

Bed wise cost analysis of in-patient treatment of brachial plexus injury at a Level I trauma Center in India

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ABSTRACT

Aim: The aim was to calculate, in monetary terms, total cost incurred by a Level I trauma center in providing in-patient care to brachial plexus injury patients during their preoperative and the postoperative stay.

Subjects and Methods: All patients of brachial plexus injury admitted and discharged between January and December 2010 were included in the study. Total cost per bed was calculated under several cost heads in pre- and post-operative ward care. Intra-operative costs were excluded.

Results: A total of 69 patients were admitted in the year 2010. Of these 60 were operated and the rest were planned conservative management. The total cost incurred by the trauma center in providing in-patient care to patients admitted in the ward, excluding high dependency unit, came out to be Rs. 3,650.00/patient/bed/day. Of this Rs. 2,234.645, the maximum amount was incurred in providing manpower alone. The average preoperative wait was 12 days (maximum 41 days and minimum 1-day). The average postoperative stay was 2 days. Total cost incurred in the preoperative period was Rs. 2,975,125 (US\$ 59392) or Rs. 43,117/patient (US\$ 861). It was Rs. 386,948 (US\$ 7724) in the postoperative period (Rs. 6,449 or US\$ 129/patient). Nine patients were not operated and had waited from 2 to 12 days before finally being planned for observant treatment. This itself cost the hospital Rs. 226,328 (US\$ 4518).

Conclusion: By just reducing the preoperative length of stay to 1-day the cost can be brought down by 93% for brachial plexus injury patients alone and the beds can be used to admit more critical patients.

Key words: Brachial plexus injury, cost analysis, manpower, trauma center

Introduction

Patients suffering from traumatic brachial plexus injury account for a significant proportion of admissions under neurosurgery. Lack of expertise in the proper management of such injuries overburdens the few higher centers and patients are sometimes

required to wait for many months before admission. Even after admission to a trauma center there is a significant delay in their management owing to the inevitable preference to emergency surgeries. These patients constitute a constant drain on the limited resources of the hospital. It is hence necessary to calculate, in monetary terms, total cost incurred by the hospital in providing in-patient care to brachial plexus injury patients during their preoperative and the postoperative stay. This was a retrospective study carried out to calculate the cost incurred in providing in-patient care to patients of brachial plexus injury in their pre- and post-operative stay in the ward. The operative costs were not included in the study.

Subjects and Methods

The study was conducted at Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi. All patients of brachial plexus injury admitted and discharged between January 1, 2010 and December 31, 2010 were included in the study. Cost inputs such as disposables, consumables,

Access this article online

Quick Response Code:



Website:

www.asianjns.org

DOI:

10.4103/1793-5482.136721

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laboratory and radiological investigations along with administrative costs were calculated and entered in a data master sheet. Routine preoperative investigations such as hemogram, serum urea and electrolytes, electrocardiogram and chest X-ray were done in all patients. Total cost was calculated by doing costing under various cost elements.

Calculation of Cost

Cost incurred by the hospital was calculated based on the following premises established by the Tata Consultancy Services study:^[1]

- Data on services rendered by any cost center should be gathered at the level of cost center itself
- Costs are reckoned at the time any material is consumed by the cost center
- Average costing is more appropriate and practical in hospital set up.

Elements of cost^[1]

The various elements which make up the total cost of any product may be divided into three main headings:

- Material
- Labor
- Expenses.

Material

The materials which form the total cost included all consumables and disposables. A list of all the medicines, intravenous fluids, nutritional supplements and diet was prepared for each patient.

Labor

Labor cost was calculated from the salary and allowances drawn by the staff involved directly or indirectly in the care of patients. Consultants, residents, nurses, technicians and Group D employees are the main groups in this category.

Data regarding the salaries was taken from the accounts section (trauma center) and was apportioned as per the study done by the Tata Consultancy Services, 1987.^[1]

Expenses

These are the expenses which can be directly or indirectly allocated to specific cost centers or cost units. Examples of such expenses are: Electricity, water and air condition expenses.

