STUDENT'S CORNER
RESEARCH ARTICLE

Determining the cost of acute stroke care for a single stay at a tertiary care centre in Pakistan

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Abstract

Objective: To assess the economic burden of acute stroke, and to determine the average cost of acute stroke care for a single hospital stay in a public tertiary care hospital.

Method: The cross-sectional study was conducted at the Medical Teaching Institute, Bacha Khan Medical Complex, Swabi, Pakistan, from May 16 to September 19, 2022, and comprised patients of either gender who were hospitalised with an acute stroke for the first time. All costs incurred during the care of the patients were measured using the micro-costing methodology, and the association of the cost with other variables was evaluated. Data was analysed using SPSS 24.

Results: Of the 34 patients, 24(70.6%) were males and 10(29.4%) were females. The overall mean age was 66+/-13.00 years. The mean length of hospital stay was 4+/-3.00 days. The mean total cost was 18,156+/-9,068 Pakistani rupees, which was the equivalent of 76.89+/-38.4 United States dollars. The cost of the first day of admission was the highest, declining per day as the stay progressed, and imaging/laboratory investigations formed the highest component of the overall cost ($p<0.001$).

Conclusion: The cost of acute stroke care was found to be high even in a public hospital. The length of hospital stay was the most important determinant of the overall cost.

Key Words: Cost of illness, Healthcare costs, Stroke/economics, Length of stay, Hospitalisation, Economics, Pakistan, Public facility.

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Introduction

According to the World Health Organisation (WHO), stroke is characterised by a sudden onset of neurological symptoms lasting >24 hours or leading to death, with no apparent cause other than vascular origin.[1] Stroke is a medical emergency that results from interruption of blood flow to the brain, leading to brain damage and neurological deficits. It is a serious and often life-threatening condition requiring urgent medical attention. Stroke results in a significant economic burden from several perspectives. It is the leading cause of death and disability,[2] and results in substantial human costs. The economic burden of stroke has gained increasing attention in recent years, owing to the high costs associated with stroke care. According to an international comparison of stroke cost studies, national health systems spend an average of 0.27% of the gross domestic product (GDP) on stroke, with stroke care accounting for 3% of the total healthcare expenditure.[3] These statistics demonstrate the need for more effective healthcare planning and resource allocation to address the economic burden of stroke.

A study at government hospitals in India reported that the total out-of-pocket direct cost ranged from Indian rupees (INR) 12,727.21 to INR23,649.68.[4] These financial conditions are comparable to those in Pakistan, highlighting the need for cost-effective stroke care strategies in low- and middle-income countries (LMICs).

A recent study in Pakistan found that the average direct medical cost per patient was Pakistani rupees (PKR) 55,775 (approximately 343 United States dollar [USD]), including hospitalisation, investigations and medications. Hospitalisation accounted for the biggest cost component (89.6%).[5]

One study reviewed literature from 1966 to January 2014, and revealed that the highest mean direct medical cost of stroke was in Nigeria at USD8,424, while the lowest mean cost was in Senegal USD416. The average length of

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hospital stay (LOS) was the longest in China (20 days).[6] The current study was planned to assess the economic burden of acute stroke, and to determine the average cost of acute stroke care for a single hospital stay in a public tertiary care hospital.

Materials and Methods

The cross-sectional study was conducted at the Medical Teaching Institute, Bacha Khan Medical Complex, Swabi, Pakistan, from May 16 to September 19, 2022, employing a micro-costing (bottom-up) methodology.[7]

After approval from the ethics review committee of Gajju Khan Medical College, Swabi, the sample size was calculated using standard formula (Sample Size = [z2 * p(1-p)] / e2 / 1 + [z2 * p(1-p)] / e2 * N][8] with confidence level 95%, prevalence proportion 1.2% and population size 1.6 million[9]. Informed consent was obtained from the subject or the subject's legally authorized representative respecting their choice and privacy. The sample was raised using using non-probability convenience sampling technique. Those included were patients of either gender who were hospitalised with an acute stroke for the first time. Patients with a history of previous stroke attacks and those who died during their hospital stay were excluded.

