ORIGINAL ARTICLE

Secondary prevention of stroke: an evidence-based clinical audit in the primary care

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Objective To audit secondary preventive care in non-acute stroke patients in a local General Outpatient Clinic of the Hospital Authority.

Design Comparison of two samples from a case series at different time-points.

Setting General Outpatient Clinic, Hong Kong.

Patients Non-acute stroke patients fulfilling the inclusion criteria and regularly followed up in a local General Outpatient Clinic during the audit cycle were recruited. Evidence-based audit criteria and performance standards were established after thorough literature review. A sample from this case series was compared retrospectively at two time-points. First-phase evaluation was performed in October 2009 and deficiencies were identified. After 9 months of active intervention, second-phase evaluation was performed in July 2010. Chi squared test and student's *t* test were used to compare the significance of relevant changes noted.

Results First-phase data showed marked deficiencies in proper assessment of cardiovascular risk factors. Satisfactory blood pressure, glucose and lipid control was evident only in 47% of the hypertensive, 45% of the diabetic, and 37% of the dyslipidaemic stroke patients, respectively. After 9 months of implementing changes, significant improvements were noted with respect to standard targets being achieved. In the second phase, more comprehensive tackling of cardiovascular risk factors was noted, with satisfactory blood pressure control in 73% of hypertensive patients, and adequate metabolic control in 62% diabetic patients ($P<0.01$ for both). Only 59% of the dyslipidaemic stroke patients had optimal lipid control, though their mean low-density lipoprotein concentration was significantly reduced ($P<0.05$).

Conclusion This study provided a valuable lesson in identifying deficiencies in secondary prevention for stroke patients managed in a local primary care facility. Using a team approach intervention, quality assurance was promoted and a definite impact on patient care was demonstrated.

New knowledge added by this study

- Marked deficiencies exist in the delivery of secondary preventive care to non-acute stroke patients managed in local public primary care settings.
- Proper assessment of cardiovascular disease (CVD) risk factors among stroke patients was far from optimal during the first phase. Satisfactory blood pressure, glucose, and lipid control was only achieved in 47% of hypertensive, 45% of diabetic, and 37% of dyslipidaemic stroke patients.
- Using a team approach intervention, comprehensive cover of CVD risk factors could be attained, such that a significantly greater proportion of non-acute stroke patients can achieve satisfactory blood pressure, metabolic, and lipid level control.

Implications for clinical practice or policy

- This clinical audit has provided valuable evidence for understanding the common problems encountered in secondary preventive care of non-acute stroke patients managed in local primary care settings.
- Through the process of clinical audit with a structured approach at clinic, doctor and patient level, quality assurance was promoted and a definite impact on patient care was demonstrated.

Key words
Cardiovascular diseases; Guideline adherence; Hypertension; Secondary prevention; Stroke

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關於腦中風的二級預防在社區醫療的臨床循證審計

目的 在醫院管理局轄下一所普通科診所對非急性中風患者的二級預防進行循證審計。

設計 比較於兩個不同時段的病例系列中的患者樣本。

安排 香港一所普通科診所。

患者 對香港一所普通科門診定期復診治療非急性腦中風疾病並符合研究標準的病人進行臨床審計。參照循證臨床指引以制訂本臨床審計準則及標準。2009年10月進行一期評估以找出二級預防中風診治的不足之處，經過為期九個月的改善，於2010年7月進行二期評估。以卡方測定及Student's *t* test進行顯著性差異分析。

結果 一期評估結果顯示基層醫療對於心血管危險因素的評估有嚴重不足之處。只有47%高血壓中風患者的血壓控制達標，45%糖尿病中風患者的血糖控制達標，37%血脂異常的中風患者有滿意的血脂控制。經過為期9個月的積極干預後，大部分審計準則指標均明顯改善。二期評估結果顯示73%的高血壓中風病人的血壓得以有效控制（P<0.01），62%的糖尿病中風病人的血糖控制達標（P<0.01）。儘管只有59%患高脂血症的中風患者的血脂控制良好，其平均低密度脂蛋白濃度在審計期間顯著降低（P<0.05）。

