FEATURE

Serious Adverse Events Experienced by Survivors of Stroke in the First Year Following Discharge from Inpatient Rehabilitation

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Abstract

Purpose: To identify the incidence of adverse events (AE) that occurred in stroke survivors during the first year following discharge from inpatient rehabilitation and to determine the type and patterns of AE.

Methods: Data were collected for 12 months on events resulting in admissions to the emergency department, hospital, long-term care facility, or death. Descriptive statistics were used to depict the patterns of AE and univariate comparisons were made of the differences between survivors who did or did not experience one or more AE.

Results: Of the 159 participants, 50% reported a total of 163 AE. Most AE (82.2%) were unexpected and the majority occurred during the first 6 months; 12 recurrent strokes and 6 transient ischemic attacks occcurred.

Conclusions: Education on prevention and treatment of common AE is important prior to discharge. Anticipatory guidance may help survivors and caregivers modify their lifestyle and prevent common AE.

Survivors of stroke who are discharged home are susceptible to adverse events (AE), which may result in visits to the emergency department (ED), admission to hospitals or long-term care (LTC) facilities, or even death. Readmissions to the hospital are often caused by recurrent strokes or by medical complications of the stroke (Andersen et al., 2000). These complications may be a direct result of the stroke, related to disability caused by the stroke, or may arise from stroke-related treatments (Kumar, Selim & Caplan, 2010). The majority of the literature about poststroke sequelae and complications focus on patients in acute, sub-acute, and rehabilitation settings, (Bae et al., 2005; Davenport, Dennis, Wellwood & Warlow, 1996; Hong et al., 2008; Indredavik, Rohweder, Naalsund & Lydersen, 2008; Johnston et al., 1998; Kalra, Yu, Wilson & Roots, 1995; Kumar et al., 2010; Roth et al., 2001; Weimer et al., 2002). Bae et al. (2005) reported that complications during the acute and sub-acute stages of hospitalization significantly influenced adverse events, including mortality for up to 3 years post-stroke. Likewise, Langhorne et al. (2000) noted that early complications may act as barriers to recovery. However, although AE continue to plague survivors of stroke long after their discharge from the inpatient settings, they are rarely reported in the literature.

Adverse events that occur to survivors of stroke who are in funded research studies must be described and reported to the Institutional Review Board (IRB). By definition, an AE is any detrimental sign, symptom, or medical or psychological occurrence that can be related or unrelated to the study intervention (United States Food & Drug Administration, [USFDA], 2010). Stroke survivors' readmissions for AE may reflect new or unresolved problems at the time of discharge, lack of education, and/or inadequate resources available for posthospital care. Research has suggested that AE may also be associated with a lack of knowledge

of the potential complications survivors of stroke face when they are discharged home (Hanger, Walker, Paterson, McBride & Sainsbury, 1998; Hare, Rogers, Lester, McManus & Mant, 2006; Rodgers, Bond & Curless, 2001).

Common Postdischarge Adverse Events

Approximately 185,000 of the estimated 795,000 annual strokes are recurrent strokes; 25%–35% of Americans who experience a stroke will have a second one in their lifetime (National Stroke Association, [NSA], 2012a). Within one year after a stroke, 5%–14% of survivors will experience a second stroke (National Stroke Association, 2009); within 5 years, 24% of women and 42% of men will experience a second stroke (National Stroke Association, 2012a). Research has also demonstrated that brain damage due to strokes increases the risk of dementia with a prevalence of 6%–32% depending on the population studied, the diagnosis criteria, and the time interval between stroke and the neuropsychological evaluation (Henon, Pasquier & Leys, 2006). Pendlebury and Rothwell (2009) estimated that approximately 10% of the survivors of stroke developed dementia soon after their initial stroke and more than one-third developed dementia after a recurrent stroke. Moreover, the combination of an old stroke and even small amounts of plaques and tangles characteristic of Alzheimer's disease may greatly increase the severity of the symptoms associated with dementia, which in turn most likely increases the burden related to dementia care (Snowdon et al., 1997).

