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Complications in Stroke Patients: A Study Carried out at The Rehabilitation Medicine Service, Changi General Hospital

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ABSTRACT

Aim: The aim of this study was to look at the type and frequencies of complications after an acute stroke in an inpatient rehabilitation setting. We also looked at the type of complications which required the transfer of patient care back to the primary referring physician.

Materials and Methods: A retrospective review of case notes of patients transferred to the rehabilitation team was conducted. The study period was a six-month period from the beginning of January 2001 to the end of June 2001. A list of complications was made. Each pre-determined complication was then defined. The frequency of each complication was then calculated.

Results: A total of 140 case notes were reviewed. The overall complication rate was 54.3%. The more common complications, in order, from highest to lowest frequencies, were: constipation (complicating 22.9% of strokes); acute retention of urine (ARU, 20.9%); urinary tract infections (UTI, 14.3%); depression (9.3%); and limb pain (8.6%). Females were more likely to have UTI (p=0.038), ARU (p=0.002) and depression (p=0.018). Patients 65 years and above were more likely to suffer multiple complications although the results did not reach statistical significance (p=0.055). The care for eight patients (5.7% of patients with complications) had to be transferred back to the primary referring team or physician.

Conclusions: Complications post stroke are common. Some patients required transfer of care back to the primary referring physician. A pro-active approach is ideal in all post stroke patients, in order to identify and treat any complications early, thereby, improving outcome and reducing costs.

Keywords: stroke, complications, inpatient, stroke rehabilitation

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INTRODUCTION

Stroke is Singapore's fourth leading cause of death, accounting for 10% of all deaths[1].

Previous studies have shown that although death in the immediate acute period post stroke is usually a direct consequence of brain damage, a substantial proportion of morbidity and mortality occurring later on in the ensuing weeks is due to potentially preventable or treatable complications of stroke[2,3]. Patients with acute stroke are vulnerable to the development of various complications as a result of the stroke and the disability caused by the stroke. Not only are these complications common, they are related to poor outcome[2,4].

Such complications delay successful rehabilitation and start a vicious cycle of deconditioning which is the harbinger of further complications; the eventual outcome being that of higher morbidity, mortality, prolonged hospital stay and escalating health care costs[5]. The presence of even one medical complication has been shown to be an independent predictor of poor prognosis[2]. We also know that the presence (or absence) of medical complications is one of the determinants of the final functional status achieved[6]. Data from the RANTTAS trial[2] showed that there was a relationship between serious medical complications and severe disability that was not due to the severity of stroke.

The prevention, recognition, and management of medical conditions after stroke form an integral part of inpatient rehabilitation post stroke[6]; yet, there are no statistics for complications in patients with stroke in the local setting. Therefore, we conducted a retrospective study to estimate the type and frequencies of pre-defined complications in patients post stroke in the rehabilitation setting in a general hospital with both acute medical and rehabilitation facilities on site. We also aimed to determine which complications required a transfer of care back to the referring physician.

METHODS

A retrospective case notes review was conducted for the period from January 2001 to June 2001 in a

Table I. Table of complications and their definitions.

Neurological	
Recurrent stroke	CT/MRI findings and/or clinical diagnosis by a neurologist
Epileptic seizure	Clinical diagnosis of focal and/or generalised seizure in a non epileptic patient and/or EEG evidence of seizure activity
Infection	
Urinary tract infection	Documented pyuria with systemic symptoms requiring treatment
Chest infection	Clinical diagnosis based on auscultatory findings and/or radiological evidence of consolidation
Mobility	
Pressure sore/Skin breaks	Skin break/necrosis resulting from either pressure or trivial trauma including those resulting from falls
Falls	Any documented fall regardless of cause
Thromboembolism	
Deep vein thrombosis	Clinical diagnosis and/or imaging evidence
Pulmonary embolism	Clinical diagnosis and/or imaging evidence
Limb and joint pain	Pain requiring analgesia for a period of time and/or steroids for SHS*
Psychological	
Depression	Low mood requiring pharmocological treament, evaluation by a psychiatrist not required
Cardiovascular including	
Acute Coronary syndrome, Cardiac failure, Arrhythmias	Clinical diagnosis by a cardiologist and/or ECG or Holter evidence
Uncontrolled hypertension	Severe hypertension requiring consultation of the acute medical team
Urinary retention	Residual urine of more than 100 mls and/or patient on intermittent catheterisation or use of an indwelling catheter
Gastrointestinal	
Gastrointestinal bleeding	Record of coffee grounds aspirate from nasogastric tube and/or positive faecal occult blood
Constipation	1. When bowels not opened for two days or more and/or suppositories or enema 2. When patient is on regular oral laxatives to aid bowel movement
Others	e.g. pyrexial illness of unknown source, unexplained anaemia category to include complications unrelated to CVA
Undiagnosed medical problems requiring transfer back to acute medical team	

