

## Triage, Treatment, and Transfer

### Evidence-Based Clinical Practice Recommendations and Models of Nursing Care for the First 72 Hours of Admission to Hospital for Acute Stroke

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Stroke is a medical emergency and care provided in the first hours is critical in shaping patients' long-term recovery and prognosis.<sup>1</sup> There is robust evidence demonstrating significant reductions in death and disability with early interventions in acute stroke care, including antiplatelet therapy<sup>2</sup> stroke unit (SU) care<sup>3</sup> and thrombolysis.<sup>4</sup> International clinical guidelines for stroke provide key recommendations to guide clinical practice<sup>5-8</sup>; however, uptake of evidence-based care is variable and often less than optimal.<sup>9-14</sup> For example, among patients with ischemic stroke, rates for treatment with intravenous recombinant tissue-type plasminogen activator (r-tPA) are relatively low in the USA (5%)<sup>9</sup> and Australia (7%),<sup>10</sup> compared with Canada (12%)<sup>11</sup> and some European centers (14%).<sup>15</sup>

Nurses play a pivotal role in rapid identification and triage of patients with acute stroke, initial assessment, and coordinating the timely flow of patients with acute stroke through the health system. Nurses enable delivery of relevant time critical treatments, and rapid transfer to acute SUs for ongoing assessment and provision of further treatment.

The purpose of this article is to highlight nursing's essential contribution to the expedient delivery of acute stroke care by providing evidence-based recommendations for clinical practice processes of care and models of care where nurses have a pivotal role during the first 72 hours from arrival at the emergency department through to SU care. A more detailed comprehensive overview of nursing and interdisciplinary care for patients with acute ischemic stroke extending beyond the first 72 hours has been published previously.<sup>16</sup>

Where available in existing guidelines, the class and level of evidence for recommendations shown in tables have been provided using the American Heart Association taxonomy.<sup>6</sup> As there is a dearth of evidence from high-quality stroke nursing research, not all the recommendations described in this article have been evaluated using randomized controlled trials. Therefore, we have included examples of clinical models and systems for which lower levels of evidence suggest improvement in patient outcomes or a reduction in barriers to rapid assessment and management of stroke.<sup>17-19</sup> Furthermore, we

also have included models of care that emphasize the multidisciplinary team, as examination of nursing care in isolation from care provided by other health professionals does not reflect current evidence-based practice. Where no rigorous evidence exists for a recommendation, we have labeled it a good practice point.<sup>7</sup> Finally, opportunities for future research are identified in an effort to direct the growth of acute stroke nursing research.

#### Triage and Rapid Management

Key processes relevant to emergency nurses that are tied to timely assessment, triage, and rapid management of acute stroke in the emergency department are outlined in the table. As urgent administration of thrombolysis provided  $\leq 4.5$  hours from symptom onset is one of the few proven interventions for stroke,<sup>4</sup> the aim of rapid triage is to commence immediate assessment of suitability for this treatment. It has been estimated that each 15 minutes decrease in treatment delay results in 1 month of additional disability-free life after a stroke.<sup>20</sup> However, triage times<sup>21</sup> and process<sup>22</sup> on arrival in the emergency department remain variable.

The use of a Code Stroke alert system has been shown to improve time to diagnosis and treatment and reduce intravenous r-tPA door-to-needle times.<sup>17-19</sup> Recently, the use of stroke team models led by appropriately trained advanced practice nurses have been shown to be efficient, accurate, and safe at identifying and treating patients with r-tPA.<sup>23-26</sup> These teams capitalize on the 24-hour-a-day nature of nursing providing around the clock on-site expert input for both Code Stroke calls and ongoing acute stroke patient management. Code Stroke advanced practice nurses oversee the diagnostic work up, interpretation of neuroimaging, review of laboratory work, and communicate remotely to physicians about their estimation of suitability for r-tPA treatment. This model of care enables rapid decision making that may significantly reduce door-to-needle times. Advanced practice nurse-led teams offer a method to safely extend vascular neurologist services when an in-house neurologist is unavailable 24 hours a day<sup>23-25</sup> and to augment telemedicine services (Table 1).<sup>26</sup>

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**Table 1. Triage: Key Nursing Elements for Timely Assessment, Triage, and Rapid Management of Acute Stroke in ED**