Falls are a very common adverse event; Kanis, Oden and Johnell (2001) reported a greater than sevenfold increase in fall risk during the first year after hospitalization for stroke. Falls have been reported to occur in as many as 66% of survivors of stroke (Harris, Eng, Marigold, Tokuno & Louis, 2005; Hyndman, Ashburn & Stack, 2002; Kelley et al., 2010; Kerse et al., 2008; Lamb, Ferrucci, Volapto, Fried & Guralnik, 2003; Langhorne et al., 2000; Yates, Lai, Duncan & Studenski, 2002); many falls require additional medical treatment (Kerse et al., 2008). However, Kelley et al. (2010) found that only 12% of those who fell sought immediate medical attention. In addition to actual falls, Hyndman et al. (2002) found that 78% of survivors of stroke reported almost falling. Falls not only cause medical consequences, such as pain and decreased mobility, falling may also lead to psychological consequences, such as fear of falling that further impairs recovery (Teasell, McRae, Foley & Bhardwaj, 2002; Watanabe, 2005). Fear of falls may also affect caregivers. They reported that fear of falling led them to curtail their activities outside of the home and more closely supervise their spouses who had experienced a stroke (Kelley et al., 2010).

Seizures arising during the recovery phase often take the patient and family by surprise, may signal a recurrent stroke, and often present an imminent emergency. Survivors who experience seizures subsequent to stroke range from 2% to 11% (Bladin et al., 2000; Langhorne et al., 2000; Misirli et al., 2006). Survivors of hemorrhagic stroke are more likely to experience seizures immediately post-stroke than those experiencing ischemic strokes (11% versus 9%) (Bladin et al., 2000). Survivors of ischemic stroke more often develop delayed seizures, sometimes months to years after the initial stroke. The reason is not totally clear, but may be related to ischemia-induced neuronal death or associated physiological changes (Epsztein, Ben-Ari, Represa & Crépel, 2008). Adverse events, like recurrent strokes, falls, and seizures in the months following a stroke, have the potential to turn what was perhaps initially a mild stroke into a new medical emergency (Rizzo & Glick, 2007).

The purpose of this article was to (1) identify the incidence of AE that occur during the first year postinpatient rehabilitation and require medical intervention (emergency, hospital, or LTC facility admission), or result in death, (2) determine the percent of AE that are expected and unexpected, and (3) describe the type and timing of AE.

Methods

Design

This article reports a secondary analysis of data that was reported to the IRB during a randomized controlled trial with survivors of stroke and their spousal caregivers. The study, commonly referred to as Committed to Assisting with Recovery after Stroke (CAReS), randomized couples into a 12-month intervention where they received either a mild, mailed-intervention or an intensive, home-based intervention, with advanced practice nurses, physical and occupational therapists providing education, support, skill training, counseling, and resource referrals. Couples in both groups received information about management of risk factors for recurrent strokes and tips about preventing and/or managing common stroke-related sequelae and complications. The proportion of survivors of stroke with a reported AE was not significantly different between the groups. CAReS was approved by the university IRB and by the IRB committees of the hospitals from which patients were recruited.

Sample

The sample for this study was 159 persons who were hospitalized with a diagnosis of stroke, age 50 or greater, discharged home with a spouse, and English speaking. Persons with stroke who were on hospice, had global aphasia, or another major physical or psychiatric condition (i.e., severe Parkinson's disease or dementia) were not included in the sample. The AE discussed here are those that affected the survivors of stroke, whether actually reported by the survivors themselves, by their spousal caregiver, or by the research staff. The couples were recruited between November 2001 and December 2005 from five hospitals within the Texas Medical Center, a large medical complex located in Houston, Texas, and followed for 12 months.