* SHS – Shoulder Hand Syndrome.

restructured hospital of 695 beds. A list of complications was compiled by the authors based on the paper by Davenport et al[3]. The complications studied were recurrent stroke, epileptic seizure, urinary tract infection (UTI), chest infection, pressure sores, falls, deep vein thrombosis (DVT), pulmonary embolism (PE), limb pain, depression, cardiovascular (CVS) complications, uncontrolled hypertension, acute retention of urine (ARU), bleeding from the gastrointestinal tract (BGIT), constipation and drug rash. Complications other than those on the pre-determined list were recorded in the "others" section. Each complication was then defined (Table I); some definitions were modifications based on the paper by Davenport et al. A data collation form was used to aid easy transfer of data. To identify complications, not only were the medical notes reviewed but also the nursing notes, therapists' notes and the pharmaceutical records.

The database record of all patients referred to the rehabilitation physicians was used to identify suitable cases. All patients with a primary diagnosis of a new stroke, either ischaemic or haemorrhagic, in the care of the rehabilitation team were included in the study. There were initially two reviewers of casenotes and subsequently one.

Demographic characteristics such as the sex, race, age, marital status of the patients were noted. The diagnosis of stroke was based on CT head or MRI brain findings of new infarcts/haemorrhage

Table II. Demographic characteristics of study population compared to Roth et al.

Characteristic	Male	Female	Overall	Roth et al (overall)
Number	65 (46.4)	75 (53.6)	140	1,029
Mean Age	63.71	67.43	65.7	63.6
– Range	40 - 81	41 - 90	40 - 90	–
Race (number)				
– Chinese	45 (69.2)	50 (66.7)	95	–
– Malay	16 (24.6)	22 (29.3)	38	–
– Indian	4 (6.2)	2 (2.7)	6	–
– Others	0	1 (1.3)	1	
Marital status				
– Single	9 (13.8)	3 (4.0)	12 (8.6)	–
– Married	47 (72.3)	54 (72.0)	101 (72.1)	447 (46)
– Widowed	0	12 (16.0)	12 (8.6)	–
– Divorced	0	0	0	–
– Not known	9 (13.8)	6 (8.0)	15 (10.7)	–
Stroke type				
– Infarct	44 (68.8)	55 (75.3)	99 (70.7)	730 (71)
– Haemorrhage	20 (31.3)	17 (23.3)	37 (26.4)	294 (29)
– Infarct with haemorrhagic conversion	0	1 (1.4)	1 (0.7)	–
Stroke site				
– Cortical	12 (18.8)	19 (25.3)	31 (22.1)	533 (53)
– Subcortical	33 (51.6)	38 (50.7)	71 (50.7)	481 (47)
– Brainstem	6 (9.4)	2 (2.7)	8 (5.7)	–
– Others	13 (20.3)	16 (21.3)	29 (20.7)	–
Stroke side				
– Bilateral	7 (10.9)	10 (13.5)	17 (12.1)	106 (10)
– Left	27 (42.2)	32 (43.2)	59 (42.1)	462 (46)
– Right	30 (46.9)	32 (43.2)	62 (44.3)	445 (44)

Percentages in brackets are within the sex.

co-relating to the physical signs and/or clinical diagnosis by a neurologist. The type of strokes was classified as infarct, haemorrhage or infarct with haemorrhagic conversion. The site of stroke was categorised into cortical, subcortical, brainstem and others.

Only complications that occurred in the inpatient setting after the patient was transferred to the rehabilitation team were noted. Each complication was recorded only once per patient. For example, a patient may have had two separate episodes of UTI while in hospital; only the first episode was documented as a complication. A separate section was included to document if there were any undiagnosed medical problems, which were unmasked after transfer to the rehabilitation team.

