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Research Article

Quality Assurance and Standard in Medical Sciences with Special Reference to Neurosciences and Quality and Standard in Operation Theatres, Wards and Intensive Care

Upadhyay PK[1]*, Tiwary G[2], Kritika[3] and Kartikeya[3]

[1]Associate Professor and Head Department of Neurosurgery, IHBAS, New Delhi, India

[2]Director of Diagnostic Branches and Head of Pathology Department, House of Diagnostic, New Delhi, India

[3]MBBS Fellow, New Delhi, India

***Corresponding Author:** Upadhyay PK, Associate Professor and Head Department of Neurosurgery, IHBAS, New Delhi, India.

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Abstract

Although Medical science is a novel, pious and respectable profession of late has been marred by multiple controversies due to deteriorating patient – doctor and other medical and health professional relationship. Mainly due to lack of proper communication and lack proper and operating procedures. There was also lack of quality standards in many aspects and there was neither good quality assurance nor proper quality bench markings. These aspects are briefly discussed in general and reference to Wards, Intensive care, and operation theatre in particular apart from other special operating procedures (SOP).

Keywords: Quality Assurance; Quality Standards; Medical Science; Neuroscience; Ward; Operation Theatre; Intensive Care Units; Benchmarking; Total Quality Management; TQM Quality Indicators; Risk Management

Introduction

The World health organization (WHO) organized an international conference on aspect like the quality in primary health care in China and quality assurance in district healthcare in Korea which helped to find quality in healthcare system a global and universal concern.

Patients have a basic need to live their lives with respect and dignity and are entitled with basic right and freedom and neurosurgery should also respect that and strive to ensure it.

The very common human right includes "right to equality" before the law," life and liberty", freedom of thought and "freedom of expression". Apart from all these basic rights, Health is also declared as the "fundamental human right" that satisfies the need for physical and mental well-being.

The Universal Declaration of human right, adopted by the United Nations (UN) in 1948, proclaimed that "everyone has the right to a standard of living, adequate for health and well-being of oneself and one's family including food, clothing, housing and medical care." These too have to have some quality.

What is quality?

Quality is one of very important concept in Neurosurgical and delivery systems. Like other medical fields quality concepts were brought intentionally in neurosurgical field as well. Survival of fittest is the dictum of the all-time [1].

Quality is Degree of excellence achieved in the given field as perceived by the service provider. It means adherence to the already determined features in rendered services which patient gets every time when he/she visits hospital service. Which enthuses confidence that He/she will get same services this time as well and it decreases the anxiety and fills comfort in the patient and their attendants. So, there should be composite positive result and value in minds of patient or service takers (clients).

The emphasis may be client oriented, or the service rendered or even cost consideration. This is a high value task and high priority to be given and this may change upwards from time to time as this determines the success of the departments or services rendered due to client's loyalty by its reliability.

Good qualified and experienced staff and good design and good infra-structure with required services with sustained reliability, continuity and cost effectiveness. It must contain empathy and must be having basic human right factors as it is directed towards human beings.

Incorporated Design of the facility should be good and adequate depending upon Vision and mission of the institution and services.

There should be strict quality control in place. It must keep in view the patients visiting to the institution by continuously monitoring through supervisor monitoring cameras attached to monitor manned by personnel to ensure that the quality standards so set is applied to the system properly. Also that the delivery of the system is optimal at all the time. There must be persistent effort to continuously improve the quality by understanding the places of deficiency and places where effort can improve the quality leading to continuous quality improvement.

Public are more aware of health care and now demanding high quality in neurosurgery as in any other field of Medical Sciences. Influence of medical insurance also emphasizes the very need of quality in neurosurgery as in other fields of medical science necessitating significant change in Neurosurgical practice.

Management Guru Deming has further taken the standard from quality management to the extreme of concept of total quality management which is being applied to all the fields of medicine including Neurosurgery.

Definitions

- **Standards**: A statement of expectation that defines the structure and process that must be substantially in place in an organization to enhance the quality of Neurosurgical care.
- **Quality**: The degree of adherence to pre-established criteria or standards.
- **Quality assurance** Part of quality management focused on providing confidence that quality requirements will be fulfilled.
- **Quality improvement**: Ongoing response to quality assessment data about a service in ways that improve the process by which are provided to Neurosurgical
- Consumers/patients.
- **Quality assurance programs** are tools used by neurosurgical and health organization to establish a quality management system and to improve continually on quality of neurosurgical services increasing neurosurgical/surgical expenditure and disease burden also demands quality control in neurosurgical care [2].
- **Definition**: Quality assurance (QA) is an activity where the primary objective is to monitor, evaluate or improve the quality of neurosurgical care delivered by neurosurgical care providers.