結論 此研究表明本地社區醫療預防腦血管疾病的復發有許多不足之處，經審計後大部分審計準則取得顯著改善，積極提高醫療質素及診治效果。

Introduction

Stroke is a major cause of mortality and morbidity worldwide. It is also a significant cause of disability in adults and has substantial economic consequences. In Hong Kong, cerebrovascular disease ranked fourth among the leading cause of mortality and in 2009 accounted for 8.4% of all deaths.[1] Survivors of a transient ischaemic attack (TIA) or stroke have an increased risk of another stroke, which is a major source of increased mortality and morbidity.[2] In addition, patients experiencing a TIA or stroke also have an increased risk of myocardial infarction and other vascular events.[3] Epidemiological studies and local reports indicate that modifiable risk factors for stroke include exposure to cigarette smoke, excessive alcohol intake, poor diet, physical inactivity, obesity, as well as the presence of hypertension, diabetes mellitus, atrial fibrillation, and dyslipidaemia.[4] Clinical trials have provided strong evidence that effective secondary prevention significantly reduces the mortality and the recurrence rate associated with stroke.[5] Therefore, rapid institution of evidence-based secondary prevention for stroke patients deserves high priority.

Much of the responsibility for delivering effective secondary prevention and managing longer-term problems associated with stroke falls on primary care teams. Family physicians are well-placed to implement such secondary prevention for stroke patients. However, major deficiencies in secondary prevention delivery after stroke have been demonstrated in primary care settings. Results from the National Sentinel Audit of Stroke 2001 in the UK revealed that 24% of patients with a history of previous cerebrovascular disease were not on appropriate anti-thrombotic medication.[6] Moreover, 6 months after their event, satisfactory blood pressure (BP) control was noted in only 31 to 40% of hypertensive patients. Another audit from Holland on the quality of care for stroke prevention by general practitioners yielded similar findings; the substantial number of shortcomings identified included: hypertension control and the assessment of patient's risk profiles for cardiovascular disease (CVD).[7] Locally, a significant proportion of patients with non-acute stroke are managed in government general out-patient clinics (GOPCs) of the Hospital Authority of Hong Kong. However, local data on the quality of stroke management in primary care are still lacking. The clinic where the authors work is one of the biggest GOPCs of the Hospital Authority, more than half the attendances being due to chronic diseases including stroke. The aim of this audit was to: (i) identify deficiencies in the secondary prevention of non-acute stroke patients in our primary care clinic, (ii) develop strategies to overcome them, and (iii) assess their impact after implementation. It was hoped that this audit could help to improve the quality of stroke patient care, so as to minimise stroke recurrence and other long-term adverse vascular outcomes.

Methods

Setting audit criteria and justification of audit standards

The following evidence-based international guidelines were used for setting the criteria:

(1) "Guidelines for the prevention of stroke in patients with stroke or transient ischemic attack" published by American Stroke Association (2011)[8];

(2) "7th Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure" published by National Institute of Health (NIH), US (2003)[9];

(3) "3rd Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III" published by NIH, US (2002).[10]

The most important goals were classified as "must do" criteria due to the abundant supporting evidence and important impact on patients. The target standard for each criterion was the expected level of performance of the audit team. For criteria 2 to 10, the standard was set at 90% since they are essential aspects for CVD risk factor identification for which subsequent effective secondary prevention strategies are necessary. For criteria 11 to 13 (to assess outcome performance on BP, glucose, and lipid control), the standard was set at 70% based on recommendations from cardiovascular prevention quality indicators for stroke and TIA in the new General Medical Service contract, UK,[11] and audit protocols on management of hypertension in the primary care published by Eli Lilly National Clinical Audit Centre.[12] In this audit, the patient was considered to have a lipid disorder if his/her level of low-density lipoprotein (LDL) was >2.6 mmol/L, total cholesterol was >5.2 mmol/L, or triglyceride was >1.7 mmol/L. Table 1 summarises all these audit criteria and the target standards.

Data collection and analysis

Audit objects

All eligible non-acute stroke patients coded by international classification of primary care (ICPC) K89, K90 and K91 attending Yau Ma Tei Jockey Club GOPC during the audit cycles (phase 1 from 1 April 2009 to 30 September 2009 and phase 2 from 1 January 2010 to 30 June 2010) were recruited. The exclusion criteria were: acute stroke (ensuing within 4 weeks), follow-up by other clinics, wrongly diagnosed patients, or those certified dead.