Data Collection

Trained nurses and occupational therapists abstracted data from the participants' charts at the time of discharge from the inpatient rehabilitation facility. These data included sociodemographic information (age, gender, race/ethnicity, occupation, educational level, and health insurance coverage), number of stroke-related risk factors, comorbidities, and impairments. The four-factor Hollingshead scale was used to calculate socioeconomic status (SES) based on the occupation and educational level of the couple (Hollingshead, 1975). The Hollingshead scale has a range of 8–66 with higher scores indicating higher SES. In addition, a trained nurse administered the Functional Independence Measure (FIM) and the Stroke Impact Scale (SIS) to the stroke survivor at baseline.

The FIM is an 18-item instrument that measures a person's degree of independence in self-care, sphincter control, transfers, locomotion, communication, and social cognition on a 7-point Likert-type scale with 1 representing total assistance and 7 representing complete independence (Granger, Cotter, Hamilton & Fiedler, 1993). The FIM has motor and cognitive sub-scores. Thirteen of the 18 items comprise the motor sub-score; the remaining 5 items make up the cognitive sub-score. The FIM Motor sub-score ranges from 13 to 91, the cognitive sub-score from 5 to 35, and the total scores can range from 18 to 126; higher scores represent more independent functioning. This instrument has previously been found to be a reliable measure of functional independence for survivors of stroke (Cronbach's alpha = 0.93) with inter-rater correlations ranging from 0.86 to 0.88 (Granger et al., 1993). Cronbach's alpha for the FIM in the CAReS study was 0.95.

The SIS (version 2) is a stroke-specific quality of life instrument that was created based on feedback from survivors of stroke and caregivers about the impact of stroke on the physical, mental, and emotional aspects of their lives (Duncan et al., 1999). The SIS includes 59 questions in eight domains: strength, hand function, mobility, and activities of daily living (ADL), emotion, memory, communication, and social participation. The SIS Physical domain score combines the strength, hand function, mobility, and ADL sub-scales into one score. For all domains, higher scores indicate a higher quality of life. The 1-week test-retest reliability correlation coefficients for the eight SIS domains ranged from 0.70 to 0.92 with the exception of the emotion domain which was 0.57 (Duncan et al., 1999). Cronbach's alpha for the SIS Physical domain in the CAReS study was 0.95.

Event Reporting

The IRB required that study personnel report all adverse medical events that resulted in a stroke survivor's visit to an ED, admission to a hospital or LTC facility, or death during the study. Survivors of stroke and spousal caregivers reported AE to the nurses or therapists during assessment or intervention visits. The study participants recorded the AE on monthly calendars that were maintained for study purposes. In addition, participants often notified the study staff of an AE via personal communication (i.e., phone call, e-mail, or card). All known AE were reported to the IRB by study personnel whether or not they were related to the study protocol. In addition to reporting the data to the IRB as soon as it was known, a log of all AE was maintained and submitted on an annual basis to the IRB for grant continuation. The AE log contained the following information: date of participant enrollment, date of AE, detailed description of AE, a rating of the seriousness of the AE, and a determination of whether the AE was expected or unexpected.

Analysis

Participants were followed for 12 months following discharge from inpatient rehabilitation. Reported AE were reviewed and categorized into expected or unexpected events. "Expected" events were events that were scheduled; these were usually planned special procedures or surgeries that resulted in a day surgery or hospital stay. For instance, the placement of a gastric tube would be an expected AE if the procedure was scheduled. An event

was categorized as "unexpected" if it resulted in an unscheduled ED visit, hospital stay, LTC facility admission, or death. Events were further grouped into categories, such as recurrent strokes/transient ischemic attack (TIA), falls, and seizures. Less common AE were categorized into larger groups (i.e., cardiac problems and surgical procedures).

Descriptive statistics were used to depict the patterns (incidence, frequency, type, and timing) of all AE throughout the first year after discharge from an inpatient rehabilitation setting. Univariate comparisons of differences between survivors of stroke who did or did not experience one or more AE were performed using the *t*-test for independent samples for continuous variables and the chi-square test for categorical variables. Level of significance for all statistical tests was $p < .05$.

