GUIDELINE

For

INTENSIVE CARE UNIT DESIGN

FACULTY OF CRITICAL CARE MEDICINE

COLLEGE OF ANAESTHESIOLOGISTS AND INTENSIVISTS OF SRI LANKA

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FACULTY OF CRITICAL CARE MEDICINE

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These are guidelines only and describes an optimum ICU design for a unit caring for adult patients. The individual design team should identify essential & optional components for their particular unit.

1

INTRODUCTION

Intensive care unit is a distinct organisational & geographic entity for clinical activity & care, operating in cooperation with other departments integrated in a hospital. It is preferably an independent unit or department with controlled access that functions as a closed unit under the full medical responsibility of the ICU staff in close concert with the referring medical specialists.

An ICU should accommodate as a minimum at least 6 beds with 8-12 beds considered as the optimum. Larger ICU may create separate specialised functional sub units with 6-8 beds sharing the same geographical, administrative and other facilities.

To establish a critical care unit in a hospital in Sri Lanka, it is strongly recommended do so only in centers which has a minimum of two Consultant Intensivists/ Anaesthetists, so that 24/7 cover to the unit can be guaranteed.

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Levels of Care in ICU [11]

Levels of Critical Care for Adult Patients (ICS)[14]

Level 1 – Patients recently discharged from higher level of care or those in need of additional monitoring/clinical interventions, clinical input or advice or patients needing critical care outreach service support
Level 2 – Patients needing pre-operative optimisation or extended post operative care or those stepping down to Level 2 care from Level 3, patients receiving single organ support or basic respiratory support
Level 3 – Patients receiving advanced respiratory support alone or a minimum of 2 organs supported

Several levels of care can be integrated in to the same ICU in a flexible organisation model.
In a high dependency unit (HDU), maximum level of care provided should not exceed level 2.

The choice to organise a HDU & a ICU separately or have a mixed ICU/HDU can be made depending on the requirements of the individual hospital.

A mixed unit may be preferred in our setting where available manpower can be used efficiently, depending on the work load for the day. There can be flexibility of the number of beds of different levels that can be managed on a particular day based on the activity of the patients where, when there is concentrated high activity in some beds, other beds on offer may only be able to provide a lower level of care.
In a mixed unit, basic structural design should be at the highest level so that, in an event the patient needing a higher level of care, instead of moving the patient within the unit to a adequately equipped bed space, necessary equipment may be brought to the patient bedside at any time.

Depending on the infrastructure available in the particular hospital, it might be prudent to have a single level of care ICU (eg Level 2 only). This is relevant to our country as certain types of hospitals (eg Base Hospitals) lack multidisciplinary input that is required to function a Level 3 ICU.

Thus it is strongly recommended that when setting up a critical care unit, the type of hospital & the expertise (cardiology, nephrology etc) and services available are taken in to consideration and based on that, appropriate level of ICU is decided.

A guide to requirements to set up an ICU is as below.

Level 1

- Recommended for .....hospitals
- Ideally 6-8 beds
- Incharge to be a Consultant Intensivist/Consultant Anaesthetist/ other suitable consultant
- Provides resuscitation & short term cardiorespiratory support
- Non invasive monitoring
- ABG analysis -desirable
- ability to safe transfer to secondary or tertiary care centre
- Availability of basic clinical laboratory facilities (FBS, Blood glucose, Electrolytes, liver & renal function tests, imaging (X-ray & USS) & ECG
- Blood Bank
- Microbiology support- local or distant

Level 11 (Level 1 requirements plus)

- Recommended for larger general hospitals
- Bed strength 6-12
- Incharge to be a Consultant Intensivist/ Consultant Anaesthetist/ Other suitable consultant
- Invasive/Non Invasive Ventilation; Ability to ventilate long term
- Invasive monitoring
- Transcutaneous pacing
- Laboratory support for 24 hours
- CT, MRI- desirable
- Strong Microbiology support with facility for fungal identification
- Nurse:patient ratio 1:1
- Support of Cardiology & other super specialities of medicine & surgery

Level 111 (Level 11 requirements plus)

