Ischemic Strokes: Current Treatment Advances and Evidenced-Based Nursing Practice

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Abstract

Ischemic strokes account for 87% of all strokes with the remaining being hemorrhagic causes. Current widely accepted modes of treatment include thrombolytic therapy (tissue plasminogen activator (tPA) within 4.5 hours of the onset of symptoms as well as mechanical thrombectomy within six hours of the onset of symptoms for acceptable candidates. New research has been conducted on some novel forms of treatment of ischemic strokes which include new delivery methods of tPA, using image-guided thrombectomy and perfusion studies to lengthen the time window for thrombectomy candidates, studies into the blood brain barrier, the use of resolvins, stem cell therapy, and transcranial stimulation. Evidence-based nursing care includes ADL training, pain assessment and management, patient and family education, early mobilization, assessing for signs of depression, as well as regular monitoring of temperature, glucose, and bladder/bowel function.

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Cardiovascular accidents (CVAs), otherwise known as strokes, is the second highest cause of death (Kuriakose & Xiao, 2020). The majority are of ischemic causes, caused by either cerebral thrombosis or cerebral embolism; 87% of all strokes are ischemic strokes (Ischemic Strokes (Clots), n.d.). Significant research has been conducted to determine possible improvements in treatment courses as well as the best evidenced-based nursing practices in stroke care.

Current Treatments

Intravenous tissue plasminogen activator (IV-tPA) is used for acute ischemic stroke patients if they are seen and treated within 3 hours of the onset of symptoms, which can possibly be extended to 4.5 hours of onset (Butler, et al., 2020). The reason for this 4.5 hour time cap has been to decrease the risk of possible hemorrhagic complications. If tPA is administered within this 4.5 hour time frame, the outcome and prognosis of these patients are improved (Henderson, et al., 2018).

The next routinely used ischemic stroke treatment is mechanical thrombectomy, which is the surgical removal of the offending clot. Patients are only candidates for thrombectomy if their onset of symptoms has not surpassed the 6 hour mark (Henderson, et al., 2018). One limitation of thrombectomy as treatment is the advanced skills required and not all hospitals or facilities may be able to provide this treatment modality to patients who may gravely need it. By the time patients are transferred to appropriate stroke centers, they may have surpassed their 6 hour mark from their symptom onset and no longer qualify to undergo thrombectomy.

Calcium (Ca^{2+}) channel blockers are another type of treatment used in ischemic strokes (Kuriakose & Xiao, 2020). Research has shown that calcium channel blockers decrease ischemic

injury. Clinical trials have since been performed on the use of calcium channel blockers among stroke patients and its use has shown significant improvement in clinical symptoms when administered within 12 hours of symptom onset (Kuriakose & Xiao, 2020).

Glucose management in stroke patients is crucial given that hyperglycemia increases edema and cell death, which subsequently speeds up the course of ischemia (Kuriakose & Xiao, 2020). Hyperglycemia has been shown to be common amongst such stroke patients so normoglycemia management and regular assessment of blood glucose levels is critical. An increase in these glucose levels has been shown to be associated with worsening of infarction, an increased risk of failed thrombolytic/thrombectomy treatment, as well as worsening clinical outcomes (Kuriakose & Xiao, 2020).

Lastly, antiplatelet therapy is used for the management of acute ischemic stroke as well as prophylaxis to prevent the stroke from occurring in the first place (Kuriakose & Xiao, 2020). The antiplatelet therapy best used is a combination of clopidogrel (Plavix), an antiplatelet blood thinner, and aspirin, a non-steroidal antiinflammatory (NSAID) and blood thinner. This combination of clopidogrel and aspirin therapy has been shown to be beneficial if started within 24 hours of stroke onset and continued for the following 4 to 12 weeks (Kuriakose & Xiao, 2020).

Novel (Controversial) Treatments)

While tPA has been a widely used treatment option for ischemic stroke patients, further research has been performed to determine possibilities of improving its use. For example, Henderson, et al. (2018) has researched new delivery methods of tPA to enhance its thrombolytic action. First, rather than administering tPA solely intravenously, their research has shown higher treatment successes when tPA was administered both intravenously as well as intra-arterially.

Other more experimental methods of tPA administration include the utilization of nanocarriers and microbubbles with ultrasound. For these methods, tPA was encapsulated into nanocarriers such as liposomes. These lipid barriers protected the tPA and increased its ability to migrate to the site of thrombosis and effectively permeate into the clot. Ultrasound use was shown to increase the thrombotic activity of tPA by mechanically disrupting the clot with oscillating waves, enabling tPA to better penetrate the clot (Henderson, et al., 2018).

