



## A Study on costing of Neurosurgery Procedure at a Public Hospital in India

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### Abstract

*Activity-based costing (ABC) is a costing model that identifies activities in an organization and assigns the cost of each activity resource to all products and services according to the actual consumption of each. The study, Costing of Neurosurgical procedures was an observational study which was carried out in SCTIMST (Sree Chitra Tirunal Institute of Medical Sciences & Technology) Thiruvananthapuram during 2009-2010. Objectives of the study were to study the charging system at SCTIMST, to analyze the various elements of cost involved in the neuro-surgical procedure craniotomy, to calculate expenses for selected cases of craniotomy, to ascertain average cost per case by preparing a cost sheet based on elements of cost. An activity based costing method was used for calculation of the cost. Ten cases of major Neurosurgery were studied. The cost included manpower, consumables, overheads etc. The cost was calculated to be Rs 77914/- as against the hospital charge of Rs 36000/-.*

**Keywords:** Activity based costing, Hospital, Neurosurgery.

### Introduction

‘Cost’ is any outlay or expenditure of money, time, labour or other resources to produce a nominated health service product. Cost is essential not only to fix price but also to ascertain the margin of profit. Activity-based costing (ABC) is a costing model that identifies activities in an organization and assigns the cost of each activity resource to all products and services according to the actual consumption of each: it assigns more indirect costs (overhead) into direct costs. In this way an organization can precisely estimate the

cost of its individual products and services for the purposes of identifying and eliminating those which are unprofitable and lowering the prices of those which are overpriced. ABC is not a financial accounting system, but an approach that provides a more effective way to view and interpret information by measuring the cost and performance of business processes and their outputs.

The study, Costing of Neurosurgical procedures was an observational study which was carried out in SCTIMST Thiruvananthapuram during 2009-

2010. The aim of the study was to find out the costing of select neurosurgical procedure of craniotomy. In a large medical institution the expense of each procedure and the amount to be charged are extremely difficult to calculate as the services of almost 90% of support staff, administrative staff etc are utilised to a certain degree in all the activities or surgical procedures done in the hospital.

### **Aim**

To study the costing of neurosurgical procedures at SCTIMST

### **Objectives**

1. To study the charging system at SCTIMST
2. To analyze the various elements of cost involved in the neuro-surgical procedure craniotomy.
3. To calculate expenses for selected cases of craniotomy.
4. To ascertain average cost per case by preparing a cost sheet based on elements of cost

### **Methodology**

Craniotomy procedure was selected for the study in the Department of Neurosurgery as it is one of the common procedures done in the Neurosurgery Department.

A sample of 10 cases of craniotomy was selected for the present study. Each patient was followed from the time he was admitted in the hospital till the time he was discharged from the hospital. The manpower involved in the surgical procedure in the OT in the ICU and in the ward were also calculated. The various lab investigations, medicine charges, equipment charges in the ward, operation theatre and ICU and the electricity charges of the machines used for the surgical procedure were also calculated. The patient's diet charges were also calculated. An account of the consumables used in the operation theater by the Anesthetists and the surgical team were calculated. The consumables used in the ICU and Ward were

also calculated. The services of the supporting staff involved in the surgical procedure were also calculated. Miscellaneous charges like electricity, water telephone, sterilization and anesthetic gases were also taken into account. A private hospital visit was also conducted to find out about the charging system adopted there. Focus group discussions were conducted with the surgeons, Doctors, Engineers, Administrators, Accountants and sisters in the neurosurgery department and various technicians. An Activity based costing approach was adopted to calculate the time required for the procedure. A detailed analysis has been done to find the charges of individual procedures.

### **Types of data**

Primary data - collected from doctors, nurses and administrative staff.

Secondary data - desk research method

### **Methods of data collection**

Primary data - survey method and observation method, Focus group discussions.

