McCance: Pathophysiology, 6th Edition

Chapter 17: Disorders of the Central and Peripheral Nervous Systems and the Neuromuscular Junction

Key Points – Print

SUMMARY REVIEW

Central Nervous System Disorders

1. MVAs are the major cause of traumatic CNS injury. Traumatic injuries are classified as closed-head trauma (blunt) or open-head trauma (penetrating). Closed-head trauma is the more common type of trauma.
2. Different types of focal brain injury include contusion (bruising of the brain), laceration (tearing of brain tissue), extradural hematoma (accumulation of blood above the dura mater), subdural hematoma (blood between the dura mater and arachnoid membrane), intracerebral hematoma (bleeding into the brain), and open-head trauma.
3. Open-head trauma involves a skull fracture with exposure of the cranial vault to the environment. The types of open-head trauma (compound fracture, perforated fracture) are linear, comminuted, compound, and basilar skull fracture (in the cranial vault or at the base of the skull).
4. DAI results from the effects of head rotation. The brain experiences shearing stresses resulting in axonal damage ranging from concussion to a severe DAI state.
5. Spinal cord injuries occur most often in young men who sustain various kinds of injuries (recreational or travel related) and older adults because of preexisting degenerative vertebral disorders.
6. Spinal cord injury involves damage to vertebral or neural tissues by compressing tissue, pulling or exerting tension on tissue, or shearing tissues so that they slide into one another.
7. Spinal cord injury often causes spinal shock with cessation of all motor, sensory, reflex, and autonomic functions below any transected area. Loss of motor and sensory function depends on the level of injury.
8. Paralysis of the lower half of the body with both legs involved is called *paraplegia*. Paralysis involving all four extremities is called *quadriplegia*.
9. Return of spinal neuron excitability occurs slowly. Reflex activity can return in 1 to 2 weeks in most people with acute spinal cord injury. A pattern of flexion reflexes emerges, involving first the toes and then the feet and legs. Eventually reflex voiding and bowel elimination appear, and mass reflex (flexor spasms accompanied by profuse sweating, piloerection, and automatic bladder emptying) may develop.
10. Immobilization of the spine is the immediate intervention for a suggested or confirmed vertebral fracture.

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11. The pathologic findings in DDD include disk protrusion, spondylosis, and/or subluxation and degeneration of the vertebrae (spondylolisthesis) and spinal stenosis.
12. Low back pain is pain between the lower rib cage and gluteal muscles and often radiates into the thigh.
13. Low back pain has a high prevalence, affecting 75% to 90% of the population at some time. Sciatica affects about 1% of those with low back pain.
14. Most causes of low back pain are unknown; however, some secondary causes are disk prolapse, tumor, bursitis, synovitis, DDD, osteoporosis, fracture, inflammation, and sprain.
15. Diagnosis of injury to the lower back is made on the basis of physical examination, EMG, myelography, CT, and MRI.
16. Treatment for low back pain includes bed rest, use of analgesics and NSAIDs, exercise, physical therapy, education, and surgery.
17. Herniation of an intervertebral disk is a protrusion of part of the nucleus pulposus. Herniation most commonly affects the lumbosacral disks (L5-S1 and L4-L5). The extruded pulposus compresses the nerve root, causing pain that radiates along the sciatic nerve.
18. Clinical improvement occurs in most cases; only 10% have sufficient pain after 6 weeks to consider surgery. There is little evidence that drug treatments are effective.
19. Cerebrovascular disease is the most frequently occurring neurologic disorder. Any abnormality of the blood vessels of the brain is referred to as a cerebrovascular disease.
20. Cerebrovascular disease is associated with two types of brain abnormalities: (a) ischemia with or without infarction and (b) hemorrhage.
21. The most common clinical manifestation of cerebrovascular disease is a CVA (stroke syndrome).
22. CVAs are classified according to pathophysiology and include global hypoperfusion and thrombotic (arterial occlusions caused by thrombi), embolic (fragments that break from a thrombus outside the brain), hemorrhagic (intracranial hemorrhage), and lacunar strokes.
23. Aspirin, systemic anticoagulation, and thrombolysis improve outcomes with ischemic stroke. Antiplatelet therapy and statins decrease recurrence. Endartectomy is effective if carotid stenosis is greater than 50%.
24. Intracranial aneurysms result from defects in the vascular wall and are classified on the basis of form and shape. They are commonly asymptomatic, but the signs vary according to the location and size of the aneurysm.
25. In cerebral aneurysms, surgical intervention is the treatment of choice before rupture.
26. An AVM is a tangled mass of dilated blood vessels. Although sometimes present at birth, AVM exhibits a delayed age of onset.
27. Clinical manifestations of AVM range from headache and dementia to seizures and ICH or SAH.