- Recommended for tertiary level hospitals
- Bed strength of 10-12, with one or multiple ICUs as per requirement of the institution
- Preferably a closed unit
- Multidisciplinary unit headed by Consultant intensivist/ Consultant Anaesthetist
- All latest monitoring methods
- bedside 2D Echo,USS & Xray
- Renal Replacement therapy
- Bedside Bronchoscopy
- Supported by blood bank & blood component therapy

3

DESIGN PROCESS

Design of an ICU requires

- Knowledge of regulatory standards (we expect this document to subsequently evolve into one)
- Expertise of critical care practitioners who are familiar with the special needs of this patient population
- Decision of level/levels of care that particular unit would provide

Designers must consider the requirements of the daily workflows as well as look at the long term function of the unit. An effective ICU design must be flexible enough to accommodate changing care practices & advances in the technology.

3.1

THE DESIGN TEAM

Should consist of following

- Intensivist/Anaesthetist
- Clinical Microbiologist
- Administrator
- Finance officer
- Architect / Biomedical engineers
- Nurse in charge
- Any other person with special expertise
- Manufacturers/ suppliers of clinical & support equipment & furnishings

Coordinator is the most important person who coordinates with everyone involved. Intensivist or any other consultant in charge is best suited to be the coordinator.

3.2

DESIGN CONSIDERATIONS

When designing the unit attention must be given to the following aspects.

- Allocation of adequate funds
- Level of ICU / Levels of care provided
- Multidisciplinary or specialised ICU - to prioritise equipment
- Location in the hospital
- Number of beds
- Adequate Human Resources/ training
- Structural designing
- Patient safety and prevention of infection programmes

- Transition in case of relocation of an existing unit during construction

After finalising the project proposal, a time frame should be fixed for completion and the deadlines strictly adhered to.

It is advisable that engineering work be done in a manner that facilitate repairs whenever needed without jeopardizing patient care.

3.3

DECIDING ON THE NUMBER OF INTENSIVE CARE UNIT BEDS[5,6]

Number of intensive care beds will depend on the data available from the hospital and current/ future developments of the hospital.

Number of ICU Beds recommended in a hospital are usually 1- 4 per 100 hospital beds.

ICUs having <6 beds are not cost effective and also they may not provide enough clinical experience and exposure to skilled human resources of the ICU. At the same time ICU with bed strength of > 24 may have to be administered as pods of 6-12 beds.

Recommendations suggest that efficiency may be compromised once total number of beds crosses 12. Therefore, it is recommended that total bed strength in ICU should be between 6 to 12.

The Canadian Department of National Health and Welfare has developed a formula for calculating the number of ICU beds required based on the average census in the existing unit and the desired probability of having an ICU bed immediately available for a new admission. (refer appendix ....)

4

DESIGN RECOMMENDATIONS

4.1

LOCATION

- Safe, easy & fast transport of a critically ill patient should be priority in planning its location. Therefore, the ICU should be located in close proximity to ETU/ER, Operating theatres, trauma ward, medical imaging department and functional testing facilities (eg. Catheter lab, endoscopy).

- Close proximity is desirable to diagnostic facilities, blood bank, pharmacy, dialysis unit etc. If pneumatic tube systems are used to transport specimens & computers are used for transmitting test results, the physical proximity is less important.

- No thoroughfare can be allowed via ICU.

4.2

ENTRY/EXIT POINTS OF ICU & CORRIDORS/DOORWAYS

- There should be single entry/ exit point to ICU for patients. A separate entrance for supplies should be designed which may be used by the staff as well. However it is required to have emergency exit points in case of emergencies and disasters.

- Entry should be through two sets of double doors and both sets should not open at the same time.

- Dedicated entrances should have video camera monitoring capability and telephone or intercom to allow communication between ICU staff & visitors. A buzzer system with telephone contact from outside the unit to an access control desk is recommended.

- Access control measures should be in place. Close proximity cards rather than swipe cards or key pads should be used as they offer better infection control.

- Corridors, lifts and ramps should be spacious enough to provide easy movement of bed/trolley of critically ill patient. They should be 2.5 m minimum width & should be high enough to allow unobstructed transport of patients and support equipment.

- A separate supply corridor for supplying & servicing as well as removal of soiled items is useful to minimise disruption of patient care activities.

