Research Paper

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Utilisation Study of CT Scan in a Multi-Speciality Hospital

Medical Science

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ABSTRACT

The cost of imaging modalities is humungous in multi-specialty care hospitals. The administrators have to drive the management of plethora of investigative modalities with utmost care. As these are capital intensive, utilisation studies of such equipment after installation is very essential and drawn lot of significance since beginning. The introduction of CT has been one of the most significant advances among the imaging techniques.The first users were physicians within Research hospitals, then, community hospitals started using them and private practitioners, meanwhile, typically did not purchase the expensive systems. To study the utilisation of CT scan, the approach undertaken was a prospective study to find the number of scans done over a 6-month period, the average scans done in a day were calculated. The average time taken per scan was found. These calculations give us the time the machine is being run over in a 8-hour shift. The 8-hour shift was considered as maximum time the machine is operable. The utilisation co-efficient index was the tool used to deduce the utilisation percentage of the CT scan. The machine in the study was utilised with 50% of its full potential.

INTRODUCTION:

Imaging equipment is very complex now than ever and the choice is extensive that the medical institutions and the administrators of the health care institutions are forced to pay close attention to the management of new kind of technology in a very efficient manner. The importance of imaging modality of investigation assumed great significance in the past two decades. 60% of diagnostic investigations require photo documentation, of which CAT scan imaging is recognised as a potentially useful mode of investigation, but also an expensive one.[1]

The Cost of Imaging modality of investigations is enormous. A forecast for 1999 for this type of investigations in world health care market done by Market Intelligence Research Co., a firm based in Mountain View, USA, 1999, said this would be around USD 5 billion. In comparison to this USD 3.5 billion was spent by non-federal General hospitals alone in the US, on imaging equipment and supplies in 2000. [2]

In today's health care environment, the equipment purchase must be cost justified. As India is a developing country with constrained resources and hi-tech hospitals, CTs are most cost effective than other image modalities on image quality. Establishment and maintenance of CAT scan unit in a hospital is expensive and every effort must be made for optimum utilisation of this equipment in appropriate manner.

In era of cost-intensive medical care, every equipment being installed in health care institutions need to be fully & properly utilized. An optimum utilisation of equipment will result in: [3]

- Optimum patient handling and rapid turnover.
- Minimum possible costs.
- Quality patient care & satisfaction.

AIM& OBJECTIVES:

To study the utilisation pattern of high-end, capital-intensive CT Scan machine. The Objectives followed are: 1)To observe the Workload of the CT scan and in the process knowing the Utilisation of the equipment.2) To analyse the utilisation hours of CT scan and suggest recommendations.

METHODS &METHODOLOGY:

PROSPECTIVE STUDY:

1) The workload of CT scan department was calculated by the number of scans done daily, over a 6-month period.
2) The average time consumed for each scan was taken.
3) The number of CTs done/day & total time the equipment used was computed.
4) The Use Coefficient/the Utilisation Index of equipment is derived with above data.

OBSERVATIONS:

Utilisation essentially means the use of the equipment to full potential. Utilisation index or Coefficient is one of the important parameters to monitor the functional status of the equipment, the parameter to assess the productivity of a service or equipment. [12]

$$\text{Use Coefficient} => \frac{N}{M} \times 100$$

Where N →Average number of hours the equipment is used per day. M →Maximum number of hours the equipment can be used per day. If the use is less than 50%, it is considered to be under-utilized and hence a bad investment. Some strategies can be built up to improve the utilisation of the equipment. However, life-saving equipment cannot be subjected to this kind of assessment.

Usually in many hospitals the facilities work only for 8 hrs, which amounts to 33% of utilisation. Facilities like CT, MRI etc. if underutilized due to paucity of workload; they should be shared with other hospitals. Networking of resources would ensure optimum utilisation of the costly equipment.[3]

RESULTS:

Workload calculation was done by going through the records maintained in the department and observing the workflow. The cases were 1993 in number, of which 1190 were plain CT scans and 803 were taken after administering the contrast.

This shows that the monthly average of scans was 332 in number. The highest number of cases was in May, i.e. 370 cases and the lowest were in the month of April, which are 271 cases. The workload is matching in standards with the workload in various CT scan establishments around the world. The OP to IP ratio being 1:1.15, it does not vary much.

Interestingly, 90% of the cases are from the institution alone, as only 10% of cases were referrals from outside hospitals. This finds out to be an interesting finding as it establishes the importance of having a CT scan facility in a multi-specialty hospital, as it will be utilized by all the specialties and thus helping in diagnosing the cases of different diseases. This also shows the importance of marketing strategies that the management of hospital should come up with in order to increase the utilisation of the equipment and the revenues generated simultaneously, by increasing the referral caseload from the local hospitals.