Quality Assurance should be integral part of all neurosurgical delivery systems including the operation theatres.

Organizations spends huge amount of money, time and man power, to get into quality system process. Many national and international organizations are available for accreditation or certification of hospitals and services in term of quality. Quality is never an accident; but is result of dedicated and intelligent efforts. All humans are entitled with basic right and freedom there by to live our lives with respect and dignity. The very common human right includes “right to equality” before the law, “life and liberty”, “freedom of thought” and “freedom of expression”. Apart from all these basic rights, health are also declared as the “fundamental human right” that satisfies the need for physical and mental well-being.

The Universal Declaration of human right, adopted by the United Nations (UN) in 1948, proclaimed that “everyone has the right to a standard of living, adequate for health and well-being of oneself and one’s family including food, clothing, housing and medical care”.

Today hospitals practice various quality management systems through accreditation. Several accreditation bodies at national and international level have been established quality management systems through various standards specific to patient care and safety.

Quality assurance in health care is a process through which the level of desired quality is defined, pursued, achieved and maintained through the mechanism for detecting and correcting fac-

tors which prevent the achievement of the desired quality. Terms such as peer review, quality assurance, quality improvement, quality activities, quality studies, and audit (Including all types audit such as medical, clinical, surgical and record audit) are often used interchangeably. Quality assurance is a broad term that describes the overall efforts of the facility to achieve effective care without compromising on quality.

Material and Methods

Quality health care is doing right thing, at right time, in right way, for the right person and having the best possible results.

Quality improvement (QI) methods and models [3]:

Plan, Do, Check, ACT method (PDCA method) – It is one of the widely used QI method developed in 1920 by Walter Stewart and latter popularized by Deming. This method in health covers following aspect: I) Establish goals and objectives, II) Develop policies and procedures to guide workers.

Six steps method - It is a continuous quality improvement approach presented by Krousel Wood with focus on healthcare application. The six –step methodology used by this approach. The six steps are:

- Record adverse or other outcomes of interest.
- Use statistical techniques to determine variation randomness.
- Suggestions to reduce adverse outcomes.
- Implement the suggestion on trial basis and monitor results.
- If improvement occurs implement the suggestion and standardize.
- Seek further suggestion for improvement.

Benchmarking [4]- It is a process of comparing a hospital performance against that of organizations that have been identified as excellent. There are three types of benchmarking.

Internal Benchmarking - It compares performance between functional areas of departments within an organization. For examples infection rate in department of Neuro- surgery, surgery and department of paediatric surgery.

Competitive Benchmarking - Used to close the gap between organization performances with that of its industry competitors. It is also called performance bench marking. For example, infection rate in department of neurosurgery of one hospital with that of other standard hospital with best result.

Comparative benchmarking exercises examining a process in another industry to apply the principles that makes it effective to a similar process. For example, success rate in hospital industry with any other successful industry.

Quality assurance includes all evaluation activities conducted in the facility. Many quality care assurance programs focus on improving the quality of care by followings

- Reducing avoidable deaths
- Reducing avoidable complications.
- Reducing unnecessary surgeries or invasive procedures.
- Identify omissions of necessary services.
- Reducing unnecessary readmissions.

Risk management – Neurosurgical services are prone to various risks. Risk is an event or situation that could potentially result in any event, or situation that could potentially result in an injury to an individual or financial loss to the hospital/organization. Effectively managing those is a major activity in any quality assurance program. The objective is to:

- Minimize the potential for injuries occurring.
- Minimize the potentially compensable events (PCEs).
- Respond appropriately to the injured patient.
- Anticipate and plan for ensuring liability when injuries occur.
- Prevent or reduce financial loss.

Risk management program [5,6], in neurosurgery services should perform the following steps

- Risk Identification - Identify risks usually by incident reporting. For example, needle sick injuries, patient or employee falls, Medication errors (wrong drug, wrong dose).
- Risk analysis- analyse the risk (rate of incidence, how and why it so happened and by whom and where).
- Risk evaluation- Evaluates the risks in work areas where it is likely to happen.
- Risk Reduction/mitigation/elimination – Try to reduce or altogether mitigate or eliminate by taking appropriate actions.

Sentinel events

A relative infrequent unexpected incident related to system or process deficiencies, which leads to death or major and enduring loss of function (at least for 2 weeks or more) for a recipient of health care service.

Certain indicators are used in Neurosurgery hospital care so that its quality of service can be evaluated using standards. These are called quality indicators.

