



# Predictors Of Returning To Oral Feedings After Feeding Tube Placement For Patients Poststroke During Inpatient Rehabilitation

By: Richard P. Krieger, Susan Brady, R. Jordan Stewart, Andrea Terry, and John Brady

## Abstract

**Objectives:** To identify the frequency and characteristics of patients admitted to inpatient rehabilitation (IPR) following a stroke who are able return to oral feedings and have their feeding tube (FT) removed prior to discharge from IPR, the timing of FT removal, and implications for outcomes. **Methods:** Medical records were identified by admission rehabilitation impairment code (RIC) for stroke (RIC 01), and reviews were completed by two physiatrists and two speech language pathologists. At random, 25% of the charts were reviewed by a second rater for data quality control. Measures collected during the chart review included the following: age, gender, onset of stroke, rehabilitation length of stay (LOS), admission and discharge FIM™, discharge destination, diet level, and feeding tube status. **Results:** One hundred forty-three patients were identified as subjects for this investigation who had an FT and were NPO upon IPR admission. Overall, 46.9% (67/143) of the patients returned to three meals daily prior to discharge from IPR. The mean days post stroke onset until returning to three meals daily was 38.43 days (SD= 26.36). Twenty percent (30/143) of the patients were able to have their FT tube removed prior to discharge from IPR. Factors associated with returning to three meals included gender (ie 1 female), longer IPR LOS, and higher admission FIM™ scores at IPR. Factors associated with removal of the feeding tube included a longer IPR LOS and younger age. Patients who were able to have their FT removed were more likely to be discharged to home. **Conclusion:** Individuals with longer IPR LOS were more likely to return to three meals daily and have their feeding tubes removed prior to discharge.

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# Predictors of Returning to Oral Feedings After Feeding Tube Placement for Patients Poststroke During Inpatient Rehabilitation

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**Objectives:** To identify the frequency and characteristics of patients admitted to inpatient rehabilitation (IPR) following a stroke who are able return to oral feedings and have their feeding tube (FT) removed prior to discharge from IPR, the timing of FT removal, and implications for outcomes. **Methods:** Medical records were identified by admission rehabilitation impairment code (RIC) for stroke (RIC 01), and reviews were completed by two physiatrists and two speech language pathologists. At random, 25% of the charts were reviewed by a second rater for data quality control. Measures collected during the chart review included the following: age, gender, onset of stroke, rehabilitation length of stay (LOS), admission and discharge FIM™, discharge destination, diet level, and feeding tube status. **Results:** One hundred forty-three patients were identified as subjects for this investigation who had an FT and were NPO upon IPR admission. Overall, 46.9% (67/143) of the patients returned to three meals daily prior to discharge from IPR. The mean days post stroke onset until returning to three meals daily was 38.43 days ( $SD = 26.36$ ). Twenty percent (30/143) of the patients were able to have their FT tube removed prior to discharge from IPR. Factors associated with returning to three meals included gender (ie, female), longer IPR LOS, and higher admission FIM™ scores at IPR. Factors associated with removal of the feeding tube included a longer IPR LOS and younger age. Patients who were able to have their FT removed were more likely to be discharged to home. **Conclusion:** Individuals with longer IPR LOS were more likely to return to three meals daily and have their feeding tubes removed prior to discharge. **Key words:** *dysphagia, feeding tube, outcomes, rehabilitation, stroke*

Swallowing difficulties that require the placement of an enteral feeding tube (FT) to safely maintain adequate nutrition and hydration are common following a severe stroke.<sup>1</sup> Previous reports in the literature have shown stroke is often the most common diagnosis associated with placement of an FT.<sup>2,3</sup> Several medical complications are known to be associated with FT placement, and outcomes are not always improved as a result of the FT.<sup>4,5</sup>

To date, relatively little attention has been placed on monitoring the outcomes of individuals in the inpatient rehabilitation (IPR) setting with an FT following a stroke. Iizuka and Reding<sup>6</sup> evaluated functional outcomes of patients requiring FT placement for dysphagia who were undergoing IPR, and they found those patients to be at an increased risk for medical complications and death compared to those patients with a stroke who did not require FT placement. However, other reports have shown a positive association between FT placement and rehabilitation outcomes. Horn et al<sup>7</sup> found patients who had

an FT placement were associated with higher stroke rehabilitation outcomes. Additionally, James et al<sup>8</sup> found greater motor and cognitive improvement in patients who received tube feedings as part of their nutritional support following a severe stroke.