Secondary data – Medical records

### **Population**

- Doctors
- Patients
- Nurses
- Administrative staff

### **Sampling Method**

- Judgment sampling

### **Sample size**

10 cases of craniotomy procedures done in SCTIMST

### **Tools for analysis**

- Percentage method
- Cost sheet analysis

In the study the patient is followed from the time he/she was admitted in the hospital till the time of discharge. The average length of stay in normal circumstances was found to be 9 days. The duration of the surgical procedure was 8 hrs, The patient spent at least 1 day in ICU and the ward stay was around 7 days.

### Observations

For the surgical procedure the personnel involved and the time they spend for surgical procedure is calculated. Manpower in the ward and ICU is taken into account. The amount of consumables used, medicines in ICU, OT, ward are calculated.

Activity based costing is indispensable to arrive at a realistic amount chargeable on the patient undergoing particular medical procedure, especially in institution where humanitarian considerations are a major part of decision making. In SCTIMST all the medicines and consumables are supplied at a subsidized rate. The important elements of cost included in the total estimation of the procedure are manpower charges (Table 1,2,4) consumables, medicines, lab investigations, diet expenses, administrative overheads and machine charges (Table 3).

### Data Analysis & Interpretation

The elements of costs and expenditures are obtained from continuous follow up of the 10 cases of craniotomy, from the point of admission, to the point of discharge. The data obtained are given in the table and from these data a cost sheet is developed which represents the average cost of the selected neurosurgical procedure craniotomy.

An average of the consumables used by each patient were found out and these average then multiplied with the unit cost of each gave the total cost of the consumable. The same procedure was done for calculating the total cost of medicine consumed. The machine cost for the craniotomy procedure was also calculated and the electricity consumed has also been calculated.

The methods of calculation of other expenses such as manpower cost in the OT, ICU and the ward were also taken into account. Miscellaneous charges relating to the craniotomy procedure have also been taken into account. The final cost sheet has been prepared which gives an account of the expenditure incurred in the surgical procedure.

### Discussion

Activity based costing tries to identify all the activities that consume resources in order to

accumulate cost per type of activity. For this logistics and accounting of the entire organization has to be taken into account. Each and every item used in the procedure, the time spent by the doctors for the operation, the time spent by the nurses and the other supporting staff for each patient has been taken into consideration. The usage of costly equipments, the electricity consumed and other miscellaneous charges were also taken into account. Once costs of the activities have been identified, the cost of each activity is attributed to each product to the extent that the product uses the activity. In this way ABC often identifies areas of high overhead costs per unit and so directs attention to finding ways to reduce the costs or to charge more for costly products.

An average of 120 cases were reported each month for neurosurgical operations out of which about 100 cases were craniotomy and craniectomy. There are 26 operating days with 8 operating hours in a day. The time taken by the professor, assistant professor, post graduate, anesthetist, sister in charge, anesthesia technician, unit helper and cleaner in the operation theatre was found out. Their salary for each activity was also calculated. After that the manpower costs in the ICU and ward were also found out. The administrative overhead was also calculated, which included the salaries of the Director, Deputy Director, Medical Superintendent, Administrative Medical Officer, Administrative Officer, Accounts Officer, Finance Officer, Purchase / Stores Officer, Senior Medical Records Officer, Office Superintendent, Office Assistant, UD Clerk, LD Clerk, Cashier, Medical Records Assistant, Medical Social Worker & Security Personnel.

Miscellaneous charges included anesthesia-gas; telephone charges, water charges, etc. were also identified. The equipments, consumables used in the central sterilization supply department the manpower utilized in the CSSD were also taken into account. The next step was to identify the time spent by the personnel for each case. The time spent by the personnel for each case was

identified and there average was found out .The consumables used in the OT, the anesthetic consumables ,consumables in ICU, consumables in the ward, the anesthetic medicines used, ICU

medicines ward medicines and lab investigations done for each patient were also identified and the proportionate expenditure for each patient was calculated.