The use of evidence-based rapid stroke screening tools at triage such as the Los Angeles prehospital stroke screen, the Cincinnati Prehospital Stroke Scale (FAST),<sup>27</sup> or Recognition of Stroke in the Emergency Room Scale<sup>28</sup> (class I: level of evidence B)<sup>6</sup>

Assignment of a high-severity triage category, to be seen within <10 min of ED arrival,<sup>6</sup> using a standardized triage system such as the Emergency Severity Index (GPP)

Systems to urgently notify the hospital stroke team such as hospital prenotification and initiation of Code Stroke (see below; class I: level of evidence B) aiming for rapid brain imaging (class I: level of evidence A), assessment for suitability for r-tPA and thrombolytic administration where indicated (class I: level of evidence A) with a door-to-needle time of <60 min (class I: level of evidence A)<sup>6</sup>

Code Stroke alerts including (1) prenotification: ambulance to the ED or directly to stroke team and ED notification to stroke team, (2) rapid assessment of airway, breathing, circulation, and disability, with assignment of triage category to be seen in <10 min, (3) rapid patient registration or use of a preregistration alias, (4) priority use of CT scanner, (5) immediate intravenous access, with blood drawn for standard laboratory tests, (6) immediate transfer to CT directly from ambulance after obtaining a brief but thorough history including time last seen normal, anticoagulant use, and medical–surgical history pertinent to thrombolysis risks, (7) rapid imaging interpretation by stroke team and completion of the NIHSS, (8) rapid control of arterial blood pressure as indicated by r-tPA treatment criteria, with infusion kit brought to CT to expedite treatment, and (9) r-tPA bolus and infusion initiated on CT scanning bed when possible (class I: level of evidence C)<sup>17,18</sup>

Assessment of initial stroke severity using the NIHSS on arrival in ED and before and after treatment with r-tPA (class I: level of evidence B)<sup>6,29</sup>

Rapid imaging of the brain (class I: level of evidence A)<sup>6</sup> with either noncontrast CT or MRI within 25 min of arrival to the ED with r-tPA administration commenced before the use of additional imaging sequences (ie, CT angiography; GPP)

CT indicates computed tomography; ED, emergency department; FAST, Face, Arm, Speech, Time; GPP, good practice point; NIHSS, National Institutes of Health Stroke Scale; and r-tPA, recombinant tissue-type plasminogen activator.

## Transfer

Organized SU care significantly reduces death and disability<sup>3</sup> and improves processes of care<sup>30</sup> as grouping patients together by clinical specialty is associated with improved outcomes.<sup>31</sup> However, overall access to SUs is variable and suboptimal, for example, 23% (Canada),<sup>11</sup> 58% (Australia)<sup>10</sup>; and SU staffing, structure, and organization may vary considerably. Timeliness of SU access also may be a critical factor.<sup>32,33</sup> Extended waiting time in emergency departments for non–stroke-specific conditions is associated with poorer outcomes and higher inpatient mortality.<sup>34</sup> Although data are limited, better outcomes have been reported in patients with stroke with shorter admission times (>6 hours compared with within 3 hours),<sup>32</sup> and earlier admission to SU (within 2 days) has been associated with fewer complications.<sup>33</sup> Hence, any unnecessary delays in transfer to a SU likely may compromise patient outcomes, especially for patients requiring complex stroke care and those needing close nursing surveillance. Key nursing elements and models of care that facilitate rapid admission to the SU include prenotification of incoming stroke to the stroke team<sup>35</sup> and use of protocols to ensure that patients are admitted directly to the SU.<sup>32</sup> The effect of admission to a short-stay ward before transfer to a dedicated SU is unknown and requires further research (Table 2).

Significant variability exists in the nursing qualifications, education/training, and services offered in hospitals throughout the world<sup>37</sup> and this variability is likely also to be reflected in SUs. Local policies and procedures, often underpinned by nursing care safety concerns (lack of nursing staff, lack of nursing staff with necessary skill mix) may impede direct admission to SUs for the entire hospital admission. For example, in some hospitals, an admission to an intensive care unit or high dependency unit is required<sup>6</sup> after thrombolysis administration or for those patients requiring more complex care including cardiac monitoring or acute blood pressure (BP) management. Specifically, in the United States, SUs commonly are set up as general care wards with a few dedicated beds and rarely are r-tPA–treated patients admitted to SUs directly, without first spending 24 hours in an intensive

care unit. In contrast, in Australia and Europe, r-tPA patients often are admitted directly to SUs that offer an ability to provide close monitoring of these patients. Recent evidence from the USA suggests that an intensive care unit admission solely for monitoring patients post–r-tPA may be unwarranted and unnecessarily expensive and that these patients safely can be managed in a SU when nurses have undertaken specialized education and training.<sup>38</sup> Furthermore, admission directly to a SU for r-tPA patients improves continuity of care and the opportunity to provide early and consistent education about the stroke event, stroke recovery, and strategies for stroke prevention.