Ickenstein et al<sup>9</sup> investigated the predictors for removal of an FT from stroke patients during rehabilitation. They identified three negative predictors (bilateral stroke, aspiration during videofluoroscopic swallowing study [VFSS], and age) for the removal of the feeding tube during IPR. A follow-up study by Ickenstein et al<sup>10</sup> reported that 11.6% of stroke patients admitted to a rehabilitation hospital required an FT placement secondary to dysphagia. At the 2-year follow-up in the same study, only 45% of the patients were able to resume to oral diets and have their FTs removed.

Patients, family members, and health care providers need to be aligned on the expectations for potential clinical outcomes for individuals following a stroke who qualify for IP rehabilitation and require an FT. Better information on outcomes and predictors are required in order to make an informed decision. To that end, the goals of this case-controlled retrospective study were to identify the following:

1. The percentage of patients with an FT placement following a stroke who are non per os (NPO) secondary to dysphagia at IPR admission and who are subsequently able to return to any type of oral feedings and/or three meals daily by time of discharge from IP rehabilitation
2. The mean length of time from onset of stroke until resumption of oral feedings for those patients who are able to return to oral feedings and/or three meals daily
3. Patient characteristics that may be predictive of returning IPR patients who have suffered a stroke to oral feedings and/or three meals daily
4. Potential factors associated with returning to oral feedings and FT removal by discharge destination

## Method

### Sample

One hundred forty-three patients were identified as subjects for this investigation who had an FT and were NPO upon IPR admission. These 143 patients came from an initial group of 1,928 patients who were admitted to a free-standing rehabilitation hospital over a 4.5-year timeframe (July 1, 2002, until June 30, 2007) with a diagnosis of stroke. Of these admissions, only 143 (7.4%) were NPO secondary to dysphagia with a gastric FT upon admission and these became the subjects of this investigation.

### Procedures

The evidence demonstrated in this article is derived from a retrospective study where participants were identified using medical records

over 4.5 years. The primary variables included in the medical chart reviews included the following: age, gender, rehabilitation impairment code (RIC), impairment group category (ICG), onset of stroke, diet level, FT status, IPR length of stay (LOS), admission and discharge FIM™ score from IPR, and discharge destination. The medical chart reviews were completed by two psychiatrists and two speech language pathologists. A second rater randomly reviewed 25% of the charts for data quality control. If discrepancies were observed, then the case was reviewed by both the first and second reviewers until consensus was reached. This study was approved by this facility's institutional review board.

The diagnosis of a stroke was determined according to admission rehabilitation impairment code (RIC) for stroke (ie, RIC 01) and further classified by the impairment group category (IGC) including the following: ICG 1.1 (left body involvement), ICG 1.2 (right body involvement), ICG 1.3 (bilateral involvement), ICG 1.4 (no paresis), and ICG 1.9 (other stroke). Inclusion criteria included all adult patients admitted to IPR with a diagnosis of a stroke (as identified by the admission impairment code) who were NPO at admission and were receiving all nutrition and hydration via FT.

The primary purpose of the study was to determine the percentage of patients who were able to return to any type of oral feedings and/or three meals daily of either a regular or modified diet by the time of discharge from an IPR setting following an admission where they were NPO with an FT. As part of the standard clinical protocol, all patients who are admitted with a stroke, who are NPO, and who have an FT are screened for dysphagia by the admitting physician and are also automatically referred to a speech-language pathologist (SLP) for dysphagia evaluation and treatment. The diagnosis of dysphagia for the study sample was confirmed either by a clinical swallowing examination or an instrumental assessment of the swallow. The investigators also evaluated the length or time from the onset of stroke to a return to oral feedings as described earlier. Diet levels were coded as regular, modified, therapeutic feedings, or NPO. A regular diet was defined as three meals daily with no restrictions in either a solid or liquid consistency.

A modified diet was defined as three meals daily with an alteration of the solid and/or liquid consistency. Therapeutic feeding was defined as small controlled amounts of food and/or liquid provided by a SLP for practice swallows. The total amount given during a therapeutic feeding ranged from a minimum of three to five boluses to a maximum of 4 to 6 ounces and was not sufficient to maintain nutritional needs. Patients receiving taste stimulation only were coded as NPO.