Results

Profile of Survivors of Stroke

Table 1 displays the descriptive statistical data of the survivors of stroke. It presents a comparison of the sociodemographic and functional variables and the total number of inpatient rehabilitation complications of the survivors of stroke who did and did not experience at least one AE. The only significant demographic difference between those who reported an AE requiring immediate medical attention and those who did not was insurance coverage ($\chi^2 = 5.02$, p-value = .025). Those with comprehensive insurance coverage (i.e., Medicare with supplement, private insurance, or insurance through Veterans Affairs) were more likely to report an AE than those with inadequate coverage (i.e., no insurance, Medicare without supplement, or Medicaid).

As can be seen in Table 1, stroke survivors who experienced AE also had significantly lower cognitive function scores, as measured by the FIM, and lower sub-scores on the memory dimension of the SIS.

Table 1 Sociodemographic and Stroke-Related Characteristics of Persons with Stroke Who Experienced an Adverse Event the First Year Following Hospital Discharge

	AE $n = 80$		No AE $n = 79$	
Variable	$\overline{X}$	SD	$\overline{X}$	SD
Age	66.0	9.57	66.7	8.73
SES	43.8	11.7	43.1	11.6
Total FIM	87.2	25.4	92.5	20.3
FIM motor	59.4	21.4	62.4	17.4
FIM cognitive[a]	27.8	6.73	30.1	5.2
SIS physical	51.3	22.0	50.5	21.9
SIS emotion	76.8	19.2	79.6	14.3
SIS memory[b]	71.8	25.1	79.4	22.6
SIS communication	78.0	25.5	84.1	24.1
SIS social participation	47.2	24.7	47.3	23.0
Number of inpatient rehab complications	3.8	2.9	3.4	3.1
	n	%	*n*	%
Male	62	77.5	57	72.2
Minority (black, Hispanic, Asian and Other)	36	45.0	31	39.2
Insurance-comprehensive coverage[c]	70	87.5	58	73.4

[a] $t = 2.41$, p-value = .017; [b] $t = 1.99$, p-value = .048; [c] $\chi^2 = 5.02$, p-value = .025.

Types of Adverse Events

Fifty percent ($n = 80$) of the stroke survivors in the CAReS study reported a total of 163 AE during the first year postdischarge from inpatient rehabilitation. A total of 43 (27%) experienced two or more AE during the year. None of these AE occurred as a result of participation in the CAReS intervention study. Adverse events were categorized into one of 10 types: seizures, falls, stroke, TIA, other stroke complications, cardiac problems, respiratory problems, diabetes mellitus problems, surgery or special procedures, and other. "Other" included events such as kidney stones, car accident, dehydration, and dizziness.

Unexpected Adverse Events

The majority of AE, 82.2% ($n = 134$), were unexpected (see Table 2). Of the survivors of stroke in this study, 44 (27.7%) experienced at least one stroke-related AE. Almost 10% ($n = 15$) of the survivors of stroke had one or more recurrent strokes/TIAs (Table 2). Twelve recurrent strokes occurred among 10 survivors; all were hospitalized except one that was admitted directly to hospice in a LTC facility. Six TIAs occurred, and all but one resulted in a hospitalization.

Fourteen (8.8%) survivors of stroke had at least one seizure, three of those had more than one seizure (range 2–6); fourteen of the 22 seizures were serious enough to require a hospital admission. Fifteen participants (9.4%) experienced at least one fall; four of whom were admitted to the hospital after being seen in the ED; six of the falls resulted in fractures. Among the unexpected AE, 12.7%

(n = 17) were other stroke-related complications, including DVT, dehydration, multi-infarct dementia, shoulder pain, and readmissions for intensive inpatient rehabilitation. One survivor also required two visits to the ED for a malfunctioning PEG tube that had to be surgically repositioned.