- Doorways should be minimum of 1 m in width [4]

4.3

INDIVIDUAL AREAS/ROOMS

Overall ICU floor plan and design should be based upon patient admission patterns, staff and visitor traffic patterns and the need for support facilities such as nursing station, storage, clerical space, administrative and educational requirements and services etc.

The floor plan should be designed to accommodate the following areas. Need for certain areas/rooms may be decided by the design team based on the requirement, space & budget.

A. Patient areas
    I. Bed Spaces
    II. Isolation rooms
    III. Assisted Shower Rooms/ Patient Toilet – wheel chair
    IV. Management Base – Nursing / Management Station
B. Clinical Support spaces
    I. Storage rooms

II. Equipment Storage area/ Parking Bay
III. Laboratory area
IV. Nourishment preparation area
V. Utility Rooms – Clean Utility & Dirty Utility
VI. Decontamination Room
VII. Clinical Equipment Service Room (Optional)
VIII. Procedure Room

C. Staff Areas
I. Offices
II. Rest Rooms
III. On call Rooms
IV. Changing rooms (optional)
V. Conference & Teaching Area

D. Public Areas
I. Reception
II. Visitor Waiting Area
III. Quiet Room/ Consultation Room

4.3.A PATIENT AREAS

I. BED SPACES

- Patients must be stationed so that direct or indirect (e.g. by video monitor) visualization by healthcare providers is possible at all times. This permits the monitoring of patient status under both routine and emergency circumstances.
- Patient area could either be of ward type or single room type;
    - Ward type ICU should allow at least 225 square feet per bed
    - Room type - 250 square feet per room with minimum width being 15 feet.
- In addition there should be 100 to 150% extra space to accommodate other areas required for the unit, as detailed below.
- There should be an unobstructed corridor / circulation space of at least 2.5m width, in the unit.
- It may be prudent to make one or two bigger rooms /areas which may be utilised for patients who undergo major bedside supports such as renal or hepatic replacement therapy, ECMO and have large array of equipment attached to them.
- It is recommended that there should be a partition/separation between rooms/ patient areas as patient privacy is desired. Standard curtains soften the look and can be placed between two patient areas. However they are displaced and become unclean easily and patient privacy is disturbed. Fabrics used should be durable, colourfast, flame and static resistant.
- Doorways to the bed spaces/rooms should be wide enough & appropriately placed to allow an ICU bed along with any attached equipment to pass easily.

- In ICUs with a modular design, patients should be visible from their respective nursing substations. Sliding glass doors and partitions facilitate this arrangement, and increase access to the room in emergency situations.
- Patient should be oriented so that they can see the nurse but not the other patients.
- All patient areas/rooms should possess a daylight source. Ideally should allow a direct view of outdoors, preferably overlooking a garden, courtyard or other natural setting.
- Clear floor space is space not occupied by the patient, fixed room furnishings & equipment. Each room/ patient area should be designed to accommodate portable bedside x-ray, Ultrasound and other equipment such as ventilators and intra aortic balloon pumps etc. Single patient rooms should have an optimal clearance of 4 feet at the head & foot of the bed and not less than 6 feet on each side of the standard critical care bed.[16]
- A minimum ceiling height of 3m is required at the bed spaces.

II. ISOLATION ROOMS –

10% of the intensive care unit beds (1 or 2 per 10 beds) may be used exclusively for isolation of patients such as those with burns, serious contagious infections or immunocompromised. These rooms may have 20% extra space than other rooms.

The ratio may be higher (5-6 per 10 beds) in special ICUs (burn units, transplantation units etc)[12]

Isolation rooms should be equipped with an anteroom of at least 3 square metres for hand washing, gowning and storage of isolation material.

Separate pathway for evacuation of contaminated material is recommended.

Negative pressure isolation rooms

These are for isolation of patients infected/ suspected to be infected with organisms that spread via airborne droplet nuclei of <5µm in diameter.

Windows of these rooms do not open. They have greater exhaust than supply air volume, with pressure difference of 2.5 Pa.

Clean to dirty airflow i.e. direction of the airflow is from the outside space into the room. Air from the room is preferably exhausted to the outside, but may be recirculated provided it is through high efficiency particulate arrest (HEPA) filter.