Types of Quality indicators

- Percentage of medication errors. (Total no of medication error in given period of time/total no of discharge and deaths in that period) x 100.
- Percentage of transfusion reactions. (Total no of transfusions in a given period/total no of transfusions in that period) x 100.
- Urinary tract infection rate. (No of urinary catheter associated UTIs in a given period/No of urinary catheter days in that period) x100.
- Respiratory infection rate. (No of ventilator associated pneumonias in a given period/no of ventilator days in that period) x 100.
- Intra vascular device infection rate. (No of central line associated blood stream infection in a given period/No of central line days in that period) x 100.
- Surgical site infection rate. (No of surgical site infection in a given period/no of surgeries performed in that period) x 100.
- Incidence of bed sore after admission. (No of patients who developed new/worsening of pressure ulcer in a given period/No of discharges and deaths in that month) x 100.
- Bed occupancy rate and average length of stay.

Bed occupancy rate

- (No in-patient days in a given period/No of available bed days in that period) x 100.
- Average length of stay (combined and specialty wise).
- (No in-patient days in a given period/No of discharges and deaths in that period of time) x 100.
- Incidence of needle stick injuries (injury due to sharp).
- (No of parenteral exposure in a given period of time/no inpatient days in given period of time) x 100.

The above points are symbolic only. Idea of quality is very vast and involves each and every step we take in the profession what is called as total quality management (TQM).

Discussion

Quality should be inherent in every walk of work areas of the organization what may be called as institutionalization of quality. It should come in day to day practice involuntarily to become successful. This should be diligently done by all the health care worker of the facility without any exceptions to achieve required goal. Now we will discuss quality and standards of operation theatre, wards and Intensive care unit and their variations wit advantages and disadvantages of such variations.

Quality and standard of operation theatres [7]:

- Operation theatre should have the proper zoning concept. Whereby we have created four different zones here: A) Reception zone. B) Protected zone. C) Sterile zone. D) Disposal zone.
    - Care should be undertaken to avoid crisscrossing of traffic between the zones. It is ensured that there is unidirectional flow of work and materials.

- Air conditioning should be planned to support a clean and optimal environment at all places in the operation theatre. There may be a laminar flow with central air-conditioning and HEPA filters with positive pressure environment in all operating suits.
- Entry to protected and sterile zones is restricted and due care is taken that only authorized persons enter these areas and they are properly clothed as per the requirements.
- Any member of staff suffering from contagious infections is forbidden entry to these areas till he is clinically cured.
- Regular washing and sterilization of operation theatre should be carried out and these activities are done in a planned manner and a record of these is maintained by the operation theatre nurse in charge.
- Regular fumigation of operating suits should be carried out and a record of these is maintained by the operation theatre nurse in charge.
- It is ensured that OT change clothes, slippers/foot wears, caps, masks, plastic gown, sterile drapes and gowns etc. should be available in adequate quantity as per the requirements.
- Personnel in OT should be properly trained and educated in proper maintenance of the OT Environment and are provided with logistics and materials.
- Culture swabs should be regularly taken from the operation theatre area for surveillance of hospital acquired infections. This should be done by the HIC nursing sister. The results are documented and a record of this is maintained and findings discussed with all those involved in OT operation.
- All statutory provisions with regard to Bio- medical waste management should be complied with in the OT.
- Regular fumigation of operating suits is carried out after cleaning and a record of these is maintained by the operation theatre nurse in charge.

OTs should have a three-tier structure as follows,

- Primary structure of any hospital which includes main structure with floors, columns and walls, should be built to have at least 50-60 years of life span.
- Secondary structure including steam, ventilation, cooling, water supply, gases, waste-water systems, electric lines, fire extinguishing system, IT net with optic cables supply and disposal pipelines, elevators, heating, radio net, etc. should be built to have a15-20 years of life span.
- Tertiary Structure Should be built to have a10-15 years of life span.

The tertiary structure includes all decoration, furnishing, wall panelling, paint colours, lighting, floor mats etc. It also includes all flooring, wood fitting, furniture, sanitary equipment, false ceiling etc.

The operation theatre complex consists of operating rooms, pre-medication room, post-operative room, reception, Neurosurgeons/surgeon room, nursing rooms, male/female changing rooms and other ancillary areas. The neurosurgery operation theatre is a high cost area to the hospital management hence proper utilization of theatres is essential. The facility within the neurosurgery operating room requires presence of high-end equipment, sterile operating environment and good lighting and ventilators system. It is preferred to go in for grouping of operation theatres for effective as well as cost effective utilization and overcome duplication of resources.

Design consideration

The Neurosurgery operation theatre should be located on the 1st floor (Ideal) in a vertical structure. It should be away from the main patient movement, close to surgical wards and surgical post-operative rooms and neurosurgery ICU. The central sterile supplies department should have close access to the OT. It is preferred to have drum-waiters, (sterile and dirty) for movement of sterile and unsterile surgical items to and from the theatres respectively. The work flow should be unidirectional. In planning operation theatres for Neurosurgery the following criteria may be considered.