The SPSS 10.0 for Windows software was used for data analysis. The Fisher Exact Test and The Mann U Whitney Test were used for the analysis.

RESULTS

A total of 261 case notes were reviewed. Two hundred and thirty five of these patients had stroke as a diagnosis, of which 202 were transferred to the rehabilitation medicine service. One hundred and forty patients were finally included in the study. The case notes of 20 patients were unavailable. As for the remaining 42 patients, stroke was either a secondary diagnosis or had occurred previously.

There were 65 (46.4%) male patients and 75 (53.6%) female patients. The overall mean age of the cohort was 65.7 years (range 40-90). The mean age of males was 63.7 years (range 40-81) whilst the mean age of the females was 67.4 years (range 41-90). Ninety-nine patients (70.7%) had cerebral infarcts, 37 (26.4%) had cerebral haemorrhages and one patient (0.7 %) had haemorrhagic conversion of the infarct. The national figures for frequencies of infarcts and haemorrhages are 74% and 24% respectively[7]. Information regarding the type of stroke was missing in three patients (2.1%). The demographic data of the cohort is summarised in Table II.

The lesions in 20.7% of the patients were categorised under the "others" section. These were either multiple lacunar infarcts, both cortical and subcortical lesions as well as normal CT Brain scans. One patient had concomitant hydrocephalus, another had bilateral subdural haematomas, and one had an intracerebral haemorrhage with intraventricular extension. Information for stroke site was missing for one patient (0.7%).

Overall, 64 (45.7%) did not have any complications. Thirty-two patients (22.9%) had at least one complication. Twenty-five patients (17.9%) had three or more complications each. The most common complications were constipation (complicating 22.9% of strokes), ARU (20.9%), UTI (14.3%), depression (9.3%) and limb pain (8.6%).

We compared our data to that obtained by Roth et al[6]. As shown in Table II, despite the difference in the total numbers in the studies, the demographics of our study group were actually very similar to the demographics of the patients in the study by Roth et al (other than racial groups recruited). The marked difference in stroke site was probably due to differing definitions in the two studies. Also, as mentioned earlier, we classified brainstem strokes into a separate category; in Roth et al brainstem strokes were classified as subcortical infarcts. The complication rates of various complications were also fairly similar (Table III). There were several differences; the most obvious difference was in the rates of UTI's and ARU. In our study, the rate of UTI was lower than that found by Roth et al (14.3% vs 30.5%) whilst the rate of ARU was higher (20.9% vs 4.8%). The rates for limb pain, depression, falls, uncontrolled hypertension and pressure sores were lower in our study.

Miscellaneous "other" complications occurred in 12.4% of stroke patients. These complications included haematuria, pre-renal renal failure, bleeding from haemorrhoids, hypotension and hypoglycaemia among others (Table IV). These were not included in the statistical analysis. One patient (0.7%) had an undiagnosed medical problem requiring the patient to be transferred back to the primary referring physician. An initial diagnosis of stroke was made; the patient was later found to have paraparesis secondary to a cervical cord tumour.

Subgroup analysis

Using univariate analysis, no significant differences in the demographic characteristics were found between the male and female groups (Fisher Exact Test, Mann Whitney U Test). No significant differences were found in the types of strokes between males and females (p = 0.338, Fisher Exact Test).

The five most common complications were analysed to see if there were any differences in complication rates in males and females. Female patients were more likely to have UTI (p = 0.038, OR = 3.00, 95% CI 1.03 to 8.77), ARU (p = 0.002, OR = 4.44, 95% CI 1.68 to 11.76) and depression (p = 0.018, OR = 5.41, 95% CI 1.15 to 25.64). No significant differences in the complications rates of constipation and limb pain were found.

Table III. Comparison of complication rates with the study by Roth et al.

Complication	Study (%)	Roth et al (%)
Recurrent stroke	0	1.6
Epileptic seizure	0.7	1.5
UTI	14.3	30.5
Chest infection	5	4.0
Pressure sore	0.7	4.3
Fall	4.3	10.5
DVT	0.7	4.1
PE	0	1.1
Limb pain	8.6	14.2
Depression	9.3	13.0
CVS complication	1.4	–
Uncontrolled hypertension	2.9	9.0
ARU	20.9	4.8
BGIT	8.6	3.1
Constipation	22.9	–
Drug rash	2.1	–
Others	12.4	–
Undiagnosed problem	0.7	–

Table IV. Other complications.

