

Case Study: Bonnie's Neurology

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Neurology is a complex system. The neuron cells are unique as they do not regenerate (Norris & Lalchandani, 2019). A deviation from the normal metabolic operation of neuron cell alters their function for a lifetime (Norris & Lalchandani, 2019). In this paper with the use of Bonnie's case study of her recent ischemic stroke the following will be reviewed: assessment, follow-up, brain tissue injury, ischemic penumbra, hypoxia versus ischemia, and cerebral edema.

Assessment

There are a couple of factors involved in making the determination to refer Bonnie to a neurologist. One is the Mini-Mental State Examination (MMSE) which assesses cognitive deficits (Bour et al., 2010). There are several questions in the MMSE that ask information about basic daily tasks, cognitive memory and assess if they are able to follow directions with fine motor skills. Bonnie's score is 27 on the MMSE; the result do not suggest the need to refer to a neurologist. A score of 13 lower is considered an indicator that further evaluation is required by a neurologist (Bour et al., 2010). Another factor is the complexity of the stroke furthering selective therapy (Swarztrauber, & Vickrey, 2004). Gauge of complexity would be patient condition worsening or not responding to medication/rehabilitation therapy (Swarztrauber, & Vickrey, 2004).

Follow-up

Stroke represents one of the leading causes of death in the United States (Pedersen, Petursson, & Hetlevik, 2018). While primary prevention is recognized as the golden standard, the aftermath of a stroke is secondary prevention. Pedersen et al., (2018) finds a person is at a heightened risk for repeated strokes, thus effective secondary prevention aims to lower disability and mortality.

Bonnie's follow-up focus is secondary prevention with her primary care provider (PCP) (Pedersen et al., 2018; Norris & Lalchandani, 2019). The PCP and Bonnie can begin with managing current antihypertensive medications to establish a blood pressure less than 140/90 mmHG (Pedersen et al., 2018). Simultaneously addressing any underlying health issues such as (atherosclerosis) hyperlipidemia, antiplatelet therapy using Plavix, diabetes, or smoking cessation (Norris & Lalchandani, 2019). Along with Bonnie's medication management, occupational, physical, and speech therapy would maximize her recovery (Norris & Lalchandani, 2019). Monthly clinic visit to PCP is recommended until blood pressure is less than 140/90 mmHG with antiplatelet therapy monitoring and rehabilitation therapy (Pedersen et al., 2018).

Brain Tissue Injury

Stroke results from of a serious crucial neurological insufficiency of a vascular disorder that can cause brain tissue damage (Norris & Lalchandani, 2019). Many Americans suffer from stroke damage each year which leads to lifelong nerve damage (Norris & Lalchandani, 2019). There are two categories of stroke: ischemic and hemorrhagic (Norris & Lalchandani, 2019). Norris & Lalchandani (2019) describe bursting of a blood vessel as hemorrhagic stroke and the blockage of blood flow into a cerebral vessel as ischemic stroke. The focal point here is ischemic stroke in particular ischemic penumbra.

Ischemic Penumbra

Ischemic penumbra is an area with marginally perfused brain cells within the border of the brain tissue (Norris & Lalchandani, 2019; Ermine, Bivard, Parsons, & Baron, 2020). The brain cells within the ischemic penumbra are functioning at a minimum requirement and maintain cell structure (Norris & Lalchandani, 2019). The timeliness of return of blood flow contributes to survival of brain cell activity (Norris & Lalchandani, 2019; Ermine et al., 2020)

The other factors involved in the survival of the neurons include sufficient blood perfusion, the number of toxic byproducts released by the dying cells in the same area, the extent of cerebral edema, and variations of blood flow in the surrounding area (Norris & Lalchandani, 2019; Ermine et al., 2020). If the cells of the penumbra are unable to be preserved, repercussions could be death to brain cells caused by the toxic products, further loss of cells in the penumbra, enlargement of the dying tissue, and an increased amount of surrounding ischemic tissue (Norris & Lalchandani, 2019). Lack of perfusion can worsen the long-term side effects of ischemic stroke (Norris & Lalchandani, 2019).

Hypoxia & Ischemia

Cerebral hypoxia results from inadequate oxygen to the brain cells causing brain damage (Strapazzon et al., 2021). The hypoxia results from a secondary injury caused by trauma to the head or obstruction of the airway (Norris & Lalchandani, 2019). Ischemia on the contrary results from insufficient blood perfusion to an organ within the body leading to hypoxia (Norris & Lalchandani, 2019). Comparatively both hypoxia and ischemia lack normal metabolic necessities for the organ to function properly (Nalivaeva, & Rybnikova, 2019). Both impairments can lead to long term detrimental effects on neuronal cells (Nalivaeva, & Rybnikova, 2019). In sum, hypoxia is reduced oxygenation whereas, ischemia is impaired blood flow (Nalivaeva & Rybnikova, 2019).

Nalivaeva and Rybnikova (2019) state that of the two the more dangerous is ischemia. In this ischemia causes the biochemical fluctuations of methionine metabolism and homocysteine collection pool their toxins after impaired perfusion (Nalivaeva, & Rybnikova, 2019). Leading to post-translational modifications and reactive oxygen species of proteins via thiolation and

homocysteinylation injuring neuronal cells (Nalivaeva, & Rybnikova, 2019). The ischemia effects the intracellular signaling (Nalivaeva, & Rybnikova, 2019).

Cerebral Edema

As previously mentioned, impaired blood flow causes ischemia. When ischemic stroke happens, this syndrome triggers cerebral edema (Norris & Lalchandani, 2019). The reasons this can happen is increased intracranial pressure from water and sodium accumulation (Norris & Lalchandani, 2019). Increased inflammation turns minimal perfusion causing neuronal damage (Norris & Lalchandani, 2019). This then triggers the inflammatory response by misfolded protein accumulation and mitochondrial dysfunction resulting in edema from swelling (Norris & Lalchandani, 2019).

Conclusion

Bonnie's care can be managed at the PCP level via medication management and therapy in terms of secondary prevention. There are two main categories of stroke, ischemic and hemorrhagic which can cause detrimental effects if treatment is delayed. Ischemic penumbra maintains the minimum perfusion to brain cells, timeliness of return of blood perfusion is of essence. Hypoxia is reduced oxygenation whereas, ischemia is impaired blood flow furthering the syndrome causing cerebral edema by the inflammatory response.

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