Functional criteria [8]**:** Zoning concept should be incorporated while considering the functional criteria.

- **Ultra clean Zone**: This covers one meter around the operating site.
- **Sterile Zone:** This area covers the operation rooms/suite; scrub room; gowning area; sterile linen area.
- **Clean Zone:** This includes drug store; sterile store; staff-room; anaesthetist room; premedication room.
- **Protective Zone:** These are the area through which patient are wheeled into; personal movement; lifts; OT reception, Waiting area; change rooms; all forms part of this zone.
- **Disposal Zone:** This is outer most zones and comprise of the dirty corridor around the OT complex. Soiled linen and unsterile instruments are taken out of the operating through the hatch, and then moved out of OT complex through this corridor.
- **Aseptic zone:** Putsep had coined this term to represent the site of incision.

Work Flow in Neurosurgery operation theatre

The flow of material and work should be from clean to dirty zone in one direction only. The corridors leading to the Neurosurgical operation room should be 2.85-3.2 square meter. The direction flow should be unidirectional and it should not cris-cross.

Equipment

The technology is rising. The requirement of equipment will be according to the choice of the neurosurgeons/surgeon and the type of cases being dealt with. They may include electronic- hydraulic operation table, high speed drill, ultrasonic aspirator, electro cautery, operation suit, neuronavigation/other navigation, stereotactic frame or even frameless stereotactic surgery etc. these are symbolic each place will decide specific equipment as required at that place depending on need.

Space requirement (UK Standard)

Space required for an operating room is about 625 square feet (25 x 25 feet) for super-specialty Neurosurgery operation theatre details of area and height etc. is provided below in following table.

Table size of operation theatres [9].

SN	Type of operation theatres	Size (feet)	Areas (Square feet)	Remarks
1	Minor OT	18 x 16	288	Minor surgery/ neurosurgery OT
2	Major specialty OT	18 x 18	324	Surgery, orthopaedics etc.
3	Super specialty OT	25 x 25	625	Neurosurgery, cardiac surgery etc.

Table 1

The ceiling height should be at least 3.1 to 3.2 meters to a maximum height of 3.6 meter.

Environmental criteria

The operation theatre should be well ventilated, there should be adequate lighting and a good lighting and a good infection control protocol should be adopted to decrease the risk of infection and related morbidity and mortality.

Temperature

The temperature should be maintained between 21^0 -23^0. However, 22-26 ^{0} C may be used in Neurosurgery ICU.

Humidity

The humidity of 45-55% should be ideal for OT while 30-60% may be used in neurosurgery ICU.

Air changes

Air changes should be 15-20/hour is accepted norm in OT while even 6 air changes suffice in NS ICU. The exhaust should be placed at ground level. HEPA (high efficiency particulate aggregate) filters which have the filtration capacity between 0.3-0.5 microns may be used in case of operating rooms taking up neurosurgeries requiring ultra-sterile environment while even HEPA or Millipore filter (0.5 micron) can be used in neurosurgery ICU. A continuous positive pressure should be maintained.15-20 mm of positive pressure should be in OT while 15 mm of hg may be ideal in NSICU (Neurosurgery intensive care unit).

The wall may be metallic in modular OT with antibacterial paint. However, wall may be plain and easily washable. The colour of the wall should be glare free; shades of green, blue, violet are preferred. The corners should be rounded to prevent bacteria from

harbouring in sharp corners. The terrazzo tiles or mosaic may be used for flooring. Sliding doors are ideal for the operation theatre. Proper grounding is essential. Electrical switches should be of high quality, spark proof. There should be a minimum of 4 sockets with two of them 15 amps; all sockets should be placed at 4 feet height within the theatre or outside.

Ventilation flow types

The ventilation system is essential within the OT, both to maintain the desired temperature and also to maintain the air changes. Different flow pattern has been used.

Turbulent flow

In this type there is uniform mixing of air in the room. This method uses continuous turbulent flow diluting the clean incoming air, with the contaminated operating room air exhausted through the exit with same rate as in coming clean air.

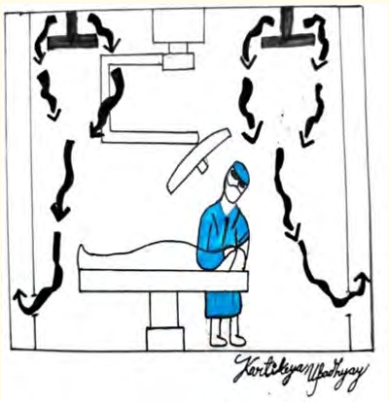

Figure 1: Turbulent Flow.

Laminar flow

In this type of, is most preferred where there is high velocity air flow. These are further classified into vertical, horizontal and others (tunnel type, cross – flow pattern) (Figure 2).