Complication	Number of patients with complication
Haematuria	4
Bleeding piles	2
Pre-renal renal failure	2
Haemorrhagic conversion	1
Confusion	1
Hypotension	1
Giddiness	1
Hypoglycaemia	1
Non-cardiac chest pain	1
Diarrhoea and vomiting	1
Thrombocytopaenia	1
Chest wall abscess	1
Pelvic inflammatory disease	1
Wound infection	1
Vaginal bleeding	1
Intestinal obstruction	1

There were no significant differences in the frequencies of the five most common complications in the 65 years and above age group as compared to the below 65 years age group. However, patients 65 years of age and above were more likely to suffer multiple complications. In the group of patients 65 years of age and above, 23% suffered three or more complications per patient compared to 9% of patients below 65 years.

Eight patients were transferred back to the primary referring team or physician. This gives a transfer rate of 5.7%. Two had uncontrolled hypertension despite three to four antihypertensive drugs. One patient had bleeding from the gastrointestinal tract and subsequently underwent laparotomy. Two patients had severe pneumonia. Of the three patients from the "others" category who were transferred back, one had intestinal obstruction, another, hypotension, and the third had thrombocytopaenia. The outcome data for one patient with chest pain were missing. There were no deaths during rehabilitation.

DISCUSSION

In several studies of variable designs done in overseas centres, the complication rates for medical complications after a stroke vary from 48-96%[5]. The complication rate in the study by Roth et al was 75%[6]. Results from these studies show a wide variation due to differences in study designs and patient cohort, selection and diagnostic criteria, length of inpatient stay and duration of follow-up. Also, most of these studies focused on individual complications rather than a spectrum of complications, thus enabling more detailed diagnostic criteria to be employed. The frequencies of complications such as pain and depression may have been underestimated, as they are not always screened for.

The study by Roth et al[6] was one of the large studies done in a rehabilitation centre to look at post stroke complications using a pre-defined list of complications adapted from Davenport et al[3]. In spite of their much larger study cohort, we used the study by Roth et al for a comparison of results because: 1. Complications that occurred only after the transfer of patients to a rehabilitation unit were noted, as in our study; and 2. Roth et al also analysed the types of cases which were transferred back to the primary referring physicians.

Constipation

The prevalence of constipation in the general population is high – around 15%[8]. The prevalence is higher in the female population and in the elderly. A study on 15,000 women, quoted in a review article by Winge et al[9], found that 14% to 27% were constipated.

After an electronic search of various databases (including MEDLINE and the COCHRANE databases), we were unable to find previous studies which looked specifically into constipation as a complication post-stroke. The studies by Davenport et al[3], Langhorne et al[4], Roth et al[6] and Kalra et al[8] (all of which looked at multiple complications) also did not include constipation as a complication. Yet constipation and stroke seem to be associated.

In our study, constipation was added to the main list when it was found to be a very common complication in the "others" column. Constipation turned out to be the most common complication (22.9% of strokes). The results of the analysis by age and gender were not statistically significant. In the RANTTAS trial[2], 16% of the patients studied had constipation.

We felt that this result has important implications to clinical practice. Constipation can be associated with significant morbidity; e.g. acute confusion, subacute intestinal obstruction, abdominal pain, loss of appetite, nausea and vomiting, etc. All of these will have a significant negative impact on the rehabilitation process and eventual outcome[11].

The stroke event itself, immobility after stroke, dehydration and nasogastric formulations can all contribute towards constipation[11]. Awareness of all of these contributory factors among healthcare professionals dealing with stroke patients is therefore extremely important. Early mobilisation, ensuring adequate hydration, use of appropriate nasogastric formulations together with the judicious use of oral laxatives and enemas when necessary can greatly alleviate constipation post stroke.

Acute retention of urine and urinary tract infections

A review by Marinkovic et al[12] found that the predominant symptoms of voiding dysfunction after stroke were urinary frequency, urgency and urge incontinence and urinary retention. Evaluation and management of urinary symptoms is often complicated by other co-morbidities, including the presence of diabetes mellitus, coronary artery disease, changes secondary to ageing for example cognitive impairment, bladder instability and benign prostatic hypertrophy (BPH).