Based on the results of the total cost to the hospital during the period of the study; the cost to hospital per bed per day was calculated as below:

Cost to hospital per bed per day = Total per day cost for the whole hospital/total number of beds in the hospital.

In compliance with the Cost and Accountancy guidelines and standard practice, all across the globe; total cost just can't be arrived at without calculating the indirect cost, of which the building, furniture, equipment are invariable and significant cost

elements. Having not factored them in would have rendered the calculation of total cost/bed/day invalid and infructuous. Further, an astute manager/administrator will always like to know the opportunity cost and/or sunk cost, in order to rationalize them; for which Indirect cost estimation is equally important.

These indirect costs, which are borne by the hospital include.

Support and utility services

- Laundry services
- Central sterile supply department
- Blood bank
- Dietary services
- Medical record section
- Radiology and laboratory services
- Hygiene and sanitation services.

Administrative support services

- Building cost
- Cost of furniture and equipment: A discounting value of 10% p.a. can be charged to this account assuming the life of such article as 10 years
- Maintenance of building.

A list of equipments and furniture used in the ward was obtained from the sister in charge of the ward. The cost per item was obtained from the central stores department and the total cost per bed was calculated as;

$$\text{Total cost per day} = (\text{cost of equipment}/10)/365.$$

Total cost per day per bed = total cost per day/total number of beds in the ward.

Similarly building cost and maintenance cost were obtained from the Central Public Works Department CPWD and the cost was calculated taking into account the presumed life of the building. The acquisition cost was not taken into account. Total cost per bed was then calculated taking into account the above data [Figure 1].

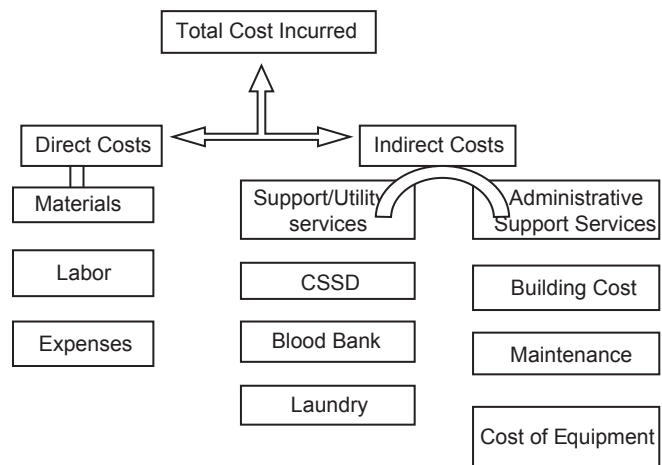


Figure 1: Summary of cost analysis

Results

During the study period, 69 patients (all males, mean age 24.6 years [ranging from 11 to 55 years]) with different grades of brachial plexus injury were admitted. The average total length of stay for a pt. of brachial plexus injury was 14 days, maximum being 43 days and minimum being just 2 days [Figure 2]. Of the 69 patients, 60 (87%) underwent surgical interventions. The mean hospital stay of these patients was 12 days with a range of 1-41 days [Figure 3]. The average postoperative stay was 2 days ranging 1-14 days [Figure 4]. Nine patients were not operated and opted for conservative treatment after counseling. The average waiting period for these patients was 6 days (ranging 2-12 days). This itself costed the hospital Rs. 226,328 (i.e. Rs. 25,147.61 or US\$ 503/patient).

Cost of manpower [Table 1] as per the Tata Consultancy Services report, faculty and senior residents spend 67% and junior residents spend 50% of their time towards patient care the rest being spent in teaching and research work. Therefore the salary of faculty and residents was apportioned accordingly. The nursing and class C and D employees are involved in only patient care, so for the final calculation their whole salary was apportioned toward patient care.

Based on the capital and other costs, the total cost of staying in ward came out to be Rs. 3,650.46/bed/day [Figure 5]. The maximum amount Rs. 2,234.645 (61.21%) was incurred in providing manpower only. Rs. 636.11 was spent in material supplies while the remaining was spent in building maintenance and support services (indirect costs).