The exponential flow

This gives a trumpet shaped air flow pattern. In this type there is down ward and out ward flow of air. This type of air flow has the facility of moving the sterile air centrally downward over the operation table and operating team, and then curves progressively outward towards the periphery of the clean (Figure 3).

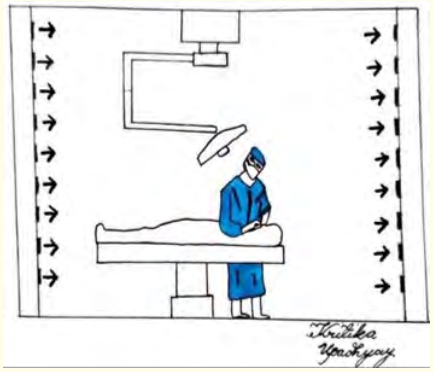

Figure 2a: Laminar flow (horizontal type).

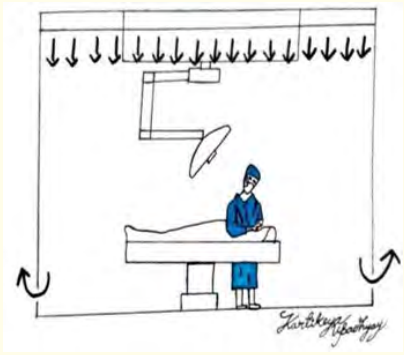

Figure 2b: Laminar flow (Vertical type).

Figure 3: Exponential Flows.

Noise level should be low than 30-40 decibel in OT whiles it should be below 40 in NS ICU.

WARDS (Quality and standards)

A ward is an area in the hospital which provides accommodation and care for the 'in-house' patients of the hospital. Planning of a ward involved placement or grouping of beds at one place. Several wards placed together for a ward block because each ward functions similarly. All the hospital departments need wards, but each department has different needs and requirements so the ward design has to be different for different situations.

The total internal area for emergency department, excluding observation ward should be around 500M^2 for a daily load of 50 -75 patients.

Definition

It is the development of service facilities which enables the healthcare staff to care for the admitted patients of the hospital.

Objectives

- To increase quality of care.
- To enhance the satisfaction of the patients it is necessary that the hospital strives towards providing quality care in medical services.
- To provide maximum comfort

The ward created for in house patients should be of the desired environment to the patient in terms of security, safety, convenience, privacy and comfort. Efforts should be made to avoid factors causing inconvenience such as direct sunlight, slippery flooring etc.

- Enhance satisfaction of staff
- Staff satisfaction is important as it has a direct effect on patient care rendered. The healthcare staff should be well motivated which makes the patients stay more comfortable and pleasant.
- Patients relatives and visitor's convenience
- There should be enough privacy for the relatives of the patients during their stay at the hospital.

There should be enough privacy for the patients without compromising the inpatient monitoring from the nursing counter.

- Cost and maintenance of service
- Planning should involve the necessary facilities required for rendering good and efficient patient care while ensuring minimum expenses on maintenance and service costs.

Nursing area

The nursing zone consists of nursing space, patient space and corridors. Wards may consist of ancillary area, circulation space and the bed area. The bed area may consist of rooms with single beds, twin sharing rooms, or halls with multiple beds. The ancillary area consists of bathrooms, treatment rooms, nurse's station, and ward pantry, clean and dirty utility.

It is recommended that the distance of the remotest area of the hall should not exceed more than 100 feet from the nursing station.

Design and layout

- **Size:** The size of the wards depends on several factors. It can vary from as low as 10 beds to high as 90 beds in a single ward. Some of the parameters influencing the design and layout of the wards are:
- Severity of the patient condition to be housed. The more the severity smaller the ward e.g. ICU. CCU, T.B Sanatorium etc.
- Category of the ward General wards has more number of beds than special room or deluxe wards.
- **Location:** The location of the wards depends on the activities taking place, services rendered, movement of patients, relatives of patients, doctors, nurses, paramedical staff, visitors etc.
- **Ward Areas:** The various areas that need to be included while designing the wards are:
- *__Patient space:__ It includes Multi-bed bays, patient rooms
- *__Other space:__ Which serves as a space for reading, writing, watching TV, etc.
- *Patient relative's area
- *Visitor's waiting area
- *Corridor space

Ward design

Nightingale ward

It is named after Florence nightingale. This type of ward was designed in 19th century after the Crimean war by Frenchman. Later it was adopted by name of Florence Nightingale and is known by her name. The characteristics of Nightingale ward is described as below:

- Ward consists of total of 40 beds.
- Patient Bed in two rows at right angle to the longitudinal wall.
- It may have side rooms for utilities and perhaps one or two side rooms that can be used for patient occupancy when patient isolation or patient privacy is important.
- Nursing Station, Doctor's room and others facility at one end. Bathrooms and sanitary areas at the other end.