Acute retention of urine can be due to the stroke event itself, impaired consciousness, immobility, faecal impaction or temporary over-distension of the bladder. There may be other contributing factors such as co-existing bladder outlet obstruction secondary to BPH, diabetic cystopathy and administration of anti-cholinergic medications[13,14].

A study by Burney et al[13] showed that 47% of patients after stroke had urinary retention, 75% of which were due to detrusor areflexia. The frequency of UTI was lower (14.3% vs 30.5%) and the rate of ARU was higher (20.9% vs 4.8%) in our study compared to the results in the paper by Roth et al[6]. We postulate that this was probably due to the routine testing of post void residual urine in all stroke patients by the rehabilitation team in our hospital. Hence, as more patients with ARU were identified and

treated, the rates of UTI were correspondingly lower. The studies by Davenport et al[3] and Langhorne et al[4] did not include urinary retention in their list of complications.

The correlation between site of stroke and urinary retention is presently not clear. Burney and colleagues[13] showed that 85% of haemorrhagic infarcts, compared to only 10% of ischaemic infarcts, had detrusor areflexia. In this study, lesions in various anatomical areas of the brain were found to be associated with detrusor areflexia; the frontoparietal area, internal capsule, basal ganglia, thalamus, pons and cerebellum.

In practice, it is therefore necessary to pro-actively screen for voiding dysfunction after a stroke, to take a detailed history on voiding dysfunction which may have been present prior to the stroke as well as a detailed medication history. A bladder chart may help to identify voiding problems. Actively screening for urinary retention with routine measurement of post-void residual urine with institution of appropriate corrective measures is important to prevent urinary tract infections. Most of these voiding difficulties tend to improve with time after stroke[15].

Our study has highlighted the incidence of this problem in a small cohort of stroke patients. More studies are required, especially to look specifically into voiding difficulties after stroke, and to look at characteristics of patients who develop this after stroke, the predictors of developing such complications, the treatment prescribed and follow-up to look at resolution.

Depression

Depression after stroke is thought to be secondary to two main causes. Firstly, it is postulated that the stroke event itself has a direct neuropsychological effect resulting in depressive symptoms. Also, there is likely to be a reactive component related to the degree of disability[16].

In the last 20 years, neurological diseases are among the physical illnesses best studied with respect to their relationship with depression. Yet, there is still significant controversy about the relationship between stroke and depression[17]. The true prevalence, severity of depressive symptoms post-stroke, the relationship with site of stroke and its effect on outcome are not really known. In one study, depression has been found to occur in up to 50% of acute stroke patients[18]. In numerous other studies, the prevalence of post stroke depression varies from 18% to 60%[19-22]. Some studies suggest that the symptoms of depression post-stroke are acute and short-lived[23] whereas other studies show a chronic nature to the relationship[16,24]. The Perth Community Stroke Study[25] showed that 50% of men and 30% of female patients have chronic symptoms. In the study by Wade et al[26], 33% of patients recover but over 50% of those depressed at three weeks post-stroke remain depressed at one year. The Sunnybrook Stroke Study[17], which assessed 436 patients post-stroke prospectively, showed that 22% to 27% (percentage dependent on the diagnostic tool used) of patients had major depression at three months after stroke. One year after stroke, 21% to 22% had marked depressive symptoms. These patients had more neurological impairment and were more likely to be female.

These studies show that depression after stroke plays a major role in the functional status achieved after a stroke. The presence of depression may decrease motivation, resulting in lower scores on functional and neurological scales. This magnifies existing disability[2]. Depressed patients tend to make less progress with rehabilitation, have longer lengths of stay and tend to be less compliant. Upon discharge, the problems continue with such patients reporting less satisfaction with leisure pursuits and reduced social contact. Also, House et al[27] showed that depressive symptoms post-stroke were related to higher 12- and 24-month mortality. However, the results were of borderline significance.