Unexpected AE were also related to previous comorbidities. Cardiac problems (i.e., angina, hypertension, hypotension, myocardial infarction, and congestive heart failure) comprised 11.9% (n = 16) of all unexpected AE; three resulting in death. Nine participants (5.7%) were seen in the ED or admitted to the hospital due to an unexpected AE related to a respiratory problem, seven of which were infections. Complications of diabetes mellitus, (hyper- and hypoglycemia) accounted for 5.2% (n = 7) of all unexpected AE, and were primarily seen in the ED. (See Figure 1).

Other unexpected AE, unrelated to the stroke were grouped as "other." They included such diverse events as car accidents, alcohol intoxication, bleeding ulcers, kidney stones, fungal infections, and trips to the ED for anxiety attacks. These 26 events involved 19 different survivors of stroke and accounted for 19.4% of all unexpected AE.

Table 2 Type and Relative Frequency of Unexpected Adverse Events Among 159 Survivors of Stroke Over the First Year Postdischarge

Unexpected Adverse Event	Number of Stroke Survivors (%)	Frequency of Event (%)
Stroke-related event		
Recurrent stroke	10 (6.3)	12 (9.0)
TIA	5 (3.1)	6 (4.5)
Falls	15 (9.4)	16 (11.9)
Seizures	14 (8.8)	22 (16.4)
Other stroke complication	12 (7.5)	17 (12.7)
Nonstroke-related event		
Cardiac problems	14 (8.8)	16 (11.9)
Diabetes mellitus complications	6 (3.7)	7 (5.2)
Respiratory problems	9 (5.7)	10 (7.5)
Surgery/special procedures	2 (1.3)	2 (1.5)
Other	19 (11.9)	26 (19.4)

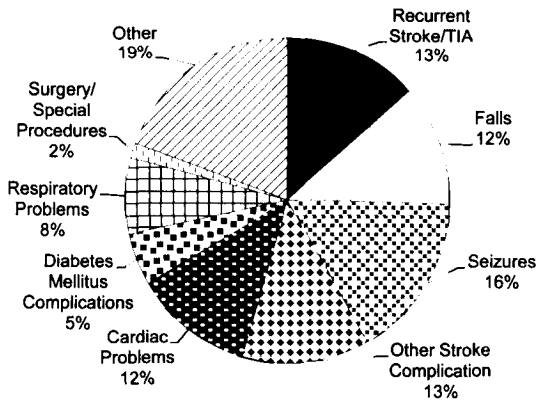

Figure 1 Unexpected Adverse Events Experienced the First Year Postdischarge by Type

Expected Adverse Events

Expected AE accounted for only 17.8% (n = 29) and were primarily scheduled medical or surgical procedures. As can be seen in Figure 2, 45% (n = 13) of these expected AE were stroke-related. These included procedures like shunts, arteriograms, endarterectomy, and placement of baclofen pumps for spasticity. An additional 21% (n = 6) were cardiac related and included angiograms and coronary vessel stents. The remaining expected AE (34%, n = 10) were reported for a wide variety of scheduled procedures and surgeries. Examples included removal of cysts and cancerous tumors, reversal of colostomy, cystoscopy, cholecystectomy, laser surgery on the retina, and creation of a fistula for hemodialysis.

Timing of all Adverse Events

The majority of all adverse events occurred within the first 3 months after discharge (Figure 3). Approximately 45% (n = 8) of additional strokes and/or TIAs, 36.4% (n = 8) of seizures, 31.3% (n = 5) of falls, and 26.7% (n = 8) of other stroke-related events occurred in the first 3 months postdischarge. The majority of all stroke-related adverse events occurred within the first 6 months: 77.8% (n = 14) of recurrent strokes and/or TIAs, 68.2%

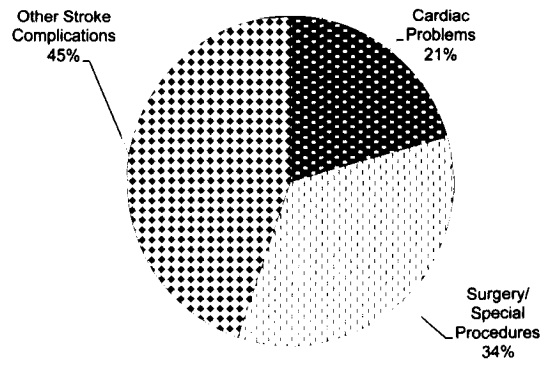

Figure 2 Expected Adverse Events Experienced the First Year Postdischarge by Type