The study showed that Neurology and Neurosurgical Sciences are the main user departments of the CT scanner. They together comprise of 64% of the total census. This does stress how essential is the CT in aiding the diagnosis of Head trauma or brain disease cases.The other broad specialties that use more in order

are General Medicine, General surgery, Orthopedics.

The maximum number of scans taken is of Head, which when compared with a study conducted by Swartz which shows 1500 head scans in the same period, is more or less the same. [4] For the Chest cases the CT scan helps in fine needle aspiration studies of the lung cavities. The miscellaneous cases a few in number are that of cancers, liver diseases etc.

TABLE 1: NUMBER OF SCANS / DAY:

PART IN BODY	SCANS / MONTH	SCANS/ DAY	AVG TIME / SCAN (in min.)	TIME / DAY (in min.)
HEAD	215	7	20	140
ABDOMEN	79	2 (app.)	30	60
CHEST	14	0.5	30	15
PELVIS	14	0.5	20	10
MISCEL	10	0.5 (app.)	30	15
TOTAL	332	10.5		240 min. (4 HRS)

The average time taken per each scan for different parts of the body was noted over a period of 2 months during the six-month study period. The Sundays were also considered as a working day as on an average there were more than 50% of cases on Sundays that of the weekdays. The number of cases done in a day was noted, few in approximated figures and the time taken to perform individual case and the total time taken by these cases in a day was computed. This gives around 4 hours of operating time of the equipment in a day's work.

The Use Coefficient or Utilisation Index of the CT scan at this hospital is, considering the fact that the equipment works one shift in maximum, i.e. 8 hours,

$$\text{Use Coefficient} \Rightarrow \frac{4}{8} \times 100$$
$$\Rightarrow 50\ \%.$$

According to the authors of this index, if this value is less than 50%, then the equipment is under-utilized. This shows that the CT scanner at this hospital is not under-utilized. The Utilisation can be improved by networking the resources with the local hospitals. And as such CT scan being life-saving equipment helping in clinching the diagnosis of high-risk cases and reducing their hospital stay of the patients, its utilisation in best possible way is very important.

As suggested by REKER, I would like to agree with the view that the hospital administrator should carefully consider cost and work load before deciding whether to have an in-house CT scan facility or regionalized CT scan facility. But, I also consider that institutions at the tertiary care level should have an in-house diagnostic facility.[5]

DISCUSSION:

The staff to scan ratio, considering the 4 staff present in the department, who are directly involved in sharing the workload- the radiologist, the staff nurse, the radiographer/radiology technician, the receptionist in scheduling the cases, works out to be 1:83 scans per person per month.

TABLE 2: THE UTILISATION STATISTICS:

Sl. No.	PARTICULARS	VALUES
1	PATIENTS/MONTH	332
2	PATIENTS/WEEK	83
3	STAFF PRESENT	4
4	STAFF: SCAN RATIO	1:83
5	USE COEFFICIENT	50%
6	DOWNTIME/WEEK	5 HRS

In a study conducted by Babcock in Germany shows this was around 1:82, hence workload is confirming to the past studies. [6] And this was observed to be more than the workload specified by Putsep in 1979, which means there is a rising trend in the Utilisation of CT scan as the time is passing.

The observations of Blake et al, with a staff strength of 7.5 having a workload of 350 scans per month is far less when compared to this facility.[7]

The present study differs with the observation of Haga and Alfidi who found that most of the CT scan facility units in US were being looked after by generalists who did not have specialized training while the CT scan centre of our institution had specialized staff. [8]

Knaus and Davis, according to their study in a hospital in US over a period of 12 months came out with a figure of 255.83 scans per month, when compared to that our hospital having a caseload of 332 cases is around 1.3 times higher.[9]This study is relevant to be compared in the sense that in a highly developed country like US with a high per capita income and a high GDP, records only 0.75 times the workload as compared with the present study in our teaching hospital.

CONCLUSION:

Medical equipment used for diagnostic,monitoring and therapeutic purposes is a keycomponent of medical treatment. Managingthe equipment is one of the most importantfunctions of hospital for continuous,uninterrupted and quality services.It is emphasized that the state of arttechnology is what gives the hospital thecutting edge in maintaining the treatmentstandards as well as the advantage inmeeting the exciting cutthroat competition.Utilising the purchased equipment to their fullest potential is the important duty of hospital managers &the management. Under-utilised equipment will lead to major losses to the stakeholders in the business.

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