First-phase data collection and analysis

On 1 October 2009, 1134 non-acute stroke patients in this clinic during phase 1 and fulfilling the above inclusion criteria were recruited. Clinically stable non-acute stroke patients are generally followed up in this clinic at 2-4–month intervals and unstable patients more frequently. This 6-month retrieval period was therefore likely to suffice for all such patients regularly followed up in this clinic. Every patient on the stroke registry was allocated with a case number. Using the internet sample size calculator (Survey Software from Creative Research System, http://www.surveysystem.com), a sample size of 287 was obtained so that the results would have 95% confidence level and 5% confidence interval (CI). A list of random numbers was then generated from the research randomiser

TABLE 1. The audit criteria and target standard

Criteria/standard*		Standard
The "must do" criteria		
1.	Patients diagnosed as stroke or TIA has been recorded in a practice stroke registry.	100%
2.	The records show clear documentation on the category of stroke, ie ischaemic stroke or haemorrhagic stroke.	90%
3.	The practice can produce a registry of stroke patients with correct ICPC coding.	90%
4.	The records show that an assessment has been made of the lifestyle risk factors for CVD and that if necessary, appropriate advice and treatment has been given: smoking habit, excessive alcohol intake, obesity, and physical inactivity.	90%
5.	The records show that assessment on BP has been made in the preceding 6 months.	90%
6.	The records show that at least annually the fasting blood glucose has been checked.	90%
7.	The records show that at least annually the blood lipids have been checked.	90%
8.	The records show that at least annually concomitant other CVD or CVD equivalents (such as ischaemic heart disease, peripheral vascular disease) have been assessed.	90%
9.	The records show that all patients diagnosed as having an ischaemic stroke or TIA should be on antiplatelet or anticoagulant therapy unless contra-indicated or side-effects are recorded.	90%
10.	The records show that patients with a stroke or TIA have been regularly reviewed at intervals not exceeding 6 months.	90%
11.	The records show that hypertension is well controlled, the average of the last three recorded BP readings being <140/90 mm Hg. For patients with diabetes or renal disease, the goal of BP control is <130/80 mm Hg.	70%
12.	The records show that diabetes is well controlled, with the latest HbA_{1c} reading being <7%.	70%
13.	The records show that at least annually stroke patients have been advised or referred to dieticians for dietary advice and are recommended on lipid-lowering medication if still with poor lipid control. The goal of lipid control is LDL-C <2.6 mmol/L.	70%
The "should do" criteria		
14.	The records show that at least annually compliance and side-effects of drugs have been assessed.	70%
15.	The records show that immunisation against influenza has been given in the previous season or contra-indications or refusal have been documented,	70%

* TIA denotes transient ischaemic attack, ICPC International Classification of Primary Care, CVD cardiovascular disease, BP blood pressure, HbA_{1c} glycated haemoglobin, and LDL-C low-density lipoprotein–cholesterol

(http://www.randomizer.org/form.htm), from which the 287 patients to be included were selected. Data were subsequently collected by reviewing the medical records of all the selected patients by using a data collection form (Appendix). Twenty cases were rejected including nine being followed up in other clinics, five certified as dead, three newly diagnosed (acute stroke patients referred to casualty), and three wrongly diagnosed as stroke.

Implementing changes and intervention: from 1 October 2009 to 30 June 2010

The audit group (led by the authors) was formed in September 2009. A structured team approach was adopted with strategies specific to different levels being worked out. At the patient level, a series of education programmes were delivered and a standard stroke prevention pamphlet was designed. All nurses and supporting staff were reminded to undertake initial assessment of new stroke cases in the clinic. At the doctor level, a copy of the latest stroke management guideline with special emphasis on secondary prevention was given to all physicians for reference, and important points were also explained at staff meetings. A stroke management protocol was created in the clinical management system (CMS) and provided a standard reference for consultations. Regular quarterly review on the progress of the audit was carried out and feedback regarding deficiencies was tackled promptly. At the clinic level, a policy on CVD risk factor screening was advocated and a continuous monitoring and feedback system with ongoing problem solving was reinforced. Possible deficiencies and corresponding implementation strategies are summarised in Table 2.