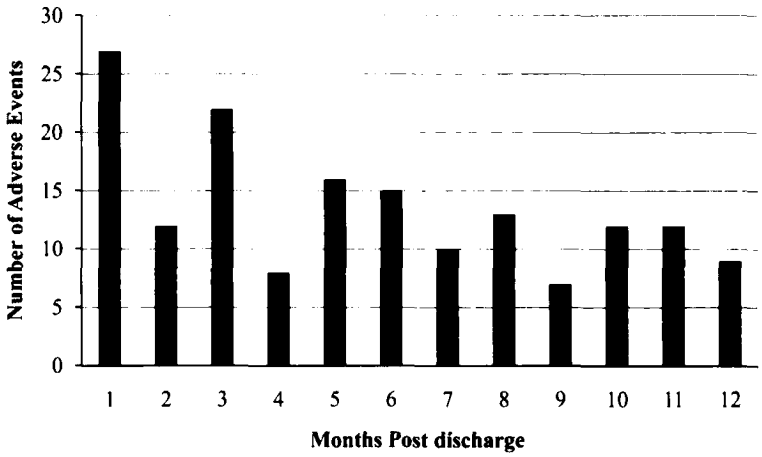

Figure 3 Number of Adverse Events by Months Post discharge

(n = 15) of seizures, 75% (n = 12) of falls, and 40% (n = 12) of other stroke-related events.

Deaths

Ten (6.3%) survivors of stroke died within the first year after discharge. Six of the 10 deaths occurred after the survivors of stroke had been moved to hospice. The major causes of death were recurrent stroke (n = 4) and cardiac disease (n = 3). The three cardiac deaths were due to unexpected myocardial infarctions. Five (50%) of the 10 deaths occurred during the first 3 months.

Discussion

The CAReS research study found that survivors of stroke continue to have serious AE during the first 12 months after discharge from inpatient rehabilitation; the vast majority of these AE are unexpected. The majority of unexpected AE were stroke-related, either directly (e.g., recurrent stroke and seizures) or secondary to disability related to the stroke (e.g., falls). Some negative outcomes of AE may be reduced by identifying individuals at greatest risk, and providing education on the prevention, early identification, and management of these risks. In this study, survivors of stroke with impaired cognition and memory were more likely to experience unexpected AE than those without impairments. Impairments such as impaired decision-making, impulsiveness, lack of insight, inability to anticipate problems, and memory loss often accompany stroke and put survivors of stroke at greater risk of AE. This suggests that survivors who are being discharged home with these impairments will need closer supervision and their family caregivers must to be counseled on the importance of being vigilant. Because of the fatigue associated with constant vigilance, these caregivers may benefit from referrals to home health agencies and adult day care programs that can provide some relief from constant demands.

Falls are one of the most common unexpected AE experienced by survivors of stroke and may be related to cognitive or motor deficits. Approximately 10% of survivors of stroke experienced at least one fall after their stroke that was serious enough to require treatment in the ED or admission to a hospital. This is consistent with the study of Rubenstein and Josephson (2002), who reported that only 5%–10% of falls resulted in serious outcomes like fractures. Many falls do not reach that level of seriousness and so may not be reported (Kelley et al., 2010). Falls in survivors of stroke may be related to extrinsic and intrinsic factors and both should be addressed before discharge home. Interventions may focus on improving strength, balance, and gait; individual exercise programs have demonstrated reductions in the frequency of falls (Campbell et al., 1997; Jorgensen, Engstad & Jacobsen, 2002; Robertson, Devlin, Gardner & Campbell, 2001). It is also suggested that medications to treat osteoporosis and the use of hip protectors to reduce fracture risk may be useful (Kanis et al., 2001). However, a recent Cochrane review reported that hip protectors were only marginally significant in reducing hip fractures and adherence to wearing them is uniformly poor (Gillespie, Gillespie & Parker, 2010). Multiple medications increase the risk of falls and other complications. Ostwald, Wasserman and Davis (2006) reported that survivors of stroke being discharged home from inpatient rehabilitation settings were prescribed an average of 11.3 (SD = 4.94) medications with a range 3–27 medications representing over five different drug classifications. Nurses must identify the potential medications, extrinsic and environmental factors that can contribute to falls, and initiate interdisciplinary discharge education to address these factors.