A secondary aim of the study was to identify patient characteristics that may be associated with or predictive of the following three outcomes by the time of discharge from IPR: (1) returning to any type of oral feedings; (2) returning to three meals daily; or (3) removal of the feeding tube. The following variables were collected for this objective: age, gender, RIC ICG, duration of onset of stroke until admission to IPR, LOS at rehabilitation, and admission FIM™ score. Standard clinical protocol for removal of the FT included the following: ability to maintain nutritional and hydration needs by oral intake alone for a minimum of 5 to 7 days; type of tube placed and appropriateness to remove the tube at bedside (ie, traction vs non-traction FT); duration of tube placement (ie, 4 to 6 weeks duration prior to removal based upon surgeon's guidelines); assessment of bleeding risk; assessment of any chronic or underlying condition that could lead to a high potential for future decline; patient/family preference; and attending physician's clinical judgment.

The final aim of the study was to assess any relationship between oral feeding and tube feeding status with IPR outcomes of discharge destination and discharge FIM™ scores. For the purpose of this study, discharge destination was classified into three general categories of acute care, subacute, and home.

#### Data analyses

Descriptive statistics including percentage of occurrence, the mean, and standard deviations were calculated for demographics. To evaluate the significant predictive relationships for returning to oral feedings, returning to three meals daily, and for removal of the feeding tube prior to IPR discharge, binary logistic regression analyses were

completed using a backward stepwise elimination technique. Paired *t* tests were computed for continuous variables. Cross tabulations and chi-square tests were completed for categorical variables. Level of significance was set at an alpha of .05. Statistical calculations were completed using Minitab Statistical Software™, Release 13 (Minitabs, Inc., State College, PA).

## Results

### Study sample description

The majority (61.5%, *n*=88) of the study sample were male and the age range was 22 to 95 years with a mean age of 68.4 years (*SD* = 14 years). The mean number of days from onset of stroke until IPR admission was 30.3 days (*SD* = 34.7). The mean LOS for the study sample at IPR was 22.9 days (*SD* = 10.1 days). The mean total admission FIM™ score was 25.95 (*SD* = 12.4) and the mean total discharge FIM™ score was 40.78 (*SD* = 22.9). The distribution for RIC 01 (stroke) ICG was as follows: 42 subjects were classified as ICG 1.1 (left body involvement), 71 were ICG 1.2 (right body involvement), 5 were ICG 1.3 (bilateral involvement), 25 were ICG 1.4 (no paresis), and none of the study participants were classified as ICG 1.9 (other stroke).

Overall, 65% (93/143) of the patients were able to return to some type of oral feeding with 46.9% (67/143) able to return to three meals daily prior to discharge from IPR. The mean number of days from onset of stroke until returning to any type of oral feedings averaged 36.5 days (*SD* = 24.9) and until returning to three meals daily averaged 38.43 days (*SD* = 26.4). Specific diet categories by the time of discharge from IPR for the entire study sample are as follows: 50 patients remained NPO, 26 therapeutic feedings with SLP only, 55 modified/dysphagia diet (three meals daily), and 12 regular diet (three meals daily).

**Table 1** summarizes discharge destination as classified by the primary swallowing outcomes of this study. Overall, 20% (30/143) of the entire study sample were able to return to three meals daily and have their FT removed prior to discharge from IPR. Those patients who were able to have their FT removed prior to IPR discharge were more

Table 1. Discharge destination

Outcome	Discharge destination			Significance
	Acute care	Subacute	Home	
Return to any type of oral feedings (n=93)	12.9%	43%	44%	$\chi^2 = 18.162, P \leq .0001$
Return to three meals daily (n=67)	10.4%	47.8%	41.7%	$\chi^2 = 10.65, P = .005$
Removal of feeding tube at time of IPR discharge (n=30)	13.3%	30%	56.6%	$\chi^2 = 8.51, P = .014$
Remained NPO (n=50)	40%	44%	16%	$\chi^2 = 23.886, P = .001$

Note: IPR = inpatient rehabilitation; NPO = non per os.

likely to return to home versus the other discharge destination classifications. Additionally, the mean discharge FIM™ score for patients who were able to have their FT removed prior to discharge was 54 ( $\pm 19.2$ ) as compared to 40.3 ( $\pm 20.6$ ) for patients who still had their FT at discharge from IPR ( $t = 2.78, P = .007$ ), suggesting that these patients also did better overall with their entire rehabilitation program. The mean length of time from resumption of three meals daily until removal of the FT for these 30 patients was 21.2 ( $\pm 9$  days). For the 37 of the 67 patients who returned to three meals daily and did not have their FT removed, the rationale for not removing the FT data was available with 27 patients. It was noted in the medical record that 10 patients were continuing to receive supplemental tube feedings and 17 patients had recent FT placements (ie, less than 4 to 6 weeks).