Emerging evidence from the UK has demonstrated improved quality of care and lower mortality in SUs with staffing ratios of  $\geq 3.0$  registered nurses/10 beds. The study also found that patients admitted to a SU with 1.5 registered nurses/10 beds on a weekend had a significantly higher adjusted 30-day mortality rate (15.2%) when compared with patients admitted to a SU with a weekend ratio of 3.0 registered nurses/10 beds (11.2%).<sup>39</sup>

## Monitoring and Treatment

Nurses play a pivotal role in the ongoing monitoring and treatment of patients in the first 72 hours of acute stroke. Adherence to evidence-based processes of stroke care improves patient

**Table 2. Transfer: Key Nursing Elements for Rapid Transfer of Patients With Acute Stroke From the ED to the SU**

All patients should be cared for in a dedicated SU (class I: level of evidence A)<sup>6,6</sup>  
Rapid transfer to the SU from the ED is optimal<sup>32,33</sup> (GPP)

Prenotification of the stroke team may facilitate rapid transfer to the SU on admission (GPP)<sup>35</sup>

The use of stroke protocols may facilitate rapid transfer to the SU on admission (GPP)<sup>32</sup>

Formal appointment of a stroke coordinator may streamline stroke system processes and strengthen quality improvement of stroke services (class I: level of evidence C)<sup>36</sup>

ED indicates emergency department; GPP, good practice point; and SU, stroke unit.

**Table 3. Key Nursing Elements for Monitoring and Treatment in First 72 Hours of Acute Stroke****Monitoring**

Neurological assessment with the National Institutes of Health Stroke Scale to determine deterioration or improvement in neurological condition (GPP)<sup>6</sup>

Continuous oxygen saturation monitoring to identify hypoxia and early development of complications (eg, aspiration; GPP)<sup>6</sup>

Cardiac monitoring for at least the first 24 h to determine possible stroke pathogenic mechanism (eg, atrial fibrillation) and monitor for possible arrhythmias (class I: level of evidence B)<sup>6</sup>

BP monitoring every 15 min for 2 h, then every 30 min for 6 h, and then every hour for 16 h in patients undergoing reperfusion therapy (GPP); ongoing BP assessment to manage titration of antihypertensive medications and identify patients for improved stroke risk factor management<sup>6</sup>

Temperature monitoring at least every 4 h (class I: level of evidence B) to determine the need for treatment of hyperthermia<sup>8,43</sup>

Glucose monitoring on arrival to ED and every 6 h thereafter for the initial 72 h of care to determine the need for implementation of glucose control measures (GPP) (class I: level of evidence B)<sup>43</sup>

Dysphagia screening using a valid and reliable tool by a trained non-SLP or swallowing assessment by a SLP should occur before administration of food, drink, or oral medications<sup>60</sup> (class I: level of evidence B)<sup>6</sup> within 4 to 24 h of hospitalization.<sup>63,64</sup> Referral to SLP for those failing the screen for formal swallowing assessment (class I: level of evidence B).<sup>43,60</sup> The presence of a gag reflex does not constitute an adequate dysphagia screen as this does not indicate safety with swallowing<sup>6</sup>

Fluid balance monitoring is recommended to identify dehydration and concurrent conditions seen in vascular patients (ie, renal insufficiency associated with long-standing hypertension, congestive heart failure, or left ventricular dysfunction) (class I: level of evidence C)

Comprehensive nursing care assessment within 4 h of stroke unit admission for nutritional and hydration needs, positioning and mobilization needs, bladder control and incontinence management, pressure ulcer risk, cognitive and language capacity, hearing and visual needs, and family/carer needs (GPP)<sup>5</sup>

**Treatment**

The use of appropriately educated and credentialed advanced practice nurses where available to initiate standardized diagnostic protocols (ie, ordering and interpreting standardized laboratory tests and neuroimaging; GPP) and administer intravenous r-tPA (class IIb: level of evidence B)<sup>25</sup>