Positive pressure isolation rooms

These are to provide protective environment for patients at highest risk of infection e.g. neutropenia, post transplant.

These rooms should have greater supply than exhaust air. Pressure difference of 2.5 – 8 Pa preferred. Positive airflow relative to the corridor (i.e. air flows from the room to the outside space). HEPA filtration is required if air is returned.

Same isolation room may be used for both positive & negative isolation by using a method of conversion of air from negative to positive or vice versa.

SERVICES PER PATIENT AREA/ROOM

Each bed space should include

a) An electric or manual ICU bed (refer section 8)
b) A high backed chair (refer section 8)
c) Medical Utility Distribution Systems
d) A clinical hand wash basin (section 7)
e) Storage (Section 6)

Medical utility distribution systems are used for mounting & organising electrical, medical gas and other medical utility outlets. There are several options available.

1. Flat head wall configuration - mounted on the wall at the head end of the bed. Allows outlets to be easily arranged but may create problems during a crisis as head end may be cluttered with connecting wires/lines.

2. Column configuration - has an array of outlets on a non-movable vertical column attached to the floor & ceiling. Non movable suspended variant is available too.

3. Boom configuration - consists of a movable articulated arm(s) which could be either ceiling mounted or wall mounted. Ceiling mounted twin armed pendant offer maximum flexibility in positioning & accessing utilities.

Accessory shelves, brackets and poles may be mounted on these devices allowing optimal positioning of all support devices such as monitors, computers, communication devices, IV pumps etc, subjected to a maximum weight that can be supported.

UTILITIES PER BED AREA/ROOM

- Electrical outlets -

  Grounded 240 volt electrical outlets with 30 ampere circuit breakers

  16-28 unswitched single socket outlets per bed. 50% of them to be connected to the hospital emergency power system/ uninterrupted power supply (UPS) & these sockets should be clearly labelled/colour coded.

  Positioned about 3 feet above the floor. If it is flat head wall design, the utility outlets be distributed on either side of bed.
  (Suggested amperage of outlets - 15A- 2, 5 A – 3 and rest 13A)

- Medical Gas - 2-3 oxygen outlets

- Vacuum - 2-5 (290 Hgmm)

- Compressed air- 1-2
- Water supply -

  From a certified source, if haemodialysis is to be done.

  Hand washing sinks equipped with elbow/knee/foot or sonar operated faucets must be available near the entrances to the patient modules or between every two patients in the ward type units.

- Communication system – telephone outlet
- Data ports
- Alarm system – patient & staff emergency call
- Lighting - refer section 5.2

III. ASSISTED SHOWER ROOMS/ PATIENT TOILET

One shower room (8 m^2) & a toilet(4.5 m^2) should be designed per 6 -8 beds which should have space for a wheel chair movement.[3]

4.3.B

MANAGEMENT BASE - CENTRAL NURSING/ADMINISTRATIVE STATION

- The size of this area will depend whether or not there are individual workspace per bed for patient files, monitoring charts etc. Individual workstations are recommended to minimise cross infections and when they are available, the central station will function for administrative work for both doctors & nurses.
- Careful consideration of what level or type of activity that will occur in the central station will ensure adequate space planning.
- All/ nearly all monitors and patients must be observable from here, either directly or through central monitoring system. Most ICUs use the central station, serving six to twelve beds arranged in an L, U or circular fashion.

- Some ICUs have unit pods/modules of about four or five beds, each served by a separate workstation. Nurses assigned to patients in the pod form a team.
- The space should accommodate shelves for forms/library, satellite pharmacy, computer terminals and printers, telephone (including a direct dialing connection), intercom & emergency alarm system etc.
- A drug preparation area too may be included here.
- It is also important that a certain amount of storage space is provided for equipment, linen, instruments, medicines, disposables, stationary and other articles. All these cupboards should be labelled.

4.3C

CLINICAL SUPPORT SPACES

4.3.C (I)

STORAGE AREA/ROOM

Sufficient storage spaces/room outside the patient area is essential. The storage room/s should be easily accessible for nursing & medical staff. Ideally it should have an approach from the patient area and from the supply route.