### Study cohorts

The study sample was divided into two groups: Group 1 (n=67) included participants who were able to return to three meals daily by the time of discharge from IPR; Group 2 (n=76) included participants who did not return to three meals daily by the time of discharge from IPR. Table 2 summarizes additional subject demographics by

group assignment. Differences between the groups for age ( $t = 2.78; P = .006$ ), gender distribution ( $P = .003$ ), and IPR LOS ( $P = .0001$ ) were statistically significant indicating that age (ie, younger patients), gender (ie, female), and greater IPR LOS were all positively associated with returning to three meals daily during IPR. Even though admission FIM™ scores were similar between the two groups, by time of discharge the patients who were able to return to three meals daily had significantly higher discharge FIM™ score (Group 1 = 45.5 vs Group 2 = 34.4;  $P = .004$ ), indicating overall greater functional rehabilitation gains for this group during IPR.

### Predictors to swallowing recovery

Multivariate logistic regression analyses were undertaken for the outcomes of returning to any type of oral feedings, returning to three meals daily, and removal of FT by the time of discharge from IPR. Each variable was coded as binary for the entire study sample of 143 subjects. The predictor variables entered in each model were as follows: age, gender, number of days from onset of stroke until admission to IPR, rehabilitation LOS, and total admission FIM™ score. Table 3 summarizes the results of the significant predictors for the

Table 2. Subject demographics by group assignment

Variable	Group 1 (n = 67)	Group 2 (n = 76)	Significance
Age	65.0 years ( $\pm 14.8$ years)	71.4 years ( $\pm 12.6$ years)	$t = 2.78, P = .006$
Gender	35 males 32 females	53 males 23 females	$\chi^2 = 4.606, P = .032$
Onset of stroke to IPR	26.2 days ( $\pm 19$ days)	33.9 days ( $\pm 44$ days)	$t = -1.38, P = .138$
IPR LOS	26.59 days ( $\pm 9.73$ days)	18.69 days ( $\pm 8.97$ days)	$t = -5.47, P \leq .0001$
Admission FIM™	27.0 ( $\pm 12$ )	25.1 ( $\pm 12.7$ )	$t = -0.93, P = .356$
Discharge FIM™	45.4	34.3	$t = -2.94, P = .004$

Note: IPR = inpatient rehabilitation; LOS = length of stay.

Table 3. Logistic regression results

Outcome	Step and predictor	Significance
Return to any type of oral feedings	1. IPR LOS	$t = 5.08, P = .0001$
	2. Admission FIM™	$t = 3.78, P = .0001$
Return to three meals daily	1. IPR LOS	$t = 5.52, P = .001$
	2. Admission FIM™	$t = 2.0, P = .048$
	3. Gender	$t = 2.18, P = .031$
Removal of feeding tube prior to IPR discharge	1. IPR LOS	$t = -3.73, P = .0001$
	2. Age	$t = 2.69, P = .008$

Note: IPR = inpatient rehabilitation; LOS = length of stay.

logistic regression analyses. A longer IPR LOS was a significant predictor for all three outcomes.

### Discussion

Placement of an FT following a severe stroke for the management of dysphagia can be a stressful decision for the patients, their families, and the entire health care team.<sup>11,12</sup> Outcome studies have shown multiple medical complications associated with an FT placement and have also focused on diverse patient groups, whereas this current study focused on a specific patient population.<sup>13,14</sup> Questions regarding the potential for overall functional recovery are just one of several concerns surrounding the decision for FT placement. Previous research has shown that treating physicians and families have high expectations for the multiple medical benefits for patients receiving tube feedings.<sup>14,15</sup> Both the health care team members and families require better information on potential outcomes in order to make an informed decision. Therefore, the results of this outcome study must be interpreted within the context of the study design of a very specific patient group.

The authors' findings in this study are important as they reveal that more positive outcomes can be obtained with this patient population than previously reported. The majority of study participants (65%,  $n=93$ ) admitted to IPR following a stroke, who were NPO at admission secondary to dysphagia and were receiving all nutrition and hydration via FT, were able to return to some type of oral feeding by the time of discharge as compared to previous reports demonstrating only a 34.3% ( $n=11$ ) return rate for this population.<sup>16</sup> The differences between

these two studies may be explained by the sample size as the current study reflects a total sample size of 143 individuals and the former study represents a study sample size of 32 individuals. Additionally, it was encouraging that the average time from the onset of the stroke until returning to three meals daily was only approximately 5.5 weeks for this patient population.

