Knowledge Regarding Basic Facts of Stroke Among Final Year MBBS Students and House Officers: A Cross-Sectional Survey of 708 Respondents from Pakistan

Mohammad U. Khubaib, Farooq A. Rathore, Ahmed Waqas, Mohsin M. Jan, Sana Sohail

1. Department of Rehabilitation Medicine, CMH Lahore Medical College and Institute of Dentistry  
2. Department of Rehabilitation Medicine, PNS Shifa Hospital, DHA II, Karachi 75500, Pakistan, Karachi, Select Country  
3. Psychiatry, Combined Military Hospital Lahore Medical College and Dental College, Lahore, PAK  
4. Medical Officer, Mayo Hospital Lahore, Lahore, PAK

Corresponding author: Farooq A. Rathore, farooqrathore@gmail.com
Disclosures can be found in Additional Information at the end of the article

Abstract

Introduction:

Stroke is the leading cause of neurological disability in the world. In Pakistan, house officers (HOs) are usually the first contact for a stroke patient in the emergency department. Sometimes they need to make quick decisions regarding diagnosis and management without specialist supervision. Thousands of current final year MBBS (Bachelor of Medicine, Bachelor of Surgery) students will be performing the duties of HOs soon. This study documents the knowledge and confidence levels of final year students and HOs in Pakistan regarding basic facts related to initial diagnosis and management of stroke.

Materials and Methods:

A questionnaire was developed using two standard textbooks of medicine and current stroke guidelines of the American Heart Association. The pre-tested self-administered questionnaire was distributed among 800 final year MBBS students and HOs in 14 medical colleges and hospitals in four different cities. The response rate was 88.5%. Data analysis was done using SPSS V.21. The CMH Lahore Medical College Ethics Review Committee approved this project.

Results:

Respondents included medical students (n=496) and HOs (N= 212); most were female (n = 452, 63.9%). Of these, 31.4% had managed or assisted in the management of a patient with a stroke and had a higher confidence level in its diagnosis (p< 0.001) and management (p <0.001). Having a family member with stroke was associated with higher confidence in the diagnosis of stroke (p < 0.05) but not with confidence in its management (p = 0.41). Most correctly defined stroke (60.6%), identified the CT scan as the initial diagnostic modality (88.1%), knew the dosage of aspirin (64.9%), knew the time limit for thrombolysis (67.4%), and were familiar with the risk of deep vein thrombosis in immobilized stroke patients (85.4%). Less than half (44.5%) chose tissue plasminogen activator (t-PA) as the preferred initial intervention for acute ischemic stroke.
Conclusion:

This multicenter survey shows that the knowledge and confidence of medical students and HOs in Pakistan regarding initial diagnosis and management of stroke are inadequate in most domains. There is a need to improve the medical training for stroke in emergency departments for optimal outcomes. Public education campaigns about stroke should be conducted to increase the general awareness of the population about the prevention, signs, symptoms, and emergency steps to be taken when encountering a case of stroke.

Categories: Neurology, Physical Medicine & Rehabilitation, Public Health
Keywords: cerebrovascular accident, stroke, knowledge, undergraduate, assessment, thrombolysis, pakistan, interns, survey, hemiplegia

Introduction

Stroke is a cerebral deficit due to vascular blockage (ischemic stroke) or leakage (hemorrhagic stroke) lasting more than 24 hours [1]. It is the second leading global cause of mortality, causing an estimated 6.7 million deaths worldwide in 2012 [2]. Most deaths from stroke are in the low and middle-income countries. Considering its huge burden on health, it follows that the level of knowledge about stroke and its initial diagnosis and management, both in the general population and physicians, should proportionately match its prevalence.

Stroke is an emergency condition, and presentation of a case in the emergency department does not wait for regular physician practice hours. In the current health care system of Pakistan, the first physicians to attend these patients are usually the HOs, who are interns having graduated from medical college in the past year. They are sometimes on call for 24-32 hours at a time. Currently, there are 96 accredited medical schools in Pakistan with thousands of medical students ready to begin their careers as HOs in less than a year [3]. These students will be attending many stroke cases in emergency departments all around Pakistan.

Early diagnosis and management are important in treating a stroke case. The effectiveness of thrombolytic therapy in ischemic stroke is time-dependent (most effective within 4.5 hours since onset) [4]. Therefore, it is essential that HOs be trained and be confident in their knowledge about the immediate diagnosis and management of stroke so that the initial “golden hour” is not wasted.

The aim of this study was to document the knowledge and confidence levels of final year medical students and HOs in Pakistan regarding basic facts about the initial diagnosis and management of stroke.