Second-phase data collection and analysis

In July 2010, a list of 1219 stroke patients followed up in this clinic from 1 January 2010 to 30 June 2010 was generated from the CMS. Among these 1219 patients, 1120 were followed up from phase 1 of the audit, and 99 were newly referred non-acute stroke or TIA patients from other GOPCs, specialist out-patient clinics (SOPCs), or private clinics. In all, 14 patients were lost to follow-up in phase 2, due to hospital admission and subsequent follow-up by SOPCs (2 cases) or other GOPCs (9 cases), and for unknown reasons (3 cases). Similarly, a random sample of 297 cases was obtained to yield 95% CI as described earlier. In all, 27 cases were rejected (2 being acute stroke patients, 18 being followed up in other clinics, and 7 being certified dead during phase 2). Data were then collected by the same method as in the first phase.

Statistical methods

All data were entered and analysed using computer software (Windows version 16.0; SPSS Inc, Chicago [IL], US). The results of the first phase and second

TABLE 2. Deficiencies identified and strategies implemented

Areas of deficiencies	Strategies implemented*
Policy	
Lack of a responsible team	Appointment of an audit coordinator
Lack of regular review to monitor the secondary preventive care of stroke patients	Quarterly review policy to monitor the process
Practice	
Lack of guideline or protocol	Adopt standard guidelines, development of protocol structural stroke secondary prevention assessment form
Lack of reminder system	Set up of CMS and desktop reminder system
Lack of feedback	Regular quarterly evaluation system
Staff	
Lack of team work	Development of stroke audit team
	Sharing of workload: involving supporting staff, introduction of APN service for stroke patients with concomitant DM and HT
Lack of continuous education and training	Improvement in education and training via stroke prevention training workshop and journal club
Ineffective use of available resource	Centralised distribution and usage of available resources
Patient	
Lack of awareness and knowledge and not motivated about stroke prevention	Improve patient's awareness and knowledge by regular health talk and nurse counselling

* CMS denotes Clinical Management System, APN advanced practice nurse, DM diabetes mellitus, and HT hypertension

phase were compared for statistically significant differences. The Chi squared test was used for categorical variables and student's *t* test for continuous variables. A P value of <0.05 was regarded as statistically significant.

Results

Table 3 summarises the demographic characteristics and CVD risk profiles of the stroke patients recruited into the two phases. Among the 1219 patients recruited in phase 2, 1120 were follow-up cases from phase 1, the overlapping case rate being 92%. The demographic characteristics and CVD risk factor profiles of patients in the two phases of this audit were comparable. A comparison of the standards achieved in the two phases is summarised in Table 4. In the first phase, there were marked deficiencies in the clear documentation of the type of stroke (38%) and correct ICPC coding (50%). Proper assessment on CVD risk factors was far from adequate or standardised; there being limited documentation of smoking status (47%), excessive alcohol intake (46%), body mass index (14%), physical inactivity (15%), concomitant CVD (40%), blood sugar and lipid monitoring (47% and 39%, respectively). Only 47% of hypertensive stroke patients had their BP controlled as per targets, and the achievement of necessary target pressures in diabetic patients was much worse (24%). Adequate metabolic control among diabetic stroke patients (45%) was also suboptimal. With regard to lipid control, 43% of all stroke patients were counselled or referred for proper dietary advice at least annually, but only 37% with concomitant dyslipidaemia had their low-density lipoprotein–cholesterol (LDL-C) controlled according to the set goal (<2.6 mmol/L). Assessment of drug compliance and side-effects (in 57%) was also less than comprehensive. By contrast, aspects that were adequate (standard targets being largely attained) included: BP assessment (99%), antiplatelet or anticoagulation therapy in non-haemorrhagic stroke patients (98%), and proper follow-up for chronic disease (96%).

After 9 months of active intervention and implementation of changes, in phase 2 significant improvements were evident with respect to most of these criteria. The improvement was impressive for the clear documentation of stroke types, correct ICPC coding and CVD risk factor assessment. The latter included: lifestyle risk factor assessment, blood glucose or cholesterol monitoring, and concomitant CVD or equivalent disease assessment (criteria 2-8, all P<0.01). Satisfactory BP control was achieved in 73% of hypertensive stroke patients and adequate metabolic control in 62% of diabetic patients (all P<0.01). In addition, the mean glycated haemoglobin (HbA_{1c}) had decreased significantly from 7.6 ± 0.9% in phase 1 to 7.0 ± 0.9% in phase 2 (P<0.01). However, only 59% of dyslipidaemia stroke patients had 'optimal' lipid control, their mean LDL-C was significantly reduced (2.9 ± 0.7 mmol in phase 2 versus 3.1 ± 0.7 mmol/L in phase 1, P=0.012).