The goals of rehabilitation include enhancing function and returning to normal living, which includes oral eating. The factors predictive of returning to three meals during IPR included gender (ie, female), longer IPR LOS, and higher FIM™ scores at admission. The finding of gender as a positive predictor for recovery to three meals daily was worthy of note as previous research showed that females were more likely to present with dysphagia following a stroke.<sup>17</sup> Additionally, individuals with longer IPR LOS were more likely to have their feeding tubes removed prior to discharge and patients who were able to have their FT removed were more likely to be discharged to home. This finding concurs with previous research demonstrating an association between improved outcomes for patients following a stroke with longer IPR LOS.<sup>18-20</sup> As patients continue to improve and meet their rehabilitation goals, their length of stay may increase, which allows them additional time to improve not only their swallow function but also mobility and cognition. This may in turn allow the patients to be discharged to home from IPR.

It was interesting to note that patients who were able to return to three meals daily and have their FTs removed also had significantly higher discharge FIM™ scores and were more likely to be discharged to home. This finding may simply reflect that patients who do better with their overall

functional rehabilitation goals as measured by the FIM™ may be more likely to return home.

A recognized limitation of this study is the lack of long-term outcomes collected following discharge from IPR. Future studies may want to investigate the long-term outcome for this patient population. A second recognized limitation of this study is the lack of data available in the medical charts to explain why 37 of the 67 patients who returned to three meals daily were still using an FT at the time of IPR discharge. Even though clear evidence was present in the medical records for 27 of the 37 patients that included the need for additional nutritional support and recent FT placement, there were still missing data for the remaining 10 patients (which is a limitation of retrospective studies). Some plausible explanations for these 10 patients may include the following: (a) requests for FT removal be done by surgeons in a postdischarge visit to avoid missing scheduled therapy; (b) physician determination to keep FT in place for supplemental hydration/nutrition if the patient's oral intake is borderline or as a precautionary measure based upon the physician's medical judgment; or (c) patient and/or family preference. Other reasons, besides actual swallowing ability, may play a part in the decision for the FT removal; this requires further investigation with a prospective study to evaluate the rationale for not removing the FT for those patients who are able to return to three meals daily during IPR. Finally, this research was conducted with a specific patient population following a stroke who participated in IPR. It may be beneficial to conduct future research by replicating this study at the subacute level to assess functional swallowing outcomes at that level of care.

## Conclusion

The majority (65%, n=93) of study participants admitted to IPR following a stroke, who were NPO at admission and were receiving all nutrition and hydration via FT, were able to return to some type of oral feeding; 46.9% (n=67) were able to return to three meals daily within 5.5 weeks from onset of stroke. Twenty percent of the patients were able to have their FTs removed prior to discharge from IPR. Individuals with a longer IPR LOS were more likely to advance to three meals daily and have their FTs removed. The removal of the FT was associated with patients being more likely to be discharged to the home environment. These are important findings as previous research has not shown such positive results for patients receiving tube feedings following a stroke. From a practical standpoint, this implies that additional consideration be given to those factors identified as predictive for FT removal (eg, gender, potential LOS in IP rehab setting, FIM™ score at admission) in order to proactively case manage patients following the incidence of stroke to achieve optimal results from therapy. Indications for future research include studying this specific patient population in the subacute setting and evaluating long-term outcomes with the IPR patients after discharge.

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Table 4. Impairment group category

Outcome	Impairment group category				Significance
	1.1 Left body involvement (n=42)	1.2 Right body involvement (n=71)	1.3 Bilateral involvement (n=5)	1.4 No paresis (n=25)	
Return to any type of oral feedings (n=93)	30	43	2	18	$\chi^2 = 3.291, P = .349$
Return to three meals daily (n=67)	26	30	2	9	$\chi^2 = 5.70, P = .127$
Removal of feeding tube prior to IPR discharge (n=30)	11	12	2	5	$\chi^2 = 2.506, P = .474$

Note: IPR = inpatient rehabilitation.