The total expenditure on the patients of brief pain inventory (BPI) (operated and nonoperated) in the year

2010 was Rs. 3,588,402. The average cost borne by the hospital hence was Rs. 52,006.82/patient with the maximum being Rs. 1,56,970.12 and minimum of Rs. 7,300.00. Total cumulative cost incurred in the preoperative period was Rs. 2,975,125 (Rs. 43,117.75/patient). The postoperative stay of the patients was significantly less and hence the total expenditure was Rs. 386,948.8 (Rs. 6449.14/patient). Nine patients were not operated and were subsequently discharged. This itself cost the hospital Rs. 226,328 (i.e. Rs. 25,147.61/patient).

The comparative analysis of various groups is shown in the Figure 6.

Discussion

Brachial plexus injury is a significant economic burden not only to the patient but also to the hospital. No previous study in cost economics in BPI available in English literature until date. Studies have been directed towards costing of motor bike helmet injuries,^[2] cost of head injuries in alcoholic patients,^[3] costing of spinal injuries especially directed toward their rehabilitation,^[4] costing of routine evaluation of deep venous thrombosis in head injury patients,^[5] costing in head injury.^[6] It is hence one of its kind study.

Treatment in India is still considered a social obligation where cost considerations are irrelevant. Most of the hospitals have their own rate structure, which was initially based on what the neighboring hospitals were then charging their patients. These rates were revised from time to time. As the cost of running hospitals is increasing day by day, it is putting up a lot of pressure on the management to revise the rates upwards. The funds provided by government local bodies and charitable organizations are also drying up. Thus, the hospitals are forced to make the patients pay partly or wholly for the services available by them. Unfortunately no regular cost