It seems logical to assume that treatment of depression would improve scores of activities of daily living (ADL); however, the evidence for this is conflicting. A study by Lipsey et al[28] in the Lancet in 1984 failed to show any significant improvement in ADL scores among patients treated with nortryptiline compared with placebo in spite of improvement in mood. A more recent study by Chemerinski et al[29] showed that remission of post-stroke depression over the first three to six months after stroke is associated with greater recovery in ADL function than continued depression. In this study, not all patients were treated with anti-depressants; a large number of patients had spontaneous remissions. A small study by Gainotti et al[30] showed that treatment of post-stroke depression was associated with a faster improvement in motor and functional scores. Sinyor et al[31] concluded that depression is not only a frequent complication after stroke but also that it is associated with a degree of functional impairment and may exert a negative impact on the rehabilitation process and outcome. Based on the evidence available, depression post-stroke improves with treatment. However, we cannot definitely conclude that improvement of post-stroke depression leads to an improvement in the patient's functional status. In view of the high prevalence of depressive symptoms in this population, diagnosis and treatment of depression are important in optimising recovery post-stroke. The prevalence of depressive symptoms can only be expected to increase due to the rising

numbers of patients who survive the initial event, only to be left with physical and mental impairment.

Good community support and active programmes within the community after discharge could help to decrease the rate of post-stroke depression. The FINNSTROKE Study[32] showed that about 50% of patients post-stroke were depressed but only 17.4% were receiving treatment at 12 months after the stroke. Fewer patients in districts with active after-hospital-discharge interventional programmes were depressed (41%) compared with patients in districts without these programmes (54%).

We did not analyse the brain imaging investigations to associate depression with lesion locality. Various studies done have shown that anterior circulation strokes result in a greater frequency of depression compared to other stroke types[24,33]. However, a study by Pohjasvaara[21] did not find any significant association between post-stroke depression and stroke localisation. Herrmann et al[17] showed that there was no relationship between depressive symptoms and volume of lesion or side of lesion.

The rates of depression in our study (9.3%) and Roth et al (13.0%)[6] are much lower than the other studies. In our study, the retrospective nature of the study meant that our identification of depression was dependant on the accuracy of documentation in the case records. Also, our study was a preliminary study designed to look at the general overview of the type and frequencies of complications after stroke, hence in identifying depression we used simple diagnostic criteria based on documentation of symptoms or prescription of anti-depressants rather than the valid reliable measures of depression used in the other studies mentioned. These studies were all designed to look at single complications rather than multiple complications; hence, detailed diagnostic criteria were employed in the identification of depression. Even with the use of validated instruments, the rates in these studies are variable due to the use of different diagnostic instruments in each study.

Prospective studies using validated depression scales, with a longer follow-up are required to study post-stroke depression in more depth in the local population. It may also be useful to look at the predictors of immediate and chronic depressive symptoms after a stroke, functional outcomes and the association with the institution of treatment with anti-depressants as well as the association with the anatomical locality of the stroke.

Limb Pain

We were unable to find randomised controlled trials on limb pain after stroke. Our incidence of 8.6% was lower than that reported by Roth et al (14.2%)[6] but higher than the 4% reported by Davenport et al[3]. We attribute these differences to differences in study design and definitions.

Limb pain after stroke can be due to several causes. Isolated shoulder pain can occur on the hemiparetic side due to subluxation of the shoulder. This occurs secondary to the loss of support to the shoulder which occurs due to paralysis of the supporting muscle groups. This usually responds to simple analgesia, heat or ice application, ultrasound therapy, shoulder supports as well as to passive range of motion exercises. The shoulder-hand syndrome (SHS) has characteristic features and affects the shoulder, wrist and hand. The patient will complain of pain and there will be oedema and vasomotor changes in the affected limb. It is important to recognise this syndrome early as it results in muscle atrophy, severe osteoporosis and contractures, all of which will be devastating to the patient. The SHS responds to a short course of oral steroids or an intra-articular steroid injection. Untreated, it resolves in about a year but the patient is left with a contracted upper extremity[34].

Other complications

The rates of post-stroke falls, deep vein thrombosis, pulmonary embolism and recurrent stroke were low in our study (4.3%, 0.7%, 0% and 0% respectively). Yet, these are important complications after a stroke event with high mortality rates. A review of the literature was conducted.