Important to decide what to be stored

- By the bedside - Those supplies used repeatedly and in emergencies
- At the Central Nursing Station
- Store adjacent to ICU
- Remote central store

When medications are kept at the bedside, the storage should be lockable; these stores can store medicines, disposables, records, injections etc.

Bedside supply carts that are stocked for different subsets of patients can make storage in the room more efficient; for example, surgical, medical, trauma patients, cardiac patients where needs are different.

It is recommended to group supply by activity, like Chest tray, Central line tray, skin care tray , catheterisation tray , Intracranial pressure tray etc. They be labelled by name or colour code.

CLEANERS ROOM

A 3-4 sq meter space per 8 beds are recommended for storage of cleaning equipment & material. Housekeeping material should not be used interchangeably with public areas.

4.3C (II)

EQUIPMENT STORAGE AREA/ PARKING BAY

EMERGENCY EQUIPMENT & SUPPLIES

Provisions should me made for storage & easy retrieval of one or more emergency trollies with emergency life support equipment & drugs, 'difficult airway trolley', central venous access trolley, bronchoscope trolley etc.

This area may be a corridor or an alcove and should have an uninterrupted power supply to charge the equipment's batteries.

The trolley locations should be clearly labelled.

NON EMERGENCY EQUIPMENT

An area must be provided for the storage & securing of patient care items that are not in active use such as ventilators, IV pumps, transport ventilators, US scanners, Doppler machines etc.

Horizontal storage may be planned for other equipment.

Space should be adequate for access, easy location of desired equipment and easy retrieval.

Sufficient number of electrical outlets should be available in this area too, to permit recharging of battery operated items.

4.3C (III)

LABORATORY AREA

An area for point of care laboratory testing (blood gas machine, TEG etc) should be available with adequate bench space.

At least 10-12 electric outlets, a sink, storage space for consumables and sharp disposal utensil should be available in this space.

4.3C(IV)

NOURISHMENT PREPARATION AREA/ ROOM

This could be a separate room or any other identified area within the unit. Should have a food preparation surface, sink with running water, microwave oven and a refrigerator.

Hand washing facility should be located in or near the area.

4.3C (V)

CLEAN & DIRTY UTILITY ROOMS

These should be two completely separate spaces with separate access and without any interconnection. They should be air conditioned.

CLEAN UTILITY
A space of about 15 sq meters.
Used for storage of all clean & sterile supplies (eg linen).
Should contain a work counter and hand washing station.
Shelving & cabinets (easy to clean) for storage must be located high enough off the floor to allow easy access to the floor underneath for cleaning.

DIRTY UTILITY

A space of about 25 sq meters.

Should contain a clinical sink and facility to clean soiled utensils (bed pan) etc with faucets.

There should be adequate countertop space & space for cleaning supplies.

Separate covered containers must be provided for soiled linen & waste material. Special containers should be provided for sharps.

Removal of soiled items & waste should occur through a separate corridor.

All air supplied to the dirty utility room should be extracted.

Refer environmental requirements below for details of air conditioning requirements.

This may be used as the waste hold until they are taken away.

4.3C(VI)

CLINICAL EQUIPMENT DECONTAMINATION ROOM

A second dirty utility room for dismantling & cleaning of used equipment is desirable. This can be used to clean reusable items, trolleys etc as well.

4.3C (VII)

CLINICAL EQUIPMENT SERVICE ROOM (OPTIONAL)

Equipment needs servicing as per manufacturer's instructions but this cannot be allowed within the patient areas in the unit. Thus a room/area for this purpose is very useful considering the largenumber of equipments being in used in critical cre units.

4.3C (VIII)

PROCEDURE ROOM

May be optionally important for specific units (burns, pacemaker implantation etc). All bedside facilities should be available along with high intensity lighting and a scrubbing sink. Facilities should be adapted to the specific tasks that this room is designed to carry out.

4.3D

STAFF AREAS

4.3 D (I)

OFFICE AREAS

Consultant's Office

Equipped with telephone, intercom and alarm registration in the ICU.

A computer terminal with access to patient monitoring systems is highly desirable.

Nurse's Office

Office space for sister/head nurse with separate telephone extension, intercom, notice board, alarm system.