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28. An SAH occurs when blood escapes from defective or injured vasculature into the subarachnoid space. When a vessel tears, blood under pressure is pumped into the subarachnoid space. The blood produces an inflammatory reaction in these tissues.
29. Clinical manifestations of an SAH include headache, changes in mental status, transient motor weakness, and numbness and tingling. Vasospasm and delayed cerebral ischemia are serious complications. Treatment of vasospasm includes use of calcium channel blockers to prevent or reverse vasospasm and augmenting cerebral perfusion by volume expansion and hemodilution.
30. Migraine is now viewed as a familial episodic disorder whose marker is headache. Migraine is classified as a headache with and without aura and is precipitated by a triggering event.
31. The clinical phases of a migraine attack are the premonitory phase, the migraine aura, the headache phase, and the recovery phase.
32. Cortical spreading depression is thought to be followed by a compensatory overactivity of the trigeminovascular system of the brain.
33. Cluster headaches occur in episodes several times during a day for a period of days at different times of year. The pain is unilateral, intense, tearing, and burning. Associated symptoms include ptosis, lacrimation, reddening of the eye, and nausea. The cause of trigeminal activation is unknown. There is sympathetic nervous system underactivity and parasympathetic overactivity. The two forms are acute and chronic.
34. Chronic paroxysmal hemicrania is a cluster headache with more frequent daily attacks; it occurs primarily in women. It responds to treatment with indomethacin.
35. Tension-type headache is the most common type of headache. Both a central mechanism and a peripheral mechanism are associated with the etiology. The headache is bilateral, with the sensation of a tight band around the head. The pain may last for hours or days. There are acute and chronic forms.
36. Two main types of tumors occur within the cranium: primary and metastatic. Primary tumors are classified as intracerebral or extracerebral. Metastatic tumors can be found inside or outside the brain substance.
37. CNS tumors cause local and generalized manifestations. The effects are varied; local manifestations include seizures, visual disturbances, loss of equilibrium, and cranial nerve dysfunction.
38. The principal treatment for brain tumors is surgical or radiosurgical excision or decompression if total excision is not possible. Chemotherapy and radiation therapy also are used.
39. Spinal cord tumors are classified as intramedullary (within the neural tissues) or extramedullary (outside the spinal cord). Metastatic spinal cord tumors are usually carcinomas, lymphomas, or myelomas.
40. Extramedullary spinal cord tumors produce dysfunction by compression of adjacent tissue, not by direct invasion. Intramedullary spinal cord tumors produce dysfunction by invasion and compression.