Seizures requiring a visit to the ED or admission to the hospital were reported in 8.8% of survivors of stroke in this study, an incidence rate consistent with previously published studies (Bladin et al., 2000; Langhorne et al., 2000; Misirli et al., 2006). Seizures may signal a recurrent stroke. Recurrent strokes may cause more damage to the brain, severe disability, and higher risk of dementia and death, as well as increased healthcare costs. In 2005, cerebrovascular disease accounted for a hospitalization rate of 77.3 stays per 10,000 people over the age of 45; more than one third were the result of a TIA or other stroke precursor (Russo & Andrews, 2008). The CAReS study found that almost 10% of survivors of stroke had a recurrent stroke or additional TIA within the first year after discharge; a similar rate of recurrence was reported by Langhorne et al. (2000). The majority of recurrent strokes and TIAs in the CAReS study occurred during the first 6 months after discharge. Because of relatively high incidence of recurrent strokes and TIAs, discharge planning should include a thorough discussion of the symptoms of stroke and TIAs, the emergency that they present, and the importance of calling 911 at the first sign of a stroke or TIA.

It is important to note that 27% of all AE in these survivors of stroke were related to other chronic diseases; most survivors of stroke have comorbidities (i.e., hypertension, coronary heart disease, and diabetes with multiorgan complications). A meta-analysis of 39 randomized controlled trials reported an annual linear risk of about 2% for myocardial infarction in patients with TIA and strokes (Touze et al. (2005). As survivors of stroke share many of the same risk factors as those with cardiac disease and diabetes, early identification of these patients at high risk for AE should signal the need for patient and caregiver education, as well as monitoring after discharge. In this study, 7 of the 10 deaths that occurred were from recurrent strokes and myocardial infarctions.

Stroke, the leading cause of death and serious long-term disability, cost the United States an estimated $53.9 billion in 2010, including the medical expenditures associated with healthcare services, medications, and lost productivity (Heidenreich et al., 2011). The total cost of stroke is projected to increase substantially due to inpatient care, rehabilitation, and follow-up care (Roger et al., 2012). The cost remains high because survivors of stroke have higher rates of hospital readmissions than individuals with other chronic conditions (Wolinsky, Gurney, Wan & Bentley, 1998). At least some of the AE reported in this study may reflect factors related to poor discharge planning and potentially avoidable AE (Medicare Payment Advisory Commission, 2010). The reduction in medical expenses has become a major issue as the number of survivors of stroke increases each year with a projected 24.9% increase in prevalence from 2010 by 2030 and an estimated mean lifetime cost of ischemic stroke (accounting for 87% of all strokes) of $140,000 (in the United States) for healthcare services (Roger et al., 2012). As 70% of this cost is generated in inpatient settings, reducing hospital readmissions is a very cost-effective approach (Roger et al., 2012). Efforts to reduce or prevent AE resulting in ED visits and hospital readmissions can help survivors of stroke and their family caregivers achieve a better quality of life and also help reduce costs.