TABLE 3. Demographic characteristics and cardiovascular risk factors of stroke patients in the two phases*

Characteristic/risk factor†	Phase 1 (n=1134)	Phase 2 (n=1219)	P value
No. of sampling cases needed	287	297	-
No. of cases rejected	20	27	
No. of cases recruited into analysis	267	270	
Sex			
Male	162 (61%)	159 (59%)	0.83
Female	105 (39%)	111 (41%)	0.67
M/F ratio	1.54	1.43	
Age (years)	71 ± 13	73 ± 15	0.12
BMI (kg/m^2)	24 ± 4	24 ± 5	0.78
Ischaemic stroke cases	251 (94%)	255 (94%)	0.83
CVD risk factors			
Smoking status assessed	125	250	
Chronic smoker	38 (30%)	75 (30%)	0.94
Drinking status assessed	122	248	
Excessive drinker	9 (7%)	15 (6%)	0.63
BMI assessed	37	244	
Obesity	16 (43%)	96 (39%)	0.65
Physical activity status assessed	41	244	
Lack of exercise	5 (12%)	32 (13%)	0.87
Blood pressure assessed	264	270	
Hypertension cases	250 (95%)	263 (97%)	0.11
FBG tested	262	268	
FBG within 1 year	126	247	
FBG taken >1 year before	136	21	
Diabetes cases	84 (32%)	86 (32%)	0.99
Lipid profile tested	105	247	
Hyperlipidaemia cases	62 (59%)	171 (69%)	0.07

* Data are shown as No., No. (%), and mean ± standard deviation

† BMI denotes body mass index, CVD cardiovascular disease, and FBG fasting blood glucose

Table 5 summarises the glycaemic control of diabetic stroke patients in different age-groups in phase 2; 91% of those under the age of 59 years in phase 2 had satisfactory metabolic control with a mean HbA_{1c} (6.5 ± 0.7%), which was significantly lower than that in patients more than 80 years old (7.0 ± 0.7%; P<0.05).

Discussion

This study was the largest local clinical audit on secondary prevention of stroke ever conducted and describes the current practice in public primary care settings. In phase 1, marked deficiencies in the clear

TABLE 4. Number and percentage of patients with criteria fulfilled in phase 1 and phase 2 and comparison of the results in the two phases

Criteria*		Standard	Phase 1 (P1) (n=267)	Phase 2 (P2) (n=270)	P value	Note
1.	Stroke registry	100%	267 (100%)	270 (100%)	-	
2.	Clear documentation of ischaemic, or haemorrhagic stroke	90%	102 (38%)	260 (96%)	<0.01	
3.	Correct ICPC coding	90%	133 (50%)	262 (97%)	<0.01	
4.	CVD lifestyle risk factor assessed	90%				
	a. Smoking habit		125 (47%)	250 (93%)	<0.01	
	b. Excessive alcohol intake		122 (46%)	248 (92%)	<0.01	
	c. Body mass index		37 (14%)	244 (90%)	<0.01	
	d. Physical inactivity		41 (15%)	244 (90%)	<0.01	
5.	Blood pressure measured at least within 6 months	90%	264 (99%)	270 (100%)	0.08	
6.	Serum FBG (or HbA_{1c} if diabetic) checked at least annually	90%	126 (47%)	247 (91%)	<0.01	
7.	Serum lipid profile checked at least annually	90%	105 (39%)	247 (91%)	<0.01	
8.	Concomitant CVD or equivalents assessed at least annually	90%	108 (40%)	245 (91%)	<0.01	
9.	Aspirin or other antiplatelet therapy if ischaemic stroke or TIA	90%	247 (98%)	254 (100%)	0.17	P1: 251 ischaemic/TIA P2: 255 ischaemic/TIA
10.	Patients reviewed at least every 6 months	90%	257 (96%)	269 (100%)	0.06	
11.	Blood pressure					
	a. <140/90 mm Hg if HT	70%	117 (47%)	193 (73%)	<0.01	P1: 250 HT
	b. <130/80 mm Hg if DM		20 (24%)	52 (61%)	<0.01	P2: 263 HT
12.	HbA_{1c}				248	
	a. <7% if diabetic	70%	38 (45%)	53 (62%)	<0.01	P1: 84 DM
	b. HbA_{1c} in DM patients (mean ± SD in %)		7.6 ± 0.9	7.0 ± 0.9	<0.01	P2: 86 DM
13.	LDL	70%				
	a. Low-lipid diet advised or referred		116 (43%)	258 (96%)	<0.01	Dyslipidaemia
	b. LDL <2.6 mmol/L if dyslipidaemia		23 (37%)	100 (59%)	<0.01	P1: 62 cases
	c. LDL concentration (mean ± SD in mmol/L)		3.1 ± 0.7	2.9 ± 0.7	0.012	P2: 171 cases
14.	Drug compliance/side-effects assessed annually	70%	152 (57%)	238 (88%)	<0.01	
15.	Influenza vaccination has been given in the previous season	70%	210 (79%)	218 (81%)	0.55	