Airway and breathing support as required (class I: level of evidence C) with provision of oxygen for hypoxic patients (<94% oxygen saturation; class I: level of evidence C)<sup>6</sup>; routine oxygen for nonhypoxic patients is not recommended (class III: level of evidence B)<sup>6</sup>

Thrombolysis: Delivery of prompt intravenous r-tPA treatment for eligible patients with ischemic stroke  $\leq 4.5$  h from symptom onset (class I: level of evidence A)<sup>65</sup> with a door-to-needle time (time of bolus administration) target of <60 minutes<sup>6</sup> (class I: level of evidence B)

Hypertension management: Goals for target BP are uncertain.<sup>6</sup> However, the following are recommended

Prethrombolysis (potentially eligible patients): SBP <185 mm Hg and DBP <110 mm Hg (class I: level of evidence B)<sup>6</sup>

Post-r-tPA bolus: target <180 mm Hg SBP, <105 mm Hg DBP<sup>6</sup>

Nonthrombolysed ischemic stroke: a reasonable approach is BP lowering by 15% during the first 24 h after stroke. Withhold medications unless SBP >220 mm Hg or DBP >120 mm Hg (class I: level of evidence C),<sup>6</sup> or there are signs of cardiac decompensation because of left ventricular afterload (GPP)

ICH: Intensive BP lowering is safe and feasible.<sup>48,66</sup> BP lowering within 6 h of ICH onset to a target systolic BP of <140 mm Hg may improve functional outcome at 3 mo after stroke as compared with a traditional BP-lowering target of <180 mm Hg (class I: level of evidence B)<sup>48</sup>

Subarachnoid hemorrhage: Reduction of systolic BP to a target of 90/160 mm Hg<sup>67</sup> until the aneurysm has been occluded by endovascular or surgical means (GPP)

Ongoing monitoring and reporting of BP control throughout hospitalization to identify patients in need of medication additions or dose adjustments (GPP)

Temperature: Treatment of temperature >37.5°C with antipyretics (class I: level of evidence B)<sup>8,43</sup>; evidence supporting induced hypothermia is currently lacking (class IIb: level of evidence B)<sup>6</sup>

Hyperglycemia: Maintenance of glucose levels of 140–180 mg/dL (7.8–10 mmol/L; class IIa: level of evidence C).<sup>6,43</sup> Avoidance of hypoglycemia (blood glucose <60 mg/dL [3.3 mmol/L]; class I: level of evidence C)<sup>6</sup>

The use of standardized evidence-based stroke care protocols/pathways to inform care (class I: level of evidence B)<sup>6</sup>

Preparation for endovascular interventions for patients undergoing mechanical thrombectomy, noting emerging evidence that thrombectomy within 6 h of stroke onset caused by proximal occlusion of anterior circulation, improves functional independence at 3-mo (class I: level of evidence B)<sup>6,6a</sup>

Head positioning: There is no large trial data to date examining the best head position after stroke, although these are underway. There is some evidence to support improved blood flow when lying flat (0°) for large artery ischemic strokes, including those with fluctuating clinical presentation<sup>68,69</sup> (class IIb: level of evidence C); however, these findings cannot be generalized to patients with small vessel occlusions presenting with relatively minor symptoms who may best be served by early mobilization; ICH patients at risk for increased intracranial pressure may benefit from head of bed elevation to 30° (GPP)

Palliative care: Identification of patient goals and commencement of relevant discussions for patients with poor prognosis (GPP)<sup>6</sup>

Education for stroke survivors and their caregivers/family (GPP)<sup>6</sup>

Caregiver support for those overseeing the needs of stroke survivors, including provision of accurate information about stroke, emotional and practical support, and identification of important community resources/agencies (GPP)<sup>7</sup>

Rehabilitation: Early assessment and commencement of rehabilitation where relevant (GPP)<sup>52,70,71</sup>

**Prevention of complications**

Antiplatelets: Administration of antiplatelet medications within 48 h of stroke (class I: level of evidence A)<sup>2,6</sup> after swallowing screen or swallowing assessment undertaken<sup>6</sup>; antiplatelet agents should be withheld for 24 h in r-tPA-treated patients (class III: level of evidence C).<sup>6</sup> If the patient is unable to swallow, aspirin or other medication may be administered rectally<sup>72</sup>

(Continued)