**Table 1 Manpower**

Personnel	OT Salary/hr	ICU Salary/day	Ward Salary/day
Professor	487(1)	75(1)	26(1)
Assistant professor	433(1)	400(6)	140(6)
Post Graduate	216(1)	798(2)	420(3)
Anesthetist	487(1)		
Anesthetist PG	216(1)		
Sister in charge	60(1)	438(1)	154(1)
Staff nurse	318(2)	2348(8)	1443(14)
Anesthesia technician	130(1)		
Unit helper	136(1)	251(3)	264(3)
Cleaner	66(1)	122(3)	256(6)
Physiotherapist		31(1)	11(1)
Nursing Superintendent		9(1)	6(1)
Infection control sister		9(1)	6(1)

\*Figures in double brackets are the number of personnel

**Table 2 Salary**

Total salary of Administrative personnel per month	₹ 1066081	
Average No of patients / day	175	
Total salary of Administrative personnel per day	$\frac{1066081}{175 \times 30}$ = ₹ 203	
Average length of stay	9	
Average expenditure per patient/day	203X9	1827

**Table 3 Miscellaneous expenditure**

Anesthesia gas	350000 / 228cases	per case	1535
Electricity charges	10 lakhs/month	33333/day 190/case For 9 days	1714
Telephone charges	20000/month	667/day 3.8/case For 9 days	34
Water charges	12000 /month	400/day 2.2/case For 9 days	20
CSSD			
Equipment	100000/month	3333/day 3333/175 19/case For 9 days	171
Consumables	200000/ month	6667/day 6667/175 38/case For 9 days	342
Man power			
Staff nurse x3	33147	/30x175 For 9 days	170

Technical assistant x4	27092	/30x175 For 9 days	186
Unit helper x3	28388	/30x175 For 9 days	146
Equipment maintenance	2.49 Crores 9000 patients/year	1.21 Crores	
Building maintenance		1.28 Crores	
Average expenditure per patient/day	2.49 Crores 9000 X 365 = 8		
Average length of stay	9		
Average expenditure per patient/day	9X8		72
Total			4390

**Table 4** Manpower Cost – Average

Personnel	OT	ICU	Ward	Total
Professor	3701	113	120	3934
Assistant prof	3291	600	1040	4931
Post Graduate	1728	1197	3108	6033
Anesthetist	3799			3799
Anesthetist PG	1728			1728
Sister in charge	480	657	1140	2277
Staff nurse	2544	3522	9812	15878
Anesthesia tech	1040			1040
Unit helper	544	377	1954	2875
Cleaner	264	183	1894	2341
Physiotherapist		47	81	128
Nursing Superintendent		14	44	58
Infection control Nurse		14	44	58
Total				45080

**Table 5** Final cost sheet

Particulars	Amount	Percentage
Man power charges	45080	57.85
Consumables	9972	12.79
Medicines	6044	7.75
Lab Investigations	5686	7.29
Machine charges	3655	4.69
Diet expenses(120 x 9)	1080	1.38
Patient linen ( 20x9)	180	.23
Administrative overheads	1827	2.34
Miscellaneous charges	4390	5.63
<b>Total</b>	<b>77914</b>	<b>100</b>

**Conclusion**

People have an inherent desire for improved health levels and are willing to give money or other resources for it. Limitation of resources is causing those responsible for health care to look critically at the costs and benefits of services provided. Although it should be quite easy to define cost in financial terms, it is difficult to define and quantify effectiveness and benefit. The production process for health care product line

costing is divided into two phases .Costing includes the techniques and processes of ascertaining cost. The technique refers to the principles which are applied for ascertaining cost of products, jobs, processes are the services rendered.

An activity based costing model was followed which analysed the activities involved, case management time consumed for each, the resources consumed etc.

The percentage of expenses under different heads are being shared in the total expenditure. The various identified expenditure heads are: Manpower charges include 57.85% which accounts for more than half of the procedure charge. 12.79% consumable charges, 4.69% Machine charges, 7.75% medicine charges and 7.29% Lab Investigations. The total cost for the craniotomy procedure is Rs.77914/-. The hospital charging package for the craniotomy procedure is only Rs.36000/-.

Study Setting- SCTIMST, Trivandrum  
Source of funding – Nil

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