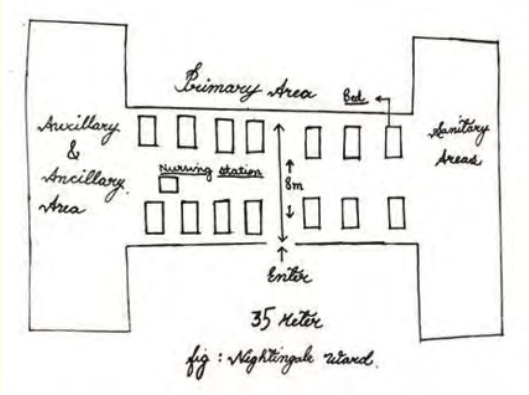

Figure 4

Advantages

Good Visibility and economical and easy to construct, plenty of fresh air and ventilation.

Disadvantage of Nightingale wards

- No privacy for patient.
- Lot of traffic in the patient care area.
- Risk of cross infection.
- Fatigue of Nurses.
- Increased distance between nurses and patients.

Space between beds reduced.

Variant nightingale ward

It is also called cruciform shape ward. The length of ward is nearly 26 meters. It was developed to overcome certain disadvantages of the nightingale ward. It has got a nursing station in Centre of ward, Ancillary and Auxiliary service at one end and utility service at other end. The nurse travel time has been reduced and the supervision over patient's condition also improved in modified pattern of ward.

Advantages

- More privacy.
- Less noise.
- Less cross infection.
- Because the toilets are attached to the wards thus it is more convenient for the patients.

Disadvantages

- Limited view from the nursing station.
- Communication with the buses is difficult for patients.
- Higher cost of construction and maintenance.

Rig's Ward

It was first made in Rig hospital in 1910 in Copenhagen.

Ward unit is divided into small compartments separated from each other. Each compartment having 4-6 or more beds arranged parallel to the longitudinal wall. Bed may be on one side or both side of nursing station. Isolation room (1 or 2) can be kept in ward.

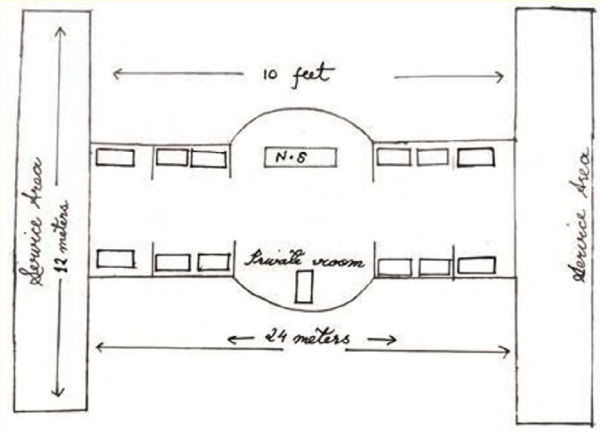

Figure 5

Advantage of RIG's Ward/Bay Ward is there would be privacy for patient, Risk of cross infection minimized, less noisy, Isolation of infectious cases can be easier.

Disadvantage of RIG'S ward include:

- Communication between patient and nurse is more difficult.
- Direct observation of patient is difficult.
- More staffing required.
- Costly and difficult to maintain than Open ward.

Nuffield ward

It was developed in the 1950s by a study, based on findings of which, an experimental ward was constructed.

Race track design

It was developed in 1950s in USA. It was called a double corridor system. This design has 36 beds with two nursing station.

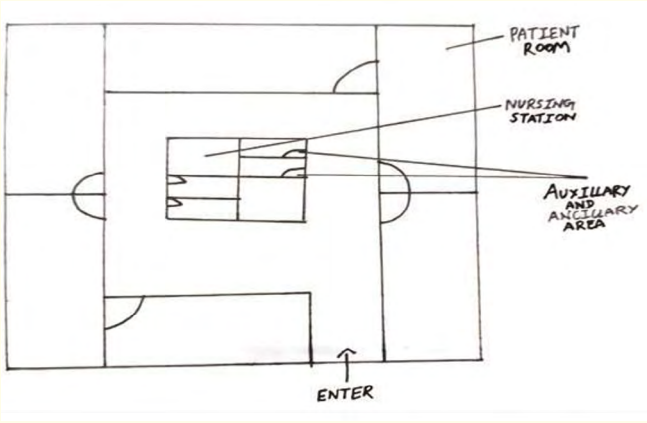

Figure 6

Harness type ward

It is also called the crossed type. It has different types of rooms with single, double, four and even eight beds.

Courtyard ward

The main selling point of this type is enough natural light and ventilation. It also helps in improving the hospital economy by saving costs.