Table 3. Continued

Anticoagulants: The use of anticoagulation to prevent recurrent stroke or improve outcomes is not recommended in noncardioembolic ischemic stroke (class III: level of evidence A).<sup>6</sup> Anticoagulation is recommended for the primary and secondary prevention of patients with cardioembolic ischemic stroke (class I: level of evidence A); however, the best timing for initiation of anticoagulation after an acute stroke event remains unknown

VTE: The use of anticoagulation provides superior VTE prophylaxis in patients with acute ischemic stroke (class I: level of evidence A). The use of intermittent pneumatic compression for immobile patients reduces the risk of VTE and possibly death (class I: level of evidence B).<sup>53</sup> Routine use of antiembolic stockings is not recommended.<sup>54,55</sup>

Incontinence: Routine use of indwelling urinary catheters is not recommended because of infection risk (class III: level of evidence C)<sup>6,7</sup>

Early mobilization: Within the first 24 h for neurologically and hemodynamically stable patients is safe and feasible (class IIa: level of evidence B).<sup>70</sup> Early mobilization (within 52 h) is associated with fewer complications.<sup>71</sup> Patients with stable neurological and hemodynamic presentation can be mobilized to out of bed chair sitting even if level of consciousness is depressed (ie, stupor, obtundation, and lethargy; class IIa: level of evidence C)<sup>73</sup>

Hydration: Euvolemia should be maintained. The use of volume expanders to achieve hemodilution is not recommended in ischemic stroke (class III: level of evidence A). Treatment of hypovolemia should include the use of isotonic intravenous normal saline (class I: level of evidence C)<sup>6</sup>

Nutrition: Ensure adequate nutrition. The use of nasogastric tube feeding in patients unable to swallow for the first 2 to 3 weeks after stroke is preferred over use of PEG tube feeding (class IIa: level of evidence B); for patients unable to safely swallow and those incapable of meeting their nutrition and hydration needs, consider initiating nasogastric feeding within 24 h (GPP).<sup>5</sup> Verification of feeding tube placement should be done by radiographic methods<sup>74</sup>

Oral hygiene: Oral hygiene should be provided to reduce the risk of aspiration pneumonia (GPP).<sup>6,7,75</sup> At least 3×/d and immediately after meals are recommended (GPP).

Pressure area care: Those at high risk of developing pressure injuries should be placed on a high-specification foam mattress (class I: level of evidence A)<sup>76</sup>

Antibiotics: Patients with suspected pneumonia, sepsis, or urinary tract infections should receive antibiotics that target the relevant pathogen (class I: level of evidence A)<sup>6</sup>

BP indicates blood pressure; DBP, diastolic BP; ED, emergency department; GPP, good practice point; ICH, intracerebral hemorrhage; PEG, percutaneous endoscopic gastrostomy; r-tPA, recombinant tissue-type plasminogen activator; SBP, systolic BP; SLP, speech-language pathologist; SU, stroke unit; and VTE, venous thromboembolism.

outcomes<sup>13,30</sup> and many of these are initiated, administered, or co-ordinated by nurses.<sup>40</sup> The use of clinical pathways and stroke care protocols also improve adherence to evidence-based care<sup>41,42</sup> and patient outcomes.<sup>43</sup> The use of specialized stroke clinical co-ordinators to implement change also can improve SU access, aspirin administration within 24 hours, use of care plans, increased allied health assessments, and result in more patients discharged to home.<sup>36</sup>

For all patients with stroke, but particularly after administration of r-tPA, and those with acute intracerebral hemorrhage (ICH), close and accurate BP monitoring is required. Noninvasive automatic oscillometric BP monitors commonly are used but are not recommended for use in patients with atrial fibrillation because of significant beat-to-beat variability. In this situation, manual sphygmomanometers should be considered recording the average of 3 consecutive systolic and diastolic measurements.<sup>44,45</sup> Importantly, noninvasive oscillometric BP monitors only accurately measure the mean arterial pressure and then algorithmically derive a systolic and diastolic pressure.<sup>46,47</sup> As current stroke BP management guidelines are not based on mean arterial pressure ranges, more research is warranted to refine the use of derived values from these devices in patients with acute stroke. Goals for BP levels are outlined in the table. In the case of ICH, aggressive BP lowering seems to be safe with potential small improvements in outcome.<sup>48</sup>