## REFERENCES

1. Norton B, Homer-Ward M, Donnelly MT, Long RG, Holmes GKT. A randomized prospective comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding after acute dysphagic stroke. *BMJ*. 1996;312:13-16.
2. Wirth R, Volkert D, Bauer JM, et al. PEG tube placement in German geriatric wards - a retrospective data-base analysis. *Z Gerontol Geriatr*. 2007;40:21-30.
3. Callahan CM, Haag KM, Weinberger M, Tierney WM, Buchanan NN, Stump TE, Nisi R. Outcomes of percutaneous endoscopic gastrostomy among older adults in a community setting. *J Am Geriatr Soc*. 2000;48:1048-1054.
4. Attanasio A, Bedin M, Stocco S, Negrin V, Biancon A, Cecchetto G, Tagliapietra M. Clinical outcomes and complications of enteral nutrition among older adults. *Minerva Med*. 2009;100:159-166.
5. Calver J, McCaul KA, Burmas M, Horner BJ, Flicker L. Use of gastrostomy tubes in older Western Australians: a population-based study of frequency, indications and outcomes. *Med J Aust*. 2009;190:358-361.
6. Iizuka M, Reding M. Use of percutaneous endoscopic gastrostomy feeding tubes and functional recovery in stroke rehabilitation: a case-matched controlled study. *Arch Phys Med Rehabil*. 2005;86:1049-1052.
7. Horn SD, DeJong G, Smout RJ, Gassaway J, James R, Conroy B. Stroke rehabilitation patients, practice, and outcomes: is earlier and more aggressive therapy better? *Arch Phys Med Rehabil*. 2005;86(12 Suppl 2):S101-S114.
8. James R, Gines D, Menlove A, Horn SD, Gassaway J, Smout RJ. Nutritional support (tube feeding) as a rehabilitation intervention. *Arch Phys Med Rehabil*. 2005;86(12 Suppl 2):S82-S92.
9. Ickenstein GW, Kelly PJ, Furie KL, Ambrosi D, Rallis N, Goldstein R, Horick N, Stein J. Predictors of feeding gastrostomy tube removal in stroke patients with dysphagia. *J Stroke Cerebrovasc Dis*. 2003;12:169-174.
10. Ickenstein GW, Stein J, Ambrosi D, Goldstein R, Horn M, Bogdahn U. Predictors of survival after severe dysphagia stroke. *J Neurol*. 2005;252:1510-1516.
11. Bell C, Somogyi-Zalud E, Masaki K, Fortaleza-Dawson T, Blanchette PL. Factors associated with physician decision-making in starting tube feedings. *J Palliat Med*. 2008;11:915-924.
12. Mitchell SL, Lawson FME. Decision-making for long-term tube-feeding in cognitively impaired elderly people. *CMAJ*. 1999;160:1705-1709.
13. Potack JZ, Chokhavatia S. Complications of and controversies associated with percutaneous endoscopic gastrostomy: report of a case and literature review. *Medscape J Med*. 2008;17:142
14. Carey TS, Hanson L, Garrett JM, Lewis C, Phifer N, Cox CE, Jackman A. Expectations and outcomes of gastric feeding tubes. *Am J Med*. 2006;119:527.e11-16.
15. Hanson LC, Garrett JM, Lewis C, Phifer N, Jackman A, Carey TS. 2008. Physicians' expectations of benefit from tube feedings. *J Palliat Med*. 2008;11:1130-1134.
16. Teasell R, Roley N, McRae M, Finestone H. Use of percutaneous gastrojejunostomy feeding tube in the rehabilitation of stroke patients. *Arch Phys Med Rehabil*. 2001;82:1412-1415.
17. Di Carlo A, Lamassa M, Baldereschi M, et al. Sex differences in the clinical presentation, resource use, and 3-month outcome of acute stroke in Europe. Data from a multicenter multinational hospital-based registry. *Stroke*. 2003;34:1114-1119.
18. Gillen R, Tennen H, McKee T. The impact of the inpatient rehabilitation facility prospective payment system on stroke program outcomes. *Am J Phys Med Rehabil*. 2007;86:356-363.
19. Ng YS, Stein J, Salles SS, Black-Schaffer RM. Clinical characteristics and rehabilitation outcomes of patients with posterior cerebral artery stroke. *Arch Phys Med Rehabil*. 2005;2138-2143.
20. Kelly PJ, Furie KL, Shafiqat S, Rallis N, Chang Y, Stein J. Functional recovery following rehabilitation after hemorrhagic and ischemic stroke. *Arch Phys Med Rehabil*. 2003;84:968-872.