Falls

Not many studies on falls post-stroke have been done. Falls in an elderly patient result in fractures, with significant morbidity and mortality. In the 1950's it was recognised that patients with hemiplegia have a propensity to hip fractures on the hemiplegic site secondary to unilateral loss of bone density at this site[35]. Stroke predisposes to bone loss via several mechanisms. The sudden loss of mobility and function results in unloading of the skeleton at the affected site. There is also increased bone resorption in the first year after stroke[36,37]. With the concurrent motor, sensory and visual-perceptual deficits, the risk of fractures secondary to falls is high. Hip fractures in stroke patients result in greater mortality than in those without stroke. Ramnemark et al[38] showed that survival and recovery of independent mobility after hip fracture were significantly reduced in patients with stroke compared with those who had not had a previous stroke. In a Swedish study, the risk of sustaining a hip fracture in the immediate post-stroke period was four times the risk in the general population[39]. Also, there was a

substantial increase in risk of hip fracture during the first year post-stoke in all ages and regardless of the gender of the patient[39,40].

A study by Forster and Young[41] showed that 73% of post-stroke patients with mild to moderate disability had fallen in the six months after discharge. Patients who fell in hospital were significantly more likely to fall at least twice at home after discharge. Patients who had fallen at least twice were less socially active at six months. Fallers were more likely to be depressed and significantly more carers of fallers were stressed at six months.

Hence, stroke as a condition is associated with an increased risk of falls. Our rates of falls were much lower, due to a variety of reasons: the retrospective nature of the study and the precautions to prevent falls which were already in practice. Also, we did not follow up on falls which may have occurred at home after discharge. The studies mentioned above have shown that falls after stroke result in significant morbidity not just for the stroke patient but also for their carers.

As mentioned earlier, patients post-stroke who develop fractures have a higher morbidity and mortality. Hence, to reduce this morbidity and mortality, we have to reduce the risk of falls post-stroke as well as prevent osteoporosis. More focus and a multidisciplinary approach need to be placed on patients who fall in hospital after a stroke. Measures to prevent bone loss and preserve bone architecture, which have so far not been a part of stroke management, should be implemented concurrently.

Deep vein thrombosis and pulmonary embolism

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are uncommon but important complications after stroke. A study at the Mayo Clinic[42] found that over a two-decade period, 30 patients developed PE. Sudden death occurred in 50% of these patients, all of whom had massive pulmonary emboli at autopsy. PE occurred from Day 3 to Day 120 (median time day 20) after the stroke. DVT was present in 11 of the 30 patients, invariably in the paralysed leg. There was insufficient awareness of the dangers of DVT in a stroke patient; only four of the 30 patients had been on prophylaxis.

Wijdicks and colleagues[35], in their paper, summarised some of the published studies of pulmonary embolism after stroke. The overall frequency was similarly low but they found a lower rate of fatalities compared to their own results. All the studies show that pulmonary embolism can occur quite soon after the stroke and is not necessarily a result of long-term immobilisation.

Although the incidence of both DVT and PE seems to be low, they are potentially fatal conditions and can be a cause of early sudden mortality after stroke. Hence, clinicians should have a low threshold for suspicion of pulmonary embolism in stroke patients who develop acute cardiorespiratory symptoms. The use of heparin for prophylaxis against DVT and PE post-stroke has been shown to be effective[43]. Mazzone et al[44] conducted a search of the Cochrane Stroke Group Trials register and found that there is insufficient evidence based on current randomised trials to support the use of physical methods for prevention of DVT in stroke patients. More studies need to be done in the local stroke population.

Recurrent stroke

The reported risk of recurrent stroke in the first year varies from 10% to 20%[45,46]. The risk of very early recurrence varies from 0.1% to 1% per day in the first two weeks after the event[45]. In a sub-group analysis of the results of the International Stroke Trial (IST)[47], recurrent stroke occurred equally often in patients with and without atrial fibrillation (AF). However, patients in AF were more likely to suffer a fatal recurrent event than patients not in AF. A recent combined analysis of the results of the IST and the Chinese Acute Stroke Trial (CAST) showed that aspirin reduces the risk of recurrent stroke in the first 14 days by 30% regardless of the presence of AF[48].

Also, the benefits of anticoagulation needs to be clarified. In the EAFT study[46], a secondary prevention study, the relative reduction with oral anticoagulation was of similar magnitude. However, the best time to start anticoagulation was not clear. The two studies on anticoagulation in the acute phase[49,50] showed no evidence of benefit of heparin compared with aspirin or no antithrombotic treatment in patients in AF. A search of the Cochrane Database by Liu et al[51] found that the available data do not support the use of anticoagulation in patients with non-embolic stroke.