Accurate and frequent neurological observation assists in early identification and subsequent management of deterioration.<sup>6</sup> The Glasgow Coma Score is not recommended for ongoing monitoring of patients with ischemic stroke and has been shown to produce a normal score of 15 when the National Institutes of Health Stroke Scale in the same patient reflects significant disability.<sup>49</sup> The National Institutes of Health Stroke Scale is recommended as a method to quantify

stroke disability and can be validly and reliably performed by nurse.<sup>50</sup> Using the full National Institutes of Health Stroke Scale more accurately reflects the vascular territory involved rather than use of a cut down version of the National Institutes of Health Stroke Scale, which involves an arbitrary selection of assessments that may not be related to the presenting stroke deficit.<sup>49</sup>

Evidence of the impact of a nurse-led multidisciplinary intervention on outcomes in acute stroke was provided by the Quality in Acute Stroke Care (QASC) Trial.<sup>43</sup> Results demonstrated that supported implementation of 3 clinical protocols for the management of fever, hyperglycemia, and swallowing dysfunction (fever, sugar, swallowing clinical protocols) in the first 72 hours of stroke significantly decreased death and dependency by 16% and also significantly reduced temperature, blood glucose level and improved swallowing management. Specifically, the fever, sugar, swallowing protocols consisted of 4 to 6 hourly monitoring of temperature with treatment of temperature >37.5°C with antipyretics; monitoring of glucose levels sixth hourly and treatment of elevated glucose >198 mg/dL (11 mol/L) with insulin; and either a swallowing screen by nurses within 24 hours of admission with referral to speech-language pathologist for those who fail the screen or a swallowing assessment by a speech-language pathologist. This is one of the few trials in stroke nursing care demonstrating that evidence-based nursing care can reduce death and dependency,<sup>13,43</sup> and results from this trial reinforce the potential that nursing quality improvement initiatives can have dramatic impact on patient outcomes.

Maintenance of glucose levels of 140 to 180 mg/dL (7.8–10 mmol/L) is recommended.<sup>6</sup> Hyperglycemic management is important not just for diabetic patients, as patients with hyperglycemic stroke not known to have diabetes mellitus (glucose 108–144 mg/dL [6–8 mmol/L]) have a 3-fold higher

**Table 4. Key Nursing–Supported Factors Guiding Stroke Care in the First 72 Hours<sup>77</sup>**

Rapid assessment	Stroke is an emergency and rapid assessment and treatment improves outcomes
Early identification	Early identification of acute stroke will improve access to time-dependent interventions
Prehospital services facilitate access	Organized prehospital services improve outcomes by increasing access and decreasing delays to time-dependent acute stroke treatments
ED systems	Systems that prioritize assessment and management of acute stroke in the ED will minimize treatment delays and maximize proportion of eligible patients receiving thrombolysis
SU access	Rapid flow of patients with acute stroke from ED to SU improves outcomes for patients with stroke
Multidisciplinary assessment and treatment	Coordinated and rapid onset of specific treatments by a multidisciplinary team within SUs will improve outcomes
Whole of system quality improvement	Quality improvement activities will improve performance within all aspects of care/system performance

ED indicates emergency department; and SU, stroke unit.

risk of death when compared with patients with euglycemic stroke not known to have diabetes mellitus.<sup>51</sup> Hence, glucose monitoring for all patients with stroke is crucial and often overlooked.<sup>13</sup>

Nurses have a critical role in implementing important clinical processes of care at the bedside, many of which have demonstrated association with improved outcomes.<sup>13,30</sup> These are outlined more fully in the table and include assessment procedures, early mobilization; avoidance of urinary catheterization; treatment of hypoxia, hyperglycemia, and suspected infection; and ongoing rehabilitation policies (eg, co-ordinated multidisciplinary team care and early assessment for discharge).<sup>52</sup> The use of intermittent pneumatic compression,<sup>53</sup> but not compression stockings,<sup>54,55</sup> has been shown to reduce the risk of deep venous thrombosis and possibly improve survival in immobile patients after stroke.