Research by Huang, et al. (2021) has shown that the time window for patients to be eligible for thrombectomy can be prolonged past the currently established 6 hours. Their research showed that providing thrombectomy treatment to patients past 6 hours of stroke onset did not result in increased risk of intracranial hemorrhage and mortality. Their clinical trials showed that patients could still benefit from image-guided thrombectomy even after the 6 hour mark. Bryer (2021) researched something similar and concluded that CT perfusion studies can help identify thrombectomy candidates past the 6 hour onset. These perfusion studies help identify such patients by showing which patients have brain tissue that is salvagable by thrombectomy.

Butler, et al. (2020) researched into the blood brain barrier and determined that time may also not be the main issue in stroke treatment. The main reason why there is a 4.5 hour time limit to tPA and a 6 hour time limit to thrombectomy is because it was believed that beyond those respective times caused an increased risk of hemorrhagic complications. However, this research into the blood brain barrier (BBB) showed that the degradation of the BBB was not actually time dependent. Injuries from a mild BBB disruption can be reversed with reperfusion while severe BBB disruption is associated with hemorrhage. Butler, et al.’s (2020) research concluded that if BBB disruption is not time based, then there are ischemic stroke patients well past the 4.5 hour and 6 hour time frame that could still benefit from these thrombolytic treatment options.

Tulowiecka, et al. (2020) has researched into the use or resolvins as a treatment option for ischemic stroke. Resolvins are essentially antiinflammatory mediators with actions such as decreasing the synthesis of inflammatory cytokines, decreasing the inflammatory response, decreasing neutrophil migration, as well as increasing phagocytosis. This antiinflammatory action of resolvins has shown to significantly improve prognosis in strokes. This research, however, is still in its infancy as the studies have mainly been carried out using rodent models.

Another novel ischemic stroke treatment option being researched is stem cell therapy. Stem cells have been highly researched being that it has capabilities of self-renewal and the ability to differentiate into a multitude of different cells. Zhang and Yao (2017) have researched the use of stem cells in ischemic stroke patients and have data suggesting that stem cells have the ability to replace lost neurons which then increases the improvement in stroke patients. These stem cells have shown to promote the repair of damaged tissue and neuronal regeneration and so have promoted neurologic functional recovery in ischemic stroke patients.

Common persisting complications from stroke include aphasia and dysphagia. Ilkhani, et al. (2017) has researched the use of repetitive transcranial magnetic stimulation (rTMS) for improvement in aphasia. When delivered at low frequency directed at Broca's area in the right hemisphere of the brain, rTMS showed improvements and symptom reduction of aphasia in post-stroke patients. Similarly, Sanchez-Kuhn, et al. (2019) researched into the use of transcranial direct current stimulation (tDCS) with results suggesting tDCS to be beneficial in improving dysphagia among stroke patients who did not respond well to traditional methods of motor rehabilitation.

Evidence-Based Nursing Practices for Stroke Care

Evidence-based nursing practice for stroke care is essential when treating these patients to help improve prognosis and decrease the risk of complications. Theofanidis (2015) has included a comprehensive compilation of strong evidence-based nursing care. First, it is important that nurses be trained in how to use a proper stroke scale to accurately assess the stroke patient's neurological status. Blood pressure (BP) should be regularly monitored; systolic should be below 185 mm Hg and diastolic BP should be below 110 mm Hg. Temperature should also be regularly monitored at least every four hours for the first 72 hours. If the temperature were to exceed 37.5°C, the fever should be treated aggressively. There should be frequent monitoring of glucose to ensure the patient does not develop hyperglycemia. The patient should remain "nil per os" (NPO) until a swallow assessment is completed and passed. The nurse should assess for bladder function and monitor for urinary retention and also assess for bowel function and monitor for persistent constipation or bowel incontinence. Patient and family education should be done. And finally, the assessment and treatment for depression among stroke patients are important and associated with improved prognosis and recovery.

Conclusion

Ongoing and new research in the treatment of ischemic stroke patients has yielded novel treatment modalities and improvements in currently utilized treatment methods. Beyond the limitations of tPA (within 4.5 hours of stroke onset) and thrombectomy (within 6 hours of stroke onset), these innovative treatment methods of ischemic stroke, which include the utilization of imaging and perfusion studies, the use of nanocarriers and ultrasound to deliver tPA, imaging of the blood brain barrier, the use of resolvins, stem cell therapy, and transcranial stimulation, have provided much hope in improving the prognosis of such patients.

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