* CVD denotes cardiovascular disease, DM diabetes mellitus, FBG fasting blood glucose, HbA_{1c} glycated haemoglobin, HT hypertension, ICPC denotes International Classification of Primary Care, LDL low-density lipoprotein, SD standard deviation, and TIA transient ischaemic attack

documentation of stroke type, correct ICPC coding, and proper assessment of CVD risk factors were identified. The reasons behind these deficiencies were multi-factorial. At a patient level, stroke patients were often unaware of the importance of CVD risk factor control and therefore their level of knowledge and understanding about stroke prevention might have been low. At a doctor level, some physicians were not up-to-date with the latest management guidelines and therefore did not know the 'optimal' targets for risk factor control. At a practice level, there was no policy to enhance CVD risk factor assessment and a feedback system on performance was lacking. In addition, the short consultation time (average 6 minutes for a case) may also have contributed to inadequate doctor-patient communication in the GOPCs.

After implementing a team-approach effort, statistically significant improvements were shown in most of the addressed criteria. Improvements were impressive for clear documentation of stroke types, correct ICPC coding, and CVD risk factor assessment. The latter included: lifestyle risk factor assessment, blood glucose/cholesterol monitoring, and concomitant CVD or equivalent disease assessment. These were essential aspects of this audit. Clear documentation on the type of stroke is important since the clinical management of ischaemic and haemorrhagic stroke differs with respect to antiplatelet therapy. The ICPC standard aims to facilitate simultaneous and longitudinal comparisons of clinical primary care practice within and across country borders; it is also used for administrative purposes,[13] which is therefore important both for

clinical registries and future research. Cardiovascular risk factor control is at the heart of current general practice incentives and our audit revealed significant improvements in the proper assessment of all known CVD risk factors in stroke patients. This simple intervention may have been effective in reducing CVD risk in patients with stroke, and in the long term may reduce the recurrence rate and other cardiovascular complications.

In phase 1, criterion 5 about BP assessment, criterion 9 about antiplatelet or anticoagulation therapy in ischaemic stroke and TIA patients, and criterion 10 on regular case view, were already satisfactorily achieved according to targeted standards. These data are very encouraging since they are essential for effective secondary prevention after stroke. The results of this audit reflect a high degree of vigilance of local doctors on BP control and monitoring and antiplatelet treatment. Notably, there were 16 patients with concomitant atrial fibrillation in phase 1 and 20 in phase 2. Among these, five cases were referred back to specialists for warfarin anticoagulation during the audit cycle and the remaining cases opted for continuation of aspirin therapy even after thorough counselling.