Materials And Methods

Study approval was obtained from the Combined Military Hospital (CMH) Lahore Medical College Ethics Review Committee. A cross-sectional survey design was used. The data collection form had three parts. The first part was the informed consent form, which described the details of the research project, its possible impact, and assurance of anonymity of the data. The second part had demographic details, including the institutional affiliation, age, gender, and work experience of the HOs. In addition, it had questions related to the level of confidence in the diagnosis and management of a case with stroke and whether the respondent had a family member with stroke. The third part consisted of fifteen questions addressing diagnosis, investigations, management, pharmacotherapy, and complications of a stroke.
The questions were prepared in the single best choice multiple choice question (MCQ) format. The main stem was followed by four possible choices and respondents had to choose the most appropriate answer. Neurology chapters of two standard textbooks of medicine widely used by the undergraduate medical students in Pakistan were consulted for the construction of these questions. These included Davidson’s Principles and Practice of Medicine, 22nd Edition, and Kumar and Clark’s Clinical Medicine, 8th Edition [5-6]. In addition, the American Heart Association/American Stroke Association Guidelines for the Early Management of Patients with Acute Ischemic Stroke publication was also consulted [4]. Two professors of neurology working in two different medical schools independently reviewed the MCQs as subject experts for content validity. The questionnaire was constructed as a test based on the best choice question format with only one correct answer and three wrong answers, rather than a Likert scale type questionnaire. Therefore, an exploratory factor analysis was not performed.

The questionnaire was pilot tested on 15 HOs of CMH Lahore. From this pilot, the survey time was estimated to be about 10 minutes. Questions were well understood and only minor changes in clarity and language were needed for the final survey. The final questionnaire was administered to 850 final year medical students and HOs in 13 different colleges and medical institutes in Lahore, Rawalpindi, Islamabad, and Quetta. The lead author, co-authors, or a representative who was briefed in advance collected the data. The response rate was 88.9%. Forty-eight forms were discarded (incomplete or multiple entries) and the data from 708 forms was entered.

Data were analyzed in SPSS V 21 (IBM, Chicago, Illinois). Frequencies and percentages were calculated for categorical variables, including demographics of respondents and responses to questions related to stroke. Mean (minimum-maximum) scores were calculated for answers on the questionnaire assessing knowledge related to stroke. Correct answers were coded as 1 and incorrect answers as 0.

Knowledge item analysis was conducted to determine the difficulty level of the stroke knowledge questionnaire. It was determined by following parameters: a) Item difficulty, b) discrimination coefficients, c) distracter analysis, and d) readability analysis as assessed by the Flesch reading ease rating and the Flesch-Kincaid grade.

Pearson Chi-Square was used to analyze associations between having a family member with a stroke and participants’ confidence in the diagnosis and management of a stroke. Similar associations were analyzed for having managed a case of stroke and its association with participants’ confidence in the diagnosis and management of a stroke. Statistical differences on mean scores obtained on the knowledge of stroke questionnaire were tested between the final year medical students and HOs as well as past experiences with management of a stroke and having a family member with a stroke. These associations were tested by running the t-test for independent samples.

The item difficulty index (P) was calculated by the formula P = R/T, where R is the number of correct responses and T is the total number of responses. Increasing scores on the item difficulty index correspond with the low difficulty level of the item. For the stroke questionnaire employed in this study, items with four alternative items should have an optimum difficulty level of 0.625. For the present study, values of (P) between 0.20 and 0.90 are considered acceptable; however, items scoring < .20 can be added as easy "warm-up" questions and those scoring > .90 might be necessary to distinguish between average and top performers.

The point-biserial correlation was used to analyze the strength of association between each item and overall scores on the stroke knowledge questionnaire. The point-biserial correlation coefficient ranges from −1.00 to 1.00. Greater values correspond with a higher discriminating
power of the item. A coefficient value of 0.20 or higher was considered acceptable in this study [7]. The percentage of participants selecting particular distracters (incorrect choices) was analyzed for each item in detail. Finally, suggestions were provided to improve the questionnaire, keeping the difficulty levels and discrimination coefficients in context.

Results

There were 708 valid forms from 496 (70.1%) final year medical students and 212 (29.9%) HOs. There were 256 (36.1%) males and 452 (63.9%) females. Approximately a quarter of the students and HOs had a family member with stroke (144, 20.3%), and 222 (31.4%) students and HOs had managed or assisted in the management of stroke cases.