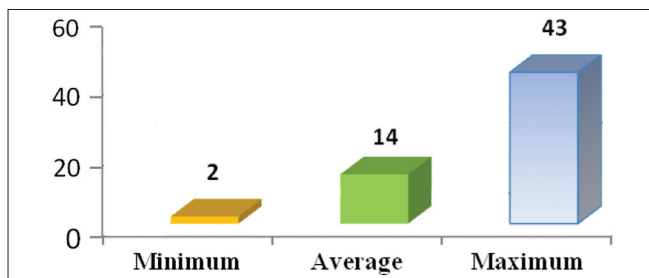


Figure 2: Total duration of stay in days

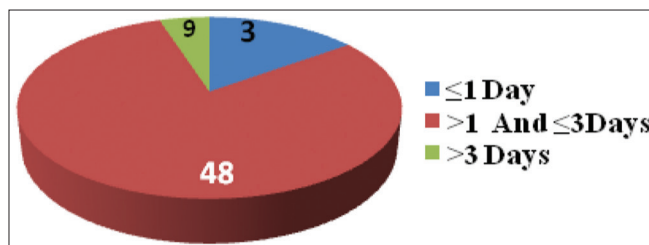


Figure 4: Duration of postoperative stay

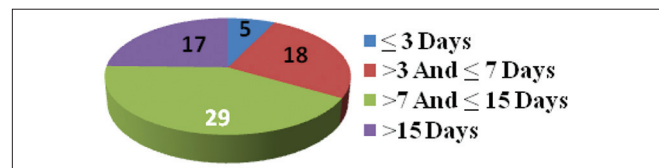


Figure 3: Duration of preoperative stay

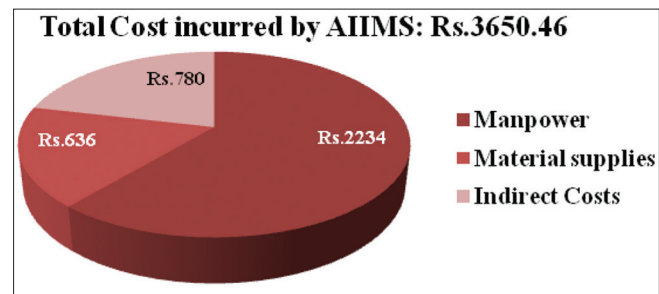


Figure 5: Total cost per bed per day

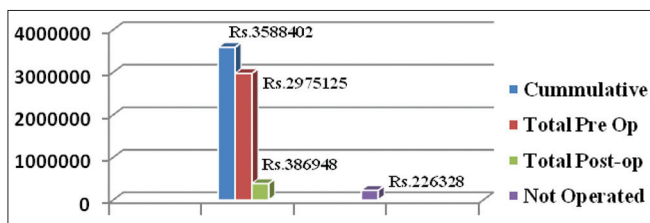


Figure 6: Comparative costs in different categories

Table 1: Apportioning of salaries of manpower towards patient care

Manpower	Cost element	Cost/day/bed
Faculty	Professors	Rs. 215,443
	Senior residents	Rs. 539,191
	Junior residents	Rs. 261,002
Nursing	ANS	Rs. 2,935
	Sister in charge	Rs. 27.8
	Staff nurses	Rs. 1,011.1
Group C and D	Technician	Rs. 93,818
	HA/SA	Rs. 58,708
Security	Guards	Rs. 24,657

ANS – Assistant nursing superintendent; HA – Hospital attendant; SA – Sanitation attendant

accounting has been introduced in any of the hospitals of this country.^[7] Accounts are being maintained only to depict the receipts and expenditure of an accounting period, based on the conventional procedure. There is no uniform procedure for maintenance of accounts for these recurring items.

Patients with BPI constitute a substantial number of total admissions under neurosurgery. Brachial plexus injuries constitute a significant burden on health care resources. The majority of these patients are young and in their productive life. This causes national loss, not only financially but also socially. By analyzing the workload and tremendous expenditure incurred on BPI patients, we can recommend the appropriate reformative steps as well as budgetary allocations.

The total cost incurred by Jai Prakash Narayan Apex Trauma Trauma Centre, AIIMS in providing in-patient care to patients admitted in the ward came out to be Rs. 3,650.46/bed/day. The mean preoperative stay in the wards was 12 days which lead to a loss of around Rs. 2,975,125.00 to the Institutes' Accounts. The average expenditure in the waiting period was Rs. 43,117.00/patient approximately US\$ 9,000. The mean postoperative stay was 2 days and incurred a cost of around Rs. 6,449.00/patient. The cumulative cost incurred on AIIMS in providing the in-patient care in 2010 was a whopping Rs. 3,588,402. The labor cost was calculated as per standard Cost and Accountancy Guidelines; wherein it (labor cost) was calculated by apportioning the salary of the entire staff spectrum involved in-patient care, to the extent of their time commitment, as evidenced by the study "Design of a Costing

System, AIIMS, Tata Consultancy Services, 1987;" in the same study setting.^[1]

The reasons for the long preoperative wait for the patients could be assigned to lesser number of operation theatres and inevitable preference to emergency surgeries. Most of these patients are also referred from wide and far parts of the country mainly due to the unavailability of expertise in treating such patients even in big cities and institutes. By just reducing the preoperative length of stay to 1-day the cost can be brought down by 93% for BPI patients alone and the beds can be used to admit more critical patients. Secondly a separate operation theatre O.T can significantly decrease the burden of long waiting periods for the patients (sometimes in years).

The study did not include the cost incurred during surgery and was hence limited in its approach to the cost incurred during the stay in the wards only. Further the personal losses to the patient due to the loss of productivity either due to the implied disability or long duration of stay in the wards were not accounted for.

Conclusion

By just reducing the preoperative length of stay to 1-day the cost can be brought down by 93% for BPI patients alone and the beds can be used to admit more critical patients. Secondly a separate operative team in trauma center can significantly decrease the burden of long waiting periods for the patients (sometimes in years). Further this study highlights the need for training brachial plexus injury management to larger group of surgeons in order to minimize overburdening higher centers.

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How to cite this article: Pandey N, Gupta D, Mahapatra A, Harshvardhan R. Bed wise cost analysis of in-patient treatment of brachial plexus injury at a Level I trauma Center in India. *Asian J Neurosurg* 2014;9:89-92.

Source of Support: Nil, **Conflict of Interest:** None declared.