Quality and Standards of Intensive care unit (ICU)

ICU is a nursing care unit for patients needing critical care which means taking special care of patients from life– Threatening conditions and who will need comprehensive care and constant monitoring.

Classifications of ICU Medical ICU.

- Surgical ICU. Coronary ICU. Pulmonary ICU. Obstetric ICU. Neonatal ICU. Burns ICU.

ICU should be place away from regular traffic.

Overall space should be 50sq m with at least one or two beds separated by partition/curtain to provide privacy and separate ventilation mechanism. With 20 sq. for each adult bed area other than service spaces. Engineering support system should include temperature up to 20 to 25 degree centigrade, humidity 59%, positive pressure ventilation with 10 air changes per hour, 300 lux uniform diffuse light, uninterrupted water and power supply for patients.

There should be 1:1 ratio for ventilated patients and 1:2 nurse, patient ration for non-ventilated and less requirement is required for patient (Australian college of critical care Nurse Guidelines ACCCN). Need or nurses may increase if patient require complex management.

It is a highly specified and sophisticated area of hospital which is specifically designed, staffed, located, furnished, equipped and dedicated to management of critically sick patients, injuries or complications. Patients admitted to these beds are in critical condition but can be treated. These patients require rigorous monitoring and life support. The development of ICU is expensive, so many small hospitals and nursing homes don't have them. IMA has recommended that any hospital with more than 200 beds should have an ICU. Other prestigious associations suggest that ICU beds should comprise not less than 2% of the total beds in the hospital.

Definition

An intensive care unit is a special unit of hospital, set up to provide extraordinary surveillance and support of vital functions and definitive therapy for patients having acute or potentially reversible life-threatening impairment of a vital system.

Layout

The ICU also known as high dependency units (HDUs) should have close access to the emergency department, OTs, post-operative wards and surgical wards. It should be closely located to central sterile supplies department land and diagnostics etc. The number of beds in ICU should be 6 to 8 beds with 1 to 2 isolation beds. It is indicated that all the tertiary care centres should have ICU for neurosurgery.

The arrangement of beds can be in the form of a semicircle with nursing station at the centre or a circle with ancillary services in the middle.

Infrastructural facilities

The infrastructural facilities should ensure good view for observation from the nursing counter. It is advisable to have a semicircular bed arrangement however a rigid partition is not recommended.

Recommendations for setting up an ICU:

- To make it easier to clean and maintain, marble or terrazzo tiles are advisable for flooring/wall.
- Corners should be rounded off to prevent accidents.
- Space requirements of 150Sq. feet/bed is essential for rapid movement of patients, equipment, health personnel.
- It is preferred that all ICUs be located on the same floor especially in multi-storey hospitals.
- The ICU is best if placed on the first floor in a vertical setting with a ramp leading to the ground floor.
- There should be a wash basin near every bed to prevent infection from other patients.
- Auxiliary facilities like doctor's rest room, dirty linen room etc. should be planned according to the workflow.
- One or two beds can be labelled as isolation beds.
- Dialysis machine should be available at ICU so that it can be used for patients requiring dialysis support.
- The internal environment of ICU should have a temperature of 22 to 24 degrees Celsius and humidity of 60%.
- The ICU should be well ventilated with air changes of 14-16 per hour.
- The beds should be specially designed with all position manoeuvres possible, slots for X-ray cassette positioning; fixing IV stands etc.
- On every bed there should be a nurse call bell facility available.
- Minimum 5-6 sockets for plugging in electronically operated lifesaving gadget should be available. 6KV strength of current would be sufficient in these sockets.
- Lines for suction/medical oxygen/air with proper backup.
- About 100 lux of light in patient care areas is necessary with availability of pedestal lamps for various procedures.

Medical Equipment requirements

The equipment to be housed in an ICU should be cardiac monitors, infusion pumps, syringe pumps, portable suction apparatus. Portable X-ray and IABG analysing machine should be available in the ICU setting. All equipment should be calibrated, maintained and checked for proper functioning on a daily basis.

Staffing

The staffing requirement for the unit should have an anaesthetist, intensive care expert/pulmonologist, critical care specialists, respiratory therapist and nursing staff and hospital auxiliary workers. The nurse requirement is based on the number of nursing hours provided in the ICU which is usual 10-18 hours, and the number of beds. It is advisable to have multi-tasking of the nurse; having them to work in other areas if ICU occupancy is low. Alternatively, the ICU staff may be rotated to create a bank of nurses having ICU expertise.