Data was collected using a well-structured questionnaire and the administrative database at the facility. Direct costs encompassed expenses, such as nursing services, drugs, medical supplies, diagnostic imaging, rehabilitation and food services, as well as productivity loss. Indirect costs included expenses related to transport, human resources, volunteer services, capital expenses and other services. Data was collected for a maximum of 13 days of patients' hospital stay. The conversion rate used was USD 1 to PKR 236.1 as of August-September 2022.[10]

Data was analysed using SPSS 24. Spearman's rho correlation coefficient was used to measures the strength and direction of the relationship between the total cost and other variables. P<0.05 was considered significant.

Results

Of the 34 patients, 24(70.6%) were males and 10(29.4%) were females. The overall mean age was 66+/-13.00 years.

Table-1: Mean cost with respect to type of stroke, gender and mode of admission.

	Mean	Standard deviation	Frequency (n)	Frequency N%	Mean cost	Standard deviation
Age	66	13.00				
Length of stay	4	3.00			18,156 (U$ 76.89)	9,068.80
Type of stroke						
Haemorrhagic	-		13	38.23%	18,981.92 (U$ 81.03)	7,493.99
Ischaemic	-	-	21	61.77%	17,644.52 (U$ 75.33)	8,130.42
Total	-	-	34	100%		
Gender						
Male	-	-	24	70.58%	18,981.92 (U$ 81.03)	7,978.40
Female	-	-	10	29.42%	17,645.05 (U$ 75.40)	8,542.02
Total	-	-	34	100%		
Admission through						
Emergency	-	-	27	79.42%	18,047 (U$ 77.04)	8,460.63
OPD	-	-	7	20.58%	18,575 U$ 79.30).	6,605.44
Total	-	-	34	100%		

OPD: Outpatient department.

Table-2: The breakdown of the of cost borne by the patients.

	Lab/radio charges (CBC, serum electrolytes, urea and creatinine, LFTs/CT, MRI, X-ray, Dopplar US, Echo etc.	**Medicines cost** (antibiotics, aspirin, clopidogrel, statins, heparin/warfarin etc),	**Transport charges** (ambulance services)	**Cost to work** (On leave wage deduction, Job loss etc)	**Food and misc.**
N	34	34	34	34	34
Mean	4,913.82(U$ 20.81)	3,933.32(U$ 16.66)	2,822.06(U$11.95)	3,934.24(U$16.66)	3,182.65U$13.48)
Median	3,172	3,486	2,750	3,550	2,400
Mode	2,750[a]	6,548	2,500	800	1,200[a]
Standard Deviation	3,570.8	2,257.7	1,503.4	2,667.5	2,474.2
Range	12,240	9,827	8,830	10,700	9,500
Minimum	1,130	640	170	800	600
Maximum	13,370	10,467	9,000	11,500	10,100

Lab: Laboratory, Radio: Radio-imaging, a: Multiple modes. The smallest value is shown. CBC: Complete blood count, LFT: Liver function test, CT: Computed tomography, MRI: Magnetic resonance imaging, US: Ultrasound.

Table-3: The association of cost with length of hospital stay.

	day 1 cost	day 2 cost	day 3 cost	day 4 cost	day 5 cost
N					
Valid	34	28	20	15	12
Missing	0	0	0	0	0
Mean	10,400 (U$43.89)	4,918 (U$20.74)	3,490 (U$14.73)	2,408 (U$10.16)	2,000 (U$8.44)
Median	9033.50	4295.00	2725.00	2200.00	1900.00
Standard Deviation	3130.317	2383.493	2846.572	941.877	592.376
Range	12050	11412	11027	3329	2100
Minimum	6250	1600	900	1300	1400
Maximum	18300	13012	11927	4629	3500

The mean LOS was 4+/-3.00 days. The mean total cost was PKR18,155+/-9,068(USD76.89+/-38.4). The lowest cost recorded was PKR6,880 (USD29.14) LOS 1 day, while the highest was PKR35,800 (USD151.63) for LOS 13 days.

The type of stroke was haemorrhagic 13(38.23%) and ischaemic 21(61.77%). Regarding the mode of admission, 27(79.42%) patients had been admitted through the emergency department (ED), and 7(20.58%) through the outpatient department (OPD). The mean cost was calculated for all the study variables (Table 1).

The total cost were grouped into five categories, and the median cost was lower than the mean cost for all categories, with standard deviation being relatively high for all categories, indicating that the costs were widely dispersed, while the range was also large for all categories, indicating wide variation in the costs incurred for each category (Table 2). Imaging/laboratory investigations formed the highest component of the overall cost ($p<0.001$).