The clinical implications are great. The current evidence advocates the early use of aspirin which offers a safe and effective option for preventing recurrent ischaemic stroke within the first two weeks after stroke.

Analysis by age group

The rates of the five most common complications analysed by age showed no significant differences. Multiple complications were more common in the older age group. However, this result was of a borderline significance ($p = 0.055$, Mann Whitney U Test). The small study numbers may be the reason for this borderline result. Previous studies have shown that the number of complications per patient varies with

the length of stay[5], although it was not possible to determine if the prolonged hospitalisation was a cause or effect of stroke related complications. Also, in the older age group, there may have been other confounding factors; for example, the patient may be waiting for nursing home placement which would prolong the hospital stay. These factors were not looked into in this study.

Analysis by gender

When analysed by sex of the patient, females were more likely to have UTI, ARU as well as depression. The higher rate of ARU in females was surprising. With the increasing incidence of benign prostatic hypertrophy (BPH) in the ageing male, we expected a higher rate of ARU in the male subgroup. However, this needs to be re-evaluated as we did not look at other risk factors which might account for this, such as underlying diabetes mellitus which could result in ARU secondary to a neurogenic bladder (diabetic cystopathy).

Rate of transfer back to primary referring physician

The rate of transfer back to the primary referring department was also lower in our study (5.7% vs 19% in the study by Roth et al)[6]. Our rehabilitation team is backed up with on-site acute medical physicians and facilities; therefore the threshold for initiating a transfer back may be higher. Also, with on-site medical facilities (both diagnostic and therapeutic), the patient could be reviewed easily by the primary referring physician and appropriate treatment initiated without necessitating transfer of patient care. In the study by Roth et al, the rehabilitation unit was physically separate from acute medical facilities and therefore the threshold for transfer may have been lower. In our local context in Singapore, a similar study based in a community hospital would not only be interesting, but would provide more comparable results to the overseas studies done in rehabilitation centres away from acute medical facilities.

Implications for clinical practice

The implications to our clinical practice are tremendous. There is an infinite number of medical complications which can occur after stroke, many of which are fatal. Hence, it is vital for these problems to be identified early and for this a high index of suspicion is necessary. All medical complications may be preventable to some extent. Implementation of certain interventions during acute care and rehabilitation may reduce the frequencies of certain complications[6]. Some of these interventions may be most effective when commenced immediately after stroke as certain complications are more likely to originate in the acute post-stroke phase[6].

More studies are required to confirm our findings, determine the time interval from onset of stroke to development of a complication and to determine the risk factors for developing these complications in our local population. Modification of these risk factors will reduce the rate of complications. This in turn will improve patient outcome and hopefully reduce healthcare costs. Studies also need to be done to ascertain the pre-existing medical conditions in these patients as these may modify risk factors. We also need local statistics for some of the rarer but potentially fatal complications of stroke, namely, DVT, PE and recurrent stroke.

Limitations

Our study has several limitations: 1. It is a retrospective study, hence our data were very much dependent on accurate documentation. For example, depression and limb pain were very often picked up by reading the therapists' notes or based on the initiation of treatment with an antidepressant or analgesic respectively; 2. There were differences in the definitions of complications compared to that used by Davenport et al and Roth et al. This resulted in different pick-up rates for the various complications; 3. The size of our cohort was small; 4. We did not document the total length of stay; it is possible that a longer length of stay allows greater opportunities to observe complications; and 5. We would also like to point out that our data are not a reflection of the true rate of complications post stroke as we only documented complications which occurred after transfer to the rehabilitation team and only those on the pre-determined list.

Strengths

We used a fixed set of complications which was based on several overseas studies[3,4,6,8]. Each complication (adapted from Davenport)[4] was pre-defined to increase the reliability of the study. Most importantly, we studied the local patient cohort. To the best of our knowledge, there has not been such a descriptive study looking at the complications which occur in patients undergoing inpatient rehabilitation after a stroke in the local setting.

CONCLUSION

This is a descriptive study detailing the complications encountered in our local stroke population during inpatient rehabilitation. Despite our small study cohort, we have shown that complications post stroke are common and pose a significant challenge to both the healthcare provider as well as the patient. We have also shown that medical complications continue to occur during the rehabilitative phase after a stroke. The rehabilitation process is a medically active discipline.

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