Study Limitations

This article reports a secondary analysis of data that was reported to the IRB during a 6-year intervention study that followed survivors of stroke for their first year postdischarge from inpatient rehabilitation. The first limitation of the study relates to the completeness of the reports provided by the study participants. The AE were reported to the research staff by the survivor of stroke or the spousal caregiver. The only AE that were recorded were those that required immediate medical attention in an ED, or admission to a hospital or LTC facility, or death. A second related limitation is that our data likely underestimate the total number of AE that occurred during 1 year, as only those requiring immediate medical attention were recorded. In particular, the incidence likely represents an under report of AE like seizures, falls, and medical problems (i.e., high or low blood pressure or blood sugar, respiratory infections) because many of these problems were probably seen in clinics or managed at home. The likelihood of survivors of stroke experiencing and not reporting adverse events such as falls without injuries, TIAs, chest pain or low blood sugar is considerable. A third major limitation relates to the lack of precision of the AE reports. Some of the reports from survivors of stroke and family caregivers may have been inaccurate and/or incomplete as the data were not verified by examining ED, hospital, LTC facility, or death records. Verification of medical records for patients receiving care in multiple hospitals, ED, and urgent care clinics in a large metropolitan area is a time and resource intensive process and was not funded as part of this research study, nor required by the IRB. It was also noted that survivors of stroke without comprehensive insurance

coverage were less likely to report AE requiring immediate medical attention. Although this hypothesis was not pursued in this study, it is unclear whether people without adequate medical coverage have less AE, or whether they may delay seeking immediate medical care for financial reasons. This requires further exploration.

Nursing Implications

This study has several implications for nursing. It is important to know that survivors of stroke are vulnerable to unexpected AE, especially in the first 6 months following discharge, and that those with cognitive deficits or memory impairments are at increased risk. The early identification and treatment of stroke sequelae and medical complications during hospitalization could reduce long-term AE and lead to better outcomes.

Transitional care programs wherein survivors of stroke and caregivers are provided with education on how to optimize stroke recovery and reduce risks from hospital admission through discharge have proven to be successful in improving quality of life and functional ability after discharge home (Chalermwannopong, Panuthai, Srisuphan, Panya & Ostwald, 2010). Education about AE prevention and the need for immediate medical attention for serious AE is a critical part of discharge planning. Thus, all rehabilitation nurses should be familiar with the American Stroke Association statement on comprehensive nursing and interdisciplinary rehabilitation care of stroke patients from inpatient rehabilitation through end-of-life care (Miller et al., 2010).

Lifestyle change education is essential to reduce the likelihood of recurrent strokes and improve the post-stroke recovery. The American Heart Association statement on lifestyle interventions for physical exercise and diet is an excellent reference for nurses (Artinian et al., 2010). In addition to a healthy diet, low in cholesterol and sodium, and regular physical activity, discharge education needs to include medication management with specific attention to managing comorbidities (i.e., hypertension, diabetes and coronary artery disease), regular follow-up clinic visits, limiting alcohol consumption, and smoking cessation (Krishner, 2003; National Stroke Association, 2012b; Straus, Majumdar & McAlister, 2002).

Conclusion

Although AE related to stroke have been reported in the acute, sub-acute, and rehabilitation settings, a prospective review of the type and frequency of AE experienced during the first year postdischarge home from inpatient rehabilitation has not been previously addressed. This study provides information about the type and frequency of AE, and thus the need for education for survivors of stroke and their caregivers before discharge. As the population continues to age, the number of people experiencing stroke is expected to increase. The results of this study provide some evidence for the need for thorough risk assessments, early implementation of risk reduction strategies and lifestyle education, and community referrals throughout inpatient rehabilitation to reduce the personal and financial costs of AE. Rehabilitation nurses are crucial to preparing survivors of stroke and their family members for demanding and challenging postdischarge care at home.

Key Practice Points

- Stroke survivors continue to experience serious adverse events during the first year home postdischarge, especially in the first 6 months following discharge
- The majority of adverse events are unexpected and are stroke-related, either directly (i.e., recurrent stroke, seizures) or secondary to disability resulting from the stroke (i.e., falls).
- Some negative outcomes associated with adverse events may be reduced by identifying individuals at greatest risk and providing education on prevention, early identification, and management of these risks.
- Education about adverse events prevention and the need for immediate medical attention for serious adverse events is critical prior to discharge.

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