving rise to individual peripheral nerves. Diseases of these plexuses (plexopathies) tend to be *focal* in symptoms and signs, whereas many diseases of the peripheral nerves and muscles are *generalized.*

Brachial Plexopathy

The brachial plexus is constituted by mixed nerve roots from C5 to T1 that fuse into upper, middle, and lower trunks above the level of the clavicle and redistribute into lateral, posterior, and medial cords below that landmark (E-Fig. 121-2). Symptoms include weakness, pain, and sensory loss in the shoulders or arms.