4.3 D (II)

REST ROOMS

May have separate areas for differed staff categories.

Can be located in or near the unit & provide a private, comfortable & relaxing environment. It needs to be linked to the ICU by telephone/ inter communication system and emergency alarm should be audible within.

Comfortable seating, secured locker facilities, nourishment storage & preparation facilities & toilets should be available.

4.3 D (III)

ONCALL ROOMS:

On call rooms for members of the staff should be available as dictated by the schedule of their rota and should be situated preferably within or adjacent to the unit.

Separate rooms for male & female staff members as well as different categories of staff must be available.

4.3.D (IV)

CONFERENCE ROOM

This room would have multiple purposes like multidisciplinary meetings & staff teaching and can be used to store reference material.

It should be linked to the ICU by telephone/ telecommunications and emergency/cardiac arrest alarms should be audible from within.

Should have adequate seating facilities; collapsible chairs may be used.

4.3 E

PUBLIC AREAS

4.3 E (I)

RECEPTION

Should be located in the area where visitors enter the unit. This may be combined with a visitor waiting lounge.

Instructions should be clearly marked and should be multilinguistic, guiding them to the correct desired location.

A buzzer system with a speaker/telephone contact to an access control desk within the unit is useful as it is not always possible to have a receptionist to man this area.

4.3 E (II)

VISITOR ROOM/ WAITING ROOM

Should have seating facilities (1.5 - 2 seats per bed) for the visitors with soothing decor and comfortable seating.

Warm colours, indirect soft lighting and windows are desirable.

May be combined with the reception area or consultation/quiet room in the event of space constraints.

Educational materials and lists of hospital and community-based support and resource services can be displayed.

A toilet should be available adjoining this room.

4.3 E (III)

CONSULTATION ROOM/QUIET AREA

A private room with about 15 sq meter area is recommended for conversations between interdisciplinary team members & families.

This room should ideally have direct access from the unit & from the relatives waiting area.

Every effort should be taken to protect the privacy of the patient & their family when designing this room.

5

ENVIROMENTAL REQUIREMENT

5.1

VENTILATION & TEMPERATURE CONTROL SYSTEM

- The ICU should be fully air-conditioned which allows control of temperature, humidity and air change.
- Suitable and safe air quality must be maintained at all times. Air movement should always be from clean to dirty areas.
- It is recommended to have a minimum of six total air changes per room per hour, with two air changes per hour composed of outside air. Where air-conditioning is not universal, cubicles should have fifteen air changes per hour and other patient areas at least three per hour.
- For critical care units having enclosed patient modules, the temperature should be adjustable within each module to allow a choice of temperatures from 16 to 25 degrees Celsius.
- For rooms having toilets, the required toilet exhaust of 75 cubic feet per minute should be composed of outside air.
- The dirty utility, sluice and laboratory area need five changes per hour, but two per hour are sufficient for other staff areas.
- Central air-conditioning systems and re-circulated air must pass through appropriate filters. High Efficiency Particulate Arrestance (HEPA) filters are recommended.
  - It is recommended that all air should be filtered to 99% efficiency down to 5 microns.
  - Heating when indicated, should be provided with an emphasis on the comfort of the patients and the ICU personnel.
  - Isolation rooms may have a choice of positive or negative operating pressure (relative to the open area) and is described in section 2.2.2

5.2

LIGHTING [10]

Light in room

Natural Light – Access to outside natural light is recommended by regulatory authorities in USA.

Data suggests that synthetic artificial daylight used in work environment may deliver better results for night time workers.

It may be helpful in maintaining the circadian rhythm.

Natural lighting in the unit can decrease power consumption and the electrical bill which is so relevant to local circumstances.

Access to natural light also means one may have access to viewing external environment which may be developed into a pleasant area.

Light for Procedures

High illumination and spot lighting is needed for procedures, like placing central lines etc.

Recommended spotlighting should be shadow free 150 foot candles (fc) strength.

Light required for general patient care

It should be bright enough to ensure adequate vision without eyestrain.

Overhead lighting should be at least 20-foot candles (fc).

Glare created by reflected light should be diffused

Light switches should be strategically located to allow some patient control and adequate staff convenience.

The Illuminating Engineering Society of North America published useful guidelines on this subject.