Policies and procedures

Some protocols should be agreed by the staff working in the ICU to prevent any confusion. ICU should have a standard operating procedure in place to simplify the working pattern. Once the pa-

tient is shifted to intensive unit, it is best to hand over the responsibilities to the ICU in-charge after having enumerated the treatment details of the earlier physician. The intensive care unit should have policies for the following:

- **Admission policy**: The admission policy should clearly state the mode of admission, whether the patient is received directly into ICU or via casualty. Protocols for the patients received during head injuries, septicaemia etc. should be written and all the working staff should know about it.
- **Patient receiving in ICU**: A protocol for receiving critical/unconscious patients in ICU, policy for handover of any valuables/gold, documents on the patient at the time of admission to patient's relative with proper documentation should be in place.
- **Training and development:** Written policies on training and development for new comers and also those already employed, in knowing the latest update in ICU treatment and patient care should be there.
- **Discharge policy:** Protocols for movement of patient out of the ICU should be written. Protocols for discharge against medical advices, discharge at request, and death in ICU etc. should be established.
- **Visitor's policy** : Formulation of visiting hours for ICU along with restricting the number of patients in order to prevent cross infection should be done.
- **Maintenance policy**: A maintenance policy for all equipment's housed in the ICU including central line, medical equipment, electric lines etc. should be available. Day-to-day checking for functioning of life saving equipment's is mandatory and calls for serious legal implications if maintenance of these equipment's is neglected.
- **Infection control in ICU:** The infection control measures adopted in ICU should be in line with hospital infection control manual. There should be written procedure for patient handling, clothing for medical personnel handling the patient, hand washing policy, periodicity of fumigation, sterilization technique etc.

Classification of intensive care unit

Level I

- It is recommended for small district hospital and small private nursing homes along with rural centres.
- 6 to 8 beds should be there
- Should provide resuscitation facility and short term Cardio respiratory support.
- ABG should be available
- Ventilation facility for at least 24 to 48 hours should be present.
- Arrangements for safe transport of the patients to secondary or tertiary canters should be available.
- Should have lab and imaging back up.

Level II (Recommendations of Level I Plus)

- It is recommended for larger General Hospitals.
- 6 to 12 beds.
- A trained/qualified Intensivist is present as director.
- Life support available.
- Presence of Invasive and Non-invasive Ventilation
- Ability of long-term ventilation.
- Presence of ABG, Electrolytes and other routine diagnostic support 24 hours.
- Imaging facilities such as CT and MRI is desirable.
- Ideally supported by Cardiology and other super specialties of Medicine and Surgery.

Level III (All recommendations of Level II Plus)

- It is recommended for tertiary level hospitals.
- 10 to 16 beds should be available.
- It should be headed by an Intensivist.
- It should be equipped with all the recent methods of monitoring, invasive and non-invasive including continuous cardiac output etc.

- It should be able to provide long term acute care of highest standards.
- Imaging facilities like bedside x-ray, USG, 2DEcho available.
- It should own or outsource CT scan and MRI facilities should be there.
- Patient/Nurse ratio should be 1/1.
- All the staff including doctors, nurses and other support staff should be continuously updated in newer technologies and knowledge in critical care.

For neonatal and paediatric surgical ICUs, a special classification was recommended.

The proposed paediatric surgical ICUs levels are:

Level 1: Neonatal resuscitation can be performed.

- It cares for term new-borns as well as infants of 3537 weeks of gestation.
- Other cases should be stabilized and transported to higher level of care.

Level 2a: Can provide level1 care.

- Cares for infants who are above 32 weeks of gestation and 1500g of birth weight.
- Cares for infants with physiological immaturity who do not require ventilation.

Level 2b: Can provide level 2a care.

- Cares for infants who need mechanical ventilation for brief duration.

Level 3a: Cares for infants greater than 1000g of birth weight and 28 weeks of gestation.

- Sustained life support available.
- Conventional mechanical ventilation available.
- Minor surgical procedures can be performed.

Level 3b: Can provide 3a care.

- Advanced respiratory support.
- Major surgical procedures can be performed excluding ECMO (Extra Corporeal membrane oxygenation) and repair of congenital heart defects.
- Prompt and on-site support of paediatric surgeon and anaesthetist.
- Advanced imaging support available on urgent basis.

Level 3c: Has capabilities of level 3b ICU.

- ECMO and surgical repair of cardiovascular defects can be done.

Results and Conclusion

The maintenance and continuous up gradation of quality and standards is the trend and requirement of present time as patients are becoming more and more aware due intensive coverage on electronic media, social media as well as better and quick modes of communications. With quality assurance with standards and special operating procedure in place miss happenings in patient care may be decreased with aim to finally eliminate any. This will also decrease the patient's dissatisfaction and rather increase the satisfaction level leading to acceptance of the services and thus increasing the earning of institution and will also decrease the litigation and thus decrease unnecessary expenditures and bringing the institution in good financial wealth so that it can add new services.

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