Dysphagia is a significant problem after stroke experienced by 42% to 67% of patients within 3 days of stroke.<sup>56</sup> Patients with dysphagia have a 3-fold increased risk of pneumonia<sup>57</sup> and should be nil by mouth until their swallowing ability has been determined.<sup>6</sup> Dysphagia screening should be performed using a validated,<sup>7</sup> evidence-based tool<sup>6</sup> and can safely be undertaken by nurses.<sup>58</sup> A dysphagia screen is defined as a pass/fail procedure to identify an individual who may need a complete dysphagia assessment.<sup>59</sup> Patients who fail a swallow screen should be referred to a speech-language pathologist for a full dysphagia assessment.<sup>60</sup>

Determination of stroke pathogenic mechanism is a key area of focus during SU care and guides subsequent secondary prevention therapies. Identification of atrial fibrillation requires either serial ECGs or telemetric cardiac monitoring.<sup>61</sup> Nurses play a vital role in overseeing this aspect of care through inquiry about stroke risk factors and mechanism, reviewing diagnostic test results, and providing advice on secondary prevention measures to prevent future stroke.

In addition, nurses are responsible for educating patients and family members/carers about their stroke care, including the pathogenesis of stroke, treatment provided, personal risk factors, medications, stroke signs and symptoms, use of emergency medical services, and strategies to reduce further stroke risk. Despite this, recent data show that patients and family members/carers poorly retain information taught to them in the hospital about stroke (Table 3).<sup>62</sup>

A summary of key nursing–supported factors guiding stroke care in the first 72 hours is shown in Table 4.<sup>77</sup>

## Discussion

The clear priority for improving stroke care outcomes is closing known evidence–practice gaps by improving timely access to early interventions with demonstrated efficacy. Nurses play a crucial role in stroke care and they are well placed to take a leadership role in implementing evidence-based care within the multidisciplinary stroke team.<sup>40,78</sup> The internationally emerging roles of the stroke advanced practice nurse and stroke nurse practitioner hold great promise for the development of new nurse-led models of stroke nursing care, including stroke telemedicine services which could be augmented by inclusion of these nursing roles.<sup>26</sup>

The future for SUs to involve critical care is worthy of consideration where nurses have the appropriate qualifications and experience to undertake complex nursing care such as care of ventilated patients, administration of intravenous insulin, co-ordination of r-tPA administration, post-tPA recovery, and care of the unstable stroke patient.<sup>6</sup>

Quality monitoring and improvement activities are recommended to ascertain adherence to nationally accepted clinical practice guidelines.<sup>6</sup> Routine collection of quality data in the form of local or national audit<sup>10,11,14,79</sup> or stroke clinical registries<sup>80,81</sup> to measure adherence to important stroke processes of care is imperative. The use of these data to drive continuous quality improvement in stroke care can benefit patients.<sup>82</sup> Recently clinical performance measures for acute ischemic stroke have been published by the American Heart Association and American Stroke Association.<sup>83</sup>

Acute stroke nursing research is in its infancy. Encouragingly, there are an increasing number of trials underway exploring vital questions for acute stroke care nursing.<sup>84–88</sup> Nurse researchers also have a pivotal role in conducting implementation research,

## TAKE-HOME POINTS

- Rapid evidence-based assessment and management of stroke are fundamental to reducing mortality and disability.
- Nurses have a key role to facilitate multidisciplinary models of care and improve uptake of evidence-based stroke care.
- Nurse-led stroke research is paramount to further inform the evidence base for nursing care.

that is, examination of methods to increase evidence uptake by clinicians.<sup>43,84</sup> Future rigorous clinical and implementation research will help to address gaps in evidence and strengthen existing models of care and clinical guidelines.

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KEY WORDS: guideline ■ nursing ■ stroke



## Triage, Treatment, and Transfer: Evidence-Based Clinical Practice Recommendations and Models of Nursing Care for the First 72 Hours of Admission to Hospital for Acute Stroke

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# Correction

In the article by Middleton et al (Middleton S, Grimley R, Alexandrov AW. Triage, Treatment, and Transfer: Evidence-Based Clinical Practice Recommendations and Models of Nursing Care for the First 72 Hours of Admission to Hospital for Acute Stroke. *Stroke*. 2015;46:e18–e25. DOI: 10.1161/STROKEAHA.114.006139.), which published online ahead of print January 6, 2015, and appears in the February 2015 issue of the journal, a correction was needed.

On page e18, in the Triage and Rapid Management section, first paragraph, line 8, “It has been estimated that each 15 minutes of treatment delay results in 1 month of additional disability-free life after a stroke.<sup>20</sup>” has been changed to read, “It has been estimated that each 15 minutes decrease in treatment delay results in 1 month of additional disability-free life after a stroke.<sup>20</sup>”

The authors regret the error.

This correction has been made to the online version of the article, which is available at <http://stroke.ahajournals.org/content/46/2/e18>.