For criterion 11, the proportion of patients with BP controlled to target (73%) was much better in the second cycle, though the proportion achieving adequate control among diabetic patients (61%) was less prominent. The mean age of stroke patients in phase 2 study was 73 years. Thus, 'suboptimal' BP control perhaps reflects the widespread clinical uncertainty about lowering BP in geriatric patients with cerebrovascular disease, which manifests as comparatively high thresholds for starting treatment and modest targets for BP reductions. Previous studies have shown that many factors contribute to doctor reluctance to treat and control hypertension in older people. They include: fear of side-effects and lack of appreciation of the risks of untreated 'mild' hypertension in this age-group.[14] Another possible reason is awareness of white coat hypertension, the prevalence of which is estimated to range from 12 to 35%.[15]

Metabolic control was significantly improved in diabetic stroke patients, for which the data were similar to the key findings in the National Diabetes Audit on the quality of care for people with diabetes in England and Wales during 2006 and 2007.[16] In addition, the mean HbA_{1c} (for all the patients) was significantly decreased from 7.6 ± 0.9% in phase 1 to 7.0 ± 0.9% in phase 2. This significant improvement was due to team work and entailed detailed diabetic education from the nurses. It also involved close monitoring of the HbA_{1c} with appropriate optimisation of oral hypoglycaemic agents by the physicians. An important finding was that younger diabetic stroke patients attained better glycaemic control (Table 5); 91% of our diabetic patients under 59 years old had satisfactory metabolic control and their mean HbA_{1c} (6.5 ± 0.7%) was significantly lower than that in patients aged 80 years or over (7.0 ± 0.7%; P<0.05). This is partly because some physicians intend to have less stringent control of HbA_{1c} among the elderly who have a limited life expectancy, more extensive co-morbidities, and possibly a greater need to avoid hypoglycaemia.

TABLE 5. Glycaemic control of diabetic stroke patients in different age-groups in phase 2*

Age-group (years)	No. of patients	No. of patients with HbA_{1c} <7%	Mean HbA_{1c} (%)	P value (compared with ≥80 years)
≤59	11	10 (91%)	6.5 ± 0.7	0.018
60-69	17	12 (71%)	6.9 ± 0.9	0.17
70-79	39	21 (54%)	7.1 ± 0.9	0.95
≥80	19	10 (53%)	7.0 ± 0.7	-
All age-groups	86	53 (62%)	7.0 ± 0.9	-

* HbA_{1c} denotes glycated haemoglobin

For criterion 13, the proportion of patients properly counselled or referred for dietary advice was significantly improved in phase 2 (96%) as it was relatively easy to pursue. Whereas only 59% of patients with dyslipidaemia had 'optimal' lipid control with LDL concentrations <2.6 mmol/L in phase 2, which was a statistically significant improvement compared to phase 1 (37%; P<0.05), where the set standard of 70% was not reached. Statin prescribing for patients with hyperlipidaemia had to be self-financed in this clinic during the audit cycle. Since a large proportion of stroke patients followed up in our GOPCs were from lower-income groups, they may have opted not to purchase these drugs. Not surprisingly, only 39% of our dyslipidaemic stroke patients were taking the statins during the audit period. Encouragingly though, the mean LDL concentration was significantly reduced in phase 2 (Table 4). Hopefully the proportion of patients with optimal lipid control and the mean LDL concentrations may improve further with the wider availability of statins in GOPCs in the near future.

Regarding criterion 14, the proportion of patients with drug compliance and side-effects assessed in the phase 1 (57%) was far from satisfactory, but improved significantly in phase 2 (88%). Results from a Chinese study to determine the rate of compliance with secondary stroke prevention 1 year after ischaemic stroke showed that long-term compliance with secondary prevention in patients with ischaemic stroke was poor.[17] This study recommended that doctors provide stroke patients with detailed guidelines on the use of preventive drugs.[17] Among the reasons given for not adhering to drug treatment, fear of side-effects was important.

In addition, it is estimated that nearly one-fifth of patients who suffer a stroke develop cognitive problems and about 6 to 10% have dementia,[18] all of which pose difficulties in adhering to drug treatment. Indeed, in this audit 28 patients in phase 1 and 31 in phase 2 suffered from dementia. Therefore, comprehensive home care with drug compliance supervision and continuous monitoring for side-effects was particularly important in this group of patients .