Having a family member with a stroke was associated with a significantly higher confidence in the diagnosis of stroke (Chi-square = 7.83, p = 0.02) but not with confidence in its management (Chi-square = 1.7, p = 0.41). Students or HOs who had assisted in the management of stroke cases had a higher confidence level in its diagnosis (Chi-square = 69.25, p < 0.001) and management (Chi-square = 71.88, p < 0.001). These results are displayed in Table 1.

| Variables                              | Confidence in Diagnosis of Stroke | Confidence in Management of Stroke |
|----------------------------------------|-----------------------------------|-----------------------------------|
|                                       | Very confident | Somewhat confident | Not confident | Very confident | Somewhat confident | Not confident |
| Family member with stroke              |                    |                    |               |                    |                    |               |
| Yes                                    | 33 (23.4%)        | 94 (66.7%)         | 14 (9.9%)     | 22 (15.6%)        | 59 (41.8%)         | 60 (42.6%)    |
| No                                     | 119 (23.3%)       | 291 (56.9%)        | 101 (19.8%)   | 56 (11.4%)        | 215 (43.8%)        | 220 (44.8%)   |
| Assisted in management of a case of stroke |                    |                    |               |                    |                    |               |
| Yes                                    | 82 (37.4%)        | 131 (59.8%)        | 6 (2.7%)      | 39 (18.1%)        | 132 (61.4%)        | 44 (20.5%)    |
| No                                     | 72 (16.1%)        | 264 (59.2%)        | 110 (24.7%)   | 41 (9.5%)         | 150 (34.9%)        | 239 (55.6%)   |

TABLE 1: Correlates of Confidence in the Diagnosis and Management of Stroke

*Missing values = 43-76 participants did not respond to these questions.

Of the participants, 60.6% knew the definition of stroke, 88.1% knew the best initial test for it, but only 25.9% knew the most accurate stroke investigations. The best initial therapy for ischemic stroke was known to just 44.5% and only 58.1% knew the first step in the management of hemorrhagic stroke. However 75.7% knew that oral aspirin should be administered within 24-48 hours of ischemic stroke. A mere 31.5% were aware of when to prescribe statins in a patient with ischemic stroke. A larger percentage knew that thrombolysis in ischemic stroke is most effective within four hours (67.4%) and that, in a patient presenting with ischemic stroke already taking aspirin, clopidogrel should be added to the prescription (60.6%). Most of the respondents knew that lowering and maintaining the blood pressure lowers the risk of stroke recurrence (70.3%), that hemorrhagic stroke is an absolute contraindication to thrombolytic
therapy (70.6%), and that deep venous thrombosis (DVT) has to be monitored in an immobilized patient (85.4%). The detailed results are shown in Table 2.

| Question                                                                 | A       | B       | C       | D       |
|--------------------------------------------------------------------------|---------|---------|---------|---------|
| **A stroke is a focal deficit of brain function, most commonly hemiplegia, with or without signs of focal higher cerebral dysfunction, lasting:** | 149 (21.3%) | 96 (13.7%) | 425* (60.6%) | 31 (4.4%) |
| **The first investigation of choice in a patient suspected of having acute stroke is?** | 622* (88.1%) | 63 (8.9%) | 14 (2.0%) | 7 (1.0%) |
| **The initial diagnostic test of choice in a case of stroke helps in:** | 608* (86.2%) | 15 (2.1%) | 39 (5.5%) | 43 (6.1%) |
| **The most accurate diagnostic test for detecting ischemic stroke?** | 88 (12.6%) | 181* (25.9%) | 315 (45.0%) | 116 (16.6%) |
| **The best initial therapy for a non-hemorrhagic stroke patient presenting within 4.5 hrs from the start of symptoms is:** | 247 (35.0%) | 112 (15.9%) | 32 (4.5%) | 314* (44.5%) |
| **The first step of management in a patient of hemorrhagic stroke should include which of the following?** | 409* (58.1%) | 33 (4.7%) | 125 (17.8%) | 137 (19.5%) |
| **Which of the following oral medicines should be administered within 24-48 hours of the onset of stroke?** | 125 (17.8%) | 23 (3.3%) | 532* (75.7%) | 23 (3.3%) |
| **What is the dose of aspirin to be given in ischemic stroke?** | 95 (13.5%) | 98 (13.9%) | 457* (64.9%) | 54 (7.7%) |
| **Statins should be prescribed to a patient with a stroke if the serum total cholesterol is:** | 85 (12.2%) | 219* (31.5%) | 181 (26.0%) | 211 (30.3%) |
| **Thrombolysis in an ischemic stroke is the most effective when administered:** | 471* (67.4%) | 60 (8.6%) | 149 (21.3%) | 19 (2.7%) |
| **A 40-year-old patient presenting with an acute stroke is taking aspirin. What medicine should be added to his/her prescription?** | 185 (26.4%) | 33 (4.7%) | 58 (8.3%) | 425* (60.6%) |
| **The risk of stroke recurrence can be significantly reduced by:** | 17 (2.4%) | 136 (19.4%) | 55 (7.8%) | 493* (70.3%) |
| **Which of the following is an absolute contraindication to thrombolytic therapy?** | 496* (70.6%) | 116 (16.5%) | 28 (4.0%) | 63 (9.0%) |
| **Development of what serious condition would you be concerned about the most in patients immobilized due to acute stroke?** | 36 (5.1%) | 49 (7.0%) | 17 (2.4%) | 599* (85.4%) |
| **The most important contraindication to anticoagulation is:** | 53 (7.6%) | 496* (71.1%) | 60 (8.6%) | 89 (12.8%) |