5.3

ELECTRICITY SUPPLY

Power failure in ICU is a serious issue. ICU should have its own power back up system in place.

Uninterrupted Power Supply (UPS) system is preferred for the ICU.

Otherwise the supply should be connected to the emergency power supply of the hospital.

5.4

MATERIALS & FINISHES [10, 11]

To enhance infection control, materials & finishes throughout the unit should be easy to maintain and clean and deter growth & spread of pathogens.

Surfaces

Surfaces are at risk of spills & high impact damage.

Avoid use of laminates in clinical areas as they provide sites for mould growth and also avoid surfaces and areas that trap water.

They should be non porous & smooth; without fissures, open joints or crevices that can retain or permit the passage dirt/liquid.

Floor

The ideal floor should be easy to clean, non slippery, able to withstand rough use and absorb sound while enhancing the overall look and feel of the environment. They should be chemically inert and resistant to antiseptics.

Carts and beds equipped with large wheels should roll easily over it.

Should be made of seamless, resilient sheet goods and should extend up the wall a short distance to form a smooth junction with the wall.

Carpets should be free from edges which create a hazard for movement of wheelchairs, walkers etc.

Vitrified non-slippery tiles may be the best option which can be fitted into reasonable budgets, easy to clean and move on and may be stain proof.

Ceiling

Material used should be those that can be easily cleaned thoroughly with routine house cleaning equipment.

They should be non friable & smooth and ideally free from fissures, joints and crevices where dust & particles could lodge.

Should ideally absorb sound.

Ceiling design may be enhanced by varying the ceiling height, softening the contours, griddled lighting surfaces, painting it with a medley of soft colours rather than a plain background colour, to make it more patient and staff friendly.

Walls

Walls should be finished with material that can be easily cleaned and they should be durable with ability to absorb sound.

Flame retardant, mildew resistant material with visual appeal is preferred.

Can have a height up to 4 – 5 ft finished with similar tile as of floor.

For rest of the wall should be painted with a soothing colour with glass panels on the head end may be a good choice.

5.5

NOISE CONTROL IN ICU [10]

The International Noise Council recommends that the noise level in an ICU be under 45 dBA in the daytime, 40 dBA in the evening and 20 dBA at night (dBA is a scale that filters out low frequency sounds and is more like the human hearing range than plain dB)

Noise level monitors are commercially available. If the unit noise exceeds that level, a light comes on or flashes to remind the staff to decrease the noise level.

6

ROOM DECOR & FURNITURE / FURNISHING

Pleasant surroundings promote comfort for patients & staff. Scenes of nature in greens & blues have been shown to decrease stress levels in patients.[11]

Selection of images may be incorporated in to the ceilings as well for the patients who are supine.

Providing the patient with a place to keep a few small personal items of his or her own make the environment more familiar and personalized.

Refer box for suggested furniture/furnishing

PATIENT AREA FURNITURE/ FURNISHING

- ICU bed
- Chair suitable for use by the patient (with cleanable covers) - a chair/sofa type chair on wheels with safety belt or vault is recommended for mobilising the patient and making him sit during recovery.
- Bedside medical storage with a work surface to prepare patients drugs- secure & able to store medications, IV fluids & other supplies that are needed on frequent or emergency basis
- Storage cupboard for patient's personal belongings
- Additional chair for visitors
- Soiled linen collection hamper
- Container for trash
- Container for hazardous waste/sharps
- Work surface for the patient's ICU notes with space for other records, radiological films etc. Over bed table with several shelves is suitable.
- Chair for the nurse
- 24 hour Clock
- Calendar