There have been no randomised controlled trials looking at the impact of flu vaccination specifically in persons with a history of stroke or TIA. Nevertheless, observational studies suggest that in the elderly vaccination against influenza may protect against brain infarction[19] and might reduce the risk of hospitalisation, CVD, as well as death.[20] In this audit, the rate of annual influenza vaccine cover in phase 1 (79%) had already reached our target standard, and improved to 81% in phase 2, although this difference was not statistically significant. This criterion is relatively easy to attain due to the local government's free-of-charge influenza vaccination programme for elderly patients suffering from chronic diseases, including stroke or those living in residential care homes. In addition, patient vigilance about influenza infection has been significantly heightened after the severe acute respiratory syndrome outbreak and H1N1 influenza pandemics.[21] Satisfactory utilisation of influenza vaccine in stroke patients during annual epidemics might render them well prepared to combat seasonal influenza pandemics.

Limitations of this study

First, retrospective data collection from case notes in the CMS only revealed what was recorded and might not always document treatment actually received and therefore could be biased. Second, the recruited non-acute stroke patients were followed up at different time intervals, with different follow-up frequencies during the audit cycles, which might have affected performance indicators. Third, some cases were excluded because they were followed up in other clinics. Moreover, two patients in phase 1 were admitted to hospital due to recurrent stroke and seven were certified dead during the audit cycle, which should all be regarded as adverse outcomes. This clinical audit mainly focused on the process and some short-term outcome aspects of secondary preventive care of non-acute stroke patients. Long-term outcomes with respect to stroke recurrence or mortality rate were not compared. Subsequent studies focusing on the long-term outcome criteria may provide a better guide for the evaluation of the effectiveness of secondary prevention. Another limitation of this audit was that the 9-month intervention phase might not be long enough for some of our criteria to achieve the necessary targeted standard, although marked improvements were shown.

Conclusion

Stroke is a major cause of mortality and morbidity both worldwide and locally. Effective secondary preventive care to control for CVD risk factors such as hypertension, hyperlipidaemia, diabetes, tobacco usage, and the use of antiplatelet therapy in ischaemic stroke patients have all been shown to reduce the risk of recurrent strokes and other vascular outcomes. This clinical audit provided valuable evidence to enable understanding of the common problems encountered in secondary preventive care of stroke patients in the primary care settings. Through the process of clinical audit with a structured approach, we managed to promote quality assurance and a definite impact on patient care. The morbidity and mortality of stroke and its recurrence could well be reduced provided that the processes described and outcome performance we achieved can be consistently met. Future studies focusing more on the long-term outcomes may provide a better guide for evaluating the effectiveness of secondary preventive care for stroke patients in community out-patient settings.

Appendix

Additional material related to this article can be found on the HKMJ website. Please go to <http://www.hkmj.org>, search for the appropriate article, and click on Full Article in PDF following the title.

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APPENDIX. Data collection form

Clinical audit on secondary prevention of non-acute stroke patients in the primary care

Stroke Record Chart

Patient's Gum label

Date:

	The "must do" criteria	**Standard**
1.	Stroke registry	Y/N
2.	Category of stroke documented	Y/N
	Ischaemic stroke or haemorrhagic stroke	Ischaemic / haemorrhagic
3.	Correct ICPC coding	Y/N
4.	CVD lifestyle risk factors assessment and appropriate advice given	
	Smoking habit	Y/N
		Smoker/ex-smoker/non-smoker
	Alcohol intake status	Y/N
		Excessive drinker/social drinker/non-drinker/ex-drinker
	BMI (kg/m^2)	Y/N
		Normal (18.6-22.9)/overweight (23.0-24.9)/obese (≥25)
	Physical activity status	Y/N
		No/occasional/regular
5.	BP assessment done in the preceding 6 months	Y/N
		Normal/HT
6.	Annual fasting blood glucose checked	Y/N
		Normal/IGT/DM
7.	Annual fasting blood lipids checked	Y/N
		Normal/lipid disorder
8.	Concomitant other CVD or CVD equivalents assessed	Y/N
9.	Antiplatelet or anticoagulant therapy if ischaemic stroke or TIA	Y/N
10.	Regularly reviewed at intervals not exceeding 6 months	Y/N
11.	HT well controlled?	Y/N
12.	Diabetes well controlled?	Y/N
13.	Advised or referred to dietician for dietary advice if dyslipidaemia or start lipid-lowering medication if still with poor lipid control	Y/N
The "should do" criteria		
14.	Compliance and side-effects of drugs assessed	Y/N
15.	Immunisation against influenza given in the previous season	Y/N