**TABLE 2: Item-wise Response Distribution on Stroke Knowledge Test**

*Correct answer
†2-12 participants did not respond to these questions.

Mean score ± standard deviation (min-max) obtained on the stroke scale was 9.56 ± 2.7 (1-15). According to the t-test for independent samples, HOs scored higher on the stroke questionnaire as compared to final year medical students (t = 9.63, p < .001). Those participants who had previously managed a case of stroke scored higher on the stroke questionnaire as compared to their counterparts (t = 3.43, p < 0.005). However, having a family member with stroke did not yield any significant association with the mean scores on the stroke questionnaire (p = .968).

The Flesch reading ease rating for the knowledge test was 54.6 and the Flesch-Kincaid grade was 7.9, indicating that the items should be understandable to students of 13-15 years of age [8].

Compared to medical students, a higher percentage of HOs answered correctly on most of the items. There was no significant difference in the proportion of HOs and medical students answering correctly on Items 7, 8, 9, and 10. The percentage of missing responses ranged from 0.3 % - 1.4% which was not significantly problematic. Detailed results have been given in Table 3.

| Questions | Participant Status | Final-year Students | House Officers | P-value | Missing Responses |
|-----------|--------------------|---------------------|----------------|---------|-------------------|
|           |                    | Frequency (n)        | Percentage (%) | Frequency (n) | Percentage (%) |
| Question 1| Incorrect           | 211                 | 42.5%          | 72       | 34.0%            | .033 | 7 (1%)          |
|           | Correct            | 285                 | 57.5%          | 140      | 66.0%            |
| Question 2| Incorrect           | 80                  | 16.1%          | 6        | 2.8%             | < .001 | 2 (.3%)        |
|           | Correct            | 416                 | 83.9%          | 206      | 97.2%            |
| Question 3| Incorrect           | 91                  | 18.3%          | 9        | 4.2%             | < .001 | 3 (.4%)        |
|           | Correct            | 405                 | 81.7%          | 203      | 95.8%            |
| Question 4| Incorrect           | 380                 | 76.6%          | 147      | 69.3%            | .042 | 8 (1.1%)       |
|           | Correct            | 116                 | 23.4%          | 65       | 30.7%            |
| Question 5| Incorrect           | 292                 | 58.9%          | 102      | 48.1%            | .008 | 3 (.4%)        |
|           | Correct            | 204                 | 41.1%          | 110      | 51.9%            |
| Question 6| Incorrect           | 235                 | 47.4%          | 64       | 30.2%            | < .001 | 4 (.6%)        |
|           | Correct            | 261                 | 52.6%          | 148      | 69.8%            |
| Question 7| Incorrect           | 130                 | 26.2%          | 46       | 21.7%            | .203 | 5 (.7%)        |
|           | Correct            | 366                 | 73.8%          | 166      | 78.3%            |
As detailed in Table 4, all of the items had difficulty levels (P) and discrimination coefficient values in acceptable ranges, except item 9, which had an optimum difficulty index but a non-significant discriminatory coefficient. It yielded only 219 (30.9%) correct answers and the distracter analysis revealed that stem D with 30.3% responses followed with stem C having 26% responses.
| Question                                                                 | Correct Answer | Distracter A | Distracter B | Distracter C | Distracter D |
|-------------------------------------------------------------------------|----------------|--------------|--------------|--------------|--------------|
| in a patient suspected of having an acute stroke is?                     | .88            | .33‡         |              |              |              |
| 3: The initial diagnostic test of choice in a case of stroke helps in:   | .86            | .44‡         |              |              |              |
| 4: The most accurate diagnostic test for detecting ischemic stroke?      | .26            | .24‡         | Distracter C “Contrast Computed Tomography (CT) scan of head” was selected by 44.5% |
| 5: The best initial therapy for a non-hemorrhagic stroke patient presenting within 4.5 hrs from start of symptoms is: | .44            | .45‡         | Distractor A “Aspirin” selected by 34.9% |
| 6: The first step of management in a patient with hemorrhagic stroke should include which of the following? | .58            | .50‡         |              |              |              |
| 7: Which of the following oral medicines should be administered within 24-48 hours of onset of stroke? | .75            | .29‡         |              |              |              |
| 8: What is the dose of aspirin to be given in ischemic stroke?           | .65            | .40‡         |              |              |              |
| 9: Statins should be prescribed to a patient with stroke if the serum total cholesterol is: | .31            | .02*         |              |              |              |
| 10: Thrombolysis in Ischemic stroke is most effective when administered: | .67            | .48‡         | Distracter C “Within 12 hrs of onset of symptoms” by 21% |
| 11: A 40-year-old patient presenting with acute stroke is taking aspirin. What medicine should be added to his prescription? | .60            | .54‡         | Distracter A “Streptokinase” by 26% |
| 12: The risk of stroke recurrence can be significantly reduced by:        | .70            | .38‡         | Distracter B “Regular Exercise” by 19.2%. Are students confusing it as an intervention to decrease BP? Reword to “The risk of stroke recurrence can be BEST reduced by” |
| 13: Which of the following is an absolute contraindication to thrombolytic therapy? | .70            | .55‡         |              |              |              |
| 14: Development of what serious condition would you be concerned about the most in patients immobilized due to acute stroke? | .85            | .48‡         |              |              |              |
15: The most important contraindication to anticoagulation is:

|   | .70 | .58‡ |

TABLE 4: Item-wise Difficulty Level of Stroke Knowledge Test

*p = > 0.05

‡p < 0.001

The complete questionnaire with the answer key is displayed in Table 5

| Question | Stem A | Stem B | Stem C | Stem D | Correct Answer |
|----------|--------|--------|--------|--------|----------------|
| 1) A stroke is a focal deficit of brain function, most commonly hemiplegia, with or without signs of focal higher cerebral dysfunction, lasting: | More than 12 hrs | Less than 12 hrs | More than 24 hrs | Less than 24 hrs | C |
| 2) The first Investigation of choice in a patient suspected of having an acute stroke is? | Computed tomography (CT) scan | Magnetic resonance imaging (MRI) | X-ray head | Lumbar puncture (LP) | A |
| 3) The initial diagnostic test of choice in a case of stroke helps in: | Distinguishing between haemorrhagic and ischaemic stroke | Identification of post-stroke depression | Localizing the aneurysm | Preventing further haemorrhage. | A |
| 4) The most accurate diagnostic test for detecting ischemic stroke? | Non-diffusion weighted magnetic resonance imaging (MRI) | Diffusion-weighted magnetic resonance imaging (MRI) | Contrast computed tomography (CT) scan of head | Non-contrast computed tomography (CT) scan of head | B |
| 5) The best initial therapy for a non-hemorrhagic stroke patient presenting within 4.5hrs from start of symptoms is: | Aspirin | Heparin | Warfarin | Tissue plasminogen activator (tPA) | D |
| 6) The first step of management in a patient with haemorrhagic stroke should include which of the following? | Lower blood pressure (BP) | Give statins | Give intravenous fluids | Give intravenous 5000 Units of heparin | A |
medicines should be administered within 24-48 hours of the onset of stroke?

8) What is the dose of aspirin to be given in ischaemic stroke?

- Prednisone
- Gabapentin
- Aspirin
- Fluoxetine

| Dose | Prednisone | Gabapentin | Aspirin | Fluoxetine |
|------|------------|------------|---------|------------|
| 75 mg daily | 300 mg stat only | 300 mg stat & 75 mg daily | 300 mg stat & 300 mg daily. |

9) Statins should be prescribed to a patient with stroke if the serum total cholesterol is

- More than 2.5 mmol/L (100 mg/dL)
- More than 3.5 mmol/L (135 mg/dL)
- More than 4 mmol/L (155 mg/dL)
- More than 5 mmol/L. (195 mg/dL)

| Cholesterol Level | Prednisone | Gabapentin | Aspirin | Fluoxetine |
|-------------------|------------|------------|---------|------------|
| More than 2.5 mmol/L | 300 mg stat only | 300 mg stat only & 75 mg daily | 300 mg stat only & 300 mg daily. |

10) Thrombolysis in ischaemic stroke is most effective when administered

- Within 4.5 hrs after onset of symptoms
- After 4.5 hrs of onset of symptoms
- Within 12 hrs of onset of symptoms
- After 12 hrs of onset of symptoms

| Time | Prednisone | Gabapentin | Aspirin | Fluoxetine |
|------|------------|------------|---------|------------|
| Within 4.5 hrs after onset of symptoms | 300 mg stat only | 300 mg stat only & 75 mg daily | 300 mg stat only & 300 mg daily. |

11) A 40-year-old patient presenting with acute stroke is taking aspirin. What medicine should be added to his/her prescription?

- Streptokinase
- Vit B-12
- Propranolol
- Clopidogrel

12) The risk of stroke recurrence can be significantly reduced by:

- Good sleep
- Regular exercise
- Subcutaneous heparin
- Reduction and maintenance of blood pressure

13) Which of the following is an absolute contraindication to thrombolytic therapy?

- Intracerebral haemorrhage (ICH)
- Pregnancy
- Age > 50 years
- Major surgery within the last 1 year.

14) The development of what serious condition would you be concerned about the most in patients immobilized due to acute stroke?

- Depression
- Dementia
- Urinary tract infection
- Deep vein thrombosis (DVT)

15) The most important contraindication to anticoagulation is:

- Epilepsy
- Haemorrhagic stroke
- Deep vein thrombosis (DVT)
- Pregnancy

| Condition | Prednisone | Gabapentin | Aspirin | Fluoxetine |
|-----------|------------|------------|---------|------------|
| Epilepsy | 300 mg stat only | 300 mg stat only & 75 mg daily | 300 mg stat only & 300 mg daily. |

**TABLE 5: Complete Questionnaire for HOs**

**Discussion**

In our sample of 708 respondents from 13 different medical colleges in Pakistan, only 51.4% of the participants had ever managed or assisted in the management of a stroke patient. However, those who had been involved in stroke management were more confident in both diagnosis and management. More than half (55.5%) were not aware of the recommended initial therapy for ischemic stroke and 41.9% were unaware of the initial steps involved in the management of hemorrhagic stroke. Most participants (68.5%) were also unaware about when to start a patient of ischemic stroke on statins. However, the majority had knowledge about the use of aspirin (75.7%), timely thrombolysis (67.4%), maintaining blood pressure for preventing recurrences (70.3%), and the risk of DVT in immobilized patients (85.4%). HOs reported better knowledge related to stroke than final year students. Having managed a case of stroke was associated with better knowledge of stroke. However, having a family member with stroke did not yield any
significant difference.

A previous survey performed on family physicians in Pakistan to assess knowledge about stroke care yielded deficiencies similar to our study. Noticeably, less than half correctly identified all five symptoms of stroke (46%) and prescribed statins for secondary stroke prevention (44%), and only two-thirds adequately treated hypertension [9]. It is not surprising, therefore, that more than 35% of strokes and more than 50% of transient ischemic attacks (TIAs) in Pakistan are misdiagnosed [10]. This might lead to inadequate or even harmful treatment, poor patient outcomes, and decreased patient satisfaction.

Surveys from all around the globe have revealed that the generic knowledge about stroke in the general population is generally inadequate in both the developed [11-13] and developing countries [14-16]. In a survey carried out in six Gulf countries, the majority of patients were not even aware of the term ‘stroke’ [14]. A survey carried out in Pakistani high schools in a single district showed that most of the respondents were unaware of stroke risk factors, symptoms, and did not know what to do in case of an acute stroke [17]. There is a need for a regular and massive public education campaign to improve awareness and, therefore, early intervention in stroke.

Current data about the countrywide prevalence of stroke in Pakistan is not available, but according to an estimate of a subpopulation, 4.8% of its population might have a stroke annually [18]. This is equivalent to approximately 8.7 million stroke patients in Pakistan. Of those affected by a stroke, 63% develop complications, 89% become dependent, and in Pakistan, unfortunately, 7-20% die [10]. It also adds a huge burden on the healthcare system, families, and the economy. Given the fact that early diagnosis and timely intervention cannot only prevent death, but also avoid debilitation and complications, adequate treatment of stroke becomes very significant in a society where whole families often rely on a single person for their sustenance.

Medical education in Pakistan presents a wide spectrum of undergraduate and postgraduate training and is not standardized across the country. At one end are the public medical colleges, which provide a variety and a huge number of cases in all disciplines of medicine and surgery for training and exposure, but might lack adequate facilities, resources, or the workforce to deal with them and utilize their educative potential properly. On the other end are private medical institutes, which might have state-of-the-art facilities and dedicated faculty willing to teach students, but usually lack the variety of clinical cases due to high treatment costs and the prevalence of poverty in the general population.

Therefore, it is necessary that medical personnel in general and HOs, in particular, be trained in a standardized manner, through focused lectures, bedside teaching sessions, and interactive workshops, in the management of prevalent and potentially disabling neurological emergencies, such as stroke, meningitis, acute paraplegia or hemiplegia, etc. It is also important to target neurological topics to better prepare and help the medical workforce in assisting their future and current patients, respectively. Public education campaigns to raise awareness about prevention, initial symptoms, and emergency measures in the case of a stroke should be held. The Pakistan Medical and Dental Council (PMDC), the College of Physicians and Surgeons of Pakistan (CPSP), and the Higher Education Commission (HEC), in collaboration with national societies (Pakistan Society of Neurology, Pakistan Society of Physical Medicine and Rehabilitation, and Pakistan Stroke Society), should devise a national policy on stroke, targeting the physicians and the public. It should focus on teaching the undergraduate medical students the basic facts in recognizing a stroke and training the HOs, postgraduate residents, and general physicians in the correct diagnosis and emergency management of acute stroke. In addition, there is a need to conduct a countrywide
epidemiological survey on stroke. There is also an urgent need to establish departments of neurology and rehabilitation medicine at all major public hospitals and medical schools. While the neurologist ensures timely diagnosis and management of acute stroke, the rehabilitation physician coordinates the post-stroke rehabilitation and smooth transition back to everyday life.

There are certain limitations of this study worth mentioning. Although this was a large sample size from 13 different medical colleges and hospitals, it still represents a fraction of the estimated 25,000 medical students in 97 medical colleges across the country. In addition, we did not correlate the confidence levels and knowledge about the basic facts of stroke with the work experience of HOs. Moreover, departments of neurology are not established in each medical college and might be a contributory factor towards inadequate knowledge in certain domains of stroke diagnosis and management.

Although this study was conducted in Pakistan, it is likely that similar problems and gaps in stroke care exist in most of the countries in the developing world. We propose similar or more extensive surveys targeting medical students, internees, residents, and physicians in other developing countries. This would help to highlight the deficits and recommend solutions to improve the quality of stroke care and reduce the global burden of this preventable disease.

Conclusions

Considering the worldwide prevalence, morbidity, and mortality of stroke and the fact that the current final year medical students and HOs will ultimately face the challenge of managing stroke cases eventually, it is evident from this study that both of these groups are not equipped with some essential, life-saving information. The results also suggest that some areas, such as initial therapeutic measures, require more attention than the others in order to save lives and prevent complications. It is important that all aspects of stroke management in general and some, in particular, be targeted to make sure that every physician is well-versed with at least the basic steps to take when facing a case of stroke. On a wider scale, public education campaigns about stroke should be conducted to increase the general awareness of the population about the prevention, signs, symptoms, and emergency steps to be taken when encountering a case of stroke.

Additional Information

Disclosures

Human subjects: Consent was obtained by all participants in this study. CMH Lahore Medical College Ethics Review Committee issued approval NA. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors declare that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

The authors would like to thank the following for their contributions and help in conducting this survey: Muhammad Wasay, MBBS, FRCPath, Professor, Section of Neurology, Department of Medicine, Aga Khan University, Karachi, and Arsalan Ahmad, MBBS, MD, Consultant Neurologist, Shifa International Hospital, Islamabad, Pakistan for review of the questionnaire.
The following are acknowledged for their support in collecting data from their respective hospitals and medical colleges: Maimoona Siddiqui, MBBD, FCPS, Consultant Neurologist, Shifa International Hospital, Islamabad, Pakistan; Muhammad Saleem Bareech, MBBS, FCPS, Assistant Professor, Department of Neurology, Bolan Medical University, Quetta, Pakistan; Usman Zafar, MBBS, FCPS, Assistant Professor, Department of Medicine, Islamabad Medical and Dental College, Islamabad; and Dr. Fareeha Farooq, Assistant Professor, Department of Biochemistry, Fatima Memorial Hospital Medical College, Lahore. The following are acknowledged for critical review of the manuscript: Dr. Fary Khan, Director of Rehabilitation, Royal Melbourne Hospital, Clinical Professor, Department of Medicine, The University of Melbourne, Adjunct Professor, Disability Inclusive Unit, Nossal Institute of Global Health, and School of Public Health and Preventative Medicine, Monash University; and Andrew J. Haig, M.D., Vice President for Accountable Care and Medical Informatics, Mary Free Bed Rehabilitation Hospital, Professor Emeritus (Active), The University of Michigan

References

1. Aho K, Harmsen P, Hatano S, Marquardsen J, Smirnov VE, Strasser T: Cerebrovascular disease in the community: results of a WHO collaborative study. Bull World Health Organ. 1980, 58:113–30.
2. World Health Organization. The top 10 causes of death. Fact Sheet No 310 . (2016). Accessed: February 16, 2016: http://www.who.int/mediacentre/factsheets/fs310/en/.
3. Pakistan Medical and Dental Council. List of Recognised medical and dental institutions/ Colleges / DAI’s . (2016). Accessed: February 16, 2016: http://www.pmdc.org.pk/AboutUs/RecognizedMedicalDentalColleges/tabid/109/Default.aspx.
4. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, D’emmerschak BM, Khatri P, McMullan PW Jr, Qureshi AI, Rosenfield K, Scott PA, Summers DR, Wang DZ, Wintermark M, Yonas H; American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology: Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013, 44:870–947. 10.1161/STR.0b013e318284056a
5. Leach JP, Davenport RJ: Neurological disease. Davidson’s Principles and Practice of Medicine. 22nd edition. Walker BR, Colledge NR, Ralston SH, Penman ID (ed): Churchill Livingstone, Edinburgh; 2014. 1137-230.
6. Jaman P: Neurological disease. Kumar and Clark’s Clinical Medicine, 8th Edition. Kumar P, Clark M (ed): Elsevier, Edinburgh; 2012. 1067-155.
7. Oermann MH, Gaberson KB: Evaluating and Testing in Nursing Education, 3rd Edition . Oermann MH, Gaberson KB (ed): Springer Publishing Company, New York; 2009.
8. Flesch R: A new readability yardstick. J Appl Psychol. 1948, 32:221–33. 10.1037/h0057552
9. Wasay M, Khealani B, Yousuf A, Azam I, Rathi SL, Malik A, Haq A: Knowledge gaps in stroke care: results of a survey of family physicians in Pakistan. J Stroke Cerebrovasc Dis. 2011, 20:282–86. 10.1016/j.jstrokecerebrovasdis.2010.01.010
10. Malik A, Khatri I, Wasay M: Stroke manifesto- What must be done for stroke care in Pakistan. Pak J Neurol Sci. 2015, 10:1–3.
11. Spark JI, Blest N, Sandison S, Puckridge PJ, Saleem HA, Russell DA: Stroke and transient ischaemic attack awareness. Med J Aust. 2011, 195:16–19.
12. Nedeltchev K, Fischer U, Arnold M, Kappeler L, Mattle HP: Low awareness of transient ischemic attacks and risk factors of stroke in a Swiss urban community. J Neurol. 2007, 254:179–84.
13. Johnston SC, Fayad PB, Gorelick PB, Hanley DF, Shwayder P, van Hunen D, Weiskopf T: Prevalence and knowledge of transient ischemic attack among US adults . Neurology. 2005, 60:1429-54. 10.1212/01.WNL.0000063309.41867.0F
14. Kamran S, Bener AB, Deleu D, Khoja W, Jumma M, Al Shubali A, Inshashi J, Sharouqi I, Al Khabouri J: The level of awareness of stroke risk factors and symptoms in the Gulf Cooperation Council countries: Gulf Cooperation Council stroke awareness study. Neuroepidemiology. 2007, 29:235–42. 10.1159/000112856
15. Góngora-Rivera F, Gutiérrez-Jiménez E, Zenteno MA; GEPEVC Investigators: Knowledge of
ischemic stroke among a Mexico City population. J Stroke Cerebrovasc Dis. 2009, 18:208-13. 10.1016/j.jstrokecerebrovasdis.2009.10.002

16. Falavigna A1, Teles AR, Vedana VM, Kleber FD, Mosena G, Velho MC, Mazzocchin T, Silva RC, Lucena LF, Santin JT, Roth F: Awareness of stroke risk factors and warning signs in southern Brazil. Arq Neuropsiquiatr. 2009, 67:1076-81.

17. Farooq MU, Bhatt A, Safdar A, Kassab MY, Majid A: Stroke symptoms and risk factor awareness in high school children in Pakistan. Int J Stroke. 2012, 7:E15. 10.1111/j.1747-4949.2012.00899.x

18. Jafar TH: Blood pressure, diabetes, and increased dietary salt associated with stroke--results from a community-based study in Pakistan. J Hum Hypertens. 2006, 20:83-85.