7

HAND HYGINE AND PREVENTION OF INFECTION

- Hand washing stations should be readily accessible throughout the unit.
- Systems using water & water free can be used.
  - The system with water should have a sink with hot & cold water, a faucet with easy on-off & temperature mixing capabilities , cleansing agents & a means for drying hands.
  - Sink should be free standing, have an offset drain to prevent splashing of the contents of the plumbing trap, be deep enough to prevent splashing and designed for excellent drainage; water should drain back in to the sink.
  - Areas around the plumbing fixtures should be sealed, moisture resistant and designed with splash protection. Dry work areas & counters should be located out of splash range of the sink. Joints at walls & floors should be covered or tightly sealed.
  - One wash basin per 2 beds may be accepted for a ward type unit.
  - Waterless system is an alcohol based anti-microbial instant hand rub, and every bed should have such a source. Each sink can have a hand rub dispenser too. They should be available at other clinical areas in the unit where they are deemed necessary. They should be also available at all entrances to the unit.
- No dirty/soiled linen/material should be allowed to stay in ICU for long times for fear of spread of bad odour, infection and should be disposed off as fast as possible. Dirty linen should be replaced regularly at fixed intervals.
- All surroundings of ICU should be kept absolutely clean and green if possible.

8

WASTE DISPOSAL AND POLLUTION CONTROL

- It is important that all government regulations be strictly complied with.
- It is mandatory to have four covered bins (Yellow, blue, Red, Black) provided for each patient or may be one set between two patients which save space and funds.
- Waste material should be kept covered in the dirty utility or other suitable disposal hold until they are taken away.

9

DISASTER PREPAREDNESS

- All ICUs should be designed to handle disasters both within ICU and out side ICU.
- A floor plan and evacuation plan of the ICU should be displayed in a highly visible place.
- Within ICU may be fire, accidents and infection or unforeseen incident and out side the ICU may be major or minor disasters like fire, accidents, terrorist acts etc.
- There must be an emergency exit in ICU to rescue patients in times of internal disaster. There should be provision for some contingency room within hospital where critically sick patients may be shifted temporarily. HDU may be the best place if beds are vacant. Post op recovery area & ETU are other possibilities.
- There should be adequate fire fighting equipment inside ICU and protection from electrical faults and accidents.
- ICU is a location for infection epidemics, therefore, it is imperative that all protocols and recommendation practises about infection control and prevention are observed and if there is a break out, adequate steps taken to control this and disinfect the ICU if indicated.

10

EQUIPMENT RECOMMENDATIONS

This is a guide only and is not a complete list.

Equipment	Per bed space	Remarks
Electric Bed	01 + 01 extra	Capable of attaining chair & Trendelenburg positions With provision for CPR
Pressure relieving mattress	01 + 01 extra	
Medical Utility Distribution System	01	Refer 4.3 A (i) Ceiling mounted twin arm pendants are favoured
Multi parameter patient monitoring unit	One per Bed+ one extra + 01 extra	Modular – 2 Invasive BP,SpO2,NIBP,ECG, RR, Temp, ETCO2 Preferably with a transport module

Critical Care Ventilators	01	With paediatric and adult provisions, graphics and non invasive modes, each should have heated humidifier
Transport Monitor	01 per 6 beds	With an additional battery
Transport Ventilator	01 per 6 beds	With an additional battery
Non invasive Ventilators	2 per 6 beds	With provision for CPAP and IPAP
Infusion Pumps	2	Volumetric with all recent upgraded drug calculation
Syringe Pump	4	With recent upgraded drug calculation
Feeding Pump	1	
Defibrillators	2 per 6 beds	With transcutaneous pacing
Blood Gas Analyser	01 per 6 beds	Arterial blood gases, electrolyte lactate assessment
Ultrasound Machine	01 per unit	Linear, curvilinear & echo probes
Glucometers	01	
Intermittent Leg Compression pumps	01	
CRRT/HD machines	2	per 6 level 3 beds
Cardiac Output Monitor	01	Per 6 beds Trans Oesophageal Echo for units with trained personnel
Portable X ray unit	01 per 6 beds	
Videolaryngoscope	01	Per unit
Fibreoptic Bronchoscope	01	Per unit
Respirometer	01	
ETT cuff pressure monitors	01	
Patient Warmers	01	
Fluid warmers	03 per unit	
ACT machine	01 per unit	For specialised units
Spinal Board	01 per unit	
Patient transfer board	02 per 06 beds	
Refrigerators	03 per unit	For drugs, patient meals & for staff
Computers	2 per unit	With internet, a printer
Difficult Airway Trolley	01 per unit	
Resuscitation Trolley	01 per 06 beds	
Resuscitator bags	01	

Laryngoscopes	01	
Stethoscopes	01	

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