The cost of the first day of admission was the highest, declining per day as the stay progressed (Table 3)

The correlation between total cost and other variables is generally weak. The most notable and statistically significant relationship is with the length of hospital stay ($\rho=0.814$, $p<0.01$), indicating a strong positive correlation between these two variables.

Discussion

The study was conducted at a government hospital where patients get free check-ups, stay and reduced laboratory/radiological and medical costs. As such, the cost calculated was quite low. The average total cost of acute stroke for a single hospital stay, as determined by the study, was PKR 18,156 (USD76.89), including all 34 direct and indirect costs. While being far less than what it might have cost in private hospitals, it is still high for the people of Swabi district, where the average income is PKR35,656 (USD151).[11]

The average age in the study was 66 years, which is consistent with the average age for stroke patients in Pakistan (52-66 years).[12]

About 70.6% of patients were male and 29,4% were female in the current study. A 2009 study[13] of 55 patients had 78% males and 22% females, while in another study of 159 patients, 66.4% were male and 34.6% were female[14].

The present study indicated that the average cost of acute stroke care for a male patient was PKR17,942 (USD76.27) and that for a female patient was PKR18,668 (USD79.35). Of the 34 patients, 61.8% presented with ischaemic stroke and 38.2% with haemorrhagic. A study had 67.9% ischaemic stroke patients, 21.4% haemorrhagic, and 10.7% had transient ischaemic attack (TIA).[15] The current study reported LOS of 4 days, ranging 1-13. A study in Taiwan[16] reported a median LOS of 7 days (mean: 11 days; range: 1-122 days). LOS is the most important determinant of the overall cost, and the present study showed that the cost of LOS 1-3 days ranged PKR10,045-14,374 (USD43.36-60.88), LOS 4-6 days ranged PKR15,930-28,471 (USD68.77-122.91), and LOS 7-9 days ranged PKR20,475-35,034 (USD86.72-148.38). These results are lower than those reported by a study at a private hospital in Karachi.[17] Direct costs accounted for 84.98% of the total average cost in the current study, while indirect costs made up 15.02%. Laboratory tests and radiological procedures were the costliest, accounting for 26.1% of the total cost. This was in line with a study done in Greece.[7]

In the current study, 6(17.6%) patients had LOS 1 day, 7(20.5%) had LOS 2 days, 6(17.6%) had LOS 3 days, 14(41%) had LOS 4 days or more. A study in Karachi showed that 15% patients stayed for 1 day, 19% for 2 days, 16% for 3 days, and 51% stayed for 4 days or more.[17]

The mean cost for the 1st day in the current study was PKR10,400 (USD43.89), for the 2nd day PKR4,918 (USD20.74), for the 3rd day PKR3,490(USD14.73), for the 4th day PKR2,408 (USD10.16), and for the 5th day PKR2,000 (USD8.44). A study in Karachi reported average total cost of PKR19,597 (USD83) for patients who stayed for 1 day was, PKR25,568 (USD108.2) for 2-3 days,PKR49,705 (USD210.5) for 4-7 days,PKR153,586 (USD648.5) for 8-30 days, and PKR588,239 (USD2491.5) for those having LOS >30 days.[14] The current study has several limitations that may potentially impact the validity and generalisability of the results. First, it was conducted

at only one medical facility, which may not be representative of the entire population. Second, the study only focussed on patients with acute stroke who were admitted for the first time, excluding those with a history of stroke and those who died during their stay. This may have excluded patients with more severe conditions and with different cost implications.

Based on the findings of the study, however, early detection and timely management of stroke are recommended, along with improved access to stroke care, cost-effective use of resources, health education and awareness as well as further multi-centre studies in other parts of the country.

Conclusion

The average cost of acute stroke care was found to be substantial even at a public-sector facility that provides free healthcare except for some tests, imaging and medicines.

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Authors' Contributions

MFK: Conception, acquisition, analysis of data, proofreading, finalizing for publication.
SR: Design of work, data analysis, proofreading, finalizing for publication.
MI: Conception, critical review.
MK: Data collection, analysis, results, discussion.
SA: Research presentation, data collection, patient follow-up.