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41. The onset of clinical manifestations of spinal cord tumors is gradual and progressive, suggesting compression. Specific manifestations depend on the location of the tumor; for example, there may be paresis and spasticity of one leg with thoracic tumors, followed by involvement of the opposite leg.
42. Spinal cord tumors are treated by surgery, radiation therapy, chemotherapy, and hormonal therapy.
43. Infection and inflammation of the CNS can occur by bacteria, viruses, fungi, parasites, and mycobacteria. The resulting infection by bacteria is pus producing, or pyogenic.
44. Meningitis (infection of the meninges) is classified as bacterial, aseptic (nonpurulent), or fungal. Bacterial meningitis is primarily an infection of the pia mater and arachnoid and of the fluid of the subarachnoid space. Aseptic meningitis is believed to be limited to the meninges. Fungal meningitis is a chronic less common type of meningitis.
45. The meningeal vessels become hyperemic, and neutrophils migrate into the subarachnoid space with bacterial meningitis. An inflammatory reaction occurs, and exudation ensues and increases rapidly.
46. The variety of clinical manifestations depends on the type of meningitis and ranges from throbbing headache to neck stiffness and rigidity and decreasing responsiveness. Specific cranial nerve dysfunction is a common occurrence.
47. Bacterial meningitis and fungal meningitis are treated with appropriate antibiotic therapy; aseptic meningitis is treated with antibiotics, antiviral drugs, and steroids.
48. Brain abscesses often originate from infections outside the CNS. Microorganisms gain access to the CNS from adjacent sites or spread along the wall of a vein. A localized inflammatory process develops with exudate formation, thrombosis of vessels, and degenerating leukocytes. After a few days the infection becomes delimited, with a center of pus and a wall of granular tissue.
49. Clinical manifestations of brain abscesses include headache, nuchal rigidity, confusion, drowsiness, and sensory and communication deficits. Treatment includes antibiotic therapy and surgical excision or aspiration.
50. Encephalitis is an acute febrile illness of viral origin with nervous system involvement. The most common encephalitides are caused by arthropod-borne viruses and herpes simplex virus. Meningeal involvement appears in all encephalitides.
51. Clinical manifestations of encephalitis include fever, delirium, confusion, seizures, abnormal and involuntary movement, and increased intracranial pressure.
52. Most encephalitides are treated with an antiviral agent or an immune globulin.
53. The common neurologic complications of AIDS are HIV neuropathy, HIV myelopathy, opportunistic infections, cytomegalovirus infection, parasitic infection, and neoplasms. Pathologically, there may be diffuse CNS involvement, focal pathologic findings, and obstructive hydrocephalus.
54. MS is a relatively common degenerative disorder involving CNS myelin. Immune system dysfunction produces the pathology but there are four different patterns. The demyelination is

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thought to result from an immunogenetic-viral cause. A previous viral insult to the nervous system in a genetically susceptible individual yields a subsequent abnormal immune response in the CNS.

55. The clinical manifestations of MS involve different types: mixed or generalized, spinal, and cerebellar.
56. There is no cure for MS. Steroid and immune therapy is used to acutely manage relapses or reduce frequency of relapses.
57. ALS is a degenerative disorder diffusely involving lower and upper motor neurons. The pathogenesis of ALS is not fully known; however, lower and upper motor neuron degeneration occurs as well as degeneration of the nonmotor neurons in the cortices and spinal cord.
58. Clinical manifestations of ALS may include weakness in all muscles. Flaccid paresis progressing to paralysis is characteristic of the lower motor neuron syndrome. One treatment is available to alter the time course of the ALS syndrome.

Peripheral Nervous System and Neuromuscular Junction Disorders

1. Neuropathies are the syndromes that result when the peripheral nerves are affected. Axon and myelin degeneration may be present. Neuropathies are classified as generalized symmetric polyneuropathies, generalized neuropathy, and focal or multifocal neuropathies.
2. Therapy for the neuropathies is directed at the primary cause, such as diabetes mellitus. Axonal regrowth and recovery of function may take months, but many neuropathies can be reversed.
3. Guillain-Barré syndrome is an acquired, acute inflammatory demyelinating or axonal disorder caused by a humoral or cell-mediated immunologic response, or both, directed at peripheral nerves. Four subtypes have been identified and clinical manifestations depend on the subtype.
4. Radiculopathies are disorders of the roots of spinal cord nerves. The roots may be compressed, inflamed, or torn. Clinical manifestations include local pain or paresthesias in the sensory root distribution. Treatment may involve surgery, antibiotics, steroids, radiation therapy, and chemotherapy.
5. Autoimmune myasthenia gravis is a disorder of voluntary muscles characterized by muscle weakness and fatigability, and has three subtypes.
6. Myasthenia gravis results from a defect in nerve impulse transmission at the neuromuscular junction. Autoantibodies, complement deposits, and membrane attack complex destroy the receptor sites causing decreased transmission of the nerve impulse across the neuromuscular junction.
7. Clinical manifestations of myasthenia gravis include weakness of the muscles of the face and throat and may involve muscles of the diaphragm and chest wall.

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8. Treatment of myasthenia gravis involves symptom relief and immunotherapy. The progression of the disease is highly variable; in some individuals it